A

B

Day & Son, (Limited) Lith.

A. MARSUPIAL. Antechinus minutissimus. B. PLACENTAL. Mus. delicatulus.

QL
711
M88X
MAMM

172829

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THE

GEOGRAPHICAL DISTRIBUTION

OF

MAMMALS.

BY

ANDREW MURRAY.

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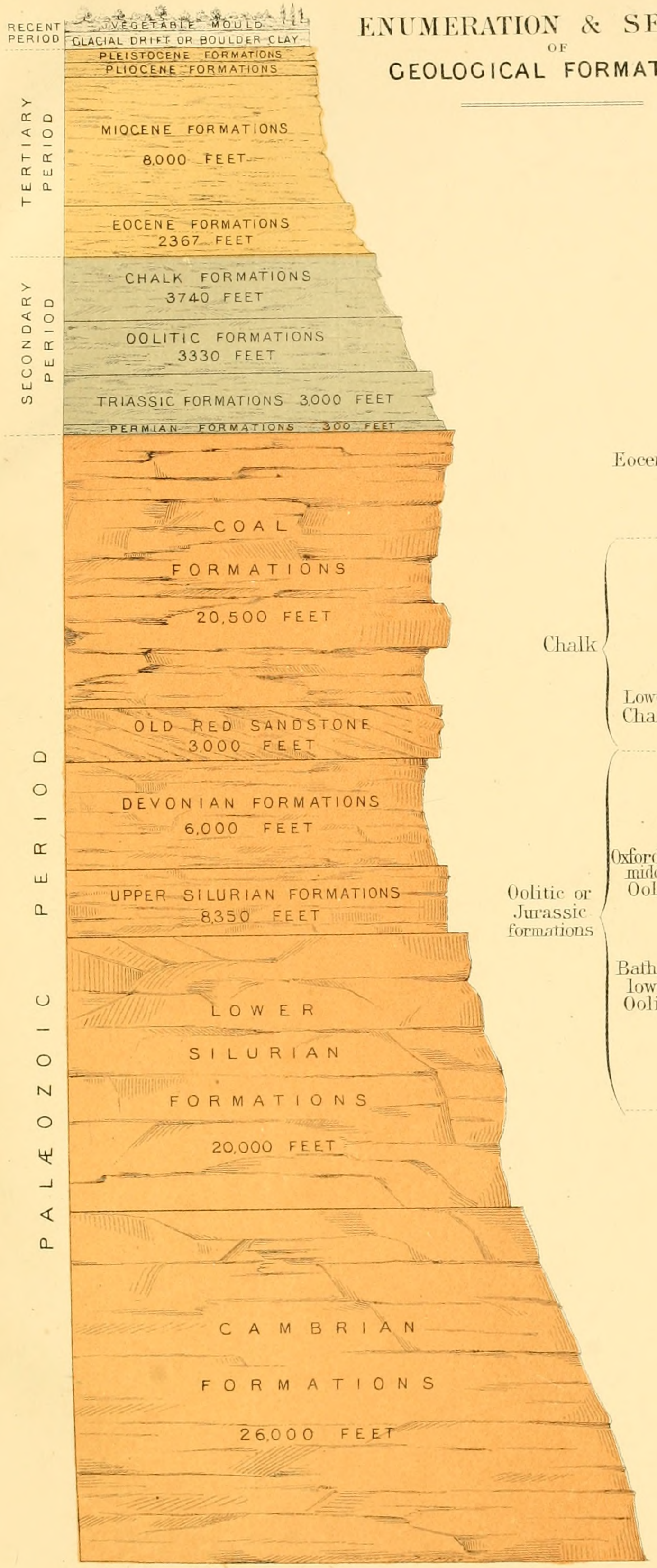
ENUMERATION & SECTION
OF
GEOLOGICAL FORMATIONS.



PERIODS		STRATA	DEPTH IN FEET.	
Recent		*Vegetable mould*	3	RECENT
		Drift or Boulder clay	30	
Pleistocene		*Superficial deposits*		TERTIARY
		High & low Gravels		
		Norwich Crag		
Pliocene		*Red Crag*	50	
		Coralline Crag	40	
Miocene		*Sands of Richmond, Virginia*	8,000	
		Mayence basin		
		Fahluns of Touraine		
		Sewalik formations		
		Hampstead series (175ft)		
Eocene	Upper Eocene	*Bembridge series*	115	
	Middle or Paris Eocene	*Osborne series*	70	
		Headon series	182	
		Bagshot series	1,270	
	Lower or London Eocene	*London Clay*	480	
		Plastic Clay	160	
		Thanet Sand	90	
Chalk	Upper Chalk	*Maestricht Chalk*	100	SECONDARY
		White Chalk with Flints	500	
		White Chalk without Flints	600	
		Chalk marl	100	
		Upper Green Sand	100	
		Gault	150	
	Lower Chalk, Wealden Beds	*Lower Green Sand*	850	
		Speeton Clay	60	
		Weald Clay	280	
		Hasting Sand	1,000	
Oolitic or Jurassic formations	Portland or upper Oolite	*Purbeck Beds*	900	
		Portland Beds		
		Kimmeridge Clay		
	Oxford or middle Oolite, Coral rag	*Upper Calcareous Grit*	780	
		Oolitic Limestone		
		Lower Calcareous Grit		
		Oxford Clay		
	Bath or lower Oolite, Cornbrash	*Cornbrash*	550	
		Forest Marble		
		Bradford Clay		
	Great Oolite	*Freestone & Rag*		
		Stonesfield Slate		
		Fullers Earth		
	Inferior Oolite	*Ragstone*		
		Freestone		
		Pea Grit		
		Lias	1,100	
	Triassic	*Keuper*	1,000	
		Muschelkalk	600	
		Bunter Sandstein	1,500	
	Permian	*Marls & Limestone*	300	PALÆOZOIC
	Carboniferous formations	*Magnesian Limestone*	750	
		Coal measures	12,000	
		Millstone Grit	1,600	
		Mountain Limestone	1,500	
		Carboniferous Slate	4,650	
	Old red Sandstone Devonian	*Old red Sandstone*	3,000	
		Devonian group	6,000	
	Ludlow group	*Upper Ludlow Rock*	2,500	
		Aymestry Limestone		
		Lower Ludlow Rock		
	Upper Silurian	*Wenlock group*	4,000	
		Mayhill group		
		Upper Llandovery Beds		
		Lower Llandovery Beds	1,000	
		Caradoc Sandstone	9,000	
		Llandeilo Flags	5,000	
		Lingula Flags	5,000	
		Cambrian Rocks	26,000	

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CLASSIFICATION OF MAMMALS,

ADOPTED IN THIS WORK.

NOTE.—The Geological formations in which remains of the different families have been found are indicated by the Asterisks.

	Recess of Glacial Epoch.	Access of Glacial Epoch.	Miocene.	Eocene.	Secondary.
QUADRUMANA.					
1. ANTHROPIDÆ	*	?	..	..	..
2. PITHECIDÆ.					
1. CATARRHINI	*	*	*	..	..
2. PLATYRHINI	*	*	?	..	..
3. ARCTOPITHECINI	*	*	?	..	..
3. LEMURIDÆ.					
1. LEMURINI	..	..	..	..	..
2. CHEIROMYINI	..	..	..	..	..
3. GALEOPITHECINI	*	..	..	..	..
CARNIVORA.					
1. FELIDÆ	*	*	*	..	..
2. VIVERRIDÆ	*	*	*	..	..
3. HYÆNIDÆ	*	*	..	..	..
4. CANIDÆ	*	*	*	*	..
5. MUSTELIDÆ	*	*	*	..	..
6. PLANTIGRADA.					
1. ARCTOCYONIDÆ	*	*	*	*	..
2. URSIDÆ	*	*	?	..	..

	Recess of Glacial Epoch.	Access of Glacial Epoch.	Miocene.	Eocene.	Secondary.
7. PINNIPEDIA.					
1. Phocidæ	*	*	*	..	..
1. Phocinæ	..	..	..	..	..
2. Otarinæ	..	..	..	..	..
2. Trichechidæ	*	*	..	..	..
UNGULATA.					
1. MONODACTYLA.					
1. Solidungula	*	*	*	..	..
2. ARTIODACTYLA.					
1. Ruminantia.					
1. Camelidæ	*	..	*	..	..
2. Bovidæ	*	*	..	..	..
1. *Ovibos*	*	*	..	..	..
2. *Bison*	*	*	..	..	..
3. *Bubalus*	*	*	..	..	..
4. *Bos*	*	*	..	..	..
3. Capridæ.					
1. *Ovinæ*	*	*	..	..	..
2. *Caprinæ*	*	*	..	..	..
4. Antilopidæ	..	..	..	..	..
1. *Bovina*	..	..	..	..	..
2. *Catablepas*	..	..	..	..	..
3. *Bubalus*	..	..	..	..	..
4. *Oryx*	..	..	..	..	..
5. *Gazella*	..	..	..	..	..
6. *Tragelaphus*	..	..	..	..	..
7. *Antilope*	..	..	..	..	..
8. *Redunca*	..	..	..	..	..
9. *Oreotragus*	..	..	..	..	..
10. *Cephalophus*	..	..	..	..	..
11. *Tetracerus*	..	..	..	..	..
5. Camelopardidæ	*	..	* ?	..	..
6. Cervidæ	*	*	*	..	..
7. Moschidæ	*	..	*	..	..

	Recess of Glacial Epoch.	Access of Glacial Epoch.	Miocene.	Eocene.	Secondary.
8. Tragulidæ.					
1. *Tragulus*	*	*	*	..	..
2. *Hyomoschus*	*	..	*	..	..
3. *Dichobune*	..	..	*	*	..
9. Anoplotheridæ	..	..	*	*	..
2. NON-RUMINANTIA.					
1. Dicotylidæ	*	*	..	..	..
2. Suidæ	*	*	*	..	..
3. Hippopotamidæ	*	*	*	..	..
3. MULTUNGULATA.					
1. PALÆOTHERIDÆ	..	..	*	*	..
2. NESODONTIDÆ	..	*	?	..	..
3. TAPIRIDÆ	*	*	*	..	..
4. NASICORNIA	*	*	*	..	..
5. PROBOSCIDEA.					
1. Mastodontidæ	*	*	*	..	..
2. Elephantidæ	*	*	*	..	..
6. SIRENIA.					
1. Dinotheridæ	*	*	*	..	..
2. Manatidæ	*	..	..	..	..
CETACEA.					
1. BALÆNIDÆ	*	*	*	..	..
2. DELPHINIDÆ	*	*	*	..	..
3. ZEUGLODONTIDÆ	..	..	*	*	..
EDENTATA.					
1. BRADYPODIDÆ	..	..	..	..	..
1. GRAVIGRADA	?	*	..	..	..
2. TARDIGRADA	*	..	*	..	..
2. DASYPODIDÆ	*	*	*	..	..
3. SCUTATA	..	..	?[1]	..	..

[1] Cuvier and Owen ascribe the remains of the MACROTHERIUM GIGANTEUM (on which the existence of SCUTATA, in the Miocene, rests) to an animal allied to the MANIS; Gervais to an ORYCTEROPUS; Giebel to one of the DASYPODIDÆ.

	Recess of Glacial Epoch.	Access of Glacial Access.	Miocene.	Eocene.	Secondary.
EDENTATA (*continued*).					
4. MYRMECOPHAGA..	..	..	..	..	..
INSECTIVORA.					
1. TALPIDÆ	*	*	*	..	..
2. SORICIDÆ	*	*	*	..	..
3. MACROSCELIDES	..	..	..	..	..
4. TUPAIADÆ	..	..	..	..	..
5. ERINACIDÆ	*	*	*	..	..
6. CENTETIDÆ	..	..	..	..	..
CHEIROPTERA.					
1. FRUGIVORA	..	..	..	..	..
2. ENTOMOPHAGA					
1. Istiophora	..	..	..	..	..
2. Gymnorhini	*	*	*	*	..
RODENTIA.					
1. TOXODONTIDÆ	..	..	*	..	..
2. HYSTRICIDÆ					
1. Caviinæ	*	*	?	..	..
2. Chinchillinæ	*	*	..	..	..
3. Octodontinæ	..	..	..	..	..
4. Echimyinæ	..	..	..	..	..
5. Dasyproctinæ	*	*	?	..	..
6. Hystricinæ	*	*	?	..	..
3. HYRACIDÆ	..	..	..	..	..
4. LEPORIDÆ					
1. Lagomys	*	*	..	..	..
2. Lepus	*	*	?	..	..
5. MYOXIDÆ	*	*	*	..	..
6. SCIURIDÆ	..	..	..	..	..

	Recess of Glacial Epoch.	Access of Glacial Epoch.	Miocene.	Eocene.	Secondary.
SCIURIDÆ (*continued*)					
1. Xerus	..	..	..	..	..
2. Rhinosciurus	..	..	..	..	..
3. Sciurus	*	*	*	..	..
4. Pteromys	..	..	..	..	..
1. Sciuropterus	..	..	..	..	..
2. Pteromys	..	..	..	..	..
5. Tamias	..	..	..	..	..
6. Spermophilus	*	*	..	..	..
7. Cynomys	..	..	..	..	..
8. Arctomys	*	*	..	..	..
7. PECTINATORIDÆ	..	..	..	..	..
8. MURIDÆ					
1. Castorinæ	*	*	*	..	..
2. Arvicolinæ	*	*	..	..	..
3. Spalicinæ	..	..	..	..	..
4. Saccomyinæ	..	..	..	..	..
5. Cricetinæ	*	*	*	..	..
6. Sigmodontes	*	*	..	..	..
7. Hesperomyinæ	..	..	..	..	..
8. Murinæ	*	*	*	..	..
9. Sminthinæ	..	..	..	..	..
10. Merionides	..	..	..	..	..
11. Dipodinæ	..	..	..	..	..
MARSUPIALIA.					
1. Entomophaga	*	*	*	*	*
1. Antechini	..	..	..	..	..
2. Phascogale	..	.	..	..	..
2. Sarcophaga	..	..	..	..	..
1. Dasyuridæ	..	..	..	..	..
2. Didelphides	*	*	*	*	..
3. Phalangistæ	..	..	..	..	..
3. Volitantia	..	..	..	..	..
1. Petauri	..	..	..	..	..
4. Rhizophaga	..	..	..	..	..
1. Phascolomyidæ	*	*	..	..	..

	Recess of Glacial Epoch.	Access of Glacial Epoch.	Miocene.	Eocene.	Secondary.
MARSUPIALIA (*continued*).					
5. Poephaga	..	..	..	..	..
1. Macropidæ	*	..	..	..	..
2. Stereognathidæ	..	..	..	..	..
3. Peramelidæ	..	..	..	..	..
6. Linguales					
1. Tarsipes	..	..	..	..	..
2. Myrmecobius	*	..	..	..	..
3. Microlestidæ	..	..	..	..	..
MONOTREMATA.					
1. Echidna	..	..	..	..	..
2. Ornithorhynchus	..	..	..	..	..

MAP I.

SHOWING APPROXIMATELY
THE 100 FATHOM LINE OF SOUNDINGS.

Day & Son (Limited) Lith.

MAP II.

SHOWING THE APPROXIMATE EFFECT OF A DEPRESSION OF THE LAND 600 FEET.

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

BAFFIN BAY

GREENLAND

ICELAND

RUSSIAN AMERICA

HUDSON BAY

BRITISH AMERICA

NORTH AMERICA

UNITED STATES

CALIFORNIA

TEXAS

G. of MEXICO

CARIBBEAN SEA

NUEVA GRANADA

ECUADOR

PERU

BRAZIL

SOUTH AMERICA

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND IS.

EUROPE

SCOTLAND

IRELAND

NORWAY

SWEDEN

LAPLAND

FINLAND

RUSSIA

PRUSSIA

BALTIC

FRANCE

AUSTRIA

TURKEY

BLACK SEA

ASIA MINOR

PORTUGAL

SPAIN

ALGIER

MEDITERRANEAN

CASPIAN SEA

PERSIA

AFRICA

SAHARA DESERT

SOUDAN

NUBIA

ARABIA

RED SEA

ABYSSINIA

SOUDA

BORNOU

SENEGAMBIA

GUINEA

BENGUELA

CAPE COLONY

MADAGASCAR

ASIA

SIBERIA

NOVA ZEMBLA

NEW SIBERIA

INDEPENDENT TARTARY

MONGOLIA

MANCHOURIA

CHINESE EMPIRE

THIBET

CHINA

OKHOTSK SEA

KAMTCHATKA

JAPAN SEA

YELLOW SEA

AFGHANISTAN

BELOOCHISTAN

PUNJAB

SCINDE

HINDOOSTAN

BIRMAH

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BORNEO

JAVA

SUMATRA

CELEBES

CAROLINE IS.

NEW GUINEA

NEW IRELAND

NEW HEBRIDES

NEW CALEDONIA

AUSTRALIA

NORTH AUSTRALIA

SOUTH AUSTRALIA

WEST AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW ZEALAND

FIJI IS.

MARIANA IS.

PHILIPPINE IS.

FORMOSA I.

LIAKHOV IS.

Day & Son, (Limited) Lith.

MAP III.

Shewing approximatively what is known of the Tertiary & Quarternary formations & generally the land including mountain ranges which was probably under water during the Tertiary or not long before the Glacial Epoch.

ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN
BAFFIN BAY
GREENLAND
HUDSON BAY
RUSSIAN AMERICA
NORTH AMERICA
UNITED STATES
G. of MEXICO
CARIBBEAN SEA
SOUTH AMERICA
EUROPE
ASIA
AFRICA
ARABIAN SEA
BENGAL SEA
CHINA SEA
JAPAN SEA
OKHOTSK SEA
KAMTCHATKA SEA
AUSTRALIA
ISOTHERMAL 32°
Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn

Day & Son Lithrs to the Queen

MAP IV.

SHOWING THE PORTIONS OF THE EARTH WHERE MARKS OF GLACIAL ACTION HAVE BEEN OBSERVED OR ARE ON STRONG GROUNDS BELIEVED TO OCCUR.

ARCTIC OCEAN
BAFFIN BAY
GREENLAND
DAVIS STRAIT
ISOTHERMAL 32°
Arctic Circle
ICELAND
ESQUIMAUX
RUSSIAN AMERICA
HUDSON BAY
BRITISH AMERICA
NORTH AMERICA
UNITED STATES
NEW CALIFORNIA
TEXAS
G. OF MEXICO
CARIBBEAN SEA
NUEVA GRANADA
GUAYANA
ECUADOR
PERU
BRAZIL
SOUTH AMERICA
LA PLATA
PATAGONIA
TIERRA DEL FUEGO
NORTH PACIFIC OCEAN
SOUTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
Tropic of Cancer
Equator
Tropic of Capricorn
SCOTLAND
IRELAND
ENGLAND
PORTUGAL
SPAIN
AZORES
CANARIES
MOROCCO
ALGIER
SAHARA DESERT
CAPE DE VERDE IS
SOUDAN
NUBIA
ABYSSINIA
GUINEA
BENGUELA
BENGUELA ANGOLA
BECHUANA
CAPE COLONY
MADAGASCAR
MAURITIUS
BOURBON
EUROPEAN RUSSIA
NORWAY
SWEDEN
FINLAND
RUSSIA
AUSTRIA
TURKEY
BLACK SEA
ASIA MINOR
MEDITERRANEAN
EGYPT
ARABIA
PERSIA
AFGHANISTAN
BELOOCHISTAN
SIBERIA
NOVA ZEMBLA
NEW SIBERIA
LIAKHOV IS
OKHOTSK SEA
KAMTCHATKA SEA
KAMTCHATKA
INDEPENDENT TARTARY
MONGOLIA
MANDCHOURIA
CHINESE EMPIRE
THIBET
CHINA
JAPAN SEA
YELLOW SEA
HINDOOSTAN
PUNJAB
BIRMAH
ARABIAN SEA
BENGAL SEA
CEYLON
MALDIVE IS
CHINA SEA
BORNEO
JAVA
CELEBES
MOLUCCAS
PHILIPPINE IS
FORMOSA
MARIANA IS
CAROLINE IS
NEW GUINEA
NEW IRELAND
LOUISIADE IS
NEW HEBRIDES
NEW CALEDONIA
FIJI IS
NORTH AUSTRALIA
WEST AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
AUSTRALIA
VANDIEMEN
NEW ZEALAND
INDIAN OCEAN
SOUTHERN OCEAN
AFRICA
ARCHIPELAGO
MARQUESAS IS
CHATHAM
FALKLAND IS
SANDWICH LAND
GEORGIA
S. ORKNEYS
S. SHETLANDS
JUAN FERNANDEZ IS
ALEUTIAN ISLANDS
ALEUTIAN IS
SANDWICH IS

Day & Son Lithographers to the Queen

INTRODUCTION.

OBJECT AND PLAN OF THE WORK — MAPS EXPLAINED — SUBSIDENCE — ELEVATION — TERTIARY FORMATIONS — GLACIAL ACTION — SARGASSO SEAS — DISTRIBUTION.

The great amount of information which has of late years been accumulated regarding the Geographical Distribution of Plants and Animals renders it very desirable that it should be classified and displayed, so that some general and connected view of the facts, and of their bearing on each other, may be obtained. To do this is the object of the present work.

I shall to a certain extent follow the arrangement suggested by Schouw,* and adopted by Decandolle† and others in regard to plants, and consider the subject under two aspects equivalent to those which in Zoology Van Der Hoeven‡ has recently proposed to distinguish respectively by the names of "Geographical Zoology" and "Zoological Geography," the former referring to the range of species, the latter to the Faunas of districts, and treat each great class separately and independently upon both these points.

I shall commence with the former, and shall first pass the different families in each class under review, giving an account of their distribution, and affinities.

Their history and that of their nearest relatives during past geological epochs is a most important point in relation to this, and to these I propose to give special attention; and I shall endeavour, by the aid of maps, to exhibit the facts more clearly and comprehensively than I could otherwise do. On these maps the localities where the groups or species are found will be marked; and the districts where they are most fully or most feebly represented will, when necessary, be shown by different intensities of colour. To save expense, and so to allow of greater use being made of maps than would otherwise be the case, they have been drawn of three sizes, so that, when a mere general reference is required the smaller ones may be used, and the larger be reserved for those cases which require more detail. Where the distribution of a species or group is peculiar, any speculations which have been made as to its cause will be noticed.

After a full inquiry into the Geographical Zoology of each class, I shall conclude its history with a summary of its Zoological Geography. The geographical distribution of each class will thus form an independent treatise by itself.

While the work is mainly addressed to the scientific naturalist, it is also intended for the general reader; and with this view, scientific names will be avoided whenever there are

* Schouw, "Grundzeuge einer allgemeinen Pflanzengeographie." Berlin, 1823, p. 4.
† Decandolle, "Geographie Botanique." Paris and Geneva, 1855.
‡ J. Van Der Hoeven, "Philosophia Zoologica." Leyden, 1864, p. 375.

English ones to express the meaning. For the same reason, in addition to displaying in correlative order the distribution of plants and animals throughout the globe, so that the facts may be analysed and reasoned on, I shall make it an object to supply general information regarding the habitats of those plants or animals as to which the educated reader is most likely to feel curiosity. References to authorities will be given whenever they seem likely to be useful. Every naturalist must have felt the want of such references when searching for information on any subject; and in the present case they are especially necessary, for the Zoologist is often unfamiliar with Botany, the Botanist with Zoology, and the specialist at sea when he gets beyond the limits of his own territory; and yet none of them can proceed far in their work without having frequent occasion to know something relating to the geographical distribution of other organized beings which incidentally come in connexion with the subject of their studies. I have endeavoured in my references to hit the medium between a burthensome display of erudition, and a selection too meagre to be of use.

It is right for me to say that I should never have ventured to undertake a work of such extended scope, were it not for the promised aid and support of many naturalists eminent in those departments in which I am myself more especially deficient.

To assist the non-geological reader in following any speculations in which extinct animals are concerned, I have given a diagram, showing the succession of geological strata, and their respective thickness.

I have also given several maps of a general nature. The first is one representing the 100 fathom line of coast; that is, the line outside of which no soundings are obtained at a depth of 100 fathoms (600 feet), so that it shows what would be the configuration of the dry land if it were everywhere raised 600 feet. I have to thank Captain Richards and the other officers of the Hydrographic department of the Admiralty for the kindness and liberality with which they enabled me to prepare this map, by giving me access to the charts in their possession, as well as ready information on every point on which I applied to them.

The second map represents what would be the probable coast-line if the whole land were depressed 600 feet. It is unnecessary to say that this is much less accurate, notwithstanding that I have had the advantage of the materials in the Geographical Society's possession. Comparatively few of the lower altitudes of the earth's surface are known; it is, therefore, not to be taken as more than a very conjectural approximate essay.

A third map shows the parts of the earth on which tertiary and quaternary formations have been ascertained to occur, that is, those which were probably under water at the time of the glacial epoch or not long previously.

A fourth map shows, so far as known, the localities where glacier action or remains of the drift or boulder clay have been remarked. My best thanks are due to Professor Ramsay for the readiness with which he has imparted to me his copious information both on this and other subjects. Nevertheless this map, too, is merely offered as a distant approximation. The importance of the effects of the glacial epoch, however, renders even such an imperfect tentative very desirable for the proper understanding of the questions arising out of the action of that period.

A fifth map is given, showing the lands which are supposed to be now rising and those now sinking.

The portion of this latter map which relates to the Northern Hemisphere is drawn from various sources, but much of it is conjectural and inferential, little being known of the greater part of it. The portion relating to the Southern Hemisphere has been chiefly deduced from the data laid down by Mr. Darwin in the map published in his volume on "Coral Formations."

Prof. Edward Forbes, in speaking of the Gulf weed in the Atlantic, suggested that it might indicate the spot where land had been submerged, and as botanists are disposed to admit that the SARGASSUM BACCIFERUM, or Gulf weed, is only another form of the SARGASSUM VULGARE, which fringes our own coasts, it seemed not an improbable conjecture, and its presence must always be taken into account in any speculations on the past changes of the distribution of land and sea. I have, therefore, added a map in which the different Sargassum Seas are laid down.

I had hoped to have given a seventh general map, illustrative of Dr. Forschammer's conclusions regarding the regional distribution of different kinds of sea-water. That gentleman has made this the subject of investigation, and has communicated the results to the Royal Society in a paper on the component parts of sea-water in all quarters of the globe. These results have induced him to divide the sea into sixteen regions, each distinguished by different physical qualities. It will be most interesting to compare how far these correspond with the regional distribution of sea animals and sea plants. Unfortunately his paper has not yet been published. Before I reach the Fishes I trust that this will have been done, and that I may then be able to give a map showing Dr. Forschammer's sea-water regions.

The order in which I shall pass the different animals and plants in review, is that known as the descending order, viz. commencing with Man and going down the scale of Nature, until we reach the lowest organisms of animal life. Perhaps the most natural course, when I have reached that stage, would be then to enter on the vegetable kingdom by the lowest links in its scale, which can hardly be distinguished from the like links in the animal kingdom, and to work upwards to the highest. I think on the whole, however, that it will be found more convenient to treat the vegetable kingdom as a parallel series, and deal with it also in the descending order.

CHAPTER I.

PRELIMINARY INQUIRIES — ORIGIN OF SPECIES — SPECIFIC CENTRES.

Before entering on the special subject of this work, there are one or two topics on which I should wish to make some profession of faith. The chief of these is Mr. Darwin's theory of the origin of species. A man's opinion on this subject must necessarily and unconsciously modify his views on many other important points, and it becomes a matter of some moment to the reader to know from what point of view the author regards things. When he once knows *that*, the reader can himself apply a compensation-balance to reduce the author's conclusions to his own standard.

I the more desire to explain the views which I now hold regarding the origin of species, that some years since (shortly after the first appearance of Mr. Darwin's work), I took exception to it, and urged various objections to his theory.* Some of these I still maintain, but others I have seen reason to modify. If it were a mere recantation that I had to make, a couple of lines would be sufficient for that purpose; I should not detain the reader long in announcing that whereas I had formerly been an opponent of Mr. Darwin's views, I was now a supporter. But it is not so. In some respects, I have come nearer to Mr. Darwin's views; but in others I still differ from him, if not as much as before, at least sufficiently to render some explanation necessary to the understanding of my opinions.

It is not, however, by way of opposition to his that I offer mine. The reader will see that mine are rather of the nature of a sequel to his, or an attempt to work out the truth by the light of his previous labours. If I have been in any respect successful in throwing more light upon the subject, I owe it to the ideas suggested by his works.

The objections which I took to his theory were not to the origin of species by derivation or descent — but to the machinery by which he supposed this to take place; viz., development by long-continued gradual variation and selection through the struggle for life.

I thoroughly accepted the theory that species are not produced by independent creation, but that, under the operation of a general law, the germs of organisms produce new forms different from themselves, when particular circumstances call the law into action. I held very much the involution theory of Bonnet and Priestley,† "that all the germs of future plants, organical bodies of all kinds, and the reproducible parts of them, were really contained in the first germ." That theory appeared to me to furnish a satisfactory explanation of the homologies in structure and of the relationships between species which are everywhere apparent throughout the organized world.

If, on the concurrence of particular circumstances, a law comes into action effecting an

* "Proceedings of Royal Society of Edinburgh," 16th January, 1860.

† Priestley, "Disquisitions relating to Matter and Spirit," vol. i. p. 201. Birmingham, 1782.

alteration on the germ which is about to be developed, it follows, that in those points where the law has not affected the germ, it should have the same form as in the parent; and on those points where it *has* affected the germ, it must produce the alteration, not by creation of new parts, but by alteration of those already existing. If fins are wanted where legs were before, they must be obtained not by the creation of a new organ, but by the alteration of the parts of the leg; hence the existence of homologies between them. No doubt Mr. Darwin's slow and imperceptible variation produces homologies too; but inasmuch as the establishment (not the first appearance, but the establishment) of such changes, is in his theory dependent on the variation being such as to enable the animal to come off successful in the struggle for life, it seemed to me less applicable to those variations (and many such exist), where, so far as we can see, the change has no beneficial effect in that struggle.

I did not deny the existence of much variation, and of its being continued, to a certain extent, by inheritance; neither did I ignore the possible bearing of hybridization on the question; nor did I dispute the existence of the struggle for life, and that that influence cleared away the weakly, and left the strongly endowed. But with perfect conviction on these points, I had not succeeded in bringing my mind to accept the possibility of a new species being eliminated out of any amount of gradual variation, hybridization, or struggle for life, either taken singly or in combination.

What impressed me more than anything else was the absence of any transitional forms or geological evidence in support of the idea; I argued that if such transition really existed, it ought to have either been seen or to have left traces of its having been; but no form has yet been discovered among fossil remains, which can fairly be adduced, as showing a gradation of form passing, during the course of time, from one species to another. Species varying to a greater or less degree are there found as we find them existing now; but they occur at the same time, and have never been found gradually increasing in diversity through successive strata, until they reach the proportions of a new species. In like manner, I looked in vain for any transitional form of existing animals in the act of passing from one type to another. It appeared to me impossible for them to exist consistently with the preservation of the order which we see in Nature. I argued that if the transition were slow and gradual, there must be a multitude of individuals in different stages of progression towards species, and branching out right and left from the old one, and consequently the homogeneity which is essential to the character of species could not exist: they would never have time to settle into a species. No sooner would one have reached that degree of divergence from the type, than its descendants must start again on a fresh progress of variation. If Nature were provided with a brake by which she could moderate and arrest the progress of variation when the species was completed, the case would be different. But according to Mr. Darwin, not only time but variation runs its ceaseless course. Were it not for that, we could realise the idea that A produced B slightly changed; B produced C more changed; C produced D still more altered, and so on until the entire change was effected, always provided that the variation then stopped. But it does not so. Like the Wandering Jew, it must go on—on—without ceasing; no sooner arrived than it must start again. This would be the result of variation, supposing it to be accomplished through single individuals, forming specific centres; and it appeared to me, that it would be still more hopeless if we abandoned the origin of species through single individuals, and adopted the view of species originating not in individuals, but in numbers. Then we should have to deal not with a change affecting one individual, one child from each parent, but with one extending over a whole army of descendants; and I came to the conclusion that it was inconsistent with what we know of the

variation which we see daily in operation, that in these descendants of different broods, exactly the same kind and degree of variation, and in the same direction, should occur in all. It seemed to me still more incredible that each of the members of all these broods should produce exactly the same amount and kind of further variation in *their* many broods; and so on, through a longer or shorter period.

There should, on this principle, be a multitude of varieties, and not one type only. This seemed to me sound reasoning; and it *is* sound, from the premises assumed. But a doubt has begun to grow in my mind as to the soundness of one part of the premises. I have no doubt as to the fallacy of this constant persistence of change; but I am not so clear as I was, that it is an impossibility for Nature *when she does make a change* to make the transition gradually or over large bodies simultaneously, and yet show no traces of the process. I think I see some facts which imply as much, and I think I see what the brake is by means of which the progress of change is arrested.

We know that throughout the world, multitudes both of local and climatal varieties occur, which, whether they are species or varieties, still possess one common facies. There are dozens of forms of plants and insects from North America, which are so like European individuals of the same species, that no one would think of separating them; and yet any botanist or entomologist will tell without fail from which side of the Atlantic each specimen came. There are similar varieties of man in every land. How have these differences of form been produced? On this point we are not wholly left without direction; we have a faint glimmering of light, because we have seen a race of man formed under our own eyes, the Anglo—or rather the Europeo-American nation, as distinct and well marked a race as any other; and yet the change has been effected over the whole of the United States without any transition men ever having been observed; and what is still more extraordinary, it has been effected over the whole of the region where it occurs at the same time. The race has apparently not been produced by an American being born from an Englishman, and then by his propagating young Americans, but hundreds of thousands have had the same impress affixed upon them over the length and breadth of the land at the same time. Agassiz may be right, after all, although not in the sense in which, I imagine, he meant it, when he contended for a multiple origin of species. Now, according to the reasoning in which I trusted, there should have been no Anglo-American nation,—the type should have been frittered away in a thousand different directions. A congeries of all kinds of different degrees of change should have been jumbled up together, leaving no distinguishable character by which to know the American from any other nation. And yet, there he is, a nation *per se;* known to "Punch,"—known to passport officers,—known to ourselves,—easily identified, easily figured, and easily caricatured. So, I believe, there is a modern Mexican race; a modern Brazilian; modern Negroes, and a modern Australian race is far on the way. Although the example of the American is, perhaps, the most striking I could select, being almost the only one where man has had the opportunity, or, at least, has had the occasion forced upon him, of observing such a change, there is no reason to doubt that what has occurred with him has also taken place in a multitude of other varieties.

Such an *argumentum* AD HOMINEM is hard to get over, and I do not mean to attempt to do so. I have come to the conclusion to accept the fact, that Nature can produce a new type without our being able to see the marks of transition, and that she can alter a whole race simultaneously without its passing through the phase of development from an individual in whom the entire change was first perfected. In the case alluded to, the prepotent typical influence has been impressed on the whole; no doubt, by derivation, but still by some additional influence affecting many at the same

time. If this is the case with varieties, I think it must follow that the same principle may also act in the formation of species. The difficulty in drawing the distinction between a variety and a species seems a sufficient reason for holding that if we find a principle affecting the production of the one, it will also apply to the other. At any rate, it will not be the Darwinians who will object to the same measure being applied to both; and as to their opponents, I have no fresh argument beyond what may be inferred from the above to bring to bear upon them.

I need scarcely say that, in other respects, this change in my views brings me no nearer Mr. Darwin. In the alteration which has been made in the European races by transfer to America, I see no indication of the principle of constant change, nor selection, nor yet of the struggle for life, which are essential parts of his theory.

These are the chief differences between his views and mine. He believes that in all organic beings a certain degree of change is at all times unintermittingly going on; and that, from that variation and selection, through the struggle for life, new species are being incessantly developed. He believes that the portals of the manufactory of new species are constantly open, and the process always going on. He makes ample provision for instability; none for stability. I believe that the gates are habitually shut, but that they are always ready to be opened to a greater or less width at a touch of the key, and *that that key is* CHANGE in the conditions under which species live. It does not matter what the change is, nor in what direction it takes place. It has no relation to adaptation nor teleological purposes, it may be for their comfort or discomfort; for their benefit or the reverse; its bearing on their organization is a matter of indifference; all that is wanted is *change* of some kind or other to ruffle the repose of the pool. The only relation *in kind*, which I can conceive between the alteration of condition and the change of species is that the greater and more sudden the change of circumstances the greater and more divergent is the change in the species.

On the other hand, it is plain to me that there must be some law which arrests variation and confines it within certain bounds. Mr. Bentham has truly said, "Every species has certain determinate limits of variation, which it only exceeds under exceptional circumstances, and the exceptionally abnormal forms thus produced are few in individuals, and are not reproduced." I imagine that the law which secures this stability of species is INERTIA. So long as they are not meddled with they stand still; but subject them to change,—whether it comes to them, or they go to it,—give them an impulse of any kind, and variation commences. Some receive the impulse more easily than others. What may be felt by one may not be felt by another. Constitutions differ: hence, the greater range of some species than others; but whenever the change makes itself felt, then I apprehend modification commences; and as we go along, we shall, I think, find instances, such as the half-completed species of the circumpolar regions, hovering between varieties and species, which prove that the degree of modification which takes place in species, bears some relation to the amount of alteration on the conditions of their existence; and it may be, that change once induced works more vigorously in warm than in cold climates. It is well known to hybridizers that it is not until the second generation of hybrids "that those which do not all revert to the specific types give rise to that irregular variation which induces, after some generations, that chaos of undecided forms, in the face of which all the efforts of botanical describers miscarry."* It is not until the barrier has been broken down that these irregularities commence; that once done, there is no end to them. A somewhat parallel case is quoted by Sir Charles Lyell from the

* NAUDIN, in "Comptes Rendus de l'Académie des Sciences." Nov. 21, 1864.

observations of the late Dr. Turner, "that when mineral matter is in a 'nascent state,' that is to say, just liberated from a previous state of chemical combination, it is most ready to unite with other matter, and form a new chemical compound."* In other words, *inertia* once destroyed, and motion given, impulse is more readily received and propagated. The ordinary state of quiescence will be resumed as soon as the animal has become habituated to the alteration; but by that time it is no longer the same animal, it has become a new species. In this way, and in this way only, do I think that hybridization may have some influence in producing a new species, viz., by disturbing the normal stability of an earlier species, and preparing it to receive an impulse from less alteration of condition than would otherwise have affected it.

It may be objected to this hypothesis, that it is inconsistent with our experience of exotic plants which have been naturalized in this country. We have plenty of plants which have been brought from the other side of the world, and have been grown for a couple of hundred years in this country, and yet no alteration is perceptible upon them. My answer to this is, that one essential element in my theory is, that the change is effected through the medium not of single individuals, but of a multitude of individuals—a whole nation of the same species; and I know of no instance in which such an agglomeration of exotic species has ever existed in this country. We can easily conceive that where the individuals are isolated or in small numbers, any change which might show itself upon one or two of their descendants may have escaped our observation, and become extinguished before it was established for want of individuals through which to propagate, develope, and extend it. Moreover, the process of change is obviously gradual and imperceptible, and extends over a greater space of time than we have had the opportunity of observing.

Again, the species may have been of those possessing constitutions adapted to admit without feeling them considerable variation in their conditions of life; and lastly, it is not absolutely true that no change has been observed; our observations in this country are made on plants or animals which are soon killed by the climate, if the conditions of life are not pretty well suited to their constitution. Where the climate is warmer, it seems that a greater change of condition can be borne than in cold countries without killing the species; and in tropical lands a change is certainly observed. In cattle, the Pelones and Calougas now existing in the warmer and warmest parts respectively of South America, having been changed from ordinary cattle so much that the former has only very fine short hair, and the latter no hair at all. The effect of climate on the wool of sheep is well known; and Mr. Winwood Reade, in speaking of the different animals and plants introduced into West Africa, speaks of a marked change in all. The horse rapidly deteriorates, and in some places cannot be kept alive at all. The sheep change in other respects than their wool; the very dogs, which we should expect to bear the change at least as well as their masters, alter under the baleful climate. "In process of time," writes Bosman, "our dogs alter strangely here; their ears grow long and stiff like those of foxes, to which colour they also incline, so that in three or four years they degenerate into very ugly creatures; and in three or four broods their barking turns into a howl." As to plants Mr. Reade says, "It is only on the borders of malarious Africa, that is to say, in Angola and Senegambia, that most foreign plants and vegetables can be made to live; and these, as Mr. Gabriel of Loanda informed me, completely changed their nature when planted in the African soil."†

But although I mention these instances, it is not on them that I rely for an answer to the

* Lyell's "Elements of Geology." Sixth edition, 1865, p. 41. † Reade, Winwood, "Savage Africa," 1863, p. 519.

objection. It is the absence of a sufficient number of individuals, and for a sufficiently long time to allow the experiment to be fairly tried.

My hypothesis seems also to furnish a satisfactory explanation of a phenomenon which has puzzled naturalists to account for. Professor Owen refers to a special law of nature the remarkable fact that, "with extinct, as with existing mammalia, particular forms were assigned to particular provinces, and that the same forms were restricted to the same provinces at a former geological period as at the present day."* Dr. Knox (whose ability at least, if not his judgment, commanded respect) held similar views still more strongly. He maintained that so specially were the inhabitants of every country adapted to that place, that they would thrive there and nowhere else; and he adduced the inhabitants of the United States, and more especially the New Englanders (they being the portion of them longest exposed to the influence of physical conditions different from those of the countries whence their progenitors came), as an instance to show the effect of a change of country or physical condition, however trifling that might be.† I have applied the illustration to a different purpose; but the use he made of it was to point to the assumed shortness of their lives, the alleged earlier maturity and more speedy loss of beauty in their women, the rapid decay of their teeth, their restless and unsettled habits, and any other similar peculiarities in which he thought they contrasted unfavourably with the English and German people from whom they sprang, as evidence of deterioration, and insisted that, but for the constant supply of fresh blood from the original stock, they would have been much worse, if not wholly extinct. How he reconciled these fancied ideas of decadence with the general acuteness of the American intellect, and what I may almost admit to be their national supremacy, in ingenuity and constructive faculty; or how he would have explained away the brilliant courage, chivalrous feeling, and heroic endurance, of which so many bright examples have been lavishly given on both sides during the late unhappy war, is no business of mine. I do not adopt the Doctor's views. I believe in change, but not in deterioration. If progress is to be imported into the question, then amelioration, not deterioration, must be the rule. He, however, maintained that the progress was retrograde, that similar symptoms were already showing themselves in the Australian colonies; and that so marked was the deterioration in the sheep and cattle, that it was only by the unceasing importation of the best stock from this country that the quality of their flocks and herds was maintained.† This was the dream or fancy of a clever but eccentric man, not perhaps too scrupulous as to the authenticity of his facts; but Professor Owen's unknown law, at least, is the deliberate opinion of a sober-minded thinker.

Sir Charles Lyell, in like manner, thus acknowledges the difficulty, "Dr. Bachman pointed out to me ten genera of birds and ten of quadrupeds, all peculiar to North America, but each represented on the opposite side of the Rocky Mountains by distinct species. The theory of specific centres, or the doctrine that each species of bird and quadruped originated in one spot only, may explain in a satisfactory manner one part of this phenomenon; for we may assume that a lofty chain of mountains opposed a powerful barrier to migration, and that the mountains were more ancient than the introduction of these particular quadrupeds and birds into the planet. *But the limitation of peculiar generic types to certain geographical areas now observed in so many parts of the globe points to some other and higher law governing the creation of species itself, which in the present state of science is inscrutable to us, and may perhaps remain a mystery for ever.*"‡

* Owen, "Report on the Extinct Mammals of Australia," 1844, and "Palæontology," 1858, p. 397.

† Knox on the Races of Man, 1862, p. 71 and 73.

‡ Lyell's "Second Visit to the United States," vol. i. 364, 1850.

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Agassiz, again, says, "Nothing can be more striking to the observer than the fact that animals, though endowed with the power of locomotion, remain within fixed bounds in their geographical distribution, although an unbounded field for migration is open to them in all directions over land, through the air, and through the waters. And no stronger argument can be introduced to show that living beings are endowed with their power of locomotion to keep within general boundaries rather than to spread extensively."* We know well enough what he means by this paradox; although, if we were inclined to be critical, we might call it rather a Hibernian definition of the purposes of the organs of locomotion, to say that limbs are given us to enable us to stay at home.

None of these authors can mean that there is any special attraction for the fauna in the *solum* of the province. The history of the glacial epoch furnishes us with a thousand instances to the contrary. As the cold retired from the Equator, the glacial inhabitants (produced, as I believe, under its influence) followed in its footsteps. The law they speak of must apply not to the place but to its conditions.

The hypothesis which I offer seems to meet all the requirements of the case. Under it, the provinces are preserved special, not by any mysterious στοργη, or peculiar law which prevents their inmates from using their limbs for going abroad, but simply, in the first place, by the *inertia*, or instinctive regard for personal ease, which leads every creature to remain where it is while it is comfortable, and so not to pass beyond the bounds for which it was originally fitted and best adapted, into others less suited for it. And, in the next place, when by geological changes, insufficiency of food for growing numbers, or other extraneous causes, it is reluctantly driven out or compelled to pass beyond its natural province, the province is still preserved special either by the death of those which have gone beyond it, or by their transformation (in consequence of their having passed under new conditions of life,) into something else—into a new phase of their old form—in a word, into new species, more or less distant from the original type according to the character of the new conditions.

This hypothesis also accords sufficiently well with what we know of the history of species during past geological epochs. If the common belief be well founded that our globe at one stage of its existence was a ball of incandescent matter, which for long went on gradually cooling, it must follow that the more such internal heat made itself felt at the surface, the more uniform the temperature and climate in every country on the face of the earth must have been, and the less the amount of variation in the conditions of life upon it.

As the internal heat diminished, the more would the surface become liable to the extraneous influence of heat from the sun, or to unequal degrees of radiation from land and sea; and as their proportions and arrangement varied, the greater would be the variety of the conditions of life upon the surface of the globe and the more frequently would changes in them take place. Now the theoretical result of such a state of things upon the production of species according to the laws which my hypothesis presupposes, would be, that during the earlier periods of the history of the globe, the number and variety of forms of life would be more uniform and fewer in number, and during the later periods when the amount of internal heat was diminishing, the forms of life would be more varied and numerous. The formation of new species being, according to my theory, dependent upon the old ones encountering a new condition of life, where there was only

* Agassiz, op. cit. p. 13.

one condition of life, there could be no change of species. Of course such an absolute uniformity of heat could not exist; a pot, although boiling, has not in every point the same degree of heat, therefore different degrees of temperature, in other words, different physical conditions which might give rise to new species, must at all times have existed on our planet; but, as in the parallel of the boiling pot, they would not be great (so might often be ineffective), and would not be permanently fixed for any time upon one spot, so that although new species might occasionally be developed, special provinces, or fauna, could not exist, or at least could only do so when the internal heat had been so far reduced as to allow external influences to bestow a more or less permanent character upon particular spots. The greatest change of all, however, must have occurred at the glacial epoch, when probably for the first time in the history of the globe organic life made acquaintance with frost and snow. Then, if there is any truth in my theory, a universal change must have taken place in everything that was exposed to that cold; that is, in fact, in everything beyond the tropics.

Now, in relation to this latter point, we find that in none of the strata of a date anterior to the glacial cold are the remains of any boreal animal to be found. Every creature adopted for life in a cold country appears to have been developed, subsequent to that epoch. For example, the mice and the voles are two nearly allied creatures, the former of which is adapted to mild countries, the latter to cold. No mice or rats are found in the arctic circle, but voles abound; no voles occur in the tropics or warmer temperate regions, but mice are abundant. So the fossil remains of mice are found in the tertiary as well as the recent deposits, but none of any vole until the diluvium deposited subsequent to the commencement of the glacial epoch. The same is to be observed of all boreal animals that I know of, and I believe the rule is universal. I apprehend that the change which took place in the northern hemisphere at the glacial epoch was absolute: nothing that remained to abide the influence of the cold could escape alteration. Whatever escaped change did so by taking to flight to the south, and carrying its climate and conditions of life with it. I shall have to discuss these points more at large and in detail hereafter. It is sufficient here to indicate the support that they seem to give to my hypothesis of the origin of species.

The facts relating to the appearance of species in the earlier geological formations seem to accord not less exactly with the requirements of this hypothesis. Geologists inform us that in the earlier periods of the world's history the changes of life in the sea (and there appears no reason to suppose that a different law should regulate life in the sea from life on the land) were accomplished at a rate much less rapid than that which prevailed in later times. The premises from which they derive these inferences are no doubt imperfect. They do so by comparing the depth of sedimentary rocks in which indications of life have been found, in the palæozoic, the mesozoic, and the cænozoic periods.† They assume the amount of changes of life on the whole to be equal in each of these periods,—an assumption which is, perhaps, not warranted,—and having done so, find, according to Prof. Phillips, the rate of progressive change to be $\frac{1}{7\,9}$ for palæozoic, $\frac{1}{1\,8}$ for mesozoic, and $\frac{1}{3}$ for cænozoic *time*.‡

If the proportion thus given by Professor Phillips for cænozoic and palæozoic time be anything like correct, or $\frac{1}{3}$ to $\frac{1}{7\,9}$, we have, I submit, a strong confirmation of the truth of the

* See Geological Diagram.

‡ Professor PHILLIPS, in "Quarterly Journ Geol. Soc.," vol. xvi. part 2, p. l. (May, 1860.)

general principles of my theory. As to the uniformity of fauna in ancient times, every one knows how complete that was. The same fossils in the older rocks indicate with perfect certainty each formation in whatever quarter of the globe it may be; and the great breaks or commencement of a new phase of life at the end of the palæozoic and mesozoic epochs may be due to some cosmical change having taken place, affecting the conditions of life over the whole globe, at these dates.

Dr. Babbage's machine furnishes an illustration of the mode in which Nature's action may perhaps be regulated in thus developing species. Dr. Babbage, as all the world knows, has invented a calculating and an analytical machine. The first is merely a machine for arithmetical calculation, the latter is a contrivance of a much higher and more difficult character. It not only does the arithmetical calculations, but changes the formulæ where it is necessary to do so in order to work out the result, and goes through the operation of equation. This machine can put upon paper a series of terms or arithmetical numbers of any kind whatever, following any desired law. If, for example, an order is given to it to make the series of the natural numbers, 1 2 3 4, &c., and this order *alone* is given, it will go on producing the series of natural numbers, without variation, until the machine is worn out, or the motive power ceases. The parallel to this in our subject would be a law in nature providing for the continuance of species by generation, but providing for no development of any new form.

But at the original setting of the machine an order might have been given to it to violate the above law, and at some term millions upon millions of times distant, to substitute a different number following some other law, and this new law might have been directed to be observed for one turn of the machine, or for any number of turns, and then that the original law should be restored for the future. This would not exactly be the parallel to the law ordaining the development of new species on the occurrence of any change in condition. It is only a parallel to one producing a new form or species at some certain time, and that time, fixed and independent of the occurrence or concurrence of circumstances. The parallel, to be complete, would require that the new law should not take place at a fixed predetermined time, but be dependent on circumstances, or a circumstance (as, for example, the occurrence in plants or animals of some change, in the physical condition of themselves or their place of abode.)

Not being quite satisfied, therefore, with the parallel so far as I could work it out from the account of Dr. Babbage's machine given in any books about it to which I had access, I had recourse to the Doctor himself—to whom I owe many acknowledgments for his kindness and patience with my dullness—and asked him the question whether he could so set the machine that it should go on producing a series of numbers until a certain concurrence of circumstances should take place, the time when such concurrence would or could take place not being known to him, and that then, and not until then, the alteration on the law should take place. The Doctor thought for a moment and then replied, "Certainly I can. I can give the machine an order to go on producing a series of numbers until the last, and the third last, and the fifth last, or any other combination, shall all be the same figure, or shall be some combination of figures—all threes, for example, or all fives, or two fours and one five, and then the new law shall come into operation. I cannot tell, when that may happen, and do not know whether it may ever happen, but whenever it does happen, be it soon or be it late, the new law will immediately come into operation." That is the parallel to our case, and I use it for the purpose of making more plain to the reader the form in which the subject of which I have been speaking presents itself to my mind.

The adaptation of species to the conditions in which they are to pass their lives, as of tree kangaroos to a life in trees, or blind animals to a life in darkness, is, I think, a phenomenon of a different nature, and regulated by other laws, the working or nature of which does not come within the scope of this inquiry. I offer no opinion here upon that subject. Only of one thing I may say, I *feel* as sure as I can be of anything which I do not know, and that is, that it is not by the process supposed by Mr. Darwin, viz., by Nature trying an infinity of experiments and rejecting them all until she hit upon the right one. Nature never makes chips. When the occasion for a tree kangaroo arose, we may be sure that the tree kangaroo appeared perfect at the first attempt. There was no failure of myriads of forms of kangaroos in other directions created or developed but to die, until by chance one in this direction appeared. *That I feel*, but I cannot prove it; it is only my feeling, and therefore of no use to any one but myself.

Of course, in adopting the view which I have above explained, I abandon, to a certain extent, the theory of specific centres of creation; and I adopt, to a like extent, the theory of a multiple origin of species. But neither unconditionally. I abandon the idea of specific centres of creation only so far as that implies that the original centre was confined to one or two single progenitors. My centre is the whole species;—from the region where it received the impress of its character, it may spread in all directions, continuing unchanged wherever it feels no important change in its conditions of life; becoming changed into another species or variety when a change on them makes itself felt. In like manner my multiple origin of species is not that of Agassiz, who imagined the same species to be produced separately and independently of each other in many different places without communication, as, for example, the same species of fish to be produced in three different rivers between which there were no means of communication.*

* I hope that I have correctly interpreted Agassiz's views; I have taken them from the following quotation from his paper on the subject in the "Edinburgh New Philosophical Journal:"

"Let us compare the different species which occur in the Danube, in the Rhine, and the Rhone, three hydrographic basins entirely unconnected with each other throughout their whole extent. They spring from the same mountain chain, as we may take the Inn as the source of the Danube. These three great rivers take their rise within a few miles of each other. Nevertheless, most of their fishes differ; but there are some which are common to the three. * * * If these animals had not originated in these rivers separately, why should not such closely-allied species—some of which occur in the three basins—have all spread equally into them; and if they originated in the separate basins, we have, within close limits, a multiple origin of the same species; and that this multiple origin must be admitted as a fact, is shown by the following further evidence. Among the carps we find, for instance, BARBUS, GOBIO, CARPIO, common to the three; but the Danube has three Gobios, whilst the others have but one—one of the Danube being identical with the one of the other two rivers. The most striking fact, however, occurs in the genus LEUCISCUS. L. DOBULA is common to the three; but in addition to it the Danube has second species, which occur neither in the Danube nor in the Rhine; and in the Rhine there are species which belong neither to the Rhone nor to the Danube. Now we ask, could all these species of LEUCISCUS have been created in one of the basins in the Danube, for instance, and have migrated in such a way that a certain number of the species should remain solely in the Danube, while some others left the Danube altogether to settle finally only in the Rhone, and others to settle only in the Rhine; that one accompanying those species peculiar to the Rhone remained in the Danube with those species peculiar to it, and settled also in the Rhine with those species peculiar to that river; and also in the Rhine, with the species peculiar to the Rhine. And whether we assume the Rhone as the primitive centre, instead of the Danube or the Rhine, the argument holds equally good. We have one species common to the three rivers, and several species peculiar to each which could never have migrated (if migration took place) in such a manner as to assume this present combination. But if, on the contrary, we suppose that all the species originated in the rivers where they occur, then we have again a multiple origin of that species which is common to the three, for it were wonderful if that one alone had migrated when they were all so closely allied."—AGASSIZ, in "Edin. New Phil. Journ." vol. xlix. p. 12.

To my multiple origin, communication and direct derivation is essential. The species is compounded of many influences brought together through many individuals, and distilled by Nature into one species; and, being once established, it may roam and spread wherever it finds the conditions of life not materially different from those of its original centre.

I may add that I do not imagine that time has anything to do with the change or creation of species, further than as it gives greater opportunity for the occurrence of change. Species may vibrate backwards and forwards between two differently situated districts in the same country, and at each vibration give off new forms, while the portion of the old which have not moved still subsist, and the longer time there is for this to go on of course the greater number of species will the country contain. It is thus not solely because Africa is a tropical, and in many parts a productive land, that the number of its species is great, nor is the paucity of species in Siberia wholly due to the ungenial nature of its soil and climate. The one owes its preponderance over the other also partly to the comparatively long period which has elapsed since it became dry land, and the other its deficiency partly to the short time which has elapsed since it emerged from below the waters.

For practical purposes, however, my opinion regarding the origin of species merely requires the coincident pre-existence in time and place of some other species from which it may have been derived; it may have been derived, as I suppose, through the effect of change letting loose an innate power of variation, or, as Mr. Darwin supposes, by selection. It may have been by descent from one individual in whom the change has been effected, or, as I now believe, by the impress of change being extended over all the individuals similarly situated. I am not greatly concerned to explain the exact mode of operation of the laws evolving new species. What I cannot do without, however, is the assumption that there is some law having such effect, and that descent is the only possible explanation of relationship and distribution.

CHAPTER II.

PRELIMINARY INQUIRIES, *continued*—MODES OF DISPERSAL OF SPECIES.

The mode in which, and the extent to which, species become dispersed, is another point which must be settled at starting. The principal question on which a difference of opinion exists is the value to be attached to accidental or occasional dispersal as a means of distribution. Taking for example the case of Oceanic Islands, there are two ways in which their faunas and floras may be accounted for. One—that advocated by the late Professor Edward Forbes—by supposing that at some period, more or less distant, the islands had been united to the nearest land, to whose faunas and floras their own was most akin. The other, which is that adopted by Mr. Darwin for most of the cases which occur, that they had been colonized by chance visitants, or what may be called the *flotsam* and *jetsam* of the ocean.

For the purpose of testing the feasibility of his hypothesis, Mr. Darwin tried many ingenious experiments as to the length of time for which seeds can float in the sea without losing their vitality. He reckoned how fast currents carry them on their way. He also showed the many different means by which they may be transported—as in earth about the roots of drift timber, or adhering to the beaks or claws of birds, by icebergs, and by means even of fresh-water fish swallowing seeds, and then being themselves swallowed by birds of prey. Edmund Burke objected to the instances of some of his political opponents, that "their examples for common cases were all taken from the exceptions of most urgent necessity." The same objection applies to Mr. Darwin's illustrations. It is not to be denied that they are all possible, but they are also all of an exceptional nature, and some of them very improbable, as, for example, the transport of seeds by means of icebergs, or by birds of prey swallowing the stomachs of vegetable-feeding fish. Where the icebergs leave their parent glacier there are few seeds of any kind, and fewer still that would suit the climate of milder regions. As to the birds of prey, their digestion is so notoriously rapid, that unless the bird set off express immediately after its meal, and the islands were not far off, there would be small chance of anything it had swallowed ever reaching their shores. The reader will remember numerous other instances of the actual diffusion of plants and animals in a similar way given by Sir C. Lyell;* and Mr. Darwin, while he adds a few others, has no doubt a multitude more in his armoury. Notwithstanding this, I can come to no other conclusion than that colonization or occasional dispersal is insufficient to account for the character of the faunas and floras of Oceanic Islands; and I believe that the normal mode in which islands have been peopled, has been by direct continuity with the land at some former period, or by contiguity so close as to be equivalent to junction; and that the exceptions to this, such as St. Helena, have been excessively rare. That a slight intermixture due to Mr. Darwin's

* Lyell, "Principles of Geology." 1st Edition. Vol. II. p. 16, and seq. 1832.

colonization occurs in many (probably in all) I am ready to admit; and from instances to be afterwards noticed, I am disposed to reckon the proportions of such intermixtures in the flora, in the most favourable circumstances, at not more than two per cent. In the fauna I think it must be much less.

As the question is a most important one in relation to geographical distribution, and Mr. Darwin's view strikes at the root of a great portion of the propositions which I shall have to submit to the reader in this work, I must consider his arguments in some detail.

"Edward Forbes (says he) insisted that all the islands in the Atlantic must recently have been connected with Europe or Africa, and Europe likewise with America. Other authors have thus hypothetically bridged over every ocean, and have united almost every island to some mainland. If, indeed, the arguments used by Forbes are to be trusted, it must be admitted that scarcely a single island exists which has not recently been united to some continent. This view cuts the Gordian knot of the dispersal of the same species to the most distant points, and removes many a difficulty. But to the best of my judgment we are not authorized in admitting such enormous geographical changes within the period of existing species. It seems to me that we have abundant evidence of great oscillations of level in our continents, but not of such vast changes in their position and extension as to have united them within the recent period to each other, and to the several intervening Oceanic Islands. I freely admit the former existence of many islands now buried beneath the sea, which may have served as halting-places for plants, and for many animals during their migration. In the coral-producing oceans such sunken islands are now marked by rings of coral or atolls standing over them. Whenever it is fully admitted, as I believe it will some day be, that each species has proceeded from a single birth-place, and when, in the course of time, we know something definite about the means of distribution, we shall be enabled to speculate with security on the former extension of the land. But I do not believe that it will ever be proved that within the recent period continents which are now quite separate have been continuously, or almost continuously, united with each other, and with the many existing Oceanic Islands. Several facts in distribution—such as the great difference in the marine Faunas on the opposite side of almost every continent—the close relation of the tertiary inhabitants of several lands, and even seas, to their present inhabitants—a certain degree of relation (as we shall hereafter see) between the distribution of mammals and the depth of the sea—these, and other such facts, seem to me opposed to the admission of such prodigious geological revolutions within the recent period as are necessitated on the view advanced by Forbes, and admitted by his many followers. The nature and relative proportions of the inhabitants of Oceanic Islands likewise seem to me opposed to the belief of their former continuity with continents." And in another place he thus sums up: "All the foregoing remarks on the inhabitants of Oceanic Islands—namely, the scarcity of kinds,—the richness in endemic forms in particular classes, or sections of classes,—the absence of whole groups, as of batrachians and of terrestrial mammals, notwithstanding the presence of aerial bats,—the singular proportions of certain orders of plants, herbaceous forms having been developed into trees, &c.—seem to me to accord better with the view of occasional means of transport having been largely efficient in the long course of time, than with the view of all our Oceanic Islands having been formerly connected by continuous land with the nearest continent: for, on this latter view, the migration would probably have been more complete: and if modification be admitted, all the forms of life would have been more equally modified, in accordance with the paramount importance of the relation of organism to organism."*

* Darwin, op. cit. p. 427.

One of the great delights in dealing with Mr. Darwin is the perfect fairness with which he states every point connected with his case. The unconscious bias, from which few men escape, seems to be wanting in his constitution. He always tells the facts which make against him as fully and fairly as those which are in his favour. And while we may feel unable at the moment to make head against the current of ingenious suggestions, illustrations, and possibilities, with which he hurries us along, he always gives us the real facts to anchor by, so that we can, when we think proper, pull up and form our own judgment. Now, on this topic he has given us some remarkable instances opposed to his hypothesis. He mentions various islands only separated from others or the mainland by a narrow channel where the species are wholly different. He refers to the Straits of Macassar as separating two widely distinct Mammalian Faunas. Such a separation was first suggested by Müller, and is laid down on his authority in Berghaus' "Physical Atlas."* He (Müller) ran the line of division up the east side of Celebes, whereas Mr. Earl and Mr. Wallace (more particularly the latter) have since shown that it lies to the west of that island; and instead of cutting the Island of Timor in two, as was supposed by Müller to be the case, passes up the narrow straits (only a few miles wide), between the islands of Bali and Lombock. Mr. Wallace also notices that "Java possesses numerous birds which never pass over to Sumatra, though they are separated by a strait only fifteen miles wide, and with islands in mid-channel."† Of course this can only apply to non-migratorial birds, and I have already suggested a cause why even birds may often be kept within the limits of their original bounds. If they go beyond them in small numbers they die off. If they go and increase in numbers, the new conditions of life affect their constitution, set in action the principle of change, and they become transformed into new species. Again, Mr. Darwin says, in speaking of the Galapagos Archipelago, "The really surprising fact in this case, and in a lesser degree in some analogous instances, is that the new species formed in the separate islands have not quickly spread to the other islands. But the islands, though in sight of each other, are separated by deep arms of the sea, in most cases wider than the British Channel; and there is no reason to suppose that they have at any former period been continuously united‡ . . . Many even of the birds, though so well adapted for flying from island to island, are distinct."

At the Hawaian Islands each separate island has, in a general way, its own set of land shells.‖ At the Sandwich Islands the same thing occurs,§ and even the fishes of different islands are said by Agassiz to be distinct from each other.¶ Other instances might be given of islands which are favourably situated for receiving immigrants, being inhabited by plants and animals different from those of the neighbouring coasts, although still bearing the far-off impress of a common origin.

But no stronger instance of the power of a small barrier in retaining species could be cited than that of the straits between the Continent and our own island. The faunas and floras both of

* Berghaus, "Physikalischen Atlas." 1845.

† Wallace, on "The Physical Geography of the Malay Archipelago," in Proceedings of Royal Geographical Society, June, 1863. (Separate copy, p. 12.)

‡ The character and the species of the different islands would lead me to a different conclusion. The American type of the whole group speaks primarily of connexion with the continent. The family facies of the group *inter se*, speaks of a period when the whole islands were separated from America, but united to each other. The endemic peculiarity of the species of each individual island tells of subsequent separation and change wrought in each probably at the same time, by the alteration of climate from continental or terrestrial, to isolated and oceanic.

§ Dr. Pickering, in "Proceedings of American Academy of Arts and Sciences," vol. iv. p. 193. 1860.

‖ Dr. A. A. Gould, in "Proceed. Amer. Acad. Arts and Sciences," vol. iv. p. 195. 1860.

¶ Prof. Agassiz, in "Proceed. Amer. Acad. Arts and Sciences," vol. iv. p. 195. 1860.

it and of the neighbouring continent have been now for a considerable time minutely known; and although all the species in Britain are also found on the Continent, there are many species in the latter which are not found in Britain. The length of time for which authentic data have existed is no doubt but a brief moment compared to the lapse of ages which Mr. Darwin requires for his colonization; but the thousand facilities for introduction which are daily furnished by the constant intercourse between England and the Continent may be allowed in some respect to compensate for the briefness of our chronicle, and we may fairly argue from what has taken place during that time as if it represented a much longer period. And what does it show? Putting aside the introduction of plants brought by commerce or in ballast, and *which almost invariably disappear in the course of a few years*, how few colonists can Britain claim from the Continent during the past century. More than that, the difficulty which a colony (much more a single colonist) must encounter in establishing itself on a foreign shore may be estimated from the fact that any attempts which have been made to introduce and naturalize species from the other side of the Channel, have always failed. The difficulty which we experience whenever we attempt to transport animals from more distant lands into other countries, even if we secure for them as nearly as can be the same conditions as those in which they used to live, is another instance of the same kind. The same thing may be observed everywhere. Sir Charles Lyell says of America, "Many European plants are making their way here, such as the wild camomile and the thorn apple (*Datura Stramonium*); and it is a curious fact, which I afterwards learned from Dr. Dale Owen, that when such foreigners are first naturalised they overrun the country with amazing rapidity and are quite a nuisance. But they soon grow scarce, and after eight or ten years can hardly be met with."* The overrunning phase seems to be the stage to which New Zealand has arrived at the present time; an immense irruption of European weeds has been made in these islands, and it will doubtless disappear there in a few years, as has been the case in America.

But much less important obstacles than straits or passages of the sea act as effectual barriers against distribution. Rivers also sometimes form effective barriers, although I believe that in most instances where they so act the phenomenon has been originally occasioned by a former different arrangement of land and sea, and the obstacle then occasioned by a strait or sea been kept up by the river now flowing in their course. This I believe to be the case with the Amazon and Orinoko, which furnish many instances in point; for example, Mr. Wallace mentions that "on the north side of the Amazon, and east of the Rio Negro, are found the following three species of monkeys:—Ateles paniscus, Brachyurus Satanas, and Jacchus bicolor. These are all found close up to the margins of the Rio Negro and Amazon, but never on the opposite banks of either river."

Again, a species of Pithecia is found on the west side of the Rio Negro for several hundred miles from its mouth up to the River Curicuriari, but never on the east side; neither is it known on the south side of the Upper Amazon, where it is replaced by an allied species, the P. irrorata (P. hirsuta *Spix.*), which, though abundant there, is never found on the north bank. He mentions, also, that on the south side of the Lower Amazon, in the neighbourhood of Para, are found two monkeys, Mycetes Beelzebub and Jacchus tamarin, which do not pass the river to the north.

Mr. Bates bears similar testimony. He informs me that it is the universal and spontaneous

* Lyell's "Second Visit to the United States," ii. 270, 1850.

statement of native hunters, that the river does limit ranges, and out of many other instances gives the case of two remarkable species of monkey, BRACHYURUS CALVUS and B. RUBICUNDUS, which are found abundantly in Ygapô Forest, north of the Upper Amazons west of Japurá, and although there are hundreds of miles of the same sort of forest on the south bank, no instance is known of either of these monkeys having been seen there.

Mr. Darwin mentions that the Bizcacha has never been seen to the eastward of the River Uruguay. "Yet in this province there are plains which appear admirably adapted to its habits. The Uruguay has formed an insuperable obstacle to its migration, although the broad barrier of the Parana has been passed, and the Bizcacha is common in Entre Rios, the province between these great rivers."*

Even birds are subject to the same law, although it cannot be expected that rivers should often limit their ranges. Mr. Wallace mentions several instances, some of which, as the birds are of a kind whose flight is short, are not so remarkable, but others are not open to that objection; for example,—

"The fine blue Macaw (MACROCERCUS MAXIMILIANUS) inhabits the borders of the hilly country south of the Amazon, from the sea-coast probably up to the Madera. Below Santarem it is sometimes found close up to the banks of the Amazon, but is said never to cross that river. Its head-quarters are the upper waters of the Tocantins Xingu and Tapagoz rivers.

"Another instance of a bird not crossing the Amazon is the beautiful Curl-crested Aracari (PTEROGLOSSUS BEAUHARNASII), which is found on the south side of the Upper Amazon, opposite the Rio Negro, and at Coari and Ega, but has never been seen on the north side. The green Jacamar of Guiana, also (GALBULA VIRIDIS), occurs all along the north bank of the Amazon, but is not found on the south, where it is replaced by the G. CYANOCOLLIS and G. MACULICAUDA, both of which occur in the neighbourhood of Para." †

Other facts to the same effect are mentioned by Mr. Wallace and Mr. Bates regarding insects and the lower animals. Similar instances can be given from the Niger, the Lena, and other great rivers. But enough has been said to show that the fact is not exceptional.

These are cases showing that under the most favourable and inviting circumstances, colonization, immigration, or occasional visitation, has not taken place. If it has failed in these, with what logic can we be asked to admit its being the rule under less favoured circumstances?

In like manner mountains, deserts, woods, and plains, all act as barriers of separation or bridges of communication, according as they are fitted or not for the occupancy of the animal.

On the other hand, where the sea between neighbouring lands is bridged over in winter by ice, it often, although not always, ceases to be a barrier. In Captain M'Clintock's journal, various incidental notices occur, showing that a general migration of the polar animals over the ice takes place on the breaking up of winter.‡

* DARWIN, "Journal of Researches." Second edition, 1845, p. 124.

† WALLACE, ALFRED, "Narrative of Travels on the Amazon and Rio Negro." London, 1853.

‡ The following are examples of this. "April 21st, temperature 8°. Whilst crossing a bay, and about a mile off the land, we passed four separate tracks of lemmings, travelling in for the land. If these little creatures are migrating across the ice, there would seem to be some land in the north-east or east. May 9th.—Delightful weather; tufts of moss and the tops of stones are gradually peeping up through the snow, and animals begin to appear. I picked up two caterpillars to-day. Fox-tracks are very numerous; the majority of these tracks are crossing to the north-westward, probably following the ptarmigan. Lemmings are abundant, and these wonderful little creatures, which constitute the chief support of foxes, ravens, wolves, owls, and

Still on the whole, I agree with those who think that the effect of barriers in preventing the spread of species has been undervalued, and that a much slighter obstacle than is generally supposed to be necessary, is sufficient to preserve neighbouring faunas from intermixture.

The above are negative arguments against the peopling of oceanic islands by occasional visitants. The reasons in favour of this having been effected through former continuity of land are more positive. One of these is the nature of the affinity which can be traced between the inhabitants of such islands and of the main coast. It is not a near affinity, but faint and far off; and this is just what we should expect. If the island were formerly united to the mainland, it must have started with the same inhabitants as it, and under the influence of the change which must have occurred in the conditions or climate of both or either through isolation, they must have gradually diverged from each other by the successive development of new species. Their affinity is still indisputable, although it has gradually become distant, and in the case of the island (which has had its opportunities of communication with the outer world very much restricted) peculiar and endemic, while the mainland, not so restricted, is more expanded in its character. If, on the other hand, the island had derived its inhabitants from colonization, they must necessarily be more recent than the separation, and the immigration must have gone on continuously through all succeeding times, so that instead of our finding a homogeneous endemic fauna and flora, we should have contributions of all dates, and from various countries; for it is to be remembered that currents and winds may, nay must, have sometimes changed, in consequence of alterations on the relative distribution of land and water, in the course of uncounted ages; and instead of having everything from the nearest land we might have a morsel from one country and a morsel from another, as we certainly should have fragments of all ages down to the most recent—a state of matters essentially inconsistent both with the reality, and with what is understood by the term endemic.

The richness of oceanic islands in endemic forms, therefore, seems a strong argument in favour of Forbes' view and against Mr. Darwin's. It seems to be as necessary a result of isolation, as restricted and confined (what may be called endemic) views used to be of the country life of the untravelled Thane. When Mr. Darwin says, that had the forms of life been derived as supposed by Forbes, they would all "have been more equally modified in accordance with the paramount importance of the relation of organism to organism," I am not sure that I understand him. He cannot mean that some paramount influence modifies the development of new species and forms into certain relations with each other? for that would be nearly equivalent to the old theory of the forms of life being dependent on the physical conditions under which they are produced—a theory which is repugnant to the whole spirit of Mr. Darwin's hypothesis; and is repudiated by himself as "a deeply-seated error." It may be so. Still I have a strong suspicion that we are in the infancy of our knowledge of physical conditions, and how they operate.* The whole length which I have yet gone in ascribing effect to physical condition is to attribute some influence to the mere fact of exposure to a change in condition. It stimulates or sets a

even every species of gull, are as active tourists as the larger animals, crossing these wide straits in all directions." —*See Captain M'Clintock's Diary in Proc. Dublin Nat. Hist. Univ. Assoc. in Nat. Hist. Rev.* April, 1856, p. 40.

* If the reader will refer to his own sensations, I think he will admit that, although these conditions are very subtle, they are also very powerful. It is to them, not less than to the abundant exercise and unloaded mind, that he owes the draughts of health which he drinks in when striding over our Highland muirs, or pacing along our salt sea beaches. The "change of air," constantly recommended by physicians, is nothing but a change of physical condition: and shall we be told that this has no influence on the animal frame?

working the organic impulses which produce organic changes. It is, I imagine, analogous to the physiological phenomena which occur in our own bodies in health and sickness, especially as seen in the weak and aged. So long as we go on in our regular daily course of life, we enjoy our usual health. Some trifle occurs to disturb this regularity. We say we are upset by it. We are jolted off the rail; the doctor tries to get us back into the old track, but the impulse of change has been set a going, and the system instead of returning into its old groove sets off in a different direction, *vires acquirit eundo*, and when he asks for us to-morrow we are grave men. It may be that particular conditions produce particular effects, as darkness, absence of eyes; but the subject is one on which we are in darkness and unable to see. No matter what the nature of the physical condition may be, if Dr. Forschammer is correct in allotting distinct physical properties to sixteen different regions of the ocean, it is not improbable that material differences may exist without our being able to detect them.

Mr. Darwin relies on other facts characteristic of oceanic islands, more especially of those which have subsided. These facts all fall under the same category, and involve the same principle. They are: —The nature and relative proportion of inhabitants in oceanic islands; the existence of some families to the exclusion of others (bats to the exclusion of batrachians and terrestrial mammals, &c.); the scarcity of kinds of animals generally; and the preponderance of arboreal over herbaceous forms of plants.*

Now, if we think for a moment of the course of events which must necessarily have taken place on the subsidence of the land of which these islands formed part, there seems nothing in the above facts to justify the idea of colonization, or inconsistent with that of former continuity. The reader will find the probable course of events following upon subsidence speculated on a little more in detail in a subsequent chapter on the Distribution of Man. Here it will be sufficient to say, that as the land became submerged, such animals as existed would for the most part be drowned or starved, unless where they betook themselves to the highest peaks, which remained longest above the waves. If man or carnivorous animals were amongst them, their extinction would only be the more rapid. If none but herbivorous animals took refuge there, the food would be insufficient for numbers, and they would drop off by inanition. It seems also very doubtful whether the peaks which we now see in the centre of the atolls, were in existence when the spot on which they stand was first submerged. They are all of volcanic origin, and may have arisen after the land was drowned. The coral atolls may have originally started from slight elevations on the surface of a flat continent, and man may have been able to maintain his place on these half-dry reefs, which terrestrial animals—excepting always bats and birds—could not. Under such circumstances it is obvious that it would be an inexplicable anomaly were we to find no "scarcity of animals generally." It is equally obvious that all other animals which could neither fly nor swim must be absent. And, as is remarked by Mr. Darwin himself, batrachia must follow in the same category, for they cannot live or propagate in salt water. Therefore their fate would be as much sealed as that of any other class of animals. Mr. Darwin claims the bats as specially supporting his view. He says, "No terrestrial mammal can be transported across a wide space of sea, but bats can fly across." But they at least are the mammals most fitted for preserving their lives so long as any resting-place at all remained. The presence of land-shells on these islands is acknowledged by Mr. Darwin as a special difficulty in his view of the case, as they can neither fly nor swim across a part of the ocean, and neither they nor their eggs can live in salt

* Darwin, op. cit. p. 427.

water;—according to Forbes' theory their presence offers no difficulty at all, so long as any portion of the land remained above the water.

The preponderance of arboreal over herbaceous vegetation again, is a peculiarity shared by other lands which are not oceanic—North America, Japan, Hong Kong. But I am ready to admit that the dissemination of such plants may have been to a certain extent due to accidental or occasional dispersion, in which, however, man was probably the chief agent. I do not so much dispute the fact of occasional colonization having taken place (especially among plants), as I object to the attempt to refer everything to that cause.

If I am correct in holding that the transformation of old species into new is usually (if not always) effected through the medium of large numbers of individuals, chance colonists, being of course solitary or few in number, would not undergo this change until their numbers had sufficiently multiplied. I would, therefore, infer wherever individuals belonging to the same identical species occur in different lands (always excepting polar districts and those where the physical condition is uniform), that their presence is probably due to colonization; and where the species are representative that there is a presumption that the land in which they occur must at some former period have been connected with that of the typical species.

CHAPTER III.

GEOGRAPHY OF THE GLOBE SINCE THE SECONDARY EPOCH—SUBSIDENCE IN SOUTHERN AND ELEVATION IN NORTHERN HEMISPHERE—CORAL REEFS—BANDS OF ELEVATION AND DEPRESSION.

It will save the reader as well as myself much subsequent digression if I lay before him at the outset a general view of what I conceive to have been the past geography of the globe during the successive epochs which have elapsed since mammals first appeared, or rather, were first established—in other words, since the close of the secondary epoch.

My theory, that change in the forms of organic life is the result of alteration on the physical conditions of the earth, requires that some important change on the condition of the globe should have occurred at the close of the secondary and commencement of the tertiary epoch; for at that time there was a great start given to the development of species, and new forms and new types came then into being.

What the change consisted in we do not know; but it may have been some great change in the relative proportions of land and water: a change from a world almost covered with water to one with less sea and more dry land. The fact that no remains of land-animals have been found during the cretaceous epoch, and very few of terrestrial plants, while soon afterwards they become plentiful, suggests the possibility of this having been the nature of the change.

Whatever it was, however, the fact seems certain that a great change did then occur, and, *inter alia*, that terrestrial life for the first time assumed an important place among created beings.

The first stage was the eocene epoch. Remains of this period occur in Europe, Asia, and America; also in North Africa; but none have been found in Africa south of the Sahara, nor in Australia.

Of Australia, Mr. Jukes says, "Above the palæozoic series there is an absolute gap, a total deficiency of all other stratified rocks whatsoever, so far as is at present known, except those belonging to a tertiary formation which, from the very recent aspect of its fossils and their resemblance to existing forms I believe to be a very modern one."* Some of the views entertained at the time Mr. Jukes wrote have since been modified, but it remains uncontroverted that a portion of Australia was above the sea in the secondary and eocene epochs, and has continued always above it until now.

As the characters of the early eocene flora and fauna of Europe bear great resemblance to those still existing in Australia, geologists have concluded that these two countries were formerly in some way united, and that a continuous stretch of dry land existed between them. It has been supposed that never having since been wholly submerged, Australia had preserved the general type of this eocene life down to the present day; and although Professor M'Coy has latterly taken exception to the correctness of this in its full extent, the comparative lists of plants found in the eocene deposits of Europe contrasted with those now living in Australia, given by

* Jukes, "Sketch of the Physical Structure of Australia," London, 1850, p. 89.

Professor Unger in his "New Holland in Europe,"* puts it wholly beyond dispute. He has there enumerated 173 plants discovered in the eocene beds of Europe analogous to species now living in New Holland or in the southern hemisphere. In his interesting paper on this subject, Professor Unger also points out that the representatives of a certain proportion of the eocene plants are now found in China and other parts of Asia, and the analogues of a third portion in North America. He might have added that another proportion occurs in the Indo-Malayan region, for Mr. Bowerbank has described no fewer than thirteen fruits of palms from the eocene beds in the Island of Sheppy, all of the recent type, now found only in India, and in the Moluccas and Philippine Islands.

The conclusion to which Professor Unger arrives from these premises is that Europe was not a centre of creation, but that it received the impress of the peculiarities of three continents; and he supposes that it did so by means of a land communication existing between Australia and Europe, through Asia, by way of the Moluccas, and by one from America across the Atlantic. Of course, it is part of his hypothesis that at that time the climate of all these countries was the same.

Professor Unger's explanation is open to the objection that he assumes, without the smallest warrant, that the floras of Australia, of Asia, and of America, were each of the same character in the eocene epoch as they are now. Europe is the only country with whose flora in the eocene epoch we are at all acquainted. With that of Australia we shall probably never be acquainted, because it apparently has no eocene formations. The eocene fossils hitherto found in America are extensive, but entirely marine, and consequently our knowledge of the fossil flora of that epoch there, is *nil*, and we know as little of the eocene flora of Asia.

The character, therefore, of the existing vegetation in the only country (Europe) with whose flora during the eocene epoch we are acquainted, is *different* from that which then grew in it, and therefore, so far as we can draw any conclusions from that solitary fact, they should certainly not be that the eocene flora of all the other countries was the *same* as their existing flora. There are grounds for making an exception in favour of Australia whose present flora is so largely analogous to the European eocene flora. The very extent of the analogy is in itself an argument for doing so, but there are no grounds for supposing this either for America or Asia, of whose elements only a small proportion appears in the eocene flora of Europe. The more generally adopted view accords better with facts, viz. that (whether as a consequence of the more uniform heat which then extended over the whole globe or not) organic life during the secondary and eocene epoch was more homogeneous than it became afterwards, or is now. The elements out of which the American, Asiatic, Indo-Malayan, and Australian floras have sprung, were doubtless intermingled then not only in Europe, but in America, in Asia, in the Tropics, and Australia; but since then, through the changes arising from altered conditions of life, the uniformity has been broken up, and the present distribution of species established.

There can be no doubt that land communication between Australia must then have existed, and the route suggested by Professor Unger seems as likely as any other. At the same time, it must be remembered that the present arrangement of the flora or fauna of any part of the northern hemisphere is not the slightest criterion of what it was in the eocene epoch, because the whole of the old relations of species there must have been completely overturned by the clearance of life which the glacial epoch brought about.

* Unger, Dr. F. "Neu Holland in Europa," and Translation in Seeman's "Journal of Botany," Feb. 1865, p. 39.

The progress of life during the eocene epoch seems to have experienced no sudden or material change. Mammalian life went on gradually from the Marsupials to the Palæotheroid animals, and onwards to the ruminants; and the flora passed from the Australian to the miocene, or North American type. These changes were apparently brought about by gradual mutation in the arrangement and distribution of land and water, possibly a gradual reduction in the temperature of the globe; but no violent or abrupt alteration of any kind seems to have occurred.

So far as we can trace these new modifications in the distribution of land and water, the main feature seems to have been a transference of dry land from the Southern to the Northern Hemisphere: that is, the submergence of land in the one, and its emergence in the other. Great alternations have taken place, and are constantly taking place in this respect, everywhere. What is now above water was formerly below it, and *vice versâ*, and in each hemisphere there are portions intermixed with each other, the one of which is rising and the other sinking. And we can see that both operations are carried on at the same time, and that the one is usually in compensation of the other; although both are intermingled, sometimes a general sinking with partial risings.

The most important of such submergences seems to have been the subsidence of the vast space in the South Pacific Ocean, now beaconed by the Oceanic Coral Islets which are scattered through it, both east and west of the Indian Archipelago and Australia.

It is now universally admitted that these coral islets are the relics of a submerged land which had formerly existed as a great continent; and the relations of the faunas and floras of South America to New Zealand and Australia on the one hand, and to Africa on the other, as well as some relations between South-West Australia and South Africa, almost compel us to admit that as complete a circlet of land formerly crowned the southern temperate regions as now does the northern.

The fact that these Oceanic Islets are vestiges of a great continent was first proved by Mr. Darwin. He showed that fringing reefs,—that is, reefs growing close to the land,—are an evidence that the land is either stationary or slowly rising, at least that the reefs have been formed when the land has been rising; that atolls and barrier reefs, that is, reefs not clinging to the shore, but separated from the land by a space of water, show that the land has been subsiding, or that a subsidence was taking place whilst they were formed; and from this mute evidence he was enabled to compile the map of elevation and subsidence by which I have profited. To give the evidence in support of this, would be to repeat Mr. Darwin's beautiful train of reasoning on the subject in his "Journal of a Naturalist." The scientific reader is already familiar with it, and it would be injudicious kindness to attempt to save those who are not the pleasure of reading one of the most delightful works in the English language. His argument is chiefly, if not entirely, drawn from the coral reefs in these seas, and from the fact that while they are composed of coral, standing on foundations of great, generally, unfathomable depth, they are yet constructed by animals requiring a foundation to start from and that foundation not to be at a greater depth than twenty or thirty fathoms.

The same fact carries the period of submergence back into the abyss of time, when the elevations in the other hemisphere took place, for it proves the slow rate and consequent long duration of the period during which the subsidence has been taking place. Unless the depression had been gradual, the coral architects would not have had time to build up their towers and buttresses as the land sank. No personal inspection is in our power here, but if we give the reins to our imagination and try to guess at the scene which would meet our eyes were a sudden uprising equal to the previous depression to take place we might find something like this to be the result. Such an

event would bring all the foundations of these reefs to the surface, each bearing its narrow, lofty, perpendicular-cliffed coral tower, circled with precipices such as it has not entered into the mind of man to conceive, whose height is not to be reckoned by feet, but by miles; where the light of day would scarcely penetrate to the bottom of the deep channels between those which stood near each other; and with the top of each, all on one level, like mighty shot-towers or bastilles. Each has no doubt been formed as the elevations on which they stand successively sank beneath the sea. Some, no doubt, may be founded on ordinary hills or even lofty mountains, when we should have, on a colossal scale, a curious resemblance to the round pillars or towers on hill-tops, with which it is the fashion of Englishmen in their different counties to preserve the memory of their great men.

Some indeed have thought, that the atolls and reefs might be the indications of the highest peaks of ranges of mountains. But this idea seems inconsistent with their position as well as their composition. Their general distribution indicates rather the beaconing of each elevation, small or great, as it successively sunk beneath the level of the ocean. Mr. Darwin objects to the idea on the ground that oceanic islands, where rock is found, are almost universally composed of volcanic minerals. If they had originally existed as mountain ranges on the land, some at least of the islands would have been formed like other mountain summits of granite, metamorphic schists, old fossiliferous, or other such rocks, instead of consisting of mere piles of volcanic matter.* The irregular distribution of many of the atolls and reefs, moreover, is opposed to the idea of their being parts of mountain ranges, and the long lines of others may be better reconciled with barrier reefs along the lines of coast than chains of mountains, when the subsidence began. Every little eminence a few feet high would furnish as good a foundation and starting-point for the coral architects as the serrated peaks of the loftiest mountains.

The facts proved by Mr. Darwin, however, all relate to the past. It is quite consistent with them that the subsidence which they prove may now have ceased, and that as contended for by M. de Rochas, an elevatory movement may have commenced. We know that there has been an elevatory movement subsequent to the depression, both on the shores of Africa and in India, and the Indian Archipelago. M. de Rochas maintains that no coral island can have been raised above the water by the agency to which their rise is usually ascribed, viz. by a deposit from the waves dashing over the reef, and that the only means by which they can have appeared is by an upheaval, pushing them up from below. He has inspected coral islands in various parts of the globe, and finds the surface free from the attrition and fractures which ought to result from the throwing over them of pebbles and sand by the waves; and he also finds the coral in many places where no upheaval has raised it above the surface, remaining in precisely the same position in which it was observed long ago, with no accumulation of *débris* at its surface. It does not concern us much to determine which is the true explanation. The fact of subsidences and elevations having taken place at certain places and in a certain order, is what we chiefly require to make sure of.

We have no data to determine with anything like accuracy to what extent these subsidences have taken place. We cannot even tell in some which are believed to be rising, whether they have only just begun to do so, or if they have for a long time changed from subsidence to elevation. It would seem as if nothing could be easier than to do this, because the raised cliffs of coral along the sea-shore should speak for themselves. But Mr. Darwin has shown, that in the natural course of things it is not probable that coral reefs elevated by a gradual rise of the land would often be

* Darwin's "Origin of Species," 3rd edit., p. 388.

preserved so as to prove that they ever existed. It is only so long as the coral is fresh that it is hard and impenetrable; when raised above or below the proper depth which suits the particular species, the coral polype dies, and if exposed to the air the coral rots, and if then exposed to the wash of the sea is swept away. He himself narrates his experience of the rotting of the coral, but on the other hand he also speaks of having heard of two coral islands which had been elevated thirty or forty feet above the sea and showed a face of perpendicular coral cliffs to the sea: these, however, had not been examined by any naturalist.*

If I am not mistaken, objections have been taken by some authors to the hypothesis of a submerged continent, on the ground that it might disturb the equilibrium of the earth. There is no doubt that on this point the arrangements, instead of being of a compensatory nature, are directly the reverse. A mass of material like the mountain-ranges protruded to one side further from the fulcrum (the centre of the earth) than the rest of its crust, must have a tendency to make the earth lop-sided, and a depression on the opposite side drawing the weight nearer to the fulcrum, and thereby diminishing its force, instead of being a compensatory movement, would only add to the disturbance. It is for astronomers and physicists to determine whether there is anything in the objection. I may, however, remark, that the parts where there is the greatest subsidence may not be opposed to those where there is the greatest rise: that subsidence and elevation often take place side by side, and that the whole alteration on the equilibrium even at the greatest, is probably too trifling to have any effect on such a large body as the earth.

As to the date when this continent or these continents existed, and when they became submerged, we have more than one indication which may assist us in coming to a conclusion. In the first place, it is a generally acknowledged principle that important geological revolutions are slow and deliberate, and extend over a long period of time; that the crust of the earth is not perpetually bobbing up and down; and that the oscillations which occur in every part of the globe are mere minor accidents, as it were incidental to the progress of the great movement, and not the great movement itself. They may be compared to the slightly tremulous movement of a man's hand when he heaves his food to head: the real movement is the raising of his hand; its vibration is the incidental.

One phase of these geological mutations is the alternation of bands of elevation and depression. It was, I think, Mr. Darwin who suggested this idea, and at any rate it was was his discoveries relating to the physical and geological history of coral reefs, which brought it into favour. It is matter of fact that the elevation and corresponding depression in the two bands generally lie alongside of each other. The Andes of South America is a band of elevation; to the west of that range there is a depression of immense depth, almost without islands or reefs; westward of that gulf there is a vast area of coral atolls and reefs, which, as a whole, have been, and perhaps still are, sinking, while through it extends a band of rising land, distinguished by numerous volcanoes. The North Atlantic is a band of depression, Europe a recent band of elevation. Where active volcanoes are in operation, the land is usually rising; and these generally lie in bands which often end in reaching to the dignity of mountain chains. Such is the band which extends from the New Hebrides through New Guinea, Borneo, Java and Sumatra. It seems a necessary consequence of the elevation of dry land in the northern hemisphere, that a corresponding depression should have taken place somewhere else. The elevation of, at least, all the land which

* Darwin's "Coral Formations."

is marked as tertiary in Map 3, and as seems more than probable of a great continent in the Atlantic, must have left a vacuity in the interior of the earth, and withdrawn a support from the crust which stretched over it. That crust is both solid and elastic, but we know, from what takes place on the withdrawal of props in coal-mines, that the strata forming it are unable to support themselves by cohesion; and it stands to reason, that the crust of the earth, although so much thicker than any strata existing above the beds of coal, being of correspondingly greater extent, will be as little able to do so. The greater thickness will be compensated by the greater extent without support. The supposed subsidence in the Pacific Ocean extends over thousands of miles, and an unsupported roof that would cohere for such an extent, must be made of other materials than those of any minerals or rocks yet known. The elevation of the land in the northern hemisphere must, therefore, have entailed a corresponding amount of subsidence elsewhere, and as there is no "elsewhere" under water of corresponding dimensions but the Southern hemisphere, it must have been in the Southern Seas that the subsidence took place. The elevation and subsidence being compensatory must have also been nearly simultaneous, not quite, indeed, for the elevation being the cause of the depression must have been first in order of time. The elevation we know has been subsequent to the commencement of the tertiary period. The depression therefore must have been a little nearer to our own time.

The sinking of the bottom of the Southern Ocean has probably been in operation long before the present rising of the Javan band of volcanoes, and the latter belongs to a different chapter in its history, and is, perhaps, more of the nature of an episode than an integral part of one operation. The former may be a chapter nearly past, the latter the commencement of a new one.

Applying this view to the occurrences since the eocene epoch, we have at least one great result, the subsidence of the Southern hemisphere, and the elevation of the Northern: perhaps accomplished by alternate elevation and depression of portions of each. If the depression in the south was, as I suppose, general over a considerable part of that hemisphere at one time, we may fix the date of the subsidence of a large part of it. The geology of South Africa and the zoology of Madagascar enable us to do this.

Africa, south of the Sahara, has probably remained stationary since the secondary epoch, at least has not been submerged. "Judging from all the evidences as yet collected," says Sir Roderick Murchison,* "the interior of South Africa has remained in that condition" (terrestrial and lacustrine only) "since the period of the secondary rocks of geologists." A narrow belt of tertiary formations along the eastern coast, from the Cape to the Zambesi, and along the south-west coast near Cape Negro, alone attests a trifling rise and extension of surface; Sir Roderick adds, "In truth, therefore, the inner portion of Southern Africa is in this respect geologically unique in the long conservation of ancient terrestrial conditions. This inference is further supported by the concomitant absence throughout the larger portion of all this vast area, *i. e.* south of the equator, of any of those volcanic rocks which are so often associated with oscillations of the *terra firma*."

To this continent Madagascar was at one time united, when it received the original elements of its fauna and flora. These are of a type subsequent to the eocene date, and akin to modern species. Before the separation, therefore, the miocene epoch must have commenced. How was the separation caused? Most probably not by the sinking of the channel between them, but by the general

* See his opening address to the Geographical Society in 1864.

MAP V.

SHOWING APPROXIMATELY THE RISING AND FALLING LAND AT THE PRESENT DAY.

- *Areas of Subsidence*
- *Sinking Coral Reefs & Atolls*
- *Areas of Elevation*
- *Rising Coral Reefs*
- *Volcanoes*

Day & Son (Limited) lith.

sinking of all around. The fringe of tertiary beds on the opposite coast of Africa must have been deposited subsequently to the submergence, and, therefore, the coast of South Africa (and as the fringe extends on both east and west shores, the whole of South Africa, and Madagascar with it) must have suffered, first, a depression sufficient to allow of these tertiary beds being deposited, and then a subsequent elevation so as to bring these beds to view. These tertiaries are referred to the upper miocene epoch; the subsidence, therefore, must have taken place not later than the middle of that epoch.

The extent of land then submerged, we cannot specify; but we may safely infer that a great continent stretched across between Africa and India. The numerous shoals in the Indian Ocean is one indication of this, but a much more important one is the fact of the fauna of India and Africa, belonging, with few exceptions, to the same families, and these families which are peculiar to those two districts. So far as regards Mammals, abundant illustrations in support of this will be found throughout the following pages, *passim*. This Africano-Indian continent was bounded on the north by the Saharan Sea, and by the sea which appears from the nummulitic eocene beds in Arabia, Persia, Beloochistan, and more modern tertiaries in the north of India, to have then covered these countries.

On still stronger grounds the existence of a large tract of land, where the North Atlantic now rolls, has been inferred. This is what is known as the Miocene Atlantis.

CHAPTER IV.

PAST GEOGRAPHY OF THE GLOBE *continued* — MIOCENE ATLANTIS — GLACIAL EPOCH.

Under the influence of the mutations in the geography of the globe which continued slowly to be carried on during the eocene and miocene epochs, the faunas and floras which had been nearly uniform over the whole globe, now began to break up into regional provinces. The old flora in which the Australian forms predominated was extirpated in the northern hemisphere, and henceforward confined to Australia, from which, in like manner, were eliminated the elements which were not suited to the climate required for the other types, descended from those of the eocene period. Each country retained (more or less altered according to the extent and nature of the change of condition) the portion of the original eocene flora which suited it best, and from that starting-point the different provinces of organic life have all gradually assumed their present places. At the commencement, however, the provinces were different from what they afterwards became.

It has been well ascertained that, in the miocene epoch, both the flora and fauna of North America (although the latter in a less degree) were closely allied to those of Europe at the same time; and that, while the miocene flora of Europe has undergone an entire change, that of North America has not, but retains to a certain extent the character of that which flourished there in the miocene age.

Our information upon these points in that age is fuller than upon them in the eocene. The upper miocene fossiliferous beds at Œningen, in the valley of the Rhine, between Constance and Schaffhausen, have supplied a mass of material which has enabled Professor Heer of Zurich to construct a miocene flora of Switzerland,* containing no less than 900 plants (which Professor Oliver would reduce to 800†), while his researches have led him to the conclusion that of phænogamous plants alone there must have been 3000 miocene species, a much richer and more varied flora than Switzerland now possesses; and the remarkable fact is, that a large number of these belong to North American genera. M. Gaston de Saporta, in a more recent paper on the plants found in the tertiary strata of the South of France,‡ has added considerably to the number; and the united result has been to establish beyond question that a very striking resemblance, and in some cases even identity, exists between the flora of the miocene epoch in Europe and the present vegetation of California and the Southern States of North America. The miocene beds of Vancouver's Island and North-west America fortunately supply similarly ample material, which has been investigated by M. Lesquereux, and he has satisfactorily established that the miocene flora of that district is extremely similar to that still in existence there, some of the species, such as

* "Flora Tertiaria Helvetiæ," by Prof. Oswald Heer. Winterthur, 1855-59.

† Oliver in "Nat. Hist. Rev." 1862, p. 149.

‡ G. De Saporta, in "Annales des Sciences Natur." 1862.

the SEQUOIA SEMPERVIRENS having apparently continued in existence from the miocene times until now.

The relative preponderance of type in the European miocene flora at that epoch was, first, that of North America, especially the southern part of the United States, as Louisiana, Florida, Georgia, and the Carolinas; second, of Europe, particularly the Mediterranean district; third, of Asia; fourth, of Africa; and fifth, of Australia. The Australian types had been diminishing in numbers as we ascend from the oolite and the lower eocene to the upper miocene. The American element is especially remarkable in the number of evergreen oaks, maples, planes, poplars, liquid-amber, Robinias, Sequoias, and Tædas, that is, pines with leaves in clusters of three. The conclusions drawn from insects, of which no less than 1322 fossil tertiary species, or supposed species, have been found in Switzerland, correspond in the main with the conclusions derived from plants.

These facts suggested to Unger and Göppert the speculation which is known as the "Atlantis theory," or the "Miocene Atlantis," viz. that the present basin of the Atlantic was occupied by land, over which the miocene plants could pass freely, and this hypothesis has been enlarged and advocated with great ability by Heer and other eminent men. To use the words of Sir Charles Lyell: "The existence of a continuous land communication between Eastern America and Western Europe in the pliocene period, by means of which many plants migrated before the glacial epoch, from one region to the other, was also suggested by Mr. Darwin, in his *Origin of Species;* and Dr. Leidy has observed that a like continuity of land from east to west is implied by the identity of some of the extinct pliocene mammalia of the Niobrara Valley in Nebraska with those of a corresponding geological age in Europe."

The fact that it is the Eastern or Atlantic side of America, or that which is nearest to Europe, which presents the greatest number of vegetable forms analogous to the miocene flora, would be an additional argument in favour of the Atlantis, *if* the present distribution of species and their relative proportion in America gave any clue to those in the miocene age, but if, as I imagine, they do not, the hypothesis must stand upon more general grounds.

On the other hand, Dr. Asa Gray, Professor Oliver, and others, following up a hint thrown out by Bentham, have argued that it is more probable that the plants, instead of reaching Europe by the shortest route over an imaginary Atlantis, migrated in an opposite direction, and took a course four times as long across America and the whole of Asia.

It rather appears to me, however, that their hypothesis does not apply so much to the miocene epoch as to a subsequent period. When the glacial epoch was at its height, ice covered the whole of North America, as far south as the north of Georgia and Texas (see Map 4) (that, as is proved by the tertiary deposits to the south of them, being the then southern termination of the North American continent), and the ice there ran into the sea in mighty glaciers. In its progress south it must, of course, have driven every plant or animal before it, making a clean sweep of all life wherever it came; and wherever it rested, covering the land as it did, for thousands and thousands of years (whether intermittently or not), it must have left the surface a *tabula rasa* for the reception of new impressions. Where there was an extension of land before it, as in the south-west corner of North America, the plants and animals would take refuge in it. Where there was no extension of land, and the glacier ice terminated in the sea, of course every living thing would be annihilated.

In Europe, on the other hand, although the drift or glacial ice did not reach so far south as

in America, nor, perhaps, the general mass of glaciers run into the Mediterranean Sea, we shall find, if we inquire a little, that it was in a still worse case than North America. The latter had an outlet; but we shall presently see that Europe had none.

Let the reader figure on a map the extent of the land in Europe covered by the glacial ice (shown in Map 4). Then let him lay down its tertiary and quaternary beds (shown in Map 3). They, of course, represent at least some of the water previous to that period—they are the site of the seas in which these beds were deposited. Next, let him remember that at that epoch itself the general level of Europe and Asia was considerably lower than it is now. The Sahara was united with the Mediterranean and the Black Sea, and the Black Sea with the Caspian.*

Sir Roderick Murchison and M. de Verneuil consider that another sea as large as the Mediterranean, and several hundred feet in depth, existed about the south of the Caspian during the pliocene epoch (that is, the commencement of the glacial epoch).† It is, therefore, no very unreasonable surmise that the level of Europe from the longitude of the western termination of the Sahara to the longitude of the Caspian Sea, was 100 fathoms lower than it is now. If the reader will add from Map 2 the portions of Europe, which in that case would be under water, to the other two (the limits of glacial action and tertiary deposits), he will find that Europe has but all disappeared. In addition to this, however, the sandy plains in the centre of Germany stretching with interruptions from the Danube to the Baltic, show every appearance of having been recently under water. If we reckon them also as submerged at that epoch, then Europe, east of the Atlantic, will be practically almost blotted out from the map.

If that be so (as so it seems to be), scarcely any life at all can have survived the glacial epoch in Europe. Whether at that time the communication with Asia was also cut off is doubtful, but is not of much consequence, as a communication after the glacial epoch was certainly opened between them. Still, to complete our knowledge of the state of facts during the miocene epoch, we may note, regarding the then boundaries of Europe, that we are sure that it was absolutely cut off on the south by the Sahara, on the south-east by sea, which then covered Arabia and Persia, and by the Aralo-Caspian seas above-mentioned; and the interesting fact to which we shall presently come, that seals of the same species as those now living in the Arctic Seas, occur both in the Caspian and Lake Baikal, renders it almost certain that a communication existed between the Caspian and the Arctic Seas; so that Europe, previous to the glacial epooh, was probably a group of islands isolated from Asia, and from Africa—whether or not from America we shall presently see.

* "I was particularly struck by the fact, that several of my fossil shells from the Sahara, in the *superficial* deposit, proved specifically identical with fresh-water tertiary fossils given me by my friend, Captain Spratt, and obtained by him in the fresh-water deposits of the Black Sea."—TRISTRAM'S *Sahara*, p. 370.

"M. Escher von dur Luith himself, together with MM. Desor and Martius, have found marine shells, especially the common Cockle, *Condium Edule*, scattered far and wide, from west to east, over the desert (Sahara); while the shells of these, and other living species, have also been found in boring Artesian wells, at the depth of many feet below the surface."—LYELL'S *Elements of Geology*, 6th edit. 1865, p. 175.

† "*Aralo-Caspian formations.*—This name has been given by Sir Roderick Murchison and M. de Verneuil to the limestone and associated sandy beds, of brackish water origin, which have been traced over a very extensive area, surrounding the Caspian Azof and Aral Seas, and parts of the northern and western coasts of the Black Sea. The limestone rises occasionally to the height of several hundred feet above the sea, and is supposed to indicate the former existence of a vast inland sheet of brackish water, as large as the Mediterranean, or larger."

"The proportion of recent species, agreeing with the fauna of the Caspian, is so considerable, as to leave no doubt in the minds of the geologists above cited, that this rock, also called by them the 'Steppe Limestone,' belongs to the pliocene period."—LYELL, op. cit. p. 209.

In America, on the other hand, where the flora was not annihilated it must have been driven into its south-west corner; and the space there into which it must have been circumscribed was much smaller than it is now, for the north-east of Mexico was also then under water as well as Texas, as is proved by the tertiary deposits now covering these districts. Thus it seems plain that all reasoning from the present distribution of plants or animals, or their relative preponderance on this or that side of the continent, must be inapplicable to the state of things which existed prior to the glacial epoch, and therefore can only have an indirect bearing on the miocene Atlantis. That question must be decided on other grounds altogether. The objections to the hypothesis are thus stated by Sir Charles Lyell: —

"If the evidence in the botanical scale were equally balanced in favour of these two opposite theories, a geologist would not hesitate to prefer that of Dr. Asa Gray as demanding an incomparably smaller amount of change in physical geography since the close of the miocene period. It is true that since the beginning of that era there have been vast alterations in the level of the Alps and contiguous regions, and in the Mediterranean, especially the Ægean Sea. And there has been, perhaps, as the late Edward Forbes contended, an extension westward of European and North African land, even in the pliocene period. If, instead of assigning an almost historical date to a continental condition of the area between Africa and the Southern States of North America, such as might realize the story of the Atlantis spoken of by the Egyptian priests to Plato,* we could look back through the whole interval which separates us from the eocene or cretaceous periods, we might then, indeed, freely grant, as geologists, any amount of change that may be required in the position of land and sea.

"It is the enormous depth and width of the Atlantic which makes us shrink from the hypothesis of a migration of plants, fitted for a sub-tropical climate in the upper miocene period, from America to Europe, by a direct course from west to east."

* Professor Unger gives the following account of the tradition here referred to:

"The early history of man is still wrapt in obscurity. It is, therefore, the more surprising to meet with a tradition of the highest importance with respect to that geological period, and containing as it were a confirmation of the former connexion of Europe with America, though we should have thought that this connexion had ceased long before man's appearance on earth. This curious tradition is found in Plato's dialogue entitled 'Timæus.' Here direct mention is made of a great island of Atlantis, situated beyond the Pillars of Hercules, and the seat of a powerful nation. A priest of Sais made this singular communication to Solon, who had gone to Egypt to become acquainted with the wisdom of that caste. It is mixed with a great deal that must appear unhistorical, and it puzzles us to know how an Egyptian priest could have come by this tradition, or how Plato could arrive at so singular a conception. Let us hear Plato himself:—'After the said priest has pointed out that Egypt is the only country where traces of the oldest history of man could be preserved, he informs Solon that Greece, and especially Athens, had a very ancient history, which, however, had been lost there, he draws his attention to the fact that that country was settled earlier even than Sais by the goddess Neith. Athens enjoyed at remote times a well-regulated political organization, and possessed a great intellectual and strategic power. As the goddess loves war as much as wisdom,' he continued, 'she selected a country which would produce men closely resembling herself. Under such laws and excellent political institutions did your nation then live, exceeding all others in virtue, as was fit for a people descended from the gods, and educated by them.

"'Many of the great deeds of your nation preserved in our writings cause surprise. But one of them exceeds all others in magnitude and splendour. It is recorded how your country once opposed a power which with great arrogance pushed its way into Europe and Asia from the Atlantic Ocean, for in those days that sea was navigable. Beyond the entrance, which you call the Pillars of Hercules, there was an island larger than Libya and Asia together. From it navigators passed to the other islands, and from them to the opposite continent, which surrounded that ocean.

"'For the sea, situated inside that strait of which we speak, appears to be a sea with a narrow entrance, but the other would justly be termed an ocean, and the adjacent land a continent. On this extensive Atlantic island there was a powerful and singular kingdom, whose dominion extended not only over the whole island, but over many other islands and parts of the continent. It ruled, also, over Libya as far as Egypt, and over Europe as far as

"The ideal map given by Heer of the Atlantis represents a continent as large as Europe precisely in that portion of the Atlantic Ocean which is now the broadest and deepest, viz., from two to three miles in its deepest portions." *

Notwithstanding this, the facts appear to me clearly to show that during the miocene epoch there must have been a land communication between Europe and America. It is well ascertained that the floras of America and Europe were the same in the miocene age, and that the miocene type still continues in America, but not in Europe. At the same time, and notwithstanding the bearing of these facts in favour of an Atlantis, it is not impossible that a "north-west passage," sufficient for the purpose of intercommunication may have existed, although not directly across the Atlantic; it may have been by Greenland; it would only require a very trifling change in the level of the land to establish a communication between America and Europe by the North Pole.

We must remember that the Polar climate at the time was genial. Frost and snow were unknown, and the northern district of Iceland, and several parts of the Arctic lands, such as Disco Island, on the west coast of Greenland, lat. 70° N., although at the present time entirely without trees, were densely wooded in the tertiary period. Fragments of trees are preserved in the lignite or "Surturbrand" of Iceland, and as they are still covered with bark they cannot have reached it as drift-wood. This vegetation agrees with that which in the miocene epoch covered the whole European continent, and a portion of the species composing it have their analogues in North America."

That route was amply sufficient to supply America, without another across the Atlantic; and, therefore, had we only to consider the miocene epoch, I should join the ranks of the opponents of the theory, simply on the ground that it was unnecessary. But if not a necessity before the glacial epoch, it becomes a necessity after it. The Polar climate was then no longer as mild as that of Madeira, nothing temperate could pass by the Polar route, and yet many instances occur of the same species being found both in Europe and North America, which must have found their way from the one to the other, subsequent to the glacial epoch; and if such a communication existed after the glacial epoch, it is an unavoidable corollary, that it also existed previous to that epoch, viz. in the miocene times, when the extent of dry land was increasing instead of diminishing, as was the case after the cold had begun to retire.

If such an extension of land between Europe and Asia formerly existed, where was it placed and what were its limits? The first position which has claims to be considered is in the line

Tyrrhenia. This kingdom, with the whole of its forces united, tried to subjugate, in one campaign, your and our country, and all the districts inside the straits. At that time, O Solon, your nation shone out from all others by bravery and power. Taking the lead by courage and in the arts of war, be it as leaders of the Hellenes, be it necessarily isolated by the withdrawal of the allies, it was placed in great danger, but it defeated the attacking army, and erected triumphal monuments. It also prevented those who had as yet preserved their independence from becoming subjugated, and generously freed all the others living inside the Pillars of Hercules. But, when at a later period severe earthquakes and great floods took place, the whole of your united army was swallowed up during one evil day and one evil night, and at the same time the island of Atlantis sank into the ocean. This is the reason why, at present, that sea is difficult to pass and explore, the deep mud which the island formed in sinking being an obstacle to navigation.'

"Thus far the curious passage in 'Timæus,' a satisfactory explanation of which historians, philologists, and naturalists, have hitherto attempted in vain. That this tradition is entirely imaginary would be bold to assume, since we have shown that its most important substratum is sound, and that at one time a continent did exist in the Atlantic Ocean."—UNGER, *Versunkene Insel Atlantis*. Wien, 1860. Copied from Translation in "Seeman's Journal of Botany." January, 1865, p. 23.

* "Elements of Geology," by Sir CHARLES LYELL. London, 1865, pp. 265–272.

MAP V.

SARGASSUM SEAS.

ISOTHERMAL 32°

Arctic Circle

Equator

Tropic of Cancer

Tropic of Capricorn

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

ARCTIC OCEAN

SOUTHERN OCEAN

Kelp

Rockweed & Sea drift

Long Kelp

Desolate Region
Mariners report few signs of life in Sea or Air

of the Sargasso Sea or Gulf weed in the middle of the Atlantic; and, as the claim founded on the existence of that weed applies not only to this case, but may have to be considered in other parts of the world, it may be desirable to state once for all in some detail the grounds on which his hypothesis is founded. They are contained in the following note by Edward Forbes in his paper on "The Geological Relations of the Existing Fauna and Flora of the British Isles:"—

"The following extract from the writings of one of the first of living Algologists (Prof. Harvey) will show that there are *botanical* grounds for my speculation respecting the Gulf weed. 'Authors who have written on this *Fucus*, have much disputed both regarding its origin, and whether it continues to grow whilst floating about. Nothing at all bearing on the former question has yet been discovered; for, though species of *Sargassum* abound along the shores of tropical countries, none exactly corresponds with *S. bacciferum*. That the *ancestors* of the present bank have originally migrated from some fixed station is probable; but further than probability we can say nothing. That it continues to flourish in its present situation is most certain. Whoever has picked it up at sea and examined it with any common attention, must have perceived not only that the plants were in vigorous life, but that new fronds were continually pushing out from the old, the limit being most clearly defined by the *colour*, which in the old frond is foxy-brown; in the young shoots, pale, transparent olive. But how is it propagated, for it never produces fructification? It appears to me that it is by breakage. The old frond, which is exceedingly brittle, is broken by accident, and the branches continuing to live, push out young shoots from all sides. Many minute pieces that I have examined were as vigorous as those of larger size, but they were certainly not seedlings, and appeared to me to be broken branches, all having a piece of *old frond* from which the young shoots sprung. As the plant increases in size it takes something of a globular figure, from the branches issuing in all directions as from a centre. On our own shores we have two species analogous to *S. bacciferum* in their mode of growth, namely, *Fucus Mackayi* and the variety B. *sub-ecostata* of *Fucus vesiculosus* (*F. Balticus*, Ag.) Neither of these has ever yet been found *attached*, though they often occur in immense strata; the one on the muddy sea-shore, the other in salt marshes, in which situations respectively they continue to grow and flourish; and it is remarkable that neither has ever yet been found in fructification, in which respect also they strikingly coincide with *S. bacciferum*. And if it be hereafter shown that *F. Mackayi* is merely *F. nodosus* altered by growing under peculiar circumstances, may it not be inferred that *Sargassum bacciferum*, which differs about as much from *Sargassum vulgare* as *Fucus Mackayi* does from *Fucus nodosus*, is merely a pelagic variety of that variable plant?'—Harvey, *Manual of the British Algæ* (1841.) Introduction, pp. 16, 17.

"My friend and colleague, Dr. Joseph Hooker, who has had great opportunities of studying the Gulf weed, believes with Dr. Harvey, that the *Sargassum bacciferum* is an abnormal condition of *S. vulgare*. Now as the latter is essentially a coast-line plant, growing on rocks with a very limited vertical range, I propose to account for its abnormal condition as *Sargassum bacciferum* in the Gulf weed bank, on the supposition of *the submergence of the ancient line of coast on which it originated.*"*

The idea here may either be, that the weed has spread from the ancient submerged line of coast over the whole of the rest of its bounds, or that the limits or outer margin of the Sargassum mark the ancient original coast-line, and that the whole of the space within these limits has been filled up with Sargassum by its having by successive subsidences all passed through the phase of coast-line.

* Ed. Forbes, on the Geological Relations of the existing Fauna and Flora of the British Isles in "Memoirs of the Geological Survey of Great Britain and of the Museum of Economic Geology." London, 1846. Vol. i. p. 349.

There is no impossibility in this, nor even any very great improbability; but there is an explanation of its dispersion and distribution (*it being once there in some part of the area*), which seems to meet the facts equally well by the phenomena in daily operation, and if there be a sufficient cause already at hand, it would be unphilosophical to abandon it, and refer the result to another whose former existence is only a supposition.

The phenomena which furnish such an explanation are the currents which surround the Gulf weed bed, and the explanation is that the Sargasso is thrown into and kept in its present position by the eddy or whirl caused by their revolution on every side of it. Humboldt, I think, was the first to notice that it occupied the eddy, and Maury states the theory broadly, that the Sargasso Seas are composed of drift matter, which cannot escape or accompany the current which brings it, in consequence of its being met by another current. "The water that is drifting north on the outside of the Gulf stream turns with the Gulf stream to the east also. It cannot reach the high latitudes, for it cannot cross the Gulf stream. Two streams of water cannot cross each other, unless one dip down and under-run the other; and if this drift water do dip down, as it may, it cannot carry with it its floating matter, which, like its weeds, is too light to sink. They, therefore, are cut off from a passage into higher latitudes. According to this view there ought to be a Sargasso sea somewhere in the sort of middle ground between the grand equatorial flow and reflow, which is performed by the waters of all the great oceans. The place where the drift matter of each sea would naturally collect would be in this sort of pool, into which every current, as it goes from the equator, and again as it returns, would slough off its drift matter. The forces of diurnal rotation would require this collection of drift to be in the northern hemisphere, on the right hand side of the current, and in the southern to be on the left. Thus, with the "Gulf Stream" of the Atlantic, and the "Black Stream" of the Pacific, their Sargassos are on the right, as they are also on the right of the returning and cooler currents on the eastern side of each one of those northern oceans. So, also with the Mozambique current, which runs south along the east coast of Africa from the Indian Ocean, and with the cooler current setting to the north on the Australian side of the same sea. Between these there is a Sargasso on the left, for it is in the southern hemisphere. Again, there is in the South Pacific a flow of equatorial waters to the Antarctic on the east of Australia, and of Antarctic waters (Humboldt's current) to the north, along the western shores of South America; and, according to this principle, there ought to be another Sargasso somewhere between New Zealand and the coast of Chili. To test the correctness of this view, I requested Lieut. Warley to overhaul our sea journals for notices of kelp and drift matter on the passage from Australia to Cape Horn and the Chincha Islands. He did so, and found it abounding in small patches, with 'many birds about,' between the parallels of 40° and 50° south, and the meridian of 140° and 178° west. This Sargasso is directly south of the Georgian Islands, and is perhaps less abundantly supplied with drift matter, less distinct in outline, and less permanent in position than any one of the others."*

It thus appears that instead of three, as stated in the former editions of Lieut. Maury's "Physical Geography of the Sea," there are really five Sargassos, and it is from his maps that I have laid them down as shown on Map 5*.

Now the objection to Maury's explanation taken by itself is, that the Sargasso, at least in the Atlantic, is composed of only one ingredient, the SARGASSUM BACCIFERUM; whilst any collection of true drift would necessarily be composed of a heterogeneous accumulation of all sorts of things. If

* MAURY, "Physical Geography of the Sea," 1860, p. 50.

the Sargassum were once there, there would be no difficulty in admitting that the effect of the streams or currents would be to keep it fenced in within their limits. And it would not be necessary for this that it should have originally occupied the whole of the space which it now does. Once within it, although originally occupying only a small corner, it might have spread all over it (the conditions of the ocean being there everywhere similar), but could not pass the boundaries of these currents. I therefore think that to obtain a true explanation of the Sargasso Seas we require both Forbes and Humboldt's theories; Forbes' to explain the original appearance of the weed, Humboldt's its present limits.

If we admit this, it follows that Gulf weed in the Atlantic indicates the submergence of land somewhere in that ocean; but it does not indicate where the submergence took place. It may not have been within it at all. It may have been in the course of some of the surrounding currents, and the weed which sprung from it may have been caught up and carried along by it until tossed into the eddy, there to spread over the whole tranquil space.

The fact, however, of the restriction of species within their original bounds, leads me to believe that the starting-point or specific centre of this species, or this form of the *Sargassum vulgare*, if it be not a distinct species, and consequently the point of the disappearance of an ancient coast of submerged land, must have probably been within the bounds of the Atlantic Sargasso. It may not have been the miocene Atlantis; that is, the route of communication between Europe and North America; but for all that the weed may mark in whole or in part the site of submerged land.

If not on the site of the Gulf-weed where else can the Atlantis have been? Heer and Unger, while they do not adopt Forbes' idea, place it, as already said, across the widest and deepest part of the North Atlantic, somewhat to the north of the Sargasso.

I think it must have been still more to the north; certainly it kept its last hold well to the north, for all the species very closely allied, or common to both Europe and America, are northern types; not species which might have crossed from Andalusia or Algeria, to Florida, nor of so extreme a polar character that they could have crossed by Greenland in its present climate, but such as might have done so by Labrador or Nova Scotia. I imagine there must have been a great extension of land on the European side of the Atlantic, reaching beyond the Azores, uniting Spain and Ireland, and stretching westward by Newfoundland and its banks to Nova Scotia and Labrador on the one hand, and northwards to Greenland and Spitzbergen on the other.

It is not to be doubted that this arrangement of land and water must have greatly contributed to the occurrence of the glacial epoch. It is also probable that the termination of that epoch was due in part, if not entirely, to the sinking of a large part of this preponderance of land, but that it had not wholly disappeared by the time the cold of the glacial epoch was in the wane. If it were so, and the connexion between Greenland and Europe still subsisted, that would much increase the probability that the connexion with America also subsisted to a greater or less extent for some time. Let us see what there is to be said in favour of this view.

It is not difficult to show that such a connexion did continue between Greenland and Europe. In the first place, Greenland has a fauna and flora which are not its own. Whence has it received them? Singularly enough they bear more than one impress. The mammalian fauna and the ornis is American. The flora and entomology is European; and these different phases of organic life represent a different distribution of land and water when they were established.

Of course when organic life began to replace the inanimate desolation left by the glacial epoch

over all Greenland, plants would come first, then insects, and afterwards birds and mammals. Until vegetation clothed the land, animal life must have been absent. There was nothing for it on which to subsist. I have said that the flora is American. This has been amply shown by Dr. Hooker in his valuable paper on the distribution of Arctic plants. He has also shown that it is peculiar in the paucity of the number of its species, compared with other equally Arctic lands; it containing actually fewer species of European plants, than have found their way eastwards from Lapland, by Asia into western and eastern Arctic America.*

He conceives that this is all explained by Mr. Darwin's hypothesis,—"First, that the existing Scandinavian flora is of great antiquity; and that previous to the glacial epoch, it was more uniformly distributed over the Polar zone than it is now. Secondly, that during the advent of the glacial period the Scandinavian vegetation was driven southwards in every longitude; and even across the tropics into the south temperate zone. And that on the succeeding warmth of the present epoch, those species that survived both, ascended the mountains of the warmer zones, and also returned northwards accompanied by aborigines of the countries they had invaded during their southern migration."*

He says, "If it be granted that the Polar area was once occupied by the Scandinavian flora, and that the cold of the glacial epoch did drive this vegetation southwards, it is evident that the Greenland individuals, from being confined to a peninsula, would be exposed to very different conditions to those of the great continents. In Greenland many species would, as it were, be driven into the sea,—that is, exterminated; and the survivors would be confined to the southern portion of the peninsula. And not being there, brought into competition with other types, there could be no struggle for life amongst their progeny; and, consequently, no selection of better adapted varieties. On the return of heat these survivors would simply travel northwards unaccompanied by the plants of any other country."†

The first point in the above propositions which I should wish to notice, is the assumed existence of a boreal flora before the commencement of the glacial epoch. This is a point which is always taken for granted.

The usual conception of the matter is that stated above by Dr. Hooker. Were the question under consideration solely what was the course of action to which these northern types were submitted during and after the glacial epoch, of course the exact period when they first made their appearance would be of little consequence. But it is different with me here. The question is one of vital importance to my theory, and I cannot afford to pass it as a matter of indifference. If the origin of species is in any respect due to change of condition of life, then at the glacial epoch, if ever, great alterations must have taken place. The southern migration of species from the north, their subsequent return, and the lingering behind of some on high mountains, no one disputes; but they are facts belonging to one category, while the original appearance of these northern types are facts belonging to another. It is essential for me to dispute the proposition that these arctic types existed previous to the glacial epoch. If that were true, my theory would be worthless, and I must give it up. But the proposition is not true. Not a single arctic or boreal species of either plant or animal has ever been discovered in any stratum of older date than the glacial epoch. It was the cold of that epoch which produced them all. How soon it was

* Hooker, in "Trans. Linn. Soc„" xxiii. p. 253.

† Hooker, op. cit. pp. 254 and 258.

after the appearance of the cold that the species were changed from their southern type into northern forms we cannot tell. My view is that it would be soon; but doubtless, as the cold increased and advanced southwards, fresh boreal species would be developed by the increase of the power of the instrument of change, and doubtless also on its decrease as well as its increase the same result would follow. But what I maintain is, that until the cold began, boreal species there were none. I speak not only of plants, but of shells, mammals, and every created thing.

Some botanists speak of the plants returning in the same line of longitude after the retreat of the glacial epoch as they had advanced before it. If my view is correct, this of course is impossible.

Neither can I adopt Dr. Hooker's view of the course of action of the glacial cold in Greenland, and its probable effect upon "the survivors," for two reasons, the one that Greenland in all probability had not then its present configuration, but was united to Europe; the other, that, supposing it not to have been so, then I cannot conceive to be possible that there should have been *any* survivors. It seems a physical impossibility that any germ of life could have survived the envelopement of the soil for thousands of years, with a thick coating of ice, which was certainly the condition of the whole northern hemisphere to a far more southerly latitude than Greenland.

When the glacial epoch arrived and advanced southwards, it must have operated in two ways—it must either have killed, or transformed into something else, all those species of plants and animals which were subjected to its influence. It is also possible that it may have driven before it, at a respectful distance, all those which escaped its influence, and which migrated southward, carrying their climate with them; but as a uniform climate had until then subsisted at least as far south as Greece, as is proved by the fossil flora of Eubœa, it is not necessary for our argument to decide whether the old miocene flora still subsisted in the southern parts of Europe in virtue of that having been the general and established flora of the country, or if, under the altered conditions of climate, it was now confined to those parts where the temperature and other conditions of life suited it.

To this it is doubtless due that certain miocene genera, such as Clethra, Bystropogon, Cedronella, and Oreodaphne, still subsist in the flora of Madeira and Porto Santo, and of the Canaries and the Azores, as well as in North America.

In either view there would, both in the Old World and the New, be a double band of species; the most southerly consisting of the old species which lived before the glacial epoch; and next, a more northerly band fringing the line of ice, consisting of what we now call Alpine and Boreal plants and animals, and which were developed out of the old species under the influence of the novel sensation of cold.

But although Dr. Hooker's explanation of the facts is not satisfactory to me, I readily accept his facts themselves, and they show that, as already said, the type of the flora of Greenland is European; and if all life existing in Greenland previous to the glacial epoch was then exterminated, it follows from their presence there now that it must have been connected with Europe subsequently to that epoch, for a sufficient time to allow it to be refurnished with European plants and insects. It is a necessity, not a matter of probability.

Next, as Iceland, Greenland, and Spitzbergen,* all three possess nearly the same flora, and that flora European, they must either have been united to each other and to Europe in one line, or united by different necks of land to the Continent; which latter supposition, although not im-

* There are some peculiarities in that of Spitzbergen to which I shall presently advert.

possible, is inconsistent with the close similarity of the floras of these lands, with the configuration of the bed of the neighbouring sea, and with other facts having a like bearing.

The European character of the plants and insects of Greenland, Iceland, and Spitzbergen, is sufficient evidence that they must have been connected with Europe in some way, but that alone throws but little light on the point of connexion. It may have been by Norway, by Nova Zembla, or by Britain. The following considerations show that it must have been by the latter:—

No tree now grows in Orkney or Shetland; the only ligneous things that do grow are the Betula alba and the common juniper, both merely existing as shrubs; but at six feet beneath a peat-bog, trees, branches, leaves, and cones, ascribed to the silver fir, have been found—one tree in particular of six feet in circumference and forty feet in height,* being recorded by Mr. Edmonston as having been found in peat in Shetland.

When did these trees grow, and what was the climate of Britain then? Was it really milder then than now, as we should be inclined to expect, from the fact of these trees being found in Shetland, where they will not now grow? As to the date of their growth there, there can be very little doubt that it was subsequent to the glacial epoch. The grinding of the ice of that time would sweep away every trace of peat-bogs from the surface of the land. Were a Swiss glacier to meet a peat-bog in its course, it would soon plough it up, and scarify the ground to the very bone below. It is plain, therefore, that the tree must have grown and died, and the peat been deposited, subsequent to the glacial epoch.

Now one of two things must have taken place since it grew; either the general climate of the Northern hemisphere must have undergone a change, and that change must have been from warmer to colder, or the individual climate of Shetland must have done so by an alteration in its configuration and physical condition.

But the growth of these silver firs (if silver firs they be and not spruces, a point on which the record is not absolutely clear) could not be due to any material change in the general climate of the whole country: for their remains are found in the peat, in company with those of the Scotch pine and spruce fir, and as these are the same trees that now grow in the corresponding isothermal line on the Continent, no general alteration from warmer to colder can well have taken place over the whole hemisphere; and as it is only on the Continent or in lands not exposed to the sea that they thrive in that latitude, it may be inferred that at the time they grew there the Shetlands were either not islands, or not such small islands.

But the Shetland Islands rise nearly precipitously from a wide submarine plain seventy-four fathoms deep, which extends from these islands to within no great distance of the coast of Norway. Their form, therefore, shows that any increase on their size could only be obtained by such an elevation as would unite them to the Continent, from Denmark southwards; and there is little doubt that that must have been the position of matters when the trees in question grew on these islands. Along the west coast of Norway a deep channel extends in continuation of that of the Baltic. That sea then must have trended away up by the west coast of Norway, and Britain must have been joined on to the present Continent from the Shetlands to the north of Denmark, all south of a line drawn between them being much less than seventy-four fathoms in depth. The Rhine and the Elbe, so soon as by the subsequent rise of the land they came into existence, probably emptied themselves into the Baltic.

* Edmonston, in "Annals of Natural History," 1841, vii. 295, and Edmonston in "Phytologist," i. 430.

There remains the difficult question whether the embouchure of the Baltic opened into the Atlantic between Iceland and the British Islands, or between Spitzbergen and Finmark; in other words, whether Greenland was united to Europe by Norway, or by Britain. As Iceland, Greenland, and Spitzbergen, were united, the Baltic must have reached the sea by one or other of the above passages.

I have tried to make out something from a comparison of the phænogamic flora of Great Britain, and of the Scandinavian Peninsula, with that of Greenland. I thought that it might show traces of its former connexion by an undue preponderance of any peculiarity existing in the one flora or the other; but they have turned out so equally balanced, that no inference, one way or the other, could be drawn from the contrast.*

It is therefore very much a matter of imagination which supposition we adopt. I prefer the union with Britain for the following fancies, I can scarcely call them reasons. 1. It carries on the land in the same line in which what we see of it is already directed. 2. There are a number of stepping-stones on the way which may be supposed to indicate the topmost summits, and the course of the sunken land; and 3. It allows the prolongation of the Baltic to pursue its course to the open sea in a straight line instead of turning it off a second time at right angles.

The proof that Greenland was united to Europe subsequently to the glacial epoch, is thus clear enough. That the communication between Europe and America also subsisted for a short time, although probably imperfect and interrupted, seems also pretty plain; it is more difficult to judge whether that communication still subsisted after the separation between these lands took place. The fact that Iceland is wholly destitute of aboriginal mammals, except perhaps what may prove to be an American Lemming, and that those of Greenland and Spitzbergen are not of the European, but American type, shows that the connexion between Europe and them, while it endured long enough to allow them to be peopled by European plants and European insects, was severed before mammals followed on their trace. The connexion with both continents may then have been severed, for although the mammals in Greenland are of the American type, they are very few, and all of a class that might have migrated across any moderate distance of ice; and Spitzbergen and Iceland may have continued united to Greenland after both were disunited from the rest of Europe. In any view it is only the now submerged north-western portion of miocene Europe, which still subsisted during and after the glacial epoch. Its south-western part cannot have done so, or we should have had a flora in Europe more nearly resembling that of North America. Some remains of it, however, still survive, to show that the miocene flora escaped, where it was beyond the influence of the cold.

I may remark, *par parenthèse*, here, that it would be difficult to find two lands better adapted for illustrations of Mr. Darwin's views of colonization by flotsam and jetsam than Spitzbergen and

* I took the Greenland flora from the tables in Hooker's essay above mentioned; the Scandinavian from Frie's "Summa Vegetabilium Scandinaviæ," and the British from Bentham's "Hand Book" (as steering a just medium between the extreme opinions regarding species on both sides), and this comparison gives 232 Greenland species as found in the Scandinavian Peninsula, and only 167 in Britain, but this apparent preponderance in favour of Scandinavia is neutralised by the fact that the number of species inhabiting the Scandinavian Peninsula is considerably greater than those in Britain, the numbers being 1708 Scandinavian plants against 1239 British, consequently the former might be expected to possess the largest actual number of species; tried according to that ratio, the proportion of Greenland plants to the whole of the Scandinavian is a little more than a seventh (about $7\frac{1}{4}$), while that of Britain is also a little more than a seventh (about $7\frac{1}{3}$), showing that the difference is too slight to allow us to draw any conclusions from it either one way or other.

Iceland, both large islands, the one with a flora limited to ninety-three species, the other apparently without an indigenous mammal. In the former, the most remarkable fact in favour of the view is that Spitzbergen appears to have two, if not three, floras represented on its *shores*,—literally its shores,—because the interior is a pile of snow and ice where nothing can live.* The flora of the west coast has been chiefly borrowed from Greenland; that on the north coast has a considerable flavour of the Melville and Parry Islands species, there being, besides half a dozen species peculiar to Melville Island, no less than 58 out of the 83 composing the flora of that island found in Spitzbergen, and chiefly on its north coast, and about 53 out of 124 species from Eastern Asia. It is not said whether these latter are chiefly found on the eastern coast or not. If it should prove so, we should then have each coast with a predominance of species from the country lying opposite it, which certainly would look something like colonization by immigration by some such means. On the other hand, Mammals, such as the Reindeer and Hare, could have come neither by flotsam nor jetsam. It is possible that they might have crossed the ice, particularly if much land lies between Spitzbergen and Melville Island; but former contiguity or continuity of land seems the more probable explanation. As to Iceland, its flora does not seem to have any of these peculiarities, and besides, although only amounting to 445 phanerogamous species, it is still greatly too large to allow of our supposing it all to have come over sea.

Before leaving these frozen regions I may remark that their floras furnish confirmation of the justice of my view of the origin of species on one point, viz., that without change of condition no new species can be produced. There can hardly be any condition more constant than continual cold; and we find in conformity with what we might expect from such a character, that the species which are frigid in their constitution exist without change in Greenland, the Alps, the Himalayahs and Andes, while those of more temperate character have disappeared in some localities and become changed in others,—the change probably being due to interventions of more moderate climate. The Greenland and Spitzbergen species are all of an arctic character, and have come back with and kept pace with the cold, consequently we should not expect to obtain any change or development of new species out of them, and so it is. With the exception of a single insignificant new grass (CATABROSA VILFOIDEA) in Spitzbergen, not a single species has been found either in Spitzbergen or Greenland which was not already known as occurring elsewhere.

* Malmgren says, "The summer's heat melts the snow and fits the soil for its scanty vegetation only on a narrow strip of land, which stretches along the coast between the sea and the nearest mountain ridge. The mountains seldom rise precipitously from the sea, there is generally such a narrow terrace of about one-eighth to half a mile in width. Its composition and the sub-fossil whale-bones and mollusca contained in the uppermost bed of gravel, which is 50 to 150 feet above the sea, show that this ledge is an old sea-shore, and that Spitzbergen is gradually rising above the sea. This narrow ledge of so comparatively recent a geological age, supports the great proportion of the vegetation; only a third of the species are found on the north coast at a greater height than 300 feet above the sea." According to his view, the flora of Spitzbergen must consequently also be comparatively recent, and still continuing to increase.—See MALMGREN, op. cit. Translation in Seeman's "Journal of Botany," p. 173.

CHAPTER V.

PAST GEOGRAPHY OF THE GLOBE *continued*—GLACIAL EPOCH.

Such a Miocene Atlantis as that above defined sufficiently explains the common distribution of plants and animals in Europe and America, up to the glacial epoch. We have now to consider how and by what channels the rehabilitation and distribution of these lands themselves were effected subsequent to that period. I have rather anticipated this in regard to Greenland, Iceland, and Spitzbergen. But the main question of the restoration of life to Europe and America still remains.

Life in North America being by the glacial cold driven into Mexico, and in Europe almost entirely extirpated, and the communication with North America cut off, except at an extreme point which lay at the greatest distance from the surviving focus of life in each country respectively, viz. as regards America in the extreme north-east, while all the surviving life was crowded into the extreme south-west; and as regards Europe in the extreme north-west, while the nearest point whence life could be drawn was probably the south-east of Asia; it is plain that neither of the continents could help the other, America could receive European colonists, and Europe American, only after they had each been re-peopled from some other source.

In the first place, as to Europe, it is plain that it must have drawn its new inhabitants almost entirely from Asia; the Sahara still subsisted as a sea, although perhaps diminished in size, and cut it off from Africa; and accordingly no trace of the fauna or flora of Africa proper is to be found in Europe.* There was, therefore, no place except Asia on which it could draw (any slight remnants of the miocene flora which are still to be found in Europe were doubtless preserved in those parts of the South of Europe which existed as islands beyond the reach of the ice of the glacial epoch;) and, in accordance with this, we find that the flora and fauna of Europe and Asia are essentially the same. It is to be expected that in such an immense tract of country climatal variations must have arisen since then; and we can distinguish three sub-provinces (which may be called respectively the Scandinavian, the Mediterranean, and the East, or Mongolo-Siberian), but essentially the whole of Asia north of the line of the Himmalayahs and Europe is of one type. When we come to trace the spread of particular species of plants and animals, I have been surprised to find how happily this view explains many seeming anomalies, which have puzzled naturalists to account for, such as the distribution of the cedars—the silver firs—many of the mammals, and in fact of every class of organic life in Europe and Northern Asia.

As to America the whole of its pre-existing flora and fauna having been crowded into the north-west of Mexico and Central America, that is the source from which it must have been restored. On the retreat of the ice the flora, of course, would follow it step by step, but its starting-point being west of the dividing ridge or backbone of America, or, what is probably more to the purpose, west of the tertiary sea which lay in the line of the Missouri and Mackenzie Rivers, and thus being penned in between the Pacific and these barriers, it would flow up in strength into Cali-

* Any instances, such as the lion or leopard, which seem inconsistent with this statement, are only so in appearance. See remarks on the distribution of the lion—*postea*.

fornia and Oregon, and only such a portion of it as might be able to cross the ridge or sea would succeed in making good its footing on the eastern side of North America.

I conceive that the Missouri sea must have been the more important obstacle of the two; because the place where that sea lay is to this day the limiting boundary between various species inhabiting the country to the east and west of it. That sea, however, was interrupted near the south, and by that interruption Eastern America doubtless received many of its species. The sea appears to have run up straight to the Arctic Ocean in the line of the Mackenzie River; but I have a strong expectation that it will be found, when the regions to the north of Vancouver's Island are thoroughly examined, that this sea had another communication with the Pacific perhaps not very far north of or on the site of the tertiary beds near that island, which acted as a barrier isolating the strip of land which lies along the coast of the Pacific between the mountains and the sea. This seems probable from the following facts in the distribution of Asiatic plants in America, or of American types in Asia.

Professor Gray has shown that the relations of the flora of Eastern Asia (as more particularly expressed by that of Japan) with that of the United States, east of the Mississippi are peculiarly intimate. This is evinced by the great number of congeneric, closely representative, and identical species in the two floras. Also that although there is a considerable number of species common to the western side of the American continent and to Japan, yet that the likeness is less strong between their floras than between those of Eastern North America and Japan.

On the other hand, large American genera (such as EUPATORIUM, ASTER, SOLIDAGO, SOLANUM) are represented in Asia by a small number of species, which diminish or disappear as we approach the Atlantic limits of Europe, whilst the types peculiar to the extreme west of Europe are wholly deficient in America. "The deficiency," says Dr. Gray, "in the temperate American flora of forms at all peculiar to Western Europe is almost complete, and is most strikingly in contrast with the large number of Eastern American forms repeated or represented in Eastern Asia."

Professor Gray thus accounts for these facts. First, he adopts the theory that a more extended homogeneous and uniform distribution of plants than we now have existed previous to the glacial epoch; that during the continuance of that epoch, the northern types migrated, or were driven southwards, (although he does not seem to accept the idea of their being driven so completely out of the country as I have supposed), and that, on the retreat of the ice before the returning warmth, the temperate flora which had survived the cold returned to the north, following the steps of the ice *pari passu;* and, what he considers an important point, that they must have advanced further north, and especially north-westward, than they now do, so far, indeed, that the temperate flora of North America and Eastern Asia must have become conterminous. He then supposes that an epoch, called by Dana the FLUVIAL EPOCH, followed the Glacial epoch, which, from whatever cause, was of a milder character than our present climate, as he thinks is proved by the remains of species of MEGATHERIUM, MYLODON, MEGALONYX, MASTODON, and the MAMMOTH, having been found in the deposits of that period. He argues that all the facts known to us, even to the limiting of the drift, show that the configuration of the two continents was nearly the same then as now, and the isothermal lines curved as now (which, so far as regards the isothermal lines, the reader will see to be correct by comparing the limits of the glacial action in Europe and America shown in Map 4); that such a more genial climate would commingle the temperate floras of the two continents by Bhering's Straits, or perhaps by the still shorter route of a tract of land between Kamtschatka and the Aleutian Islands.

Still following Dana's geological views, he imagines a third epoch (the TERRACE EPOCH), which is the transition between his fluvial epoch and the present state of things, during which he supposes that the interchange of migrations by which the preponderating affinity between the East of North America and the East of Asia over that of Western America was effected, took place by, and in virtue of, the isothermal lines. To use his own words,—"The interchange of plants between the East of North America and Eastern Asia has mainly taken place in high northern latitudes, and that the isothermal lines have, in earlier times, turned northward on our eastern, and southward on our north-western coast, as they now do, are points which go far towards explaining why Eastern North America, rather than Oregon and California, has been mainly concerned in it, and why the temperate interchange, even with Europe, has principally taken place in Asia."

I am a little sceptical about the supposed fluvial epoch; and its climate being milder than that of the present day. The presence of the Megatherium might be worth something as evidence of a warm climate, seeing that the typical South American species lived in a warm climate, and that the species itself lived previous to the glacial epoch; but the company of the Mammoth, and this not a tropical Mammoth, but the woolly fur-clothed ELEPHAS PRIMIGENIUS, adds nothing to the force of that fact. If the maxim "*noscitur a sociis*" is to be applied, its association with the species of Megatherium and Mylodon in question would be fatal to the idea of a mild climate. For, although the kindred of the Megatheres lived in a warm climate, so did the kindred of the Mammoth: and yet we are as sure almost as we can be of anything depending on palæontological evidence that the Siberian Mammoth (ELEPHAS PRIMIGENIUS) was an animal fitted for a cold climate. Moreover, the evidence of extinct Megatheres having survived the glacial epoch is not altogether beyond suspicion. The reader will find the question more fully discussed when we come to the Edentata. If they did, they did not survive it long, and only in the most southern and warmest parts of North America.

The argument from the isothermal lines is more satisfactory. There is, however, one purpose to which it is applied by Professor Gray in which I cannot concur, and that is, to explain the cause why species which, according to him, have crossed from Asia, have passed by, or omitted to enter, north-west America, and travelled on to Eastern America. His theory explains most happily and ingeniously how species, whose habitat is in Eastern Asia and Eastern America at as low a latitude as 50° N., may yet have been able to cross from one continent to the other at a latitude of upwards of 60°, but having once crossed, I do not see they should have a greater range of latitude in east than west America, nor why the species should be absent in the latter altogether. The fact is, however, that they have not spread into north-west America. That district—that strip of land lying to the west of the Rocky Mountains—has been passed by the plants, whether from Asia or Eastern America? If the plants really touched the north of this territory, there must have been some other reason for their going past it than the difference in temperature. There must have been a barrier there which they could not pass; and I think the hypothesis which I have above suggested, that at that time there was a strait or sea to the north of Vancouver's Island, joining, what I may call the Missouri-Mackenzie tertiary sea, is the true explanation of the phenomenon. Such a barrier would hem in and preserve North-West America as a comparatively isolated region, in which, as Dr. Hooker points out,—"we have, as in an oceanic island, a great mixture of types (Asiatic, European, East and West American) and paucity of species."*

* HOOKER, "On the Distribution of Arctic Plants," in Linnean Society's Transactions, vol. xxiii., p. 275. 1861.

There is, however, another feature in the distribution of vegetation in North America, which has been used as an argument in favour of the miocene Atlantis without regard to the interruption of phenomena which must have been occasioned by the glacial epoch; but which, if it was worth anything as an argument when no such interruption was thought of, should be equally good for an Atlantis after it; and that is, that the number of the species of plants which occur in Eastern Asia diminishes as we proceed westwards. Mr. M'Clelland makes an observation to a similar effect as regards the animals of Assam; his catalogue of them displaying an interesting balance numerically in favour of the extension of species from the eastward.* As to plants, out of 1550, which is the number of Japanese phænogamous species known up to this time, Dr. Gray has pointed out that, supposing them to have been spread in the direction and from the point specified, by the time they reach Europe they are reduced to 157; by the time they come to Eastern North America they only number 134; and when they get so far as Western North America we find only 120 species.

The inference from this, of course, is that there was a highway open to the plants all the way round the world from Japan to California; and that as they got further and further on their journey, species kept dropping off until, when they reached its end, only 120 species remained out of 1550. The idea is plausible at first sight, but a little consideration will serve to show that the distribution of species in North America has in reality nothing to do with that in Europe and Asia, but that they are the results of two totally different trains of action. It is plain that if they were part of the same train of action, they must bear a relative proportion to each other. If 1550 species are reduced to 157 in journeying to Europe—say 7000 miles—they ought to have suffered a further proportionate decrease by the time they have reached America, and a still greater by the time they have reached California. Does that rate correspond with the results above given? Here they are compared:—

ACTUAL LOSS OUT OF 1550.	LOSS PROPORTIONATE TO THE DISTANCES.
From Japan to Central Europe, say 7000 miles—1393=one in every five miles .	1393
From Central Europe to Newfoundland, 3000 miles, 23	600
From Newfoundland to California, . 4000 miles, 13	800

In other words, according to that ratio the whole should have been extinguished before they had well left Europe; the 157 left would not suffice to carry them across the Atlantic, even starting from the west coast of Ireland. In the first 7000 miles, the missing amounted to 1363, in the second only to 36; a result too extravagant to be seriously looked at, and yet not even so bad as it really should be, because no allowance has been made for the increased ratio of loss which we should expect to be consequent on increased distance from home.

The real cause of the similarity of the floras of Eastern Asia and America is probably that both started from a similar basis. In the miocene time one flora inhabited Europe, Asia, and America. The glacial cold all but destroyed it in Europe, but in North America it found a refuge in the south-west, and in Asia the distribution of land and water shows that its refuge there must have been mainly in the south-east—not in the Malayan south-east, which was cut off from Northern Asia—but in the south-east of Northern Asia; in other words, Japan and the north of China. The floras preserved in Asia and America would, of course, undergo different

* M'Clelland, Catalogue of Animals in Assam in "Annals of Natural History."

changes as they spread further and further from their starting-point, but in both those left at their starting-point should be nearest the original miocene type from which they have descended without undergoing the chances of change of form incident to change of place.

As regards modified species which may have found their way from Asia to America, or, *vice versa*, the difference in their proportion in East and West America is to be sought for in the comparatively insular position of the latter, fenced off, as I have shown, by seas to the west, to the greater part of the east, and also probably to the north. Hence East America, although furthest from Asia, received the Asiatic species first, and West America only received them by regurgitation from the East.

Before leaving the consideration of the effect of the glacial epoch, I should wish to notice an ingenious, cosmical speculation, in relation to it, which has recently been propounded.

That epoch plays too important a part in questions relating to the geographical distribution of plants and animals, to allow us to disregard as extraneous any views relating to it. I therefore make no apology to the reader for detaining him for a few minutes while we look into this hypothesis and endeavour to estimate it at its real value.

The speculation to which I refer is that lately made by Mr. Croll* in which he ascribes some of the phenomena of the glacial epoch to the disturbance of the centre of gravity of the earth. That gentleman has suggested that the submergence of the land in the north which is believed to have followed the termination of the glacial epoch may have been due to a disturbance or alteration of the centre of gravity of the earth, consequent on the enormous weight of ice accumulated at the North Pole during that epoch. Mr. Jamieson† had already suggested that the earth's crust may have yielded under the weight of the ice, and so caused the submergence; but Mr. Croll, while he also refers the result to the weight of the ice, argues, that instead of the earth sinking, the water, in adjusting itself to a different centre of gravity, overflowed part of the land. Mr. Croll says, "The surface of the ocean always adjusts itself in relation to the earth's centre of gravity, no matter what the form of the solid mass of earth may happen to be. Now if a portion of the water of the ocean be converted into solid ice, and placed, for example, around the northern polar regions, it will necessarily change the position of the earth's centre of gravity. The centre of gravity will be removed a little to the north of its former position. The water of the ocean will then forsake the old centre, and adjust itself in relation to the new. The surface of the ocean will, therefore, rise towards the North Pole, and fall towards the South; in other words, there will be in relation to the sea-level a depression of the land on the northern hemisphere, and an elevation on the southern. The extent of the rise of the ocean, level, or, what is equally the same, the extent of the submergence, will be in proportion to the weight of the ice-sheet. The weight, or the size, of the ice-sheet being known, we can determine with the utmost certainty the extent of the submergences; or controversely, the extent of the submergence being known we can determine both the weight and the size of the ice-sheet. It is singular why physicists should not have perceived the physical impossibility of an ice-sheet, several thousands of feet in thickness being placed upon the northern hemisphere, still retaining its former level in relation to this land, unless the ice-sheets be counterbalanced by one of equal weight placed upon the southern hemisphere. But this leads to another result. The submergence of the land during the glacial epoch leads to the conclusion that the glaciation was not contem-

* See Letter in "Reader," Aug. 1865.

† JAMIESON, in "Quart. Journ. of Geology," xviii. 170, and xix. 235.

poraneous on both hemispheres. If the ice-sheet had covered both hemispheres, the earth's centre of gravity, and consequently the ocean-level, would have remained unaffected. The submergence of the land is therefore another confirmation of the truth of the theory, which attributes the glacial epoch to excentricity of the earth's orbit; for, as you are aware, if the glacial epoch had been due to the excentricity, the glaciation could have extended to only one hemisphere at a time. One hemisphere would have been covered with snow and ice, while the other would have been enjoying a perpetual spring.

"A glacial epoch resulting from the excentricity of the earth's orbit would extend over 100,000 years. But owing to the precession of the equinoxes and the revolution of the apsides the glaciation would be transferred from the one hemisphere to the other every 10,000 years or so. A glacial epoch extending over 100,000 years would therefore be broken up with five or six warm periods. A warm period on the one hemisphere would be contemporaneous with a cold period on the other. Under these circumstances we ought to have elevation of the land during the warm periods, and submergence during the cold. The land ought to have stood higher than at present during some periods of the glacial epoch as well as lower. This, again, is in agreement with geological facts. That the cold of the glacial epoch was not continuous, but was broken up by comparatively warm periods, when the ice to a considerable extent at least disappeared, I think has been clearly proved by Morlot, Geikie, and others, from the stratified beds of sand clay and gravel, old water-courses and striated 'pavements' which have been found in the true boulder clay."

As regards the glacial epoch being the result of the excentricity of the earth's orbit, there is much that is attractive in the idea. It would explain many puzzling facts, and others which appear inconsistent with it might be explained away or reconciled to it. For example, it may be said if that is a true explanation the glacial epoch should return periodically, and that this has been so we have no evidence. But the heat of the earth until the glacial epoch may have been sufficient to have enabled it to have endured the cold with only a slight alteration of temperature, sufficient to make such a change of condition as I require for the development of new species, but nothing so great as to produce an extinction of life on any part of the globe: of course it would be less and less felt the further back we go in the history of the earth.

There are, however, some facts apparently opposed to it, which I do not at present see any means of explaining away. The excentricity of the earth's orbit would produce its effect at regular periods, always the same, and at each of these periods marks of its presence should be left—the mark of its presence which I would require would of course be more or less an important change in the types of animal and vegetable life. These we have, but they do not recur at the right times, some being separated by longer periods than others.

Then, again, the necessary assumption that the cold did not extend to both hemispheres at the same time seems inconsistent with some facts which we shall have to consider as we go along; more especially the close affinity of the Arctic and Antarctic whalebone whales, whose ancestors could never have passed from the one Pole to the other, unless the cold extended over the whole earth to such a degree as to render the equatorial seas tolerably cold, or unless the constitution of these whales was something very different from that of their descendants.

Mr. Croll next goes on to speculate on the thickness and weight of the ice-sheet, and the extent of the effect it would produce.

"It has been proved by Mr. Jamieson that in some parts of Scotland the ice-sheets must have been at least 3000 feet thick. Agassiz thinks that in some parts of North America its

thickness could not have been less than a mile; the thickness of the ice in Scandinavia and other parts of northern Europe must have been enormous." He therefore assumes that it was 7000 feet thick at the North Pole, diminishing in thickness towards the Equator, according to a law, into the consideration of which we need not here enter, so that the upper surface of the sheet should curve exactly the same as the land beneath, and ends by bringing out the result that this distribution of ice would have the effect of producing a total submergence of 1000 feet at the North Pole, and a elevation (emergence) of 1000 feet at the South Pole, and of course a lesser accumulation of ice would produce a correspondingly lesser amount of submergence and emergence.

Now this hypothesis depends upon several assumptions the withdrawal of any of which would be fatal to it. There must have been a vast accumulation of ice in the northern hemisphere, and it must have been thickest towards the Pole; there must have been not one submergence but several; and these must have taken place during the continuance of the glacial epoch.

Now, first as to the ice; is there any reason for supposing that at the present time it increases in thickness as we approach the Pole? I have not met with any statement to that effect; and if the voyagers who have penetrated furthest had observed any indication of its becoming so they would surely have mentioned it. But both from their sketches and descriptions it appears that the ice and glaciers continued of the same thickness as they advanced to the north. Into this question, the dimensions and extent of mountain glaciers, such as those of the Alps, do not enter. The inferences of Venetz and Charpentier as to the immense extent of these may be perfectly correct; but it does not follow that their height must have been correspondingly great. They are, however, exceptional and detached, and do not affect the case of the general mass of polar ice.

Of course in the case of sea ice it would probably be of a greater depth the further north we go and the greater the cold there is; but that is nothing to the purpose, for ice is lighter than water, and an addition to its depth would not add to its weight. It is only by accumulation above the level of the sea that additional weight could be produced. As no one has reached the Pole we cannot tell from observation what is the case there, but we may reason from analogy as to what should be found there. If we assume that the cold becomes more intense the nearer we approach the Pole, it by no means follows that there should be more ice there. All the ice of these regions comes from snow. Snow is produced by warm vapour-bearing clouds or atmosphere coming in contact with cold air. It never falls when the thermometer is much below 32° Fahr. The vapour-laden warm air which has risen from the tropics and ascended above the colder temperate atmosphere on meeting the frozen air of the Arctic regions, deposits its vapour in the shape of snow. It is, therefore, always on the boundary of the eternal ice that snow will be deposited. The Pole itself should be clear from fogs, or vapour, or snow. How far the direct heat of the sun might have some effect in producing them during the short summer we cannot tell; but we know that that is not the origin of the snows which fall elsewhere. It comes from the source already mentioned. Increase of snow and ice should therefore be always at the outer margin of the polar ice; when there is no yearly increase in the cold, when it is standing water between heat and cold, there will be little increase in the breadth or thickness of the ice, for the heat of summer will melt away the increase of winter. But when the cold is on the increase, as when the glacial epoch came on, its last year's gain would not be melted away indeed, but still there would be no increase of snow or ice in the interior, it would be always at the outer margin that the increase would go on; and the effect of increased cold would be, not to pile up more ice upon that which already

existed, but to advance the margin towards the equator; and all that the margin would gain in increase would be the few years' accumulation which might have fallen before it was left behind in the interior by the general advance of the margin towards the tropics. The glacial ice, according to my view therefore, never was thicker than it is now in Greenland and the Polar Seas. Of course, if I am wrong in my reasoning as to the deposit of snow in the Polar regions, and if the analogy of what is now to be seen in the Polar regions, can be disregarded or explained away, I then must abandon my position and acknowledge that here is no limiting power but time to the thickness which the sheet ice may have attained during the glacial epoch. I would only say in that case, that I am astonished at the moderation of Agassiz and his followers in limiting it to a mile. The rate at which the glaciers of the Alps move (from several inches to a foot or two in the twenty-four hours) indicates a rate of increase at the upper end of many feet during the year; for although they are, as it were, the outlets of large lakes of ice, and consequently their rate of movement is no guide as to the amount of snow which may have fallen on every square foot; still considering how much is lost by melting, the rate of movement shows that the increase is very great; or, if we merely reckon all the rain that falls during the year in our own country, which would then of course all be snow, and estimate the depth of ice as equal to that of the rainfall it will be a very low estimate to take that at a foot in the year; and if we then take Mr. Croll's reduced datum of only 10,000 years' continuance of cold without a break, we should on that ratio have a thickness about two miles in height. Or if the alternative proposition of no breaks of warmth be adopted, and his 100,000 years be accepted as the limit of time, the thickness on the same ratio would reach twenty miles in height.

Again, as to the repeated or alternate submergencies and elevations during the continuance of the glacial epoch, this, no doubt, may have been, but it can scarcely be called more than a conjecture. All that can be said of the facts to which Mr. Croll alludes as in some degree supporting this idea is, that they are not irreconcilable with it. They are as consistent with the subsidence (which all admit) having taken place subsequent to the retreat of the ice as during its subsistence. The evidence of subsidence, such as that of beds containing shells being found overlying the drift, points to a date subsequent to the cessation of the chief rigour of the glacial epoch, and some of them indicate the lapse of long periods of time between its close and the submergence. The old watercourses and striated pavements found by Mr. Geikie in the drift, speak neither for nor against submergence, but are so far in favour of a break in the intensity of the cold, although they do not necessarily prove this. They may have arisen while the ground where they occur formed part of the outer margin of ice, and vibrated between advance and retreat. In our own times, without any apparent alteration in our climate, an immense barrier of ice, which had surrounded the east coast of Greenland for four centuries, broke up in the year 1816, and in that and the following year disappeared from the coast. Its disruption and re-growth might simulate some of the phenomena referred to by Mr. Croll.

Lastly, if the elevation or transference of mountain chains and vast continents from one hemisphere to another, failed to disturb the centre of gravity of the earth, the existence of such a quantity of ice as it seems reasonable to admit the existence of, could have had still less influence especially if the balance of the earth were preserved by both Poles being refrigerated at the same time.

CHAPTER VI.

MAMMALS—CLASSIFICATION AND MUTUAL AFFINITIES.

STARTING with the principles which I have laid down in the previous chapters, and by which I mean to be guided throughout the remainder of this work, the affinity of species becomes of vital importance to our whole inquiry; and not merely the simple question, whether this or that species be allied or not, but the degree of affinity, becomes almost as necessary to be known. While it is indisputable that two different species starting on the career of change at the same time, and from the same terminus, can never be expected to make equal progress in their journey, as one will certainly outstrip the other, still it is equally clear that when they do not start simultaneously, those which have started first ought to have the advantage on the whole. Thus we can hardly escape from the conclusion that when we find two animals both apparently derived from the same stock, but one more removed from its typical character than the other, that one dates its connexion with it from the more distant period of time.

The reader will see how important such indications may be when questions arise as to the relative antiquity of the separation of different lands, or their alternate separation and reunion. No work can deal satisfactorily with geographical distribution which does not take a large account of questions of affinity.

A few words upon the chief difficulties which meet us in our attempts to classify the animal kingdom, and more particularly, mammals, will therefore be a fitting preamble to the details on which we are about to enter.

Assuming that species are derived, the one from the other, the most perfect system of classification would of course be simply a genealogical tree showing the descent of each.

The materials for making such a tree are, however, beyond our reach. The records that have been kept in the pages of geological strata, are imperfect and interrupted, and we do not even know that we can always read the language; and of by far the greater portion no record has been preserved at all.

All that we can do, therefore, is by the study of the anatomy and physiology of those living species to which we have access, to endeavour to ascertain their affinities, and to make up a fictitious tree, in the best way we can from the materials we possess.

The genealogical form of classification has, however, this disadvantage, that we can at no rate, and by no possible contrivance, squeeze it into a linear arrangement. Each species requires a separate tree for itself. Scarcely one of all the thousands of species inhabiting the globe can come into the same arrangement with another, for if two appeared in the same genealogy, one of them must either be the parent or descendant of the other, and the cases in which there is the least reason for supposing that this has been the case with living species, are few in the extreme. But although this be the case with individual species, it is not necessarily so with larger groups;

a group from which another has sprung may still subsist in its descendants; some groups may be very old, others quite modern, always supposing that the groups really do exist in nature, and are homogeneous, and may be treated as entities. If we may so treat them, the best substitute for a linear arrangement is to have as few and as short, separate, and independent lines of classification or descent as possible. But may we look upon such groups, families, or orders, as separate and independent existences? or, like genera, are they merely artificial aids to memory and arrangement. It appears to me that they are in many respects more real than modern genera.

In the first place, the different orders (or, to prevent all dispute as to what an order really is, let us say some of the different groups) are undoubtedly very homogeneous.

"In all the instances of approach of species of one order to other orders," says Mr. Waterhouse, in speaking of the classification of the different orders in one of the best of his many excellent papers, "there is not a single case which would fairly bear out the notion that these orders imperceptibly blend into each other. There is always a tolerably well marked line between them. The aberrant species are readily traced back as it were into their own groups, and when they evince an approach to other circles it is rather to the order than to any particular species of the order."*

In the next place, a species is something separate and distinct, which, although composed of many items, is still only a unit. This, I think, is an inevitable corollary to the hypothesis that new species come into existence in one body of many individuals. If we could believe the same of orders we should be relieved from some of the most difficult questions attending the origin of species.

In mammals, one of these is the relation which subsists between certain Marsupials which represent in that order equivalent groups of placental Mammals, and the difficulty arises in attempting to ascertain the respective origin of these Dromios. The Marsupials have many claims to be considered one of the oldest, if not the oldest, order of Mammals. The following table of the sequence in which Mammals have appeared on the earth, shows in a general way (without taking into account disputed or exceptional cases) their relative priority, so far as geology has been able to determine it.

Geological Epochs.	Orders of Mammals.
Recent	
Pliocene	Man (?)
Miocene	Monkeys—Proboscoid Pachyderms (Elephants)—Edentata, (Megatheria, &c.)
Upper Eocene	Insectivora (Shrews, &c.)—Rodents (Rats, &c).—Ruminants—Whales
Lower Eocene	Bats—Tapyroid Pachyderms—Carnivora
Secondary formations	Marsupials

* Waterhouse, On The Classification of the Mammalia in "Annals of Nat. Hist." Vol. xii. p. 399. 1843.

This is not worth much, the record being so very imperfect, from the greater part of the earth being now under water, or having been in ancient times above water, and hence having furnished few or no organic remains. But such as it is, it gives us the Marsupials (with a questionable trace of Insectivora) as the first Mammals which appeared on the face of the earth. In addition to the geological reasons for believing in their early appearance, the fact of their structure being lowest in the scale of Mammalian life is an important fact, for although there is no doubt that steps are taken by nature both backwards and forwards, as well as to the right and to the left, still her general course has been forwards,—her motto has always been "*Excelsior*,"—and the chances are thus in favour of the lowest having appeared first. The admirable system of classification (admirable from the point of view of organization) founded by Professor Owen, chiefly, although by no means wholly, on the characters of the brain,* seems to place it beyond doubt that the relative position of the Marsupials is at the bottom of the list, and that the place of the Rodents and Insectivora is next to them. At any rate that one or other of these three is oldest. If the Marsupials are not the oldest, then the choice lies between the Insectivora and the Rodents, the claim of the former being strongest on geological grounds, of the latter on structural, and both (if we reckon the Bats as Insectivores) as being the only placental inhabitants found in Australia along with the Marsupials; the equivalent relations above referred to being also much stronger with them than with any other order.

These equivalent groups are of two kinds. One displays relations of analogy which have been thought to typify different orders of placentals; as, for example, the pedimanous and frugivorous opossums are supposed to have foreshadowed the pedimanous frugivorous monkeys; the marsupial hyena or tiger (Thylacinus) our common carnivora; the wombat, the rodents; the kangaroo, the ruminants; the koala, the phytophagous sun-bear; the phascogales, the shrews; the Echidna and Myrmecobius, the ant-eater. This relation shows parallelism of internal structure, but little external resemblance. The cow has a complicated digestive apparatus; so has the kangaroo. Both are herbivorous; herbivorous animals require a more elaborate apparatus for digestion than carnivorous (which have a great part of the business of assimilation from vegetable to animal tissues already done to their hand), therefore both are supplied with suitable machinery for the purpose; it is not the same, but so far alike as is necessary. So with their dentition; in both it is adapted for grinding vegetable matter, but it is not the same. As to external appearance, on the other hand, they are totally void of resemblance. This kind of analogy is more of the nature of homology than of close affinity.

The other analogy is of a different character. It is a close personal resemblance promising absolute identity throughout, but not fulfilling the promise. The frontispiece is an illustration of this sort of resemblance. It is a representation of Antechinus minutissimus and Mus delicatulus, two Australian Mammals, copied, by Mr. Gould's permission, from figures in his magnificent work on the Mammals of Australia. The one belongs to the order of marsupials, the other does not; the one has rodent dentition, the other has not; and yet, as the reader sees, the two are so identical in outward appearance, that, on a hasty inspection the most experienced naturalist might be deceived, and might set them down as two species of mice. The same thing happens with other species of rodents;—the flying Marsupial Petaurus is a close counterpart, in outward appearance, of some of the flying squirrels. One or two of the Phascogales, or Antechini, resemble

* Owen, in "Proceedings of Linnean Society," vol. ii. p. i. 1857.

the jerboa. PERAGALEA LAGOTIS has considerable resemblance to a hare, and carries its habits as well as its ears—making a form in the grass like it. The Wombat has been compared to the beaver, or capybara; but there is not sufficient actual similarity of appearance in them to suit the purpose for which I refer to these analogies.

Now let us take two (the two most striking, of course) of these resemblances, — two will answer as well as a dozen. Let us take the mice and the flying squirrels as opposed to the ANTECHINI and PETAURI. All inhabit the same quarter of the world (New Guinea and Australia), and have special ordinal structure—that is, a structure which is found in the whole of the order to which each belongs, and which, therefore, may be assumed to be of primary importance and essential in character. The two first have the rodent dentition, and not the marsupial structure; the two last have the marsupial structure, but not the rodent dentition. Can these so similar species have descended the one from the other? Any one looking at the frontispiece would say that the animals there represented must have done so; that such close external resemblance is impossible on any other supposition. Assume it to be so, both with the mice and the flying squirrels, for if it be so with the one, the same rule must hold with the other — we should then have two animals independently of each other, making the same change, both from a marsupial structure to a rodent, or from a rodent to a marsupial. This is, I think, impossible. Nature never repeats herself. Had it been that the one changed to a rodent, and the other to something else — that might be — but BOTH *from* the same and *to* the same is opposed to all that we know either of the laws of nature or of the doctrines of chance.

Therefore, so far as the question is the origin of species from a single progenitor, I feel constrained to admit that it cannot be. But may not the whole order of marsupials, or of rodents, or a part of the order embracing those instances where close resemblance exists, have received in one body the impulse of change from marsupial to rodent, or from rodent to marsupial, as I think there is reason to hold is the case in whole bodies of individuals composing a species? That is an explanation which appears to me to have some germ of truth.

But the difficulties do not cease here. We have taken the two orders, Marsupials and Rodents, as *in pari casu*, and looked at the question of the derivation of these similar species from one or other, as if either might be indifferently the oldest; but one or other must be the elder—they could scarcely be twins,—or triplets if we take in the Insectivora. But might they not be the children of different parents? Is it absolutely necessary that all Mammals should spring from one progenitor or parent stock? May they not have sprung from different stocks—the bat from the pterodactyles; the duck-bill, or ornithorhynchus, from birds; the whale from the ichthyosaurus, and the general mass of Mammals from terrestrial reptiles?—or have the whole four classes of Vertebrata (mammals, birds, reptiles, and fishes) been developed into being successively in descent, not one from the other, but from some ancestor common to them all? All these inquiries are involved in the argument whether there is such a thing as an order; and if so, whether more than one part or member of it can receive simultaneously the same new impress, as appears to be the case in species. If this were possible, then I incline to think that it may have been the mode in which the orders of Mammals came into being; but if that hypothesis must be excluded, then we are driven to the conclusion that each class, order, or natural group, started from some one parent species, into which had been drawn, as into one focus, all the different rays of previous form which were afterwards dispersed among the equivalent types which sprung from it.

If we must take this as the course of Nature, it will then be most in accordance with the preponderance of evidence to admit the Marsupials to be the parent from which all the other Mammals have descended. The Rodents would come next—indeed, we are not without some grounds for considering them first. But this would not affect our classification materially. If they came first, they gave off the Marsupial as a side branch, which has gone no further; and they then went on to the development of the other orders. If they did not come first, but descended from the Marsupials, they left them behind, standing still, and proceeded as in the other case. Whether the Monotremes cannot be treated as an exception, being scarcely Marsupials, and be regarded as the direct source of the EDENTATES (ant-eaters, &c.) is another question involved in doubt. From the Rodents would then spring two antagonistic organizations—the carnivorous and the herbivorous, a partition of a bifold principle embodied in the Rodent itself—some of them like the rat, being both vegetable and flesh-feeders. The Insectivores under our supposed case would be the first of the flesh-feeders. The lower monkeys, PROSIMIÆ, I would, with M. Gratiolet, refer directly to the Insectivores. From them also I would draw the Carnivores; and from the Carnivores, the monkeys and man.

Reverting to the herbivorous section of the Rodents, there seems more direct evidence of the descent of the Pachyderms from them (as through the TOXODON, the CAPYBARA or HYRAX,) than is accessible for most other groups. From the Pachyderms to the Ruminants and Sea Cows follows, as a natural step. The whales are generally supposed to be drawn from the same source, but their location is attended with peculiar difficulty.

In all this, however, there is a multitude of objections, puzzles, and contradictions, which can only be got over by an amount of reconciling and explaining away which appears to me to be quite an exception to the usual simplicity of truth. This remark, however, only applies to the orders and general mass of typical forms, each taken as a whole. When we come to deal with the individual species of the different groups, their affinities to each other are generally simple and clear; and this inclines me to think that we have probably reached the truth in the one case, and not in the other. In the meantime, however, feeling no confidence in any plan of descent which I can suggest, I shall, in the main, follow the system of classification of Mammals laid down by Professor Owen; merely deviating from it in those points on which I have formed a decided opinion of my own in opposition to his conclusions, although derived from the same premises.

That arrangement proposed by Professor Owen will be found in the Appendix, along with those of Cuvier, Milne Edwards, and other eminent naturalists. The modification of it, which I have adopted, has been given at the commencement of this volume, coupled with a table of the first geological formations in which remains of the different orders and families have been discovered.

Before leaving this subject I would wish to draw the reader's attention to one noteworthy inference to be drawn from the course of descent, whichever view be adopted; and that is, the excessive rarity of any important change in the form or structure of animal life. When we think of the extraordinary prolificness of nature, of the vast diversity of form and organization scattered all over the globe, we are apt to imagine that the changes must have been frequent. But on more careful inquiry we see that at the utmost only three or four important changes have succeeded each other in any one direction from the first appearance of Mammals, down to the present day. Taking all the orders together, and including the small changes in each, their number is beyond reckoning; but, looking at important changes of type, the number is as I have stated.

CHAPTER VII.

DISTRIBUTION OF MAN — BLACK AND WHITE RACES.

The races of man as defined in most of our works on Ethnology are six,— the Caucasian, the Mongolian, the American, the Ethiopian, the Malayan, and the Australasian. To these many add a seventh, the Papuan or Oceanic.

Although this division maintains its place, it does so more from the difficulty of finding a satisfactory substitute, than from any general assent to its propositions.

It appears to be unsupported by any argument or consideration beyond this, that in each of the countries allotted to these seven sections, certain different tribes or races of mankind are found; but that they are all of equal value, or that no other varieties can be pointed to showing as marked distinctions between them as some of the above, no one who has thought on the subject will affirm. For example, is there no more difference between a Mongolian and an Englishman than there is between an Englishman and a Negro? Most people would say that the Mongolian was half-way between the European and the Negro. I shall, I think, presently show that he is greatly less than half-way towards the Negro; but assuming for the nonce that he is half-way, what kind of system of arrangement is that, which places the race which stands half-way between two others on the same footing and equality as those which are separated the whole way? Or if races showing lesser degrees of difference are to be associated with, and placed on the same platform as those more widely separated, why are not all minor sections to be taken into account too? It seems plain that the present usual scheme of classification is erroneous, both in principle and in application.

The opinion which I have formed is, that there are no more than two great divisions of mankind, equal in value and marked by characteristics of equal importance, each of which again is divisible into an indefinite multitude of smaller sections. Speaking roughly, these two great races may be distinguished as the Blacks and the Whites. Map 6 will show the territory which I think is occupied by each, and the following is the line of reasoning by which I have arrived at this conclusion.

If we begin our survey at the North Pole, we find one race of men (the Esquimaux) inhabiting the first habitable land all around it. The Esquimaux in Greenland, the Esquimaux at Baffin's Bay, the Esquimaux at Bhering's Straits, and the Esquimaux in the North of Asia, are one and the same. In this respect, the facts with regard to man correspond with those of other organized beings. The faunas and floras* of all the countries around the Pole are nearly the same.

* The words Fauna and Flora are now naturalized English, and being so it would be a mistake to speak of them in the plural as Faunæ and Floræ. The same remark applies to a multitude of other scientific words in common use, especially names of plants; and I take the opportunity, once for all, to claim the right to treat all such words as English, and to give them English plural terminations when speaking of them in that number.

MAP VI.

SHOWING THE DISTRIBUTION OF

MAN.

White race.

Black race.

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

GREENLAND

BAFFIN BAY

HUDSON BAY

ESQUIMAUX

RUSSIAN AMERICA

BRITISH AMERICA

UNITED STATES

MEXICO

CALIFORNIA

TEXAS

CARIBBEAN SEA

BRAZIL

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

SCOTLAND

IRELAND

FRANCE

SPAIN

PORTUGAL

AUSTRIA

PRUSSIA

SWEDEN

NORWAY

FINLAND

RUSSIA

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

SAHARA DESERT

EGYPT

ARABIA

NUBIA

SOUDAN

ABYSSINIA

GUINEA

CONGO

CAPE COLONY

MADAGASCAR

INDEPENDENT TARTARY

PERSIA

AFGHANISTAN

BELOOCHISTAN

HINDOOSTAN

THIBET

CHINESE EMPIRE

MONGOLIA

MANCHOOURIA

OKHOTSK SEA

KAMTCHATKA SEA

JAPAN SEA

YELLOW SEA

ARABIAN SEA

BENGAL SEA

CHINA SEA

NEW SIBERIA

LIAKHOV IS.

NOVAYA ZEMLA

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

Davis Straits

Behring Straits

Arabian Sea

Red Sea

Persian Gulf

Caspian Sea

Aral Sea

Baikal L.

Lake Aral

Lake Superior

Lake Michigan

Lake Huron

Lake Erie

Lake Ontario

Lake Winnipeg

Great Slave L.

Great Bear L.

Lake Nicaragua

Lake Titicaca

Lake Maracaibo

Lake Chad

Lake Ngami

Lake Tchad

Lake Victoria Nyanza

Lake Tanganyika

Lake Nyassa

Lake Aaron

Lake Ashangi

Lake Dembea

Lake Tzana

Lake Aschangi

Lake Maracaibo

Lake Titicaca

Lake Nicaragua

Lake Winnipeg

Great Slave L.

Great Bear L.

Lake Superior

Lake Michigan

Lake Huron

Lake Erie

Lake Ontario

Lake Baikal

Lake Aral

Lake Tchad

Lake Ngami

Lake Victoria Nyanza

Lake Tanganyika

Lake Nyassa

Lake Aaron

Lake Ashangi

Lake Dembea

Lake Tzana

Lake Aschangi

Lake Maracaibo

Lake Titicaca

Lake Nicaragua

Lake Winnipeg

Great Slave L.

Great Bear L.

Lake Superior

Lake Michigan

Lake Huron

Lake Erie

Lake Ontario

Lake Baikal

Lake Aral

Lake Tchad

Lake Ngami

Lake Victoria Nyanza

Lake Tanganyika

Lake Nyassa

Lake Aaron

Lake Ashangi

Lake Dembea

Lake Tzana

Lake Aschangi

Day & Son (Limited) Lith.

Taking the East of Bhering's Straits, and passing southwards into America, we see the Esquimaux imperceptibly changed into the North American Indians. The Chinooks, and other northern tribes nearest the Esquimaux, cannot be distinguished from them; and the tribes next to *them* on the south again pass insensibly into the red-skinned tribes of middle North America. These pass into the digger tribes of California, which have in their turn many of the characteristics of the tribes of Central and South America, and all attempts to elevate the tribes of South American Indians into separate races, have long since been abandoned. In short, it is now universally acknowledged, that the whole of both North and South America, from the Arctic Sea to Tierra del Fuego, has been peopled by one race. The physical characters, the traditions, the linguistic affinities of the different tribes, white, red, yellow, copper, and brown skins, all bear one stamp. We are compelled, therefore, to receive them as one, and that one identical with the inhabitants of the Arctic regions.

Returning to Bhering's Straits again, and turning westward, we find the Esquimaux amalgamated with the Samoiëdes and Tunguseans of North-Eastern Asia, who in their turn pass into the Mongolians on the south; and so strong is the affinity of the Esquimaux with these tribes, that not long since, *apropos* to two North American Esquimaux who visited the United States, and were the subject of examination and ethnological speculation, Dr. Pickering, whom no one will accuse of an undue tendency to diminish the number of races, stated that there could not be a doubt that they were Mongolian.* If the American Indian is an Esquimaux, and the Esquimaux is a Mongolian, the Mongol must be an American Indian too. Additional confirmation of this view is furnished by the Mongol features cropping up in other unexpected places in America; for example, in Patagonia and Tierra del Fuego.† But to proceed further. Does any one propose to erect the Tartars into more than a tribe of the Mongolians? No:—and it is only when, in passing westward, we reach the Caucasus, that ethnologists have seen evidences of a distinct—the European—race. And what are these?—not linguistic peculiarities, for the Sanscrit is the root of all the languages of Europe and Northern Asia; as little physical structure, for the beautiful Georgian, whose almond-shaped and somewhat oblique eye proclaims descent from the Mongols, can scarcely be separated from the Circassian of the neighbouring mountains. The Laps and Fins are Esquimaux according to some, Mongols according to others; they are both, and Caucasians into the bargain. The Tartarian extraction of the Russian peasant is scarcely disputed, "*Grattez le Russe*," said Napoleon, "*et vous en trouverez le Tartar!*" neither is there any room to raise up a wall of division between the Russian and the Pole, or the Russian and Slavonian. In fact, there is no point at which a line can be drawn, separating the Englishman from the Tartar, *as types of great races.* Not as tribes, families, or sections; there is no difficulty in distinguishing these, any more than there is in distinguishing between the Scotsman and the Englishman—the Gael and the Lowlander—

* "Dr. Pickering referred to two Esquimaux now on exhibition in this city. From their low stature, florid complexion, broad, flat countenance, with the profile very slightly projecting, one would be disposed to reject the idea of affinity with the general aboriginal population of this continent. But the sea-going tribes of north-west America, of which he had seen the Chinooks, are intermediate in aspect, having very generally a lighter complexion and less prominence of profile than the interior or hunting tribes. In addition to his published opinion, that, with one minor exception, America was originayll peopled from the north-west by the sea-going tribes following the coast, personal inspection now satisfied him that the Esquimaux are Mongolians, and that there is no distinct physical race of man in the Arctic regions."—*Proceedings of the Boston Society of Natural History*, vol. ix. p. 182. (April, 1863.)

† See the portraits of a Patagonian in "Wilkes' Voyage," and of "Jemmy Button," (especially that in sailor's dress), in Fitzroy's "Voyage of the Beagle."

the Irishman and the Kentish yeoman. All are tribes which have acquired, from force of character, locality, physical conditions of life, or other circumstances, features or dispositions, to a certain extent, distinctive; but as great original races, they cannot be distinguished one from the other.

Next to the Mongol tribes, we have the Chinese and Japanese, which have no claims to more than tribal distinction; distinct races they are not. Of the Hindoos, Major-General Briggs truly says:—"The Hindûs are universally acknowledged to be of that branch of the human family denominated by Blumenbach Caucasian, and they believe they invaded India from the north-west."* Neither are the Affghans and Persians any thing more than tribes, and as little are the Greeks, Turks, Egyptians, and Arabs of the shores of the Mediterranean.

The Malays, or brown tribes of the Indian Archipelago, are farther separated than any of the rest from the other inhabitants of the continents of Asia and Europe; and if any third race, besides the whites and the blacks, is to be admitted, it should be the Malays. Still, there are points of affinity between them and the Chinese and other Mongolian tribes which prevent their being so received. There is as much difference between the South American Indian of the Amazons, and many of the tribes of North American Indians, as there is between the Malay and the Chinese; and if we retain the two former as one, in defiance of their physical dissimilarity, on what parity of reasoning can we separate the two latter? I regard the Malays as merely one of the many offshoots or tributaries of the great white race.

Now there is one thing to be observed regarding all the lands and people over which we have cast our eyes, viz. that they are conterminous and continuous; and not only so now, but if we suppose the northern hemisphere to be sunk one hundred fathoms (as shown in Map 2), even then there is easy communication between all the unsunk portions of this great extent of land. The Straits of Bhering are sufficiently near to furnish such a people as the Esquimaux with an easy means of transit from one continent to the other at any time; and there is no other physical barrier of any kind to interrupt the progress of man from Cape Horn to Singapore. No doubt Ceylon is separated from India; and Sumatra, Java, and Borneo, all of which are inhabited by the Malay stock, are separated from Siam and China by straits and seas; but these are narrow, and would form no obstacle to the passage of a moderately maritime people, and in addition, a rise of the land to the extent of 100 fathoms would unite the whole of these islands with the continent (see Map 1).

As already said, however, in the East, after we reach the south-eastern extremity of Borneo, the shallow seas give place to an unfathomable ocean, out of which spring lands, which, although comparatively near in point of distance, and without geological distinction, bear a different fauna, a different flora, and a different race of men. These two regions are separated from each other by the Straits of Macassar and the Straits of Lombock; Borneo, Java, Sumatra, and the Malayan Archipelago, lying on the one hand; Celebes, Gilolo, New Guinea, and Australia, on the other.

It seems a reasonable inference from these facts, that Borneo, Java, and Sumatra, have been connected at some former period with each other and the mainland, while Celebes, New Guinea, and the neighbouring islands, have never been connected with them, or at least have been separated from them for a long period. The former countries, says Mr. Wallace in a recent paper on the subject, "are, in fact, still connected, and that so completely, that an

* Briggs on the Aboriginal Tribes of India, in "Reports of British Assoc." 1850, p. 160.

elevation of only 300 feet would nearly double the extent of tropical Asia. Over the whole of the Java Sea, the Straits of Malacca, the Gulf of Siam, and the southern part of the China sea, ships can anchor in less than fifty fathoms. A vast submarine plain unites together the apparently disjointed parts of the Indian zoological region, and abruptly terminates exactly at its limits in an unfathomable ocean. The deep sea of the Moluccas comes up to the very coasts of Northern Borneo, to the Strait of Lombock in the south, and to near the middle of the Strait of Macassar.* May we not, therefore, from these facts very fairly conclude that, according to the system of alternate bands of elevation and depression, which seems very generally to prevail, the last great rising movement of the volcanic range of Java and Sumatra was accompanied by the depression that now separates them from Borneo, and from the Continent?"†

The fauna and flora of the Malayan islands, too, is closely allied to the fauna of the neighbouring continent. The elephant, rhinoceros, and tapir, found in Sumatra, are also found in Southern Asia. Every family, most of the genera and many of the species of birds and insects, which are found on these islands, are also to be met with on the continent. On the other hand, the species found in New Guinea, Celebes, and the islands to the east and south, are of a totally different type, in many respects distinct and peculiar to themselves, but in others showing Australian affinities.

Reasoning from these facts, geologists have conceived that while Sumatra, Java, Borneo, and the Philippine Islands, are parts of Asia separated from it at no distant period, Celebes, Timor, the Moluccas, New Guinea, and Australia, are remnants of a vast submerged continent, traces of the existence of which appear in the coral islands of the Pacific Ocean, and in the affinities

* It is perhaps right to say that it is not to be considered as absolutely settled, that the Straits of Macassar are of great depth all through. The western or Malayan side is shallow all along the coast of Borneo. The soundings which have been taken show great depth on the east, both to the north and south, but in the centre an equal depth is not so well ascertained. In the largest and most detailed map of soundings which has been published, viz. that by Jacob Swartz, the soundings taken at the middle of the straits gradually increase on the western side from fourteen to thirty-five fathoms, and a few scattered soundings in mid-channel are noted where the depth varies from twenty to forty fathoms: these are continued until within about ten miles of the coast of Celebes, when no more are recorded.

One is apt to suppose on seeing this, that a bank of from twenty to forty fathoms in depth extends across the middle part of the straits; but in the first place the want of soundings for ten miles across on the side where we know the water to be deepest, and where a little to the north and south no soundings are to be had with a hundred-fathom line, prevent us assuming this; and in the next place, on personal inquiry at Mr. Wallace, he assures me of his firm conviction that there is deep water there as well as on each side of it, and informs me that the scattered soundings to which I have referred are not to be taken as indicating the general depth around the spot marked, but merely the depth at the particular spot, usually a reef or a sand-bank, where they occur He had met with residents who remembered the taking of these soundings, and they informed him that the way in which the officer who was charged with the duty proceeded was this: he allowed his vessel to drift about during the night with a light anchor attached to a forty-fathom cable hanging overboard, and when this caught upon a bank or reef, then soundings were taken and registered, but his forty-fathom anchor might have been swinging about all around, without touching the ground. With this information to guide us in estimating the value of the soundings in Jacob Swartz's map, it is clear that they are worth nothing for our purpose, unless where numerous and close together. I therefore have adopted Mr. Wallace's view, and assumed that the water on the eastern side of the Straits of Macassar is throughout of very great depth.

† See paper by Mr. WALLACE in Linn. Soc. Proc., Feb. 1860. See also a communication by Mr. WALLACE in the *Ibis* for October 1859. On this last point I am not prepared at once to go unreservedly along with Mr. Wallace. It may be that the surrounding depression was due to a more extensive general previous sinking, and that the area in question has been again raised by the volcanic action referred to by Mr. Wallace, stretching through or running across the general depression. The theory of alternate bands of elevation and depression may be pushed too far.

which can be traced between some of the plants and animals inhabiting widely separated portions of the supposed continent.

On this subject Professor Owen says, "Certain it was that geologists had conceived that the islands on the south of the present great Continent of Asia might be remnants of some antecedent very distinct group of land, and naturalists (and he would more especially mention Sir J. Emerson Tennent, who had paid so great attention to the fauna of Ceylon), had brought to their knowledge a host of facts confirmatory of the idea that Ceylon was not a dismemberment of India, but part of a distinct and antecedent continent. In confirmation of that idea, they had the result of the geological researches of Cautley, Falconer, and others in India, which seemed to show that the Himmalayahs had risen, lifting up the fossiliferous beds on their present slopes within comparatively recent geographical time, proving that India had been the site of one of the latest of these greatest systems of upheaving forces that resulted in the formation of new continents." *

We find, in the islands and coral islets surrounded by this unfathomable ocean, a race which will in no respect harmonise with, and by no ingenuity can be made to fit into, the brown tribes of the Malayan Peninsula and Islands, and still less the white races of Asia: this race is that known as the Papuans, or Negritos.

It is a new and distinct race, the like of which we have not previously met with. We shall find its like, however, if we turn to Africa, to the south of that point where a barrier as effective as the deep sea of Celebes has interrupted the continuity of the land, viz. the Desert of Sahara. It does not much matter whether we look upon that barrier as consisting of the present arid desert or a broad sea occupying its place. Either barrier would probably be sufficient to stop the extension of the northern race into Africa south of the desert. Be that as it may, certain it is that something has isolated South Africa from North Africa, for north of the desert we have one fauna and flora, and south of it another; and as to man, north of the Sahara we have the Arabs—undoubtedly a portion of the white northern race—while south of it we have a new race, the Negro, as distinct from them as at the other barrier the Papuans and surrounding nations are distinct from the Malays and Chinese.

And strange, too, both of these new races lying on the south side of these respective barriers have much in common. Both are black, both have their hair frizzled or woolly, both have broad noses, thick and prominent lips, receding foreheads and chins, and what should be the white of the eye of a turbid yellow, or, as a recent writer phrases it when speaking of the aborigines of Fraser's or Great Sandy Island, near Brisbane in Australia, "They appear to be very bilious, for what ought to be the white of the eye is a dirty yellow." † Both have broad shoulders and deep chests, both are inferior in the make of their lower extremities, having long lanky legs, splay feet, and curved shins, and of both it may be said, "From every pore of him a perfume falls." Two distinctions have been attempted to be drawn between them,—the one that the colour of the African is black over brown, while that of the Papuans is blue over black, or black with a bluish tinge, but this is now known to be a mistake. The blue black of the Papuans is due to some artificial application, "pro-

* Owen, in "Proceedings of Geographical Society," vol. vi. p. 44, 1862. As we go along, I think we shall see reason to doubt the sufficiency of Sir J. Emerson Tennent's arguments against the appurtenancy of Ceylon to India, and rather to look upon it as a dismembered portion of that peninsula, than belonging to Sumatra or the Malayan Peninsula.

† "Narrative of a Trip from Sydney to Peak Downs, Queensland, and back," by E. S. H., London, 1864, p. 4.

bably the decoction of the bark of a tree, possibly the 'rosamala' of commerce."* The other that the hair of the African spreads over the whole surface of the head, while that of the Papuan grows in small tufts, each of which is separate from the rest. But there are African tribes, the Hottentots and Bushmen, for example, which have the hair growing in this same tufty fashion; and I see that M. Du Chaillu observed the same thing in the pigmy race, which he met with in his last expedition into the interior of West Africa—a race which may possibly be a tribe of the Bushman variety of the African race. Such distinctions, moreover, even although well founded, are only of minor significance, and point to a distinction of tribes, not of races.

So far as physical character goes then, the Papuans and Africans are clearly allied. How far the languages are so is a point which is not yet settled, but in one respect they certainly have an affinity. Some of the African tribes make a peculiar clucking noise in their speech. This is a much more remarkable character than those who have not heard it have any idea of. I remember on one occasion dining in company with some missionaries destined for Caffirland, one of whom was a Caffir who had been brought to this country in early youth, and had been educated as a divinity student in order to go back as a missionary to his native land. He gave us examples of the Caffir language, talking in his native tongue, and the clucking was so like the drawing of corks and pouring liquid out of a bottle, that on one of the English missionaries who was to accompany him saying that he meant to take lessons from him in the language in his cabin on the way out, one of the guests cautioned him that the sound of so many corks being drawn would destroy their character for temperance with the rest of the passengers.

But this clucking would appear to be a character of the language of some of the Oriental as well as the African black tribes. Mr. Earl, in speaking of the North Australians who have a certain affinity to the Papuans, says:—"In the Croker Island dialect a cluck occasionally occurs in the middle of a word, which is effected by striking the tongue against the roof of the mouth."† This illustration shows that there *are* grounds for looking for proof of relationship between the African and the Oriental negroes in their linguistic affinities as well as in their physical attributes. I do not in any way go along with the bold conjecture hazarded by Professor Agassiz that "the languages of different races of men were neither more different nor more similar than the sounds characteristic of animals of the same genus, and their analogy can no more be fully accounted for on any hypothesis of transmission or tradition than in the case of birds of the same genus uttering similar notes in Europe and in America."‡ On the contrary, I think that the structure and roots of language preserve decided evidence of the intellect of man, and furnish valuable aid in tracing the affinities of nations.

To meet the requirements of the hypothesis of a common origin for the languages of the African negro, Oriental negro, and Australian, it is only necessary that the radical structure of all the languages should be the same; the languages themselves may be widely different and wholly unintelligible to the different tribes. A few remote connexions with the main staple of the language are probably all that could be expected, in countries so long and so widely separated; but each country, according to the hypothesis, should have one type to itself, and each should, in

* "Ethnographical Library," vol. i. "The Native Races of the Indian Archipelago—Papuans," by George Windsor Earl. London, 1863. P. 47.

† Earl, op. cit., p. 222.

‡ Agassiz, in "Proceed. Amer. Acad. Arts and Sciences," vol. iii. p. 7. 1857.

some way, however faint, be connected with the other. That each has a common type to itself, we know to be the case. The Australian languages are all referable to one type. So are the African (those north of the Sahara always excepted). Mr. Burton* says of one of the tribes on the Cameroon Mountains on the west coast of Africa:—"Their dialect is a branch of the great South African family whose type is the Kaffir tongue." And Dr. Kirk informs me that the same thing is the case with the languages of the Zambesians and those of the tribes stretching across Africa. The Papuan language in like manner has many dialects.

The inquiry leaves an alternative problem for the philologist to solve, viz., either to point out the presence of some common elements of structure showing connexion between the languages of all three countries,—Africa, Papua, and Australia, or else to show some discrepancy wholly inconsistent with it. They have this basis to start from—that the foundation and structure of these languages is different from that of the tribes north of the barriers above mentioned.

Let us now see what peoples and countries may be referred to this black stock. Taking Africa by itself, it is scarcely necessary to go into any argument to prove that all the tribes on that continent south of the Saharan barrier belong to the same race. That may be safely assumed as proved. Nearest to Africa, and, only separated from it by a comparatively shallow connecting submerged neck of land, lies Madagascar. The present state of its population requires to be subjected to qualification before it can be admitted as relevant to this inquiry—a considerable portion of it bearing strong evidence of colonization by the Malays. This is of comparatively recent date, probably within, or not much beyond our own historic times, and of course cannot be taken into account in speculating on the aboriginal population of the island. The result of this immigration is not only a certain amount of Malay element among a portion of the Malagese, but the occurrence in their language of a considerable body of Malayan and Javanese words. That such a colonization should have taken place is the more remarkable when we look at the great distance (3000 miles) from Madagascar to Java and the Malay peninsula. Ethnologists have attempted to account for these peculiarities by supposing that a fleet of Malay pirates had been tempest-driven on the coast of Madagascar, and, unable to find their way back, had at first been able to protect and establish themselves, and afterwards becoming absorbed in the general population by intermarriage, had, besides communicating a portion of their blood, imparted some of their knowledge, cultivation, and language. Mr. Crawford, speaking on this subject,† says: "The people of Madagascar (that is, the aboriginal people) are not Malays, nor do they bear any resemblance to them. They are, in fact, negroes; but negroes of a particular description. They are negroes in the same sense that Portuguese, and Laps, and Englishmen, Germans and Spaniards, are European, and in no other." This is exactly what may be said not only of the Malagese, but of all the other black tribes spread over the islands of the Southern Ocean.

The Mauritius and Bourbon Islands may be dismissed as islands which were probably not inhabited at the time of the original peopling of the other lands of which I speak. The Dodo would never have survived to furnish even a solitary specimen or two to our museums had the islands on which it lived been peopled by savages, whether black or white, or, I should rather say, had they been peopled at all.

Next, looking farther eastward, it will scarcely be disputed that, whatever objections there may

* Burton, in "Proceedings of Geog. Soc." p. 241. (1862.)

† Crawford, in "Proc. Geog. Soc." vol. ii. pp. 69, 70. (1862, 1863.)

be to ranking the Oriental negroes with the African negroes, all the New Guinea blacks are of one race, whether natives of Papua itself, or of any of the numerous islands lying around it. Some authors, doubtless led astray by the apparently parallel, but really most distinct case of the Hill tribes in India, &c., have attempted to make a distinction between the natives of the hills and those of the coast, in Papua and other islands. This distinction is shown by the most trustworthy authors* to be without foundation, except so far as we have in our own lands a population differing somewhat according to the nature of their occupation and localities. In like manner, the negritos of the Philippine Islands cannot be separated from the other Papuan blacks; and if it be true that there are negritos in Formosa, (which Mr. Swinhoe's recent observations gives us reason to question), they also without doubt belong to the same race;† and, lastly, there is an overwhelming weight of testimony that all the oceanic tribes of Polynesia belong to the same race. The natives of the different groups of islands, no doubt, have each some peculiar characters of their own, but all belong to one type, and that type, the black Papuan. Some of the islands, such as New Zealand, are indeed supposed to have been colonized only very recently, and within the historical epoch; but if so, they have been colonized from the original black stock.

There is, perhaps, more difference when we come to estimate the discrepancies and resemblances between the Papuans and Australians. In doing so, there are various collateral points to be taken into consideration. In the first place, we must remember that although the Papuan Islands, or Austro-Malayan region and the Polynesian have numerous plants and animals peculiar to themselves, both their faunas and floras have, to a considerable extent, an Australian character. In mammals, for example, while the Indian region, including Borneo, Java, Sumatra, &c., possesses no marsupials, but abounds in forms of the most highly developed mammals, the Austro-Malayan or Papuan region does not, but has several marsupials; and Polynesia so far accords with it, that its only mammals belong to an order also found in Australia—the bats. In birds, as Dr. Sclater and Mr. Wallace have shown, although the actual number of species common both to Australia and Papua be not great (about twenty-five out of one hundred and eighty-six)‡ there is a great affinity in many remarkable genera, and the resemblance extends not only to genera which have been found in both, but also to those which are absent in both, although present in strong force in the neighbouring Indian district. Dr. Günther has come to similar conclusions as regards the Reptiles and Batrachians. In Entomology, Australian relations also occur, some of which (in the *Hymenoptera*) have been pointed out by Mr. Frederick Smith of the British Museum,§ and similar connexions occur in other groups. The botany of Australia and Papua, so far as the latter is known (which is not much), has similar points of resemblance.

The inference to be drawn from these facts is, that as a connexion subsists between the other animals of Papua and those of Australia, there may be one between their human inhabitants also. Professor Agassiz holds that the distribution of man will be found in the main to coincide with the regional distribution of other animals; and so far as man's tribal distribution goes, the idea is not without warrant. For example, the Arctic fauna and flora is nearly homo-

* Modera, "Verhaal van eene Reize naar de Zuid-West Kust van Niew-Guinea." Haarlem, 1830. Earl, op. cit. p. 61.

† Swinhoe, in "Proc. Geog. Soc," vol. viii. p. 26. (1863–64).

‡ Reckoned from "Catalogue of the Mammalia and Birds of New Guinea, in the Collection of the British Museum," 1859.

§ F. Smith, in "Proc. Linn. Soc." vol. v. p. 93, et seq 1861.

geneous;— so, one tribe of man, the Esquimaux, inhabits the same region. The Mediterranean district has a sub-fauna and sub-flora of its own, composed of a mixture of European and North African species; the African coast having the preponderance of African, the European of European types. We see something like this in the human inhabitants of the same district; the Europeans (Spaniards, Italians, Greeks, and Turks) are more swarthy and liker the Arabs than their more northerly brethren. Other instances of tribes of men corresponding more or less to the zoological districts in which they live might be quoted. We may thus fairly use the analogy of such correspondence, between the regional distribution of man and the other animals, as an argument, *valeat quantum*, for holding that there is such a relation between the human tribes of Papua and Australia, because we find a similar relation between their other animals.

Another circumstance which has an important bearing on the probable affinity of the Papuans and Australians is, that a rise of land of no more than two or three hundred feet would unite Papua to Australia. We have already seen that while a rise of the same amount would unite Java, Borneo, and Sumatra with the Indian continent, it would still leave them separated from the Papuan region by a deep channel.

The probability of the connexion of Papua and Australia, and the fact of their marked separation from the Indian continent being thus established, we may be more disposed to admit the force of such resemblances as can be traced between their respective peoples. There is no doubt considerable difference in their appearance. Most of the Australians have long, unfrizzled hair, and their hollow cheeks and starved countenances give them less of the features of the African negro. We have been so long accustomed to think of them as a race by themselves, that any proposition which tends to destroy their theoretical position goes against our preconceptions. But examined abstractedly, we must abate our preconceived notions considerably. First, the homogeneousness of the Australians is not absolute. Considerable variation occurs in their form. They have not all lank, straight hair. The aborigines of Van Dieman's land on the one hand, and some of the tribes on the north coast and in the interior of Northern Australia on the other, have frizzled hair, Papuan features, and other negritan characters. So much so, that Mr. Earl* sets himself to work to devise some theory of Polynesians or Papuans having engrafted Papuan blood on Australian stock; "for many circumstances," says he, "which I shall have to state more distinctly below, would induce the supposition that the *aboriginal* inhabitants of this part of Australia very closely resembled the Papuans of New Guinea, or, what is almost the same thing, the aborigines of Van Dieman's Land." If any one part of Australia is once admitted to be peopled by the same race as the Papuans, the general character of the race and their geographical position would lead to the inference that the whole must be so too.

The Nicobar Islanders and the Andaman Islanders are other isolated items of the great black race. Without attempting to find relations for these, Professor Owen puts very clearly the negative position that the latter do not belong to any of the neighbouring peoples (that is, the Hindoo, Burmese, or Malay). He says:—"Why should ethnologists when they come to study the natives of an insulated group of people like the Andamaners deem it necessary to determine to what contemporaneous people they were allied, on the assumption that they had been derived from some existing

* Earl, in "Journ. Geograph. Soc." xvi. 239.

and neighbouring land? Geological science had established the fact of continuous and progressive, though extremely slow mutations of land and sea, and had taught them that the continents of modern geography were only the last phases of those mutations. How long the human species had existed, and how far they had been contemporaneous with such mutations were the preliminary questions which presented themselves in grappling with the problem suggested by a peculiar insular race like the Mincopies. . . . Was it not possible that the Andamaners might have come from *nowhere*, that is to say, from no actual contiguous and separate land, but might be the representatives of an old race belonging to a former continent that had almost disappeared?"*

* OWEN, in "Proc. Geograph. Soc.," 1862, p. 82.

CHAPTER VIII.

DISTRIBUTION OF MAN *continued*—HILL TRIBES OF INDIA—RANK AND PRIORITY OF BLACK AND WHITE RACES.

There still remains undisposed of one other peculiar type of human beings which seems to be very much *in pari casu* with the Andamaners, except that the latter have their place of abode surrounded by the sea, while the former are surrounded by dry land and a sea of strange people. It is what are called the Hill tribes of India. A number of isolated tribes, each speaking a language of their own, and described as the most degraded specimens of humanity on the face of the earth, are found in the fastnesses of the mountains of India and some of the Malayan Islands, and of the adjoining continent. They exist in one or two parts of Borneo ; * they are not found in Sumatra,† nor in Java, at least now ;‡ but they occur in the Malay Peninsula,§ in Siam, and, it was said, in Burmah ; they are also said to be found in parts of Cochin China,‖ and even in China itself. They are not found, or perhaps it would be safer to say not *now* found, in Ceylon,¶ but they still remain in a good many of the mountainous parts of India in all the three Presidencies, where they are known under the name of Tudas or Todars, Badagars, Koters, Kurumbers, Bheels, Kulis,** &c. The more general opinion regarding these Hill tribes is that they formerly occupied the land round about their present fastnesses, and that they had been gradually encroached upon by the other nations which now occupy the country

* Earl, op. cit. 144 ; and Dalton in Moor's "Notices of the Indian Archip." 1831, p. 49.

† Earl, op. cit., 175.

‡ Remains of some ancient race, which had used spear-heads similar to those used by the present inhabitants of North Australia, are described as having been found in Java, in the "Natuurkundige Tydschrift voor Nederlandsch Indie," 1850.

§ A woolly-haired race called Lemanys. See Anderson, in "Journal of Indian Archip." iv., 425, 1838.

‖ A savage race of people, very black, and resembling in their features, the Caffres. Chapman's "Report to the Bengal Government of a Diplomatic Mission to Cochin China. in 1778," in Parliamentary Papers relating to India.

¶ The Veddahs of Ceylon seem only what may be called a *feral* tribe of the other Cingalese.

** Major-General Briggs gives the following as the names of *some* of these tribes, adding that there are many others of which he has not sufficient details, viz. "Minàs, Mérs, Bhils, Dhiro Kolies, Mhars, Mangs or Mans, Béders, Dhérs, Gowlies, Barka, Tallary, Carumba, Cherumars, Morawa, Collary, Pully, Pariah, Yenedy, Chenchy, Gond, Kond, Sawara, Banderwa, Cheru, Bengy, Kooki, Garro, Kassia, Hajin, Bhar, Dhanuk and Dhome." And he adds, "Among these tribes the etymologist may, without difficulty, trace the names of many of the territorial divisions which have been assigned to several portions of India by the Hindûs. Thus, Kolwan, from the Koles ; Bhilwan and Bhilwara, from the Bhils ; Mhar-rashtra, by contraction Mharatta, from the Mhars ; Man Désa, from the Mans or Mangs ; the city of Beder, from the Beders ; Gondwara, from the Gonds ; Oria-Desa, or Orissa, from the Orias ; Kolwan and Koliwara, from the Koles."

Doubtless, many of these may be mere sub-races of the Hindoos ; my argument applies only to those whose physical and other characters approach those of the Negritos. See "Report on the Aboriginal Tribes of India," by Major-General John Briggs, in Reports of the British Association. 1850, p. 159.

around them, and driven into the hills or retreated to them for shelter.* Others, as Mr. Crawford, believe that "they are no other than natives of the country, mere mountaineers who had escaped from the bondage, and hence from the civilization, of the plains." The accounts which we read of their physical attributes, of the low scale of their intellectual and moral perceptions, and the degraded level which they occupy in the scale of humanity, forbid us, I think, to accept Mr. Crawford's explanation. The more generally received view is less open to objection, but there is usually a hypothesis appended to it which does not appear to me to meet the facts of the case, viz. that the tribes of which we speak are of Tartar or Thibetan extraction. Major-General Briggs

* The following data, quoted from Major-General Briggs' report above cited, support the view that these aboriginal tribes were in possession of the whole of India prior to the incursion of the Hindoos, and that they had been gradually driven into their present fastnesses by their encroachments.

"About twenty-seven centuries ago, according to the Vedas or Holy Scriptures of the Hindûs, it would appear that the Hindûs had not yet penetrated further south than the twenty-second parallel of north latitude, beyond which (the work states) there then existed "extensive forests, inhabited by a wild and impure race speaking barbarous tongues."

"At what precise period the Hindû invasion from the west first occurred it is impossible to say, but the geography of India indicates at once that that race necessarily came through Afghanistan and the Punjaub ere it turned the borders of the Great Desert and penetrated in the direction of Dehli. There is every reason to believe that the Hindû race gradually overspread the territory of Upper India east and west between the Himalaya Mountains and the Great Desert, without penetrating to the south for many centuries; that it enslaved the aboriginal races as it subdued them, compelling them to till their own lands as serfs, and took from the latter the whole produce, except what was actually required as food for the tillers of the soil.

"The historical as well as the religious works of the Hindûs, of a comparatively modern date, together with monumental remains existing in sculptured edifices and rock caves, all tend to show that no portion of the Peninsula of India was subdued by them anterior to the fifth century of the Christian era. About that time it is supposed that the Peninsula became gradually overspread by the Bramanical race. They seem to have entered in two directions; the one from Guzerat gradually extending over Khandeish and Berar till they reached to the forests which fringe the banks of the river Wurda, where it meets with the Godavery; the other invasion, according to tradition, occurred about the same time. It passed from the valley of the Ganges and penetrated southward along the line of coast of the Bay of Bengal, keeping within the range of mountains on the east and the ocean, till after reaching the embouchures of the Godavery and the Kistna the invaders spread out over the plains and proceeded southward.

"It has been assumed that about the same period, the Bhudists, a peculiar sect of the Hindûs, reached the shores of Ceylon and Southern India from the opposite coast, and thence proceeding northward, spread their religious doctrines among the aborigines. About the ninth or tenth century the Bhudists and Bramans appear to have met from opposite directions, which led to deadly conflicts, and ended in the Bramans putting down the Bhudist tenets.

"We have historical proof that the island of Bombay was not subjugated to the Hindû rule till the fourteenth century; and that in the beginning of the next century the Mahommedans found princes of the aboriginal race occupying in force several strongholds not far from Poona. The town and district of Sorapoor, lying between Hydrabad and the western mountains, is still held by an aboriginal chief with a portion of his tribe; and within the memory of man the kingdom of Mysore contained several principalities of the Béder race.

"Further south, the Morawas and Collars obtained celebrity in modern times by their adhesion to one or other of the European belligerent powers (France or England), and evinced fidelity, and even devotion, to the cause of the party which each espoused.

"The aboriginal races differ, one and all, in every respect from the Hindûs. Their government is strictly patriarchal; all crimes are punished and disputes settled by the award of the elders or heads of tribes assembled. They have no prejudices against animal food of any kind, whether the animal be slaughtered or die a natural death. In those parts still unsubdued, such as a great part of Gondwana and the contiguous tracts of Goomser and Bustar, and in some portion of the country lying farther eastward among the Assam Hills, they continue to make human sacrifices; a practice to which these races have been prone, according to Hindû records, from the earliest ages. They also worship power in every shape to avert danger; hence all beasts of prey, such as tigers, bears and leopards, venomous serpents and other reptiles; as also the elephant and rhinoceros in a wild state."—BRIGGS, op. cit. p. 169.

says that their domestic habits and institutions have a strong affinity to those of the great Tartar family; they may serve as a specimen of the whole race. In some parts both men and women bore their ears, and wear heavy rings to extend the lower lobe. Captain Newbold, of the Madras army, who has written on the Chenchies of the Nalla Malla, or Black Mountains, represents those he saw as having long bushy hair, thick lips, high cheek-bones, and small piercing eyes.* Sir Richard Jenkins and Colonel Agnew confirm this description in speaking of the Gonds; and I believe no instance will be found of those residing entirely on the hills having the aquiline nose or the delicacy of feature of the Caucasian family. General Briggs thinks that they partake rather of the Tartar or Thibetan physiognomy, than of the Hindu. He adds, however, a sort of apologetic explanation which does not show great faith in their Tartar parentage: "The remote period of their settlement in India, and the possibility of an occasional intermixture with the Hindûs, may, in some cases, have somewhat changed their physiognomy from that of their ancestors, so as to render it doubtful whether or not they are derived from that branch of the human family, though in their habits and institutions they certainly bear a strong affinity to the Tartar branch."† The view which has occurred to me as most reconcilable with facts is, that, like the Andamaners, these tribes are remnants of the inhabitants of the great submerged continent above alluded to by Professor Owen.

This continent at some time or other, not all at one time, or in the same direction, but from time to time, and with breaches of continuity which interrupted communication between various parts of it, probably included all the oceanic Archipelagoes, Papua, Australia, Africa south of the Sahara, East India south of the Himmalayahs, the Indian Ocean, the Bay of Bengal, Burmah, Siam, the Malay Peninsula, Cochin China, part of China, and the whole of the Philippine Islands, Borneo, Java, and Sumatra. That all this vast space was at any one time a united continent I do not suppose nor maintain; on the contrary, there is everything to lead to a different conclusion; there appear to have been at least two continents; as now we see the very same area of the southern hemisphere rising in some parts and falling in others, no doubt this happened in former times also, and its size and configuration would constantly vary. Opportunity of access might thus be given for one type to traverse and penetrate every part of this vast area; but by long interruptions and suspension of communication, many might never be able to avail themselves of it, and these long lapses of time might give opportunity for the development of new species or varieties from others which had only reached half way, as it were, on their journey, and who, while the way was still open to them to penetrate deeper and spread themselves further in one direction, had perhaps their retreat cut off by a subsidence of the continent behind them, and no opportunity of spreading their offspring of newly developed forms in the direction from which they came.

Lastly, I assume that these continents were peopled by a black race of many tribes, of which the Negritans are the descendants; that as the Chagos Bank, the Laccadive Islands and Maldive Islands have sunk, so did Ceylon and India; so did the land in the Bay of Bengal; so did the other lands in which Hill tribes are found; in fact, that the whole or certain parts of the supposed land sunk more or less gradually; we know that almost the whole of Africa and Madagascar, and a

* Can the clucking sound in the language of the Negroes have anything to do with a palatal peculiarity in the speech of these aboriginal tribes? Dr. Reinhold Rost of Berlin, remarks, "that the palatal sounds of the letters r, d, j, t, are confined to India, and cannot be pronounced without difficulty by any but a native of the province in which the language containing them is spoken." He adds, "These sounds are unknown in Sanscrit."

† Briggs, op. cit. pp. 172, 173.

portion of Australia, were not submerged; but the most of the rest, at one time or other, was.

As under the gradual sinking of the land, which I suppose to have taken place, the ocean encroached upon the great tracts submerged there would be a deluge and a loss of life, such as we can only faintly imagine; something to which we have no parallel. It may perhaps have been the Noachian deluge, which still dwells in the traditions of every race or tribe on the face of the earth. As the ocean slowly and gradually invaded the plains, the inhabitants must have retreated to the high mountain-tops,—become Hill tribes, in fact. Doubtless great tracts of this supposed continent, as is the case in all other continents, consisted of vast plains, which, gradually converted into muddy marshes, may have taken thousands of years to sink beyond the depth of man; and when this was the case, he must have there died off by hardship, exposure, and want of food, long before the sea rose so high as actually to drown him; but where there were mountains, hills, or even trifling elevations, a small remnant would be saved, but not without enduring great hardships. On the mountains, so long as other animals, which may have shared the refuge, lasted, they would have a precarious supply of food; but as the space, and with it the food diminished, bloody struggles must have taken place for space and means of life; and if we could delve into the heart of some of the atolls we might perhaps find there mute evidence of the strength and despair of the combatants, in mutilated relics of humanity.

Let us assume that all were not so cut off; that before the last family on the islet was extirpated, the gradual downward motion ceased, over a portion of the district of which we have spoken; that volcanoes and earthquakes spoke of change, and that by-and-bye the land began to rise, or, as the poor inhabitants would think, the sea began to fall, and their lives were saved to puzzle the brains of another race with their affinity and descent.

As the land rose above the sea, and the fertile ooze of these tropical seas became rich in verdure, the inhabitants would descend and take possession of the land: but by-and-bye, when the northern hemisphere rose in its turn, and was peopled with a fauna, flora, and human inhabitants of its own, the events indicated by General Briggs probably took place. A portion of these northern Asiatics (that is, the Hindoos) invaded India.

Now what would be the effect of such an invasion upon the aboriginal inhabitants who had been previously in very much the same position as that in which the Andamaners are now left? Let us try to realize it by applying the test to them. Suppose the Indian Ocean to be raised, so as to unite the Andaman and the Nicobar Islands to the mainland on both sides and throw open the plains which were but lately at the bottom of the Bay of Bengal, and now were rich in vegetation, to the grasp of the Hindoo and Burmese—I shall say nothing of the European, for what would happen were he, with his civilization and knowledge of science and arts, to come in contact with a tribe of savages, furnishes no fair parallel to what would take place with a less highly endowed people. Let us turn loose the aboriginal Hindoos and Burmese in millions to compete with the few Andamaners for the possession of the rich bottoms of the Indian Ocean. The contest would not be long. The fertile plains would soon be seized and appropriated by their more numerous, stronger, and comparatively more intelligent competitors. The Andamaners would be driven back to their old fastnesses—their original mountain-tops. And what would happen then? would the Hindoos try to exterminate the Andamaners in order to seize what would be the impregnable tops of the Andaman mountains, or would they allow their inhabitants to live as the Hill tribes now do, still, as on an island in the midst of the sea, surrounded by a sea

of new people, not increasing, perhaps gradually diminishing, but for long preserving the memory of a different and bygone state of things? I imagine they would neither covet their fastnesses nor seek to deprive them of them. The labour of toiling to the top of mountains is distasteful to these races, not to speak of the aimless warfare they would have to encounter, and the black races would be allowed to enjoy their sterile fastnesses unmolested. Such is the fate which I believe has befallen the Hill tribes; and these are the grounds on which I think that if there is nothing but their geographical distribution to prevent us referring them to the great black race on the ground of their physical attributes, we may venture to follow that course.

There are other facts founded on the distribution of animals and plants, in India and the Australian region, which give support to the explanation of the position of the Hill tribes which I have above suggested. From the fact of a large proportion of the animals which are found in Borneo, Java, and Sumatra, being identical with those found on the mainland, there is little or no doubt that these islands must at some former period have been united to it; so that it appears that before the present upward movement, which these are now undergoing, there must have been a downward one, and before that again an upward one, as we have seen is probably the case with other countries. The islands must have been first united with the mainland to allow the intercommunication of species. A subsidence must then have taken place to throw them into something like their present configuration, and there is now again a gradual rise reuniting them slowly to the mainland.

Now, Dr. Joseph Hooker, in his Flora of Australia,* gives a list of nearly 500 plants found in that country, which are either identical, or very nearly so, with continental or insular Indian species; but, on the other hand, he states that there is scarcely a single Australian type to be found in India, and the few that occur are in Eastern India. It would appear as if there had been no reciprocity, that all the mutual types have been borrowed from India, and that Australia had given none in return (for 10, which is the number, against 500 can scarcely be called reciprocity). Now, this is quite in accordance with the course of events, which I have supposed to have occurred. If Australia and India were united for a time, a mutual communication of their respective floras must have followed, as a necessary consequence. If, when India sunk, the tops of the mountains, where the Hill tribes still exist, were not submerged, a certain proportion of the flora would be there preserved. When, long afterwards, India again emerged from below the waters, a new Indian flora would gradually be developed out of the remnant left on the tops of the mountains to supply the new lands: but as the new emergence went no further south than Ceylon, the new types could not find their way to Australia. There appear to have been only ten Australian plants which have found their way by flotsam and jetsam from Australia to India, against 500 Indian plants which remain in Australia by ancient continuity. If there is any foundation for the above speculation, the connexion between India and Australia must have been very ancient, and at a time when one or other of them was not in a condition to supply the other with mammals, although it could with plants.

I must not occupy the time of the reader here with botanical speculations, which will come better when we reach that branch of our subject, but I cannot refrain from citing one instructive instance in favour of the existence of the connexion already indicated between Africa and south-west Australia. It is long since a connexion between the vegetation of these countries has been

* "Flora of Australia," by Jos. D. Hooker. Introductory Essay, p. xlii. (1859).

surmised. Lambert, in his "Genus Pinus," forty years ago, said of Podocarpus Saligna, that it afforded one of many examples of coincidence between the vegetation of Chile with that of New Holland, and the southern extremity of Africa;* and Dr. Hooker, in the essay above quoted, mentions various botanical facts confirmative and indicative of an ancient communication between south-west Australia and South Africa. Besides great differences in the genera and species of south-east and south-west Australia; he found many new forms, and types, and curious analogies between the flora of the latter and that of South Africa. On this Dr. Hooker remarks, "There is another way of viewing the whole question, but one so purely speculative, that I hesitate to put it forward. It is, that the antecedents of the peculiar Australian Flora may have inhabited an area to the westward of the present Australian continent, and that the curious analogies which the latter presents with the South African flora, and which are so much more conspicuous in the south-west quarter, may be connected with such a prior state of things."†

Here, too, the relationship between many of the plants in the south-west of Australia and the Cape of Good Hope does not extend to the mammals. Therefore, it is not illogical to infer that the former continuity of land by which these African types found their way to Australia must have existed before mammals in Africa had appeared there, at all events, in any numbers, or it would have contributed them too. The period of continuity must therefore have been very ancient. Africa here contributed types; Australia, few or none. If it contributed none, then another inference follows, viz., that the connecting land could not have been united with both at the same time. The bridge must have been begun on the African side, and by the time the invaders had reached a certain distance on their way, it must have been broken down behind them; but as it continued to be formed or to rise from the ocean in the direction of Australia until it reached its south-west corner they completed the passage, and their descendants have remained there after the land which formed the passage has sunk out of sight.

There still remain one or two accessory points of great difficulty regarding the distribution of man which had better be here disposed of.

First. What is the rank of the two races?—the blacks and the whites. Are they to be reckoned as species, or are they merely tribes, in the same way, although better defined and more widely separated from each other than the tribes into which they themselves branch off?

The difficulty of separating species increases as we ascend the scale of life. Professor Agassiz has drawn attention to this in monkeys, in the lion, the bear, and other highly organised vertebrata, and it seems to reach its culminating point in man. It would appear as if the action of the developing power had, in its long course, undergone some change, not in nature but in degree, some modification such as we see typified in the actual growth and life of man and his fellow-creatures; its steps were wider apart and more decided in earlier days, and its ideas, so to speak, simpler and less matured: in age its action has become more precise and more important, and as the creatures developed have acquired a higher and higher grade, the steps in advance have been shorter and more frequent.

It may be, for example, that had the influence of development, or creation, to which we owe the two races of man, or any of the doubtful species of monkey, been exercised on less highly organised animals, the product would have been more absolutely distinct species. I incline to regard the two races not as the result merely of ordinary generation and variation, but of the

* Lambert, "Genus Pinus," 2nd edition, 1832, ii. No. 71.

† Hooker, op. cit. p. lv.

action of the law of development through which new species are derived; and I account for the product being something less than what would be reckoned a species in other orders by the high organisation of the creature developed.

Still in whatever light we regard them, or by whatever means we attempt to account for the difference between the two, we must trace the one to the other; and two other questions arise—viz. Which race is descended from the other, that is, which is the oldest? and through which of its known tribes, supposing us to know them all, (which, by the way, we can scarcely suppose that we do,) did the other draw its origin?

These are questions which we have not sufficient data to enable us to answer. Such as we have, however, seem rather to point to the white race drawing its origin from the black, than the black from the white. In the first place, it is in the direction of progress. In the next place, according to the alternations of elevation and subsidence on which we have been speculating, while the great continent of the southern hemisphere was in its prime and peopled by the black race, the northern continents were almost wholly under water, and possibly without human inhabitants. (See Maps 2 and 3.)

The second question is not less difficult: Where has the passage from the one race to the other been made? We may coast along the barrier line, and try everywhere for a point of resemblance which may guide us in saying, "Here is the point where the crossing took place," but we can find absolutely none; the line is everywhere clear and defined; and this is another reason for thinking that here there has been an exercise of the developing power similar to what we see in the case of new species. Where nature really takes a step from one species to another she leaves no trace of her passage; and this, as the reader knows, is the recalcitrant fact which, by refusing to be backed into the line of Mr. Darwin's argument, chiefly disarranges its array; we seek in vain for the passage from an elephant to a rhinoceros, or from a monkey to a man; as Prof. Huxley says, "The fossil remains of man, hitherto discovered, do not seem to take us apparently nearer to that lower Pithecoid form by the modification of which he has probably become what he is;"* no such transitional forms appear ever to have existed, and if so of course none can be found.

The only indication which occurs to me as likely to lead to even an approximation to the truth, is perhaps to be looked for in the habits of tribes. Where two tribes of the different races have similar habits or weapons, that fact may perhaps be taken as evidence of proximity or acquaintance at some period long since gone by; for instance, the sumpitan, or blow-pipe, is used by some of the tribes of New Guinea, and also by those of the Amazons and Orinocko, and by no other race in the whole world. It is rather a peculiar weapon, not one likely to occur independently to two minds; may they not both have derived it from a common source? Dr. Daniel Wilson on other grounds supports the conclusion to which this would lead,—he says that "many analogies confirm the probability of some portion of the North American stock having entered the continent from Asia;" but that "while theoretically the northern passage seems so easy, yet so far as any direct proof goes, the Polynesian entrance into the south across the wide barrier of the Pacific is the one most readily sustained."† Another point not to be overlooked is, that at some period in the past history of these regions, South America was most probably united to Australia, if we may draw any inference from the presence of allied forms of life common to both.

* Huxley's "Evidence as to Man's Place in Nature," 1863.

† Prehistoric man—"Researches into the Origin of Civilisation in the Old and New World," by Daniel Wilson, L.L.D.

MAP VII.

MONKEYS.

Smaller number of Species

Greater preponderance

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

GREENLAND

BAFFIN BAY

ESQUIMAUX INDIANS

RUSSIAN AMERICA

HUDSON BAY

BRITISH AMERICA

NORTH CANADA

UNITED STATES

NUEVA CALIFORNIA

TEXAS

G. of MEXICO

MEXICO

WEST INDIA IS.

CARIBBEAN SEA

VENEZUELA

GUAYANA

NUEVA GRANADA

ECUADOR

PERU

BRAZIL

LA PLATA

PATAGONIA

CHILI

BOLIVIA

PARAGUAY

TIERRA DEL FUEGO

FALKLAND I.

AZORES

PORTUGAL

SPAIN

FRANCE

SCOTLAND

IRELAND

ENGLAND

NORWAY

SWEDEN

FINLAND

LAPLAND

PRUSSIA

RUSSIA

AUSTRIA

ITALY

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

SAHARA DESERT

EGYPT

NUBIA

ARABIA

RED SEA

NOVA ZEMBLA

IRKUTSK

Altai M.

INDEPENDENT TARTARY

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

JAPAN I.

PERSIA

AFGHANISTAN

PUNJAB

HINDOOSTAN

BURMAH

ARABIAN SEA

BENGAL SEA

CHINA SEA

COCHIN CHINA

PHILIPINE IS.

CEYLON

BORNEO

CELEBES

JAVA

N. GUINEA

NORTH AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

NEW HEBRIDES

NEW ZEALAND

YANDIEMEN

MADAGASCAR

CAFFRARIA

CAPE COLONY

CASPIAN SEA

KAMTSHATKA

ALEUTIAN I.

SANDWICH I.

MARQUESAS I.

SOCIETY I.

COOKA I.

LOW ARCHIPELAGO

NAVIGATORS I.

VANCOUVER I.

OREGON

CUMBERLAND

DAVIS STRAIT

ICELAND

160 140 120 100 80 60 40 20 0 20 40 60 80 100 120 140 160

70 60 50 40 30 20 10 0 10 20 30 40 50 60

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CHAPTER IX.

MONKEYS — EXTINCT AND LIVING.

The kind and extent of the distinction between Man and the higher Apes, has formed the subject of much discussion of late years, especially upon some premises laid down by Professor Owen. The Professor, while admitting that the distinction between Man and the Apes could not be considered as "other than a difference in degree," maintains that the difference in degree is so great that Man must form a separate and independent section of equal importance to the other great sub-classes into which zoologists have divided the animal kingdom. In support of this he adduced certain anatomical peculiarities which he thought he had discovered in the brain of Man, sufficient to distinguish it in character from that of the nearest Apes.* His views have been controverted by Professor Huxley† and other eminent zoologists; and the general verdict of anatomists would seem to be that the differences mentioned by Owen either do not exist or are not of the importance he supposed, and consequently that the distinction is not well founded, so far as it rests on them; and Professor Huxley has, I think, satisfactorily shown that Man (considered purely as an animal, which is all that the zoologist has to do with) cannot be regarded as more widely separated from the Apes, than the different families of them are from each other.

The first quadrumanous fossil which has been discovered was found in the Himmalayahs by Lieuts. Baker and Durand in 1836.‡ It has proved to belong, like subsequently discovered quadrumanous fossils in the same district (the Sewalik (Miocene) tertiaries), to the Indian genus Semnopithecus. The next discovery was made by William Colchester, in 1839, in a bed of whitish sand, beneath a stratum of tenacious blue clay situated by the side of the river Deben, about a mile from Woodbridge in the parish of Kingston, in Suffolk. This deposit is referred by all geologists to the eocene period, and the fossils were determined by Professor Owen to belong to a genus of Monkeys which he called Eopithecus, and which had its nearest affinities with Macacus. Since then, however, he has (1862) retracted this opinion, and with more ample materials at his command has pronounced it to belong to the genus Hyracotherium, an animal allied to the Palæotherium. This is a very important correction, for "there is now no eocene Monkey known to palæontologists, unless M. Rütimeyer is right in referring to this family a small fragment of a jaw with three molar teeth found in the upper eocene strata of the Swiss Jura."§

* Owen, on "The Characters, Principles of Division, and Primary Groups of the Class Mammalian." In "Linn. Soc. Proc." 1857.

† Huxley in "Nat. Hist. Rev." Jan. 1861, et seq., and "Evidences as to the Man's place in Nature." By Thomas Henry Huxley. London, 1863.

‡ For an account of the various discoveries of the fossil remains of Monkeys, see a paper by Prof. Owen on the Gorilla in "Proc. Zool. Soc.," 1859, p. 18.

§ "Elements of Geology." By Sir Charles Lyell. Sixth Edition, London, 1865. p. 292.

A monkey's molar tooth was taken from the pliocene beds of Essex, which has been determined to be most closely allied to the MACACUS SINICUS (a common species in captivity, whence doubt has been thrown on the authenticity of the fossil, but it is believed by Owen to be perfectly genuine).

The remains of a monkey of gigantic size (four feet in height) were discovered in 1839, with other bones, by Dr. Lund, in a bone-cave in limestone in Brazil. Its molar dentition showed it to belong to the platyrrhine family now peculiar to South America; the New-world monkeys having four more teeth than the Old-world, a supernumerary molar in each side of each jaw. It was described as a new genus under the name of PROTOPITHECUS. This belonged to the pliocene period.

The lower jaw and teeth of a small quadrumane was discovered by M. Lartet in a miocene bed in the south of France, and described by him and De Blainville. These remains are so closely allied to those of the Gibbons, as scarcely to justify the generic separation which has been made for the genus to which it belonged under the name of PLIOPITHECUS.

A portion of a lower jaw with teeth, and the shaft of a humerus of a quadrumanous animal (DRYOPITHECUS), equalling the size of those bones in man, have been discovered by M. Fontan of Saint-Gaudens, in a marly bed of upper miocene age, forming the base of the plateau on which that town is built. From this species, certain inferences have been drawn to the effect that this was a transition form between the Chimpanzee and Man, but on this point Professor Owen says: "There is no law of correlation, by which, from the portion with teeth of the DRYOPITHECUS, can be deduced the shape of the cranial characters determinative of affinity to man. All those characters which do determine the closer resemblance and affinity of the genus TROGLODYTES to man, and of the genus HYLOBATES to the tailed monkeys, are at present unknown in respect of the DRYOPITHECUS. The statement by Sir C. Lyell, that the parts of the skeleton of DRYOPITHECUS as yet known, 'are sufficient to show that in anatomical structure, as well as stature, it came nearer to man than any quadrumanous species, living or fossil, before known to zoologists,' is without the support of any adequate fact, and in contravention of most of those to be deduced from M. Lartet's figures of the fossils. Those parts of the DRYOPITHECUS merely show—and the humerus in a striking manner—its nearer approach to the Gibbons; the most probable conjecture being that it bore to them, in regard to size, the like relations which Dr. Lund's PROTOPITHECUS bore to the existing MYCETES."

Mr. Albert Gaudry conducted some government excavations in Greece, which produced no less than twenty skulls of Monkeys, several jaws, and bones from different parts of the body sufficient to enable him to make a drawing of the whole skeleton. This Grecian Monkey belongs to the genus MESOPITHECUS. It resembles in its skull the SEMNOPITHECUS, but in its limbs the MACACUS, and is thus an *intermediate* form between these genera. Whether it was a *transitional* type, as Mr. Gaudry seems to think, is another thing altogether. All that I say is that the two are by no means synonymous. Besides these, ten other supposed species have been recorded, but all upon very imperfect materials. Such as they are, two species are from South America, three from Asia, and five from Europe.*

With reference to this, Dr. Vogt says:—"Twenty years ago fossil Monkeys were unknown, now we have nearly a dozen: who can tell that we may not in a few years know fifty? A year ago no intermediate form between *Semnopithecus* and *Macacus* was known: now we possess a whole skeleton: who can assert that in ten, twenty, or fifty years we may not possess intermediate forms between man and ape?"†

* VOGT'S "Lectures on Man." Translated by Anthropol. Soc. p. 454. Longman and Co. 1864. † Ibid. loc. cit.

So thought Dr. J. W. Dawson, principal of M'Gill College, Montreal, an acute zoologist. He, like Dr. Vogt, predicted that if any osseous remains of antediluvian man should be discovered, they would probably present characters so different from those of modern races, that they might be regarded as belonging to a distinct species.* But in a recent paper, he confesses, somewhat despondingly, that "this anticipation has not yet been realized."† To be sure he qualifies the confession by the phrase, "with perhaps one exception," and that is the Neanderthal skull; which is not an exception (at least is not thought so by those who have no theory to support).

The geographical distribution of the recent species of Monkeys ranges everywhere between, and does not extend far beyond, the Tropics. The only district where they do reach beyond a tropic is Paraguay.

The same question which met us in considering the original starting-point of Man again occurs in the Monkey. We had two races of Man, the black and white. We have in like manner two sections of Monkeys, those of the New World and those of the Old, which latter are in various respects more nearly allied to Man. When guessing at the relative antiquity of the two races of Man, I gave the preference in age to the black man, and indulged in the speculation that that race peopled the supposed submerged Pacific continent, and that the point through which the passage from the black man to the white had been made was to be sought in the direction of South America.

There are objections to tracing the Monkeys in the same way. If we make the species found in Africa, India, and the Indian Archipelago, the corresponding equivalent of Man in that region, and therefore older than the species in South America, we reverse the order of dispersal which we have supposed to have occurred in Man; we place the highest Monkeys where the lowest Men are.

But the cases are not parallel. Supposing Monkeys to have had their origin on the same ground as Man, and to have colonized South America, as he may have done, the introduction of species there may have taken place before the advanced forms of Monkeys had come into being. If, by the power of an enchanter, we could see everything as it stood at the period of that colonization, we might find that the colonists were then more advanced than their Old-world ancestors, and that the higher types have come into being in the African region subsequently to that date.

As already mentioned, Professor Agassiz has pointed out the close degrees of affinity which exist between allied species of animals possessed of a high degree of organisation. He remarks that the Orang Outangs, which have been divided by some into four species, have been considered by other naturalists as forming but a single one; and the genus of long-armed Orangs, Hylobates (the Gibbons of English naturalists), is considered by some as containing eleven species, while others make but two or three.‡ A like remark may now be made on the Chimpanzees, of which five so-called species have been described. The same is to be observed of the Monkeys in the New World. The prehensile-tailed species have been reduced by one author (Wagner)§ to two, of which he regards the second as doubtful, while Reichenbach‖ describes and figures no less than thirty-seven. Dr. Slack has drawn a better medium between the extremes of these authors, and reckons them at fifteen.

The Monkeys furnish several illustrations in favour of the former existence of a now submerged Pacific or Indo-African continent.

* Dawson, J. W. "Archia," p. 237.

† Dawson, J. W. in "Edin. New Phil. Jour." Jan. 1864, p. 53.

‡ "Proceed. American Acad. Arts and Sciences," vol. iii. p. 7. 1857.

§ Wagner, A. "Die Vollständigste Naturgeschichte der Affen," part i.

‖ Schreber's "Saugethiere." Supplement Band. vol. i. p. 207. 1840.

For example, the Anthropoid Monkeys are found both in West Africa, and Borneo and Sumatra; and although the species which come from these two so widely separated countries differ a good deal in appearance they are undoubtedly pretty closely connected. It is impossible to avoid supposing that when India was connected with Africa, some other forms of anthropoid Monkeys existed in the supposed continent, now the Indian Sea, and stretched across it all the way to Zanguebar, and from thence to the Gaboon, through the tropical or equatorial band of forest, which, it is almost certain, spans Central Africa; and although far from likely, other forms of anthropoid Monkeys may yet be found there, wherever the climate is suitable for them. In other classes of animals recent researches have detected, on the east coast, and far in the interior, new species of genera, which had previously been supposed confined to the west coast, as, for example, new species of the Goliath beetle, a remarkable West African form, which, moreover, has also affinities with species found in the Indian Archipelago.

The Baboons furnish another instance of Monkeys nearly allied to each other being found both in Africa, and on the relics of the sunken continent in the east, and nowhere else. Map 9 shows first, that the true Baboons are all found south of the Saharan barrier, supporting the conclusion arrived at in last chapter, that the old Africa of which we speak, or Africa proper, was bounded on the north by the Saharan barrier, whether that were desert or sea; and next that one, if not two, allied species of Baboons also exist in Celebes. They are true Baboons, but are well distinguished from the African type, in that the latter have their nostrils at the end of their muzzle like a dog, while the Celebes species have them on the front of their face like other monkeys, without a projecting muzzle.

If it be true that a single straggling species of Cercopithecus (a genus peculiar to Africa, and more especially West Africa) exists in the Philippine Isles or in Celebes and Timor, as stated by Dr. Sclater,* the evidence of relationship between the species of Africa and the eastern remnants of the submerged continent will be still stronger. Mr. Wallace, however, who has had excellent opportunities of observation, doubts the accuracy of Dr. Sclater's information on this point.

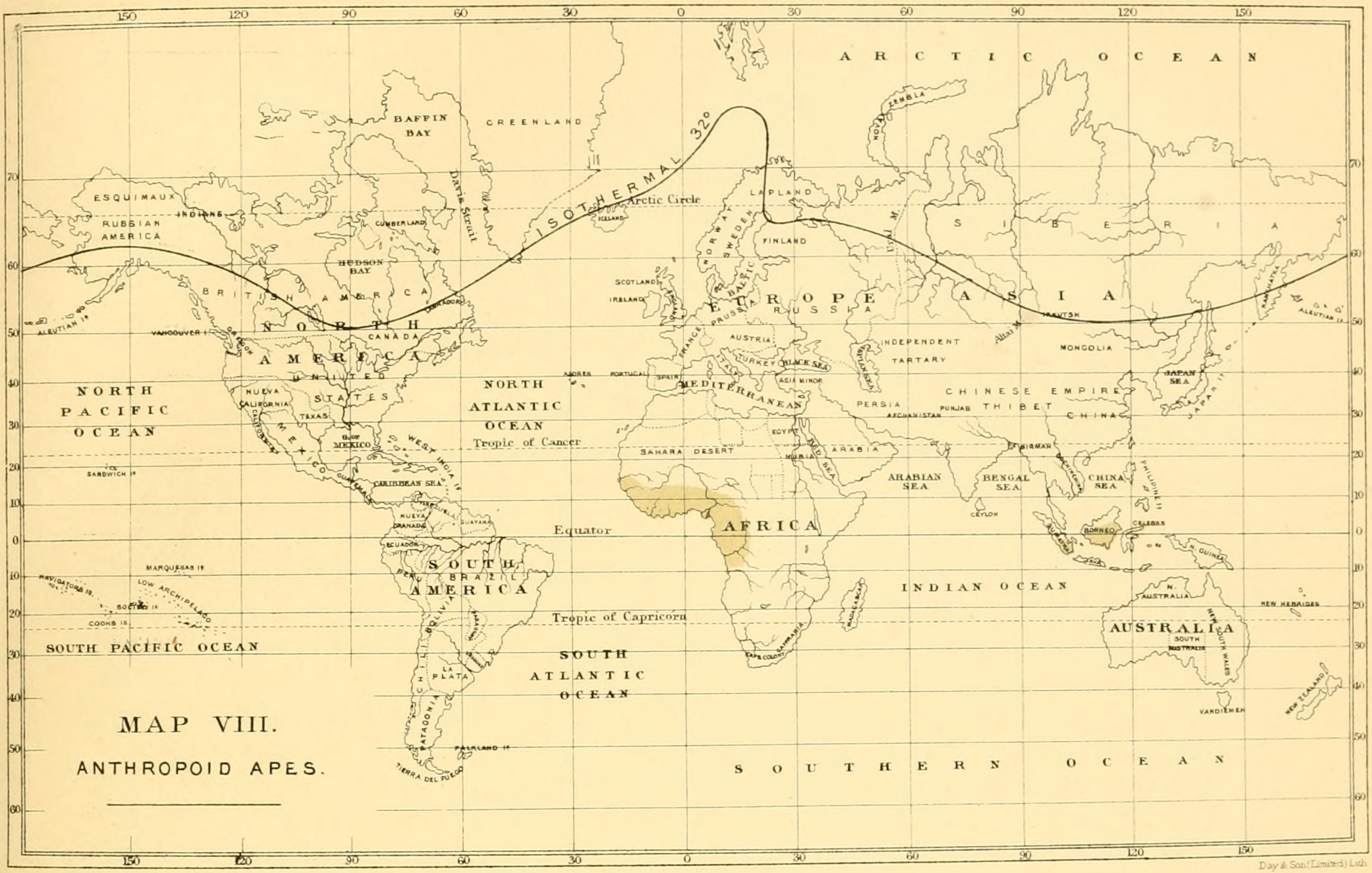
The section to which the species of Monkeys belong, and the locality whence they come, are easily distinguishable by the physical characters of the individuals. The Old-world Monkeys have a narrow septum, or division, between the nostrils, whence they have been called Catarrhini; the New-world species, a broad division, hence their name Platyrrhini. None of the New-world species have cheek-pouches or callosities; none of the Old-world species have prehensile tails. Whenever we see an individual with a prehensile tail we may be sure it is American; whenever we see one with cheek-pouches it comes from the Old World. As already mentioned, also, the Old-world species have a tooth less on each side of each jaw, and they have the "yellow spot" on the retina, which is found in Man, which the New-world Monkeys are said not to have.†

Catarrhini—Old-world Monkeys. (Maps 8 and 9.) The most important members of this family are the—

Anthropoid Monkeys. (Map 8.) They consist of the Orang Utangs, the Chimpanzee, and

* Dr. Sclater in "Proceed. Linn. Soc." vol. ii. p. 153. 1858.

† I made several ineffectual attempts to get my friends to examine or to send me home eyes of the South American Indian tribes themselves, in order to ascertain whether the yellow spot is present in the retina of *their* eyes, but could never obtain materials. I suggest the examination as an interesting inquiry to any naturalist or medical man who may have opportunities in the country itself. There is little doubt that the "yellow spot" will be present, but *if it were not*, what a curious new source of speculation would be opened to us!



MAP VIII.

ANTHROPOID APES.

MAP IX.

BABOONS.

Day & Son (Limited) Lith.

Gorillas. The native habitat of the Orang Utang is Borneo and the eastern part of Sumatra, and, like the Malay of that country, his colour is brown; that of the Chimpanzee and Gorillas, the tropical west coast of Africa; where, like the native Negro, the animal's colour is black. Agassiz suggests that these coincidences have some bearing on the origin of the different species, but I rather look upon them as belonging to a different category of facts elsewhere, namely, that which I have discussed under the title of "Disguises of Nature,"* due to some principle by which the coloration of species seems regulated by certain qualities in the place where they live. The Gorilla and Chimpanzee formerly reached to the coast south of the Niger, but have now been driven further back into the interior. Although now rare to the north of it, they are still to be met with there, and were found in abundance in that country not very long ago. Bowdich distinctly describes both as occurring in Ashantee† in his day (1824).

The long-armed, tailless genus Hylobates (the Gibbons), may almost be reckoned Anthropoid. Agassiz and Huxley so consider it, but it seems rather to be the transition form between them and the other Catarrhini. It is peculiar to the East. It does not occur in the Peninsula of India, but two species are found on the eastern side of the Bay of Bengal, and others in Sumatra, Java, &c. The number of species, according to my view, is four.

The Presbytes, or Semnopitheci (so called from the Greek words σεμνος, venerable, and πιθηξ, a monkey, in reference to the veneration paid to them in India), have all long but not prehensile tails. Their distribution is nearly the same as that of the Gibbons, but differs in their being well represented in the Peninsula of India. They are also found in Ceylon, but the fauna of Ceylon shows in some respects differences from that of Southern India, and one of these is, that not one of the Monkeys living upon the island is identical with those of India. There are found on it four species of this genus (Wanderoos, as they are there called) and one Macaca; and as Sir Emerson Tennent says, each separate species has appropriated to itself a different district of the wooded country, and seldom encroaches on the domain of its neighbour,‡ or, as I would put it, some difference in the physical condition of each of these districts has resulted in producing a different species for each.

The four-fingered genus Colobus, also with a long tail, is peculiar to Africa, more than two-thirds of the species being found on the west coast, and the remainder in Abyssinia, Senaar, &c.

The Cercopitheci are also wholly African; it might almost be said wholly West African, for out of rather more than a score of species there is only one from Abyssinia and two from Caffraria. All the rest are from the Gambia, Sierra Leone, the Gold Coast, &c. The doubtful species in Celebes has been already referred to.

The Macacus is an East Indian genus; with the exception of one or two species, found in West Africa. The only short-tailed species (M. Innuus), often incorrectly called the Baboon, is from North Africa, and is also found wild on the opposite coast on the Rock of Gibraltar. The genus stretches from thence to the East Indies, Indian Archipelago, and China, whence come the Bonnet Monkeys, Macacus cynomulgus, M. Sinicus, and M. Rhesus, the favourite companions of the organ-men, and commonest inhabitants of menageries.

Cynocephali. (Map 9.) The Baboons and Mandrils, with one or perhaps two exceptions of the aberrant form above mentioned from the Philippine Islands, Celebes, Batchian, and Lombok, are

* "Disguises of Nature," in Edin. New Phil. Journal, January, 1860.

† Bowdich's "Mission to Ashantee," 1824.

‡ Sir J. Emerson Tennent's "Ceylon." 1859, and E. J. Kelaart, "Prodromus Faunæ Zeylanicæ." 1852.

peculiar to Africa. There are three species in North Africa, three in West Africa, and one (the Chacma) in South Africa, besides a species, the GELADA, forming a subsection in Abyssinia.

So far as the Old-world Monkeys are concerned, their distribution between tropical Asia and tropical Africa is singularly equal, there being almost exactly the same number of different species in each. That number, according to some, is forty, but from what has been above said as to the difficulty of distinguishing the species, it is scarcely possible to arrive at a correct estimate on that subject.

PLATYRRHINI—NEW-WORLD MONKEYS. (Map 10.) The next section, the PLATYRRHINI, is entirely American. It is composed of two families, the CEBIDÆ and the HAPALIDÆ. They extend from the Atlantic on the east to the Andes on the west, and from Central America on the north to the southern limits of Paraguay on the south.

CEBIDÆ.—Dr. Slack, who has well monographed a portion of this section, divides it into three groups, the LAGOTHRICES, the CEBI, and PITHECIÆ. The first, LAGOTHRICES (under which name he includes the CEBI of older authors), are distinguished by their truly prehensile tails, and are found in tropical South America wherever it is covered with forests; I say *truly* prehensile tails, because there is another group of this family which have the tail, to a certain extent, prehensile, but hairy all round, and not like that of the LAGOTHRICES, which is furnished on the under side with a naked, flattened, palm-like termination, studded with papillæ analogous to those of the palm of the human hand; and which, from experiments made upon the living animal, appears to be even more sensitive than the hand itself. The structure of the species provided with it bears strict relation to a forest life. Admirably adapted to such a condition of existence, they can gather their food on the loftiest trees, and dart with inconceivable rapidity along the frailest branches, and by their agility put the most powerful enemies at defiance. On the ground, and away from their natural habitation, they are slow, weak, and helpless. Where the woods cease, there cease the CEBIDÆ.

The extent of their domain is stated by Mr. Bates at 1260 miles from west to east, its breadth varying from 600 to 800 miles, towards the east continuing with grassy breaks for 700 miles further, terminating only on the shores of the Atlantic. "But," he adds, "as there is no complete break of continuity, the statement of Humboldt (who had a glimpse of the immeasurable wilderness only from its western commencement in Peru) still holds good, to the effect that a flock of monkeys might travel amongst the tree-tops, were it not for the rivers, for 2000 miles in a straight line, without once touching the ground; namely, from the slopes of the Andes to the shores of the Atlantic."*

One genus of these Monkeys, ALUATTA, or MYCETES, the Howling Monkeys, is provided with a special drum-like structure of the hyoid bone, which enables them to make the most deafening noise when they howl, which they do night and morning most persistently, except when in captivity, when they lose their voice, or rather do not exercise it, probably from want of vigour. As a sick patient, or a man in a delicate state of health, does not indulge in vociferous shouting or irrepressible bursts of song, so our poor consumptive quadrumanous weaklings keep a languid silence in our menageries.

These are the most unattractive, and even repulsive, of all the species of American monkeys. A large pyramidal head placed upon a thick unwieldy body, contrasts strongly with the globular heads, and comparatively light bodies of the other genera. They extend through the whole of the forests from New Grenada to Brazil. They are also found in Bolivia, but do not cross the Andes.

* BATES' "Notes on Animal Life in a Primeval Forest," in "Good Words," June, 1864, p. 66.

Species have been described under at least a dozen different names, but Dr. Slack admits only five species as genuine.

The Spider Monkeys, ATELES (Sapajou of Dr. Slack), are about as numerous in species, but their range is a little more extensive. In addition to the countries where the Howling Monkeys are found, at least three of the species of Spider Monkeys extend into Peru, east of the Andes.

The second group of CEBIDÆ are less remarkably fitted for an arboreal life than the prehensile-tailed species. Dr. Slack has divided them into those having the incisor teeth erect (the CEBI), and those having them oblique and proclive (the PITHECIÆ). Their tails are not prehensile, although long and hairy; and although their quadrumanous structure still makes the forest a congenial abode, they can also live on the ground, and some of them are specially adapted for a life among rocky precipices. Some are active and diurnal; others, as the NYCTIPITHECI, are nocturnal, and pass the day in sleep. About a score of species belonging to this section have been described, all inhabiting the same range as the previous genera, but perhaps extending a little further south.

Considering the vast extent of land in South America, its mammalian fauna is singularly meagre and homogeneous. The Monkeys furnish a greater number of species than any other genus, and even these we see are much fewer than is generally supposed. The most of them are found over a very wide extent of territory, a circumstance no doubt due to the uniform character of the whole country; with exception of the high lands in Guiana and Brazil, and of course of the Andes, there is little difference in the conditions of life of any part of the land, from the Gulf of Mexico to the south of Brazil.

Map 2 shows how slight a depression would make both Guiana and Brazil islands, and there is no doubt that at some former period, not very distant in geological time, they were surrounded by sea. As the seas which then surrounded them are now replaced on the inland side by great rivers, one would have expected a more decided difference between their Mammalian fauna than really exists. The species differ, but the genera are for the most part the same. When we come to the lower animals, we shall see that the insular antecedents of these countries are more fully borne out by their faunas. If the reader refers to the table of the geographical distribution of the LAGOTHRICES in the Appendix, which is copied from Dr. Slack's monograph,* he will see that out of four species which inhabit one of these former islands, Guiana, there are three found in the adjacent part of the other island, North Brazil, none of which, however, extend into South Brazil. We also see that three out of the four extend from Guiana into Venezuela, and that two of them reach Ecuador. One of these is also found in Peru and Bolivia. The same thing occurs with the HYSTRICIDÆ, every species found in Guiana being also found in Brazil. On the other hand, the instances of separation by the Amazon, already cited from Mr. Wallace's travels, and on the authority of Mr. Bates—and others which will meet us as we go along—sufficiently show that a certain amount of isolation is produced by these great rivers.

Perhaps it may be said that the rivers should be no barrier to the Monkeys, insamuch as if they cannot swim across them, they can turn them by ascending to their sources, there being an uninterrupted highway of trees and branches all the way to the Andes. While the stream was still small, it had entered the forests, and the trees would meet overhead, or where a giant fell he would bridge the river. This is true, and the inference would be sound, but for one circumstance. Supposing a nation of Monkeys to set out from Guiana to the sources of the Rio Negro, and thence to

* SLACK in "Proc. Nat. Scien. Philad." Nov. 1862.

those of the Amazon, there is nothing to hinder them, or more properly their descendants (for the journey would be one beyond the lives of many Monkeys), from doing so; but as they journeyed they must have been gradually rising above the level of the sea, for although the ascent is gentle and imperceptible, still in hundreds of miles a small rise tells. By the time they have reached the upper waters of the Rio Negro, they have got into the granitic high lands which extend from Guiana across the sources of the Rio Negro towards the Andes, and having entered into new conditions of existence, the alteration would begin to have its usual effect, and induce a change, which would gradually end in producing a new species; and if the species thus transmogrified pursued its journey down the other bank, the change from high land to low land would again operate, and a second change would take place, but, unlike our old metamorphosed friends in the "Arabian Nights," the changeling would not be disenchanted back into its old form, but would undergo a new change into a third species. So that, although the Guiana species may reach the opposite shore by turning the sources of the river, it would have ceased to be itself by the time it had done so. The facts which have been observed seem quite consistent with this hypothesis. Mr. Wallace says, "Towards the sources, rivers do not form a boundary between distinct species; but those found there, though ranging on both sides of the stream, do not often extend down to the mouth."* And as instances he mentions the fact that on the Upper Rio Negro and its branches, are found the CALLITHRIX TORQUATUS, NYCTIPITHECUS TRIVIRGATUS, and a species of JACCHUS, none of which inhabit the Lower Rio Negro or Amazon. Where they do extend on both sides of the river the circumstance may be due to one of Mr. Darwin's exceptional modes of accidental colonization.

There are two points relating to the limits of the South American Quadrumana, in which many of our physical-geography maps are incorrect. Dr. Sclater† has pointed out one of these, viz. the inaccuracy in the limit of their northern range. This is given in Johnston's Physical Atlas‡ by a line drawn across Honduras, which is supposed to mark the northern limit of MYCETES SENICULUS. Dr. Sclater has shown by reference to authorities both published and unpublished, the most important of which is a communication from M. Auguste Sallé, that the line must be drawn considerably to the north of this, viz. in the neighbourhood of Tampico, or about 23° of north latitude: in other words, the tropic of Cancer, which is as nearly as possible the northern limit of the quadrumana in the Old World. What species are found in this part of their range is not exactly known, but some of them would appear to be the species which are most widely distributed to the south. Dr. Sclater has thrown out the suggestion that some singular new species may yet be found in these regions of Central America, on the ground that in birds he has found it "a general rule that this northern portion of the great South American (his neotropical) region possesses specifically distinct representatives of all the more important groups which characterise the ornithology of tropical South America, and that it not unfrequently happens that these northern outliers of the genus are the finest in colouring, and the most *outré* or exaggerated in form, of the whole group." No confirmation of this conjecture has yet been obtained, but it must add an intelligent interest to future explorations in that country to see whether the rule observed by Dr. Sclater in birds also holds good in other classes of beings. As yet we can scarcely say that it holds good in mammals.

The other point which I do not observe correctly stated in any Physical Atlas is the western

* WALLACE, op. cit.

† SCLATER, in "Nat. Hist. Rev." Oct. 1861, p. 507.

‡ The map in SCHMARDA'S "Geographische Verbreitung," is more correct.

MAP X

PREHENSILE TAILED MONKEYS.

Note. *Degree of prevalence indicated by intensity of colour.*

MAP XI.

LEMURIDÆ. AND CALEOPITHECI.

Note. *Degree of prevalence indicated by intensity of colour.*

Day & Son (Limited) Lith

limit of the South American Quadrumana. Peru being often loosely given as the locality of some of the species, it seems to have been taken for granted that the range of such species extended over the whole of Peru on both sides of the Andes. Now the truth is, that when Peru is given as a habitat of Monkeys, it is that part of Peru which lies east of the Cordillera that is meant. I can find no evidence of any monkey having been found west of the Andes, until, going northwards, we reach Guayaquil. Tschudi describes twenty-two species as found in Peru, but he carefully defines the different regions in which all his species are found, and the whole twenty-two occur only in the forest region east of the Cordillera. Mr. Fraser, also, than whom there can be no better authority, assures me that west of the Andes none are to be found south of Guayaquil. One or two species occur to the north of it, but he neither met with, nor heard of any further to the south between the Andes and the Pacific.

HAPALIDÆ — MARMOSETS.—The other South American family, the tiny Marmosets, HAPALE, (ARCTOPITHECI of older authors, *i.e.*, bear-like monkeys), about as numerous as the preceding group, inhabit the same regions; a few are recorded from Guiana and Surinam, but by much the greater number of species is found in Brazil, which seems to be their metropolis; some are also found in Eastern Peru. These little creatures live together in numerous troops in the great forests. They feed on fruits and insects, and have much of the habits of squirrels.

CHAPTER X.

LEMURIDÆ — FAUNA OF MADAGASCAR.

This singular and interesting group of species is confined to the African and Indian districts, and none of the true Lemurs, or Makis, have hitherto been found beyond the limits of Madagascar and the Commoro Islands. The Loris, the Nycticebus, and Tarsius, represent them in Ceylon, Sumatra, and the Indian Archipelago; and one species (Nycticebus Javanicus, *Geoff.*), a slow nocturnal animal, has an extensive range, extending from Bengal to Sumatra, Java, and Siam. The Galagos are entirely confined to the continent of Africa. A considerable number of species is now known, forty-three having been described by Dr. J. E. Gray, in his monograph of the Family.* In it he enumerates the whole of the species of this family which have been discovered up to this date. Their numbers and localities are as follow:—

		Species				Species	
Indrini.—	Indri	1		Lepilemur		4	Madagascar.
	Propithecus	1	All from Madagascar.	Callotus		1	Angola.
Lemurini.—	Varecia	4		Galago		3	Gambia. Senegal. Fernando Po.
	Lemur	10					
	Otogale	2	Natal.	„		1	South Africa.
	„	2	Fernando Po.	„		1	Senaar.
	Macrorhinus	1	Madagascar.		(doubtful)	1	Madagascar.
	Hapalemur	2	„				
	Cheirogaleus	3	„				

Several admirable additions have been made to our knowledge of this family and its allies within the last few years. In addition to Dr. Gray's monograph, Mr. St. George Mivart has given an excellent paper on their dentition and classification,† and I have adopted his arrangement in the list of species in the Appendix. He divides them into the Indrisinæ, Lemurinæ, Nycticebinæ and Galaginæ, and includes Tarsius and Cheiromys in the order, making separate sections for them. Professor Huxley has also given a valuable monographic description of a new species of this family, Arctocebus Calabariensis, from Old Calabar.‡

The possession by Madagascar of so many species of these remarkable animals naturally leads one to speculate upon the circumstances to which this specialty is due.

That country is distinguished not only by the peculiar endemic types which it possesses, but, perhaps, even more so, by the absence of other forms, which we might naturally think that it ought to

* Gray in "Zool. Soc. Proc." 21 April, 1863.

† "Proc. Zool. Soc." Nov. 1864, p. 611.

‡ "Proc. Zool. Soc." 1864, p. 314.

contain. Its vicinity to Africa, and the fact that there is a comparatively shallow submarine neck of land, which would on a small rise connect it with that continent (see Map 1), mark it *prima facie* as an African dependency, and its fauna and flora in many respects bear out the expectation; but there is still much that is difficult of explanation on this assumption. If it were formerly connected with Africa, why are so many of the special types of the neighbouring land wholly wanting?—Where are its Antelopes and its Pachyderms? It may have been that they were not yet in existence at the period when the separation of Madagascar from Africa took place, or it may have been due to the physical character of the land, and not a phenomenon involving any difference in the fauna of the neighbouring continent, from what now exists there. I have already suggested that its separation probably took place at the commencement of the miocene epoch. Imagine the fauna of South Africa, with Madagascar united to it, to have been at that time of the same type as now (with the possible exception of the Carnivora, as to which I shall speak in the next chapter). We may, without extravagance, assume the character of the fauna of Africa to have continued the same since the miocene epoch; for if the only other country (Australia) of which a considerable portion has remained above water and without much change since that date, has preserved its Mammalian type unchanged, there seems no reason why Africa, similarly circumstanced, should not have done so likewise. If that was the case when the subsidence came, it would obviously depend upon its extent and the character of the portion of Madagascar not submerged, what animals would be present and what could survive. If all but wooded peaks were under water it is plain that there could be none of the Antelopes which feed on grassy plains: they would not be there at all. All but those animals adapted for a mountainous or forest country would be destroyed, and South Africa has few of that class of animals. The Mammalian Fauna of Madagascar is singularly limited; but such as it is, it is all related to Africa and India; there is not a Mammal in Madagascar which does not belong to families whose types are both Indian and African; thus confirming the idea of the former connexion between these two lands.

Cheiromyidæ—Cheiromys—Aye-Aye. This extraordinary animal is a native of Madagascar, and only one species of the genus is known. Its place in the natural system has been the subject of much discussion; some, especially the older authors, placing it among the Squirrels,* others classing it with the Lemurs. Some modern authors of eminence, and among them Dr. Giebel,† also place it next the Squirrels. The reader will find full details regarding its affinities, in a paper by Professor Owen in the Transactions of the Zoological Society.‡ Its dentition is absolutely that of a Squirrel or Beaver, and I may add two minor characters which I have not seen noticed, viz., its hair and its dung, which are both those of the Squirrel. Notwithstanding this, however, on balancing the characters on each side, its Lemurine relations seem to preponderate. Its appearance is that of a Lemur, and one very marked peculiarity, which is shared by some of the Lemuridæ and the Aye-Aye, is entitled to much weight, viz., that one of the fingers (in the Aye-Aye the ring-finger) of the fore or hind paws is specially altered in form and adapted in structure for picking insects out of their holes in timber. This structure is very conspicuous in the Aye-Aye, but there is no instance in which it occurs in the Squirrels or any other of the Rodents. Such a peculiarity as this

* See Cuvier's arrangement in the Appendix. Dr. Shaw also, who first described it, named it "Sciurus Madagascariensis."

† Giebel "Die Saugethiere."

‡ Owen, in Trans. Zool. Soc. 1862.

found in two different animals, does more to impress the mind with a conviction of their affinity, than other more important, though less specialized, characters. To the students of geographical distribution the additional fact that the Aye-Aye is a Lemur-like animal, inhabiting a country where Lemurs abound and Squirrels are not, will be conclusive in favour of its belonging to the Lemurs, and not to the Squirrels. Its rodent characters will be to them more especially interesting in relation to speculations on the origin of that family.

Galeopithecidæ. The curious genus, Galeopithecus, is found in Java, Siam, Sumatra, Borneo, and the Philippine Islands. Some authors make a distinct Order of it; others place it among the Bats; more recently an inclination has been shown to rank it among the Insectivora proper,* but I agree with the majority of Naturalists that its place is next the Lemurs. It has no doubt some affinities to the Insectivora, especially the Bats; but those to the Quadrumana preponderate. There have been five species described, three in Java, Sumatra, Borneo, and Siam, and two in the Philippine Islands; but there is little doubt that they are not all distinct.

* See Giebel, Die Saugethiere, 653, 1859; also Wagner's Supplement to Schreber's "Saugethiere," vol. v., and Peter's "Ueber die Saugethiere's gattung Solenodon Abh. Ac. Wiss." Berlin, 1863.

CHAPTER XI.

CARNIVORA.—AFFINITIES.—EXTINCT FELINE SPECIES.—ORIGIN AND DISTRIBUTION.—BONE-CAVES IN BRAZIL.—MAUVAISES TERRES.

The Carnivora consist of the Cats and Dogs (Digitigrada), the Bears (Plantigrada), and Seals (Pinnigrada). Professor Owen places them in this order, doubtless in accordance with what he considers their respective degrees of development. Other authors have preferred to place the Bears at the head of the Carnivora, from the idea that by the plantigrade walking feet of some, and by the prehensile feet of others, they showed more relationship to the Quadrumana than the other members of the order, and so formed the most natural transition from them to it; but proximate affinity is not to be looked for in these two orders, and it is straining parallel resemblances too far to construe them as evidences of connexion: at the same time there is no harm in keeping in mind that resemblances in various points may be traced between the Arctopitheci among the Quadrumana, the Racoons among the Bears, and the Squirrels among the Rodents.

The oldest form that we can trace of each order is as perfect and advanced as any of the species of the present day; and if we trust to nothing but the evidence of fossil remains, we are compelled to admit that each had started into being like Minerva from Jove's head, fully armed, with all the attributes of our present species. The fossil monkey from the caves of Brazil is of the South American type, and has the characters of that type as fully developed as the most modern improvement upon them all; so it is with those of the Old-world section, remains of which have been found in Europe. The earliest Carnivore did not appear in the shape of some less perfect animal or intermediate modification, from which a lion, a dog, or a bear, may have successively sprung; but in as perfectly developed a carnivorous form as any subsequent species of that order. These are the extinct animals described under the names of Palæocyon, Amphicyon, &c.

The Carnivora, however, do not appear as a well-established family until the pliocene period, although scanty remnants of a few species have been found in the eocene and lower miocene formations. It is to the fossiliferous caves and diluvial deposits about the time of, or succeeding to the glacial epoch, that we are indebted for the most of our knowledge of the extinct species of this order. The caves examined by Lund in Brazil, which belong to the pliocene epoch, have contributed some most interesting materials to it. The only localities in which carnivorous remains have been discovered of an older date than the glacial epoch are—1. Some of the European eocene and miocene deposits; 2. The deposits in the Mauvaises Terres, east of the Rocky Mountains in North America, which again belong to the miocene epoch; and 3. The miocene beds of Sevalik, in the Himmalayah. All the pre-glacial remains belong to a different type from that of the existing Carnivores, which only first appeared during the glacial epoch. Map 12 shows their distribution previous to the elevation of the bed of the Saharan sea.

If these data can be held to represent at all fairly the former range of carnivorous animals, they suggest the possibility of a remarkable difference between their ancient and their modern distribution; viz., that their origin is northern, and that their presence in Africa, one of the regions in which they now chiefly flourish, is possibly of comparatively recent date.

In the first place, if the assumption is correct that Africa had always been wholly detached from Europe until after the glacial epoch, the occurrence of a species in the one country would be *primâ facie* evidence against its being found in the other, because it could only inhabit both, either by some communication having existed between the two (which is against our special premises), or by a double creation, or duplicate specific centre (which is against our general premises).

It is a natural assumption that, because feline remains have been found in the Sevalik beds, feline animals must then have lived in India, and, probably, ranged over the whole supposed continent between India and Africa, and so supplied Africa. We cannot prove that they did not. No one can prove a negative; but we can show that the Sevalik remains do not prove the affirmative.

A Sevalik sea separated India from Northern Asia, in the line of the Himmalayahs, which had not yet appeared; for the beds, which they were to tilt up, were only then being deposited. Now, a miocene sea, like every other sea, must have at least two sides; and the question comes to be, from which side, not all the animals found in the Sevalik country, but this particular form of animal, tumbled in. The inference surely ought to be, from the side on which Carnivora were known to exist—not from that where their remains have never been found. We know that they existed in the northern hemisphere previous to the glacial epoch, not only because their remains have been there met with, but because they must have been the stock out of which the present type was developed when the glacial change came. But, moreover, if the subsidence of the supposed continent between India and Africa was simultaneous with, and part of, the same action as that which sunk a bed for the Sevalik sea, (which is possible) Africa may have been disunited from India prior to the appearance of the miocene Carnivora whose remains are found in the Sevalik beds; and thus, even although they inhabited the south of the Sevalik sea, as well as the north, they may have been equally excluded from Africa.

The converse of this is the case with the Antelopes, which have marked Africa for their own. Only a few stragglers, of perhaps recent date, are found beyond its bounds and those of India; and I have not met with a single well-determined and undisputed instance of fossil remains of Antelopes being found in the northern hemisphere.

We have thus apparently the singular fact rendered probable that Africa, at least, was free from carnivorous animals until after the glacial epoch, and that the herds of Ruminants and Pachyderms enjoyed an Elysian existence—a sort of Garden of Eden, into which death never penetrated; at least in the guise which they now most dread. I have heard very excellent discourses on the beauty of the balance of life, whereby the excessive increase of one animal is kept within bounds by the destructive instincts of another; and very generally the Lion and the Ruminant wound up and gave point to the argument. But we see that no such compensation-balance is now needed or used in South America, where the herds of cattle and horses roam unchecked by the Puma or the Wolf, which are unequal to the task of subduing them. I have, therefore, less hesitation in believing that the same may have happened in former times in Africa.

As a communication subsisted in those times between Europe and North America, and between

MAP XII

Places where remains of Carnivora have been observed in formations prior to Glacial Epoch.

ARCTIC OCEAN
BAFFIN BAY
GREENLAND
Davis Strait
ISOTHERMAL 32°
Arctic Circle
ESQUIMAUX
RUSSIAN AMERICA
INDIANS
CUMBERLAND
HUDSON BAY
BRITISH AMERICA
LABRADOR
VANCOUVER I.
OREGON
NORTH AMERICA
UNITED STATES
NUEVA CALIFORNIA
TEXAS
G. of MEXICO
MEXICO
WEST INDIA Is
CARIBBEAN SEA
GUATEMALA
VENEZUELA
GUYANA
NUEVA GRANADA
ECUADOR
PERU
BRAZIL
SOUTH AMERICA
BOLIVIA
LA PLATA
PATAGONIA
TIERRA DEL FUEGO
FALKLAND Is
NORTH PACIFIC OCEAN
SANDWICH Is
ALEUTIAN Is
MARQUESAS Is
LOW ARCHIPELAGO
SOCIETY Is
GOODS Is
NAVIGATORS Is
SOUTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
Tropic of Cancer
Equator
Tropic of Capricorn
SOUTH ATLANTIC OCEAN
AZORES
PORTUGAL
SPAIN
SAHARA DESERT
AFRICA
CAPE COLONY
CAFFRARIA
MADAGASCAR
NOVA ZEMBLA
LAPLAND
NORWAY
SWEDEN
FINLAND
SCOTLAND
IRELAND
ICELAND
BALTIC
EUROPE
RUSSIA
PRUSSIA
FRANCE
AUSTRIA
TURKEY
BLACK SEA
ASIA MINOR
MEDITERRANEAN
EGYPT
NUBIA
RED SEA
ARABIA
PERSIA
CASPIAN SEA
SIBERIA
ASIA
IRKUTSK
Altai M.
INDEPENDENT TARTARY
MONGOLIA
CHINESE EMPIRE
THIBET
CHINA
AFGHANISTAN
PUNJAB
HINDOOSTAN
BIRMAH
CEYLON
ARABIAN SEA
BENGAL SEA
CHINA SEA
JAPAN SEA
JAPAN Is
KAMCHATKA
ALEUTIAN Is
PHILIPPINE Is
BORNEO
CELEBES
SUMATRA
JAVA
CHEEN-CHINA
INDIAN OCEAN
NORTH AUSTRALIA
N. GUINEA
NEW HEBRIDES
AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VANDIEMEN
NEW ZEALAND
SOUTHERN OCEAN

160 140 120 100 80 60 40 20 0 20 40 60 80 100 120 140 160

70 60 50 40 30 20 10 0 10 20 30 40 50 60

Day & Son (Limited) Lith.

North and South America, there is, of course, no difficulty in explaining the presence of the same type of early Carnivora in all three countries in that epoch.

Felidæ—Great Cats, Lions, Tigers, Leopards, &c. (Maps 12–16.) The Great Cats are so eminent members of this family, that I may be excused for treating of them separately—not as a zoological section, distinct from the small cats, but—as objects to which more human interest attaches than to their smaller and less dangerous cousins.

Extinct Species.—The Cave Lion or Cave Tiger, Felis Spelæa, whose remains have been found in almost every bone-cave in Europe, differed in little but size from the living tiger or lion; and even in size the difference is not great. By some it has been supposed to be the species of tiger still living in Asia; by others, it is thought to have been the existing lion.*

De Blainville attributed to it a mixture of the characters of the Lion and Tiger. Owen, in his "British Fossil Mammals," named it the Cave Tiger, having at that time had only imperfect specimens to examine; the maxillary bones, the most essential materials for the inquiry, not having then come into his hands. He pointed out, however, that the comparative prolongation of the nasal processes of the maxillary bones was a good character for distinguishing the skull of the existing lion from the tiger, as well as from the jaguar and its allies. The nasal processes of the superior maxillary bones extend as far back as the nasal bones in the lion, but not so far in the tiger. On the examination of perfect specimens of the Cave animal subsequently obtained, he found that they did extend as far back, and he thence concluded that the animal was not a tiger. This opinion is, however, not universal. Dr. Giebel still (1859) speaks of it as the "Cave Tiger, falsely called the Cave Lion." "Although," says he, "this Cave Tiger has a most decided affinity to the tiger in skull, skeleton, and dentition, and more widely remote from the lion than the living tiger; still it has, even in the latest times, been falsely given out by Gervais, Pictet, Quenstedt, and others, as a Cave Lion." The range of the living tiger is certainly more akin to that of the deceased animal, than is that of the lion.

Notwithstanding this, it has even been doubted whether it might not have been a leopard, a spotted cat instead of a striped one. Shorter processes of the maxillary bones are present in the skull of the jaguar as well as the tiger, but Cuvier speaks of the Cave species resembling the leopard more than the tiger or lion, in the uniform and gentle curve of the skull.

The animal was no doubt suited to a cold climate. Its remains have been found in abundance in England, and our climate in its days must have been even more severe than that which we now have. We infer this, not only from the very ample protection against cold, with which the mammoth, in whose times it lived, was provided, but from the reindeer and musk-ox having been contemporaneous inhabitants with it of England. Its other associates are either extinct, without leaving us the means of judging what climate was best suited to them, or they were of that accommodating habit which can bear considerable extremes of heat and cold, and consequently furnish by their presence no indication, either one way or other. But the same species of musk-ox and reindeer which then furnished food for the Cave Lion, still survive, although the former is now confined to the Arctic regions, and the latter only thrives in scarcely less northern lands, while it will not live at all in our menageries. Their presence, therefore, infers a considerably colder climate in England than we now possess.

* "The great Felis of the British cave deposits is now believed to be no other than F. Leo." Blyth, op. cit. 53.

Some authors, indeed, have attempted to distinguish the fossil reindeer from that now living in the North of Europe and Asia, and have supposed that it was a species peculiar to Central Europe, and separated from the Northern species by a geographical lacune. This view is not adopted, however, by the majority of palæontologists. Greater variation exists between different individuals of the existing reindeer than between them and the fossil species; and as to the geographical lacune in their distribution, M. Lartet* points out that nearly a century ago, when Pallas travelled in the south of Russia, he found them advancing southwards along the Ural mountains, and speaks of them being killed every year near Mount Caucasus. Besides, this objection does not apply to the still stronger case of the musk-ox.

On this subject it is not irrelevant to state my belief, that whatever may be the cause, the climate has improved, and in a general way still continues to do so, ever since the days of the glacial epoch (always excepting occasional, perhaps cyclical, variations which may have been due to general causes affecting the whole globe). The glaciers in Switzerland, with some oscillations, are retreating on the whole. The accounts which Tacitus, Cæsar, and other ancient writers, give of Germany, France, and Britain (Ireland is spoken of as "frozen Erin")† suggest a less favourable climate than these countries now possess. There seems to be a diminution, too, in the energy of the people of Southern Europe, since the days when their ancestors carried all before them; and we know that energy and the *vis victrix* are the attributes of climates with a certain degree of cold. Heat relaxes the human machinery, not only in those born in cold climates, but still more in the natives of warm ones; cold braces it up. That conquering power has gone forth from the Greeks and the Romans, the Moors and the Spaniards, and migrated to more northerly people. It is a fair and an open question, though all too large for discussion here, and there is no lack of arguments on the other side, such as that the temples and buildings left by these nations are all conformable to such climates as now subsist in their countries, that wine was formerly made from the grape grown in the open air in the south of England, and that corn grew in Iceland; but, as at present advised, I incline to think these exceptions are capable of being explained away, and that the arguments in favour of a continued amelioration of climate are strongest.

Besides the above-mentioned animals, the Cave lion lived contemporaneously, probably, with all the following species, viz. with the Cave bear, the Cave hyæna, the mammoth, the so-called woolly-haired rhinoceros, a large hippopotamus, the Irish elk, and various smaller animals. M. Lartet divides the recent or quaternary epoch into four periods, each characterised by these animals, thus,—

1. The period of the Cave bear, which he thinks appeared first, and became extinct first.
2. The period of the mammoth and rhinoceros.
3. The period of the reindeer; and
4. That of the aurochs.

Remains of the Cave lion have been found in caves associated with remains of the animals which lived in all the three first periods.

It appears, also, to have continued alive in Europe until a comparatively recent period, although

* Lartet's "Annales des Soc.," 1841.

† "—— Maduerunt Saxone fuso
Orcades, incaluit Pictorum sanguine Thule,
Scotorum cumulos flevit *glacialis Ierne*."—Claudian.

whether down to the age of the Aurochs and Urus is not so clear, but probably subsequent to the appearance of man there; for Messrs. Christy and Lartet record a metacarpal bone of the species found in the cave of Les Eyzies, bearing evident marks of knives (flint), which marks they imply were produced by cutting off the meat from the bones. It has left evidences of its presence in England, Belgium, Germany, Russia, France, Italy, Sicily, and Greece.

It is not proved that it extended into Asia; according to my view it must have come thence. Still earlier than its appearance in Europe, the Tiger, before referred to (F. CRISTATA), about the same size as the living tiger, already existed in Asia, remains of which have been discovered by Falconer and Cautley in the miocene formation of the Sivalik Hills.*

Remains of a still older miocene Tiger (F. APHANISTA *Kaup*) have been met with in the tertiary sands of Epplesheim. Some very imperfect remains of an animal about the size and habit of a panther have been found in the miocene beds at Sansans, in the south of France. It was described by Gervais under the name of PSEUDÆLURUS QUADRIDENTATUS.†

Another feline animal, perhaps of even more destructive character than the Cave Lion, belonging to an allied but distinct and very remarkable genus named MACHAIRODUS, lived in Europe in the miocene epoch, and not long before the Cave species, and has also left traces in America.

The most distinguishing feature in the structure of the animals of this genus was the enormous development of the upper canine teeth, which were much longer than those of the lion or tiger, more compressed, and flattened like a sabre, whence their name. The remains of European species have been found chiefly in caves. So have those of one of the American species, a most extraordinary animal, with some resemblance to the hyæna, but larger, discovered by Lund in caverns in Brazil, and named MACHAIRODUS NEOGÆUS or SMILODON. In it the upper canines are nearly as long as the entire lower jaw, and, as suggested by Professor Owen, are an instance of the mutual correlation of the structure (for offence and defence) of animals inhabiting the same region — the powerful jaws and enormous upper canines of this animal being apparently purposely adapted for tearing up the large Armadillos (GLYPTODON), whose carapaces are found in the superficial deposits of South America of the same age, which, on the other hand, are provided with an almost impenetrable tortoise-like armour.

The Jaguar, which in these countries now fills the place and performs the destructive task of the MACHAIRODUS SMILODON, has a less difficult labour to perform. Humboldt, in his "Personal Narrative," says, "We were shown large shells of turtles emptied by the Jaguars. These animals follow the *Arraus* towards the beaches, when the laying of eggs is to take place. They surprise them on the sand, and, in order to devour them at their ease, turn them in such a manner that the under shell is uppermost. In this situation the turtles cannot rise, and as the Jaguar turns many more than he can eat in one night, the Indians often avail themselves of his cunning and malignant avidity. When we reflect on the difficulty that the naturalist finds in getting out the body of the turtle without separating the upper and under shells, we cannot enough admire the suppleness of the tiger's paw, which empties the double armour of the Arrau, as if the adhering parts of the muscles had been cut by means of a surgical instrument."‡ Mr. Wallace speaks in similar terms of the clean and perfect manner in which the whole of the interior is scooped out.§

* FALC. and CAUTL. "Asiatic Researches," xix. a 135.
† GERVAIS, "Zool. Pal. Fr." p. 127.
‡ HUMBOLDT'S "Personal Narrative," iv. p. 492.
§ WALLACE, ALFRED, "Travels in Brazil."

In the Jaguar the instrument used is the paw, but we may fairly assume that the canine teeth, half a foot in length, would take their part along with the paw, when the Smilodon came to play at such a game.

One inference from this supposed similarity of function may be that the Jaguar is a legitimate descendant of the Smilodon, and that the latter was a great spotted cat.

The caverns and deposits in which Dr. Lund found remains of these, and many other most interesting animals, are situated in the mountain-chains between the Rio das Velhas and the Rio Paraopeba. This country forms an elevated plain 2000 feet above the level of the sea, and is traversed in its centre by a chain of mountains 300 to 700 feet in height, which is formed of secondary limestone stratified in horizontal beds, and possessing all the characters of the Zechstein or Höhlen Kalkstein (cavern limestone) of the Germans. It is entirely perforated with caverns, and traversed in all directions by fissures, which are more or less filled with red earth, identical with that forming the superficial stratum of the district. This bed, which varies from ten to fifty feet in thickness, covers indiscriminately, and without interruption, the plains, valleys, hills, and even the gentle slopes of the mountains. It consists principally of clay, containing subordinate strata of gravel and quartz pebbles, and is frequently ferruginous to such a degree that the particles of iron are converted into pistholitic iron ore, resembling that which fills the fissures of the Jura. The soil which fills the caverns has undergone some modifications, arising from its introduction and sojourn in them. It contains angulose, or rounded fragments of limestone. It is also hardened by the particles of lime deposited in its interior by the waters charged with this substance filtrating through the fissures of rock, and it is impregnated with saltpetre, and is on this account explored by the inhabitants of the country.*

It is in this soil that the fossil bones are found; they are deposited pell-mell, are fragile, very white in their fracture, and adhere strongly to the tongue. Frequently they are petrified, more often converted into calcareous spar. In general they are broken or mutilated, and, lastly, they frequently bear the impressions of teeth, leaving no doubt that the animals to which they belonged had been dragged into these caverns by ferocious animals then inhabiting them. The larger ones have been introduced by various carnivorous mammifera, and the smaller ones probably by a diurnal bird. At the present day not a single ferocious animal of the mammifera sojourns in these caverns, and none accumulate masses of bones comparable to those which are found in the diluvial deposits. At the utmost, all that is found in the modern excavations are bones of small animals scattered at the surface, which had served as prey to a nocturnal bird, the Terror (Effraie) of Brazil (Strix perlata).

Of these caverns, that called Sappa Nova de Marguiné, in the Sierra de Marguiné, is one of the most remarkable. The mountain consists of clay-slate, flinty-slate, and transition limestone, in which last is the principal cavern. Its total length from north to south is 1440 feet, the height being from thirty to forty feet, and the breadth from fifty to sixty. It is separated by masses of stalactite into twelve divisions, of which only three were known before Dr. Lund explored them. The others, especially the innermost, were of such extraordinary beauty, that his attendants fell on their knees and expressed the greatest astonishment. Lund examined nineteen caverns in all, in three of which he found the remains which have thrown so much light upon the ancient forms of life in Brazil.

An interesting fact relating to these caves is mentioned by Dr. Mantell as having been communicated to him by Mr. Waterhouse. M. Clausen, from whom, as well as Dr. Lund, many of the remains from the caves now preserved in the British Museum were obtained, in the course of his

* "Comptes Rendus," No. 15, Avril, 1839.

researches discovered a cavern the stalagmitic floor of which was entire. On penetrating the sparry crust he found the usual ossiferous bed, but pressing engagements compelled him to leave the deposit unexplored. After an interval of some years, M. Clausen again visited the cavern, and found the excavation he had made completely filled up with stalagmite, the floor being as entire as on his first entrance. On breaking through this newly-formed incrustation, it was found to be distinctly marked with lines of dark-coloured sediment alternating with the crystalline stalactite. Reasoning on the probable cause of this appearance, M. Clausen sagaciously concluded that it arose from the alternation of the wet and dry seasons. During the drought of summer the sand and dust of the parched land were wafted into the caves and fissures, and this earthly layer was covered during the rainy season by stalagmite, from the water that percolated through the limestone and deposited calc-spar on the floor. The number of alternate layers of spar and sediment tallied with the years that had elapsed since his first visit; and, on breaking up the ancient bed of stalagmite, he found the same natural register of the annual variation of the seasons. Every layer dug through presented a uniform alternation of sediment and spar; and as the botanist ascertains the age of an ancient dicotyledonous tree from the annual circles of growth, in like manner the geologist attempted to calculate the period that had elapsed since the commencement of these ossiferous deposits of the cave; and, although the inference, from want of time and means to conduct the inquiry with precision, can only be accepted as a rough calculation, yet it is interesting to learn that the time indicated by this natural chronometer, since the extinct mammalian forms were interred amounted to many thousand years.*

The age of the remains found in the caves is the same as that of those found in the bone-caves of Britain, namely, the later pliocene, that is, subsequent to the glacial epoch. It is remarkable that all the bone breccias and bone caves throughout the world belong to the same period. They may be called phenomena of the glacial epoch. How or why none have been discovered applicable to the miocene epoch is not easy to account for. The deposit of bone breccias is doubtless still going on in various parts, where rivers disappear in limestone countries; but I cannot help thinking that the manufactory is less flourishing than it was in times nearer to the height of the glacial epoch.

It would be a convenience, in considering questions relating to this period of geological history, if geologists would—instead of their older and newer Pliocene and Pleistocene formations—give us a nomenclature bearing direct reference to the progress of the glacial epoch—one phrase to indicate its access, another its establishment, and a third its recess. At present its access (although not less important than its recess, seeing that during it the chief changes from miocene to modern types of form probably took place) is scarcely recognised as part of the epoch at all.

The locality in North America which has supplied the greatest amount of evidence of the former existence there of species of the genus of which we have been speaking, as well as of many other extraordinary extinct animals, is the band of tertiary deposits extending, with interruptions, in the line of the Missouri and Mississippi, from the northern shore of the Gulf of Mexico to the Arctic Ocean. The most prolific portion lies along the river Missouri, and is known as the "Mauvaises Terres," or Bad Lands of the hunters. These occur at irregular intervals all along the Missouri, more especially on the Nebraska or Platte River, and the Niobrara and others of its tributaries, and in some places are of great extent. They are composed mainly of a soft half-formed sandstone or mud stone, which crumbles under a slight pressure, and is washed by the rains

* Mantell, G. A., "Petrifactions and their Teachings; or, a Hand-book to the Gallery of Organic Remains in the British Museum." London, 1851. p. 481.

into the most fantastic shapes, and as it is washed away discovers fossils and lignites of a large size, and is sometimes heard falling in large masses, with a dull, muffled sound.

The accounts given of these singular districts, and of the columnar and grotesque forms of the more indurated portions which have withstood the denuding action of the weather, might be used as descriptions, on a small scale, of the scenery which we might expect would be seen were the coral islands of the Pacific raised above the level of the sea. The following description of them is taken from Dr. Evans' account of them in Owen's "Geological Survey of Wisconsin:"—

"To the surrounding country, however, the Mauvaises Terres present the most striking contrast. From the uniform, monotonous open prairie, the traveller suddenly descends one or two hundred feet into a valley that looks as if it sunk away from the surrounding world, leaving standing all over it thousands of abrupt, irregular, prismatic, and columnar masses, frequently capped with irregular pyramids, and stretching up to a height of from one to two hundred feet or more. So thickly are these natural towers studded over the surface of this extraordinary region, that the traveller threads his way through deep, confined labyrinthine passages—not unlike the narrow, irregular streets and lanes of some quaint old town of the European continent. Viewed in the distance, indeed, these rocky piles, in their endless succession, assume the appearance of massive artificial structures, decked out with all the accessories of buttress and turret, arched doorway, and clustered shaft, pinnacle, and finial and tapering spire. One might almost imagine oneself approaching some magnificent city of the dead, where the labour and genius of forgotten nations had left behind them a multitude of monuments of art and skill.

"On descending from the heights, however, and inspecting in detail its deep intricate recesses, the realities of the scene soon dissipate the illusions of the distance. The castellated forms which fancy had conjured up had vanished, and around one on every side is bleak and barren desolation. Then, too, if the exploration is made in midsummer, the scorching rays of the sun pouring down in the hundred defiles that conduct the wayfarer through this pathless waste, are reflected back from the white or ash-coloured walls that rise around, unmitigated by a breath of air or the shelter of a solitary shrub.

"The drooping spirits of the scorched geologist are not, however, permitted to flag. The fossil treasures of the way well repay its dullness and fatigue."*

These beds have been denominated the White River Group by Mr. Meek and Mr. Hayden,† in a paper on the Nebraska deposits. They belong to the older deposits of the lower miocene. It is in another series of beds called by them the Loup River Beds, which have been deposited after the upper surface of the White River group had been worn into ravines, that remains of species of the genus Felis occur, which they consider to be very closely allied to recent species. These beds probbaly belong to the more recent period of the upper miocene.

These prolific beds have been deposited in the lakes or freshwater estuaries into which the remains of animals living on the neighbouring lands were washed, and deposited and preserved. No marine estuary deposits have been found anywhere on or near the flanks of the Rocky Mountains.

The range of these extinct feline animals in North America probably extended for a considerable space along each side of the long tertiary belt in the middle of North America and eastwards to the Atlantic sea-board.

No remains of true, or rather non-marsupial Carnivora have been found in Australia.

* Owen's "Geological Survey of Wisconsin," p. 196.

† "Proc. Acad. Nat. Soc. Philad. 1861," p. 435.

MAP XIII.

LION.

MAP XIV.

TIGER.

Day & Son (Limited) Lith.

CHAPTER XII.

CARNIVORA *continued*—EXISTING FELINE SPECIES—THEIR DISTRIBUTION IN BORNEO.

EXISTING SPECIES.—(FELIS LEO) (Map 13.) The Lion, the chief of the existing Carnivora, is now confined to Africa and the south-west of Asia, extending as far eastward as Guzerat. It is rare in most of Asia, and in some parts of Africa, and has wholly disappeared from many districts where it was formerly a resident. Within the historic period it existed in Europe. Aristotle (no doubt on the authority of Herodotus) states that the lions of Thessaly attacked the beasts of burden attached to the army of Xerxes, and mentions the circumstance as occurring between the Achelous and the Nestus.

Within the present century, it was distributed over much of Central, West, and North-west India. It is now almost confined in that country to the peninsula of Guzerat. Blyth says, that there is reason to believe that it formerly inhabited the plains of Upper India generally, if not also the table-land of the peninsula. In the early part of the sixteenth century, Báber mentions that it inhabited the Benares district. It was extirpated at Hurriana in 1824. A female was killed at Rhyli, in the Dumaoh district, Sagur and Nerbudda territories, so late as in the cold season of 1847-48, and about the same time a few still remained in the valley of the Scinde river in Central India. The species would appear to be now exterminated in that district, unless a remnant still maintains a lingering existence in certain particularly inaccessible haunts in the neighbouring district of Bundelkund, which Mr. Blyth (in 1863) mentions that he had received recent intelligence was the case.* It does not occur to the northward or eastward of the north-west provinces of the Bengal Presidency.

It is plentiful in some parts of Persia, and not rare in Asia Minor.

In Africa it is almost entirely extirpated from the more populous parts of Egypt and the shores of the Mediterranean. It is still in tolerable numbers on the Mount Atlas range, but does not penetrate into the Sahara, although a straggler from the Tunisian Mountains may occasionally be met with on its northern boundary. It does not now occur in the Gaboon and Niger districts, and is driven far back into the interior from the Cape of Good Hope; but in the other parts of the Continent of Africa it is more than sufficiently abundant. At one time or other it must have ranged into every part of Africa; for, as I am informed by Dr. Kirk, he knows of no nation or tribe which has not a name for it.

Slight differences exist in the appearance or characters of individuals from these various districts, or at least some of them; differences sufficient to have led naturalists to hold that there is more than one species. Thus the maneless Lion of Guzerat, and the Gambian Lion, have been described as

* BLYTH, "Catalogue of Mammalia in Museum of Asiatic Society," 1863, p. 54 and 65.

separate and distinct from the common African Lion ;* but the supposed blacker mane of the Gambian variety is not a specific character, but merely due to age or individual peculiarity, and the absence of a mane in the Guzerat variety is not constant, nor is that peculiarity confined to the individuals from that quarter.

This is another illustration of Agassiz's view, that the more highly organised a family or genus is, the shorter are the steps between the different forms which compose it. But while the facts support him in this observation, I think they give an intelligible qualification or restriction to another of his too sweeping propositions,—viz. that most animals and plants must have originated primitively over the whole extent of their natural distribution; that, for instance, Lions, which occur over almost the whole of Africa, over extensive parts of Southern Asia, and were formerly found even over Asia Minor and Greece, must have originated primitively over the whole range of these limits of their distribution.†

Now, while I agree with him that species have been developed simultaneously over a considerable extent of country, I do not think that the present extent of their distribution is an absolute gauge of that of their original starting-point.

Agassiz assumes that the species has always kept within its original bounds. I hold, on the contrary, that it may spread from its original field, and yet retain its general specific character, provided the conditions of the new field are materially different from those of the old; but that whenever it does so spread, such extension of its limits is marked by some degree of alteration in its minor characters; for the qualities of condition of life are so subtle that the constitution of few animals are sufficiently blunt to allow them to pass into a new territory without being sensible of them, and having the impulse to change of species brought more or less into action through them. Wherever, therefore, we see varieties of a species, I think we may at once lay it down as probable that here the species has wandered beyond the limits of its original specific centre.

Now, we have already seen that there are geological grounds for holding that the original specific centre of the carnivora was the northern hemisphere, neither the Cave Lion nor what was doubtless its descendant, the modern Lion, having appeared until the retreat of the glacial epoch had commenced,‡ and Africa and India having been until then disunited from Europe and Asia.

By the time our Lion appeared, Europe was disunited from America, and united to Africa and Asia, and the way was free to pass from the former into the latter. I have already explained my grounds for thinking that at the height of the glacial epoch almost the whole of Europe was covered either by ice or water, and organic life destroyed from off its face, with the exception of a few miocene species which may have still survived in its extreme south, where not submerged and beyond the influence of the cold. When the ice retreated, and the land began to be raised, Europe must have been re-peopled from Asia, in which the previous flora and fauna had found refuge, doubtless in the nearest habitable part, which might perhaps be Persia. Thus much premised, I imagine

* Mr. Blyth says that the Guzerat lion is fully maned, and not a nearly maneless vanity, as stated by Captain Smee, whose figure represents an immature animal. Maneless individuals, however, whether or not constituting a particular race, occur also in Mesopotamia, and even in Africa. Vide "Barth's Travels," l. 482, v. 971, 270. Wherever found the species appears to be subject to much individual variation of colouring of mane and general aspect. *See* Blyth's "Catalogue of Mammalia," in Museum of Asiatic Society, 1863, p. 53. The mane is certainly sometimes absent in the Guzerat variety. I have seen the skin of a full-grown male maneless specimen brought by a friend from that country.

† Agassiz, op. cit. p. 10.

‡ I do not adopt the common phrase, the *close* of the glacial epoch, although I may sometimes, from habitude, be betrayed into using it: for I do not think we have reached the close of it yet.

the genealogy of the Lion to have been this :—At the commencement of the cold,* the MACHAIRODUS, or some other Carnivore, has been changed into the Cave Lion ; and when mild weather began to return, the Cave Lion became the common Lion. At this time life had not returned to Europe, and the specific centre of the new animal was probably in Asia ; thence it would spread into Europe and Africa.

TIGER : FELIS TIGRIS (Map 14). The Tiger begins to appear where the lion begins to die out. It has been observed that two large species of the same family of animals are rarely found in the same district, and those who are fond of referring everything to laws have inferred a law of distribution antagonistic to their co-existence in the same area. I have no great favour for the practice of referring to the operation of special laws phenomena which can be equally well accounted for by the ordinary working of general laws, and in one sense, and that, perhaps, the sense in which the supposed law is most commonly understood, this may be said to be the case with the present fact. Looked at merely as a question why two large nearly allied species rarely, if ever, co-exist in the same area, it seems only one of the ordinary results of the struggle for life, the stronger driving the weaker before them, and in time extinguishing them. But looked at a little deeper, the struggle for life will not explain everything. How did the struggle for life ever allow a second species to get to such a head as to need to be driven out? Being allied, the one species most probably was derived from the other. How came the weak one ever to get a footing at all? The hypothesis by which I have attempted to explain the stability of established species, the origin of new species, and the existence of special faunas in special provinces in many cases explains this. The second species cannot take its origin in the same district as the first, because it is only by the species undergoing change of condition that it can be developed into a new species. This applies to two species which have sprung the one from the other. In other cases as the present, where two neighbouring species may have originated in different regions, from a common ancestor, and from different points of its range, and come in contact by extending their limits, the ordinary effect of the struggle for life will come into operation, and the stronger will destroy or dispossess the weaker.

The common notion, with regard to the Tiger, is, that it is a tropical animal which requires a warm climate to live in. The researches of late explorers reveal a very different state of things. Beginning at lofty Ararat and the frosty Caucasus on the west, and ending at the island of Saghalien on the east, its range stretches across the whole of Asia, with the exception of the high Thibetan table-land of Central Asia. Mr. Blyth mentions that a few are annually killed in Turkish Georgia. It is found in greater numbers in the Elburz mountains, south of the Caspian Sea (the ancient Hyrcania). North of the Hindu Kosh it occurs in Bokhara, and proved troublesome to the Russian Surveying Expedition on the shores of the Aral in mid-winter.† It is also found on the Irtisch and in the Altai region, and thence, eastward to Amur-land, where it is very destructive to cattle, and so round, by China and Indo-China, to India, southward of the Himmalayahs ;

* The reader will bear in mind that it is part of my theory that all changes in form take place soon after the alteration in condition is experienced. I hold that we must look for all changes at the commencement of a period of alteration ; not after it has been some time in operation. Of course, when I say soon, I do not mean in the twinkling of an eye ; but what, in comparison to the time of which we treat, is not much larger—say a few hundred, or thousand years. Such a speck as leaves no trace in time, but long enough to allow the medicine to operate. During the whole of the glacial epoch, however, as the cold advanced or retreated, perhaps oftener than once, and subjected new subjects to a change of one kind or other, there must have been a succession of change as the alteration successively reached new individuals ; but that does not interfere with the general principle that the alteration of species must always take place comparatively shortly after the change of condition.

† BLYTH, op. cit., p. 182.

but it does not extend into Ceylon, although Humboldt, probably *per incuriam*, speaks of it as found there.* It inhabits the Malayan Peninsula, Sumatra, Java, and Bali, but is not met with in Borneo.† Although thus found on every side of the high Thibetan region of Central Asia, it does not penetrate into it; but occasionally it visits its margin, speedily retreating, however, into the warmer wooded valleys and ravines by which it came. The Rev. Mr. Everest‡ says that he met with the tracks of the Tiger on the snow near his house, above the valley of the Dehra Doon in the Himmalayahs, 6800 feet above the sea, and whilst shooting in the oak forest around it, had one of his people carried away by one.

The few comparisons which have been made between the individuals from different parts of this vast area show considerable differences, but like those of the lions, rather of the nature of climatal variation than specific characters. Herr Radde§ informs us that the Amourian individuals are paler in colour, having more white on the under part of the body, and less red above; and he has compared skulls of examples from the Amour, from India, and from the Caucasus, and found those of the Indian animals considerably larger than the others, and the Caucasian specimen (he had only one) remarkable for the small size of its upper canines. There is no doubt, however, that the species attains its greatest size, beauty, and ferocity,—in other words, is most highly developed, in the East Indian region. Blyth says, that he has reason to believe that the stature of the largest tigers considerably exceeds that of the largest lions. An experienced lion-hunter in South Africa assured him that he never saw a lion-skull approaching in magnitude to the largest tiger-skulls in the Asiatic Society's Museum at Calcutta.‖

The absence of the Tiger in Ceylon may be due to one class of causes; its absence in Borneo to another; probably, some cause specially applicable to that island. We shall find, as we go along, that these are not the only large animals which make Borneo remarkable by their absence. A greater interval no doubt exists between it and the nearest land than between the other islands where they are found, but scarcely sufficient to account for the difference, especially if we suppose, as can hardly be doubted, that Borneo, as well as Java and Sumatra, was united to the mainland at a time subsequent to the appearance of these animals, and that it was before the separation of Java and Sumatra from the continent, that they became domiciled in them. This separation there is every reason to believe was a comparatively recent event. The geological events affecting Borneo must have been of the same date as those of Java and Sumatra, and these islands possess the animals which are absent in Borneo.

The cause of their absence from Borneo is perhaps to be sought for in some peculiarity in the condition of that island when the land sunk so as to separate it from the mainland.

If we imagine the island to have sunk so much as to have become an impassable morass, covered with an impenetrable thicket of trees growing in the mud, such as is to be seen now on some parts of the coast of New Guinea, it would perhaps explain the absence of large animals.

* Humboldt, "Asie Centrale," i. 340; edit. 1843.

† "At one place two rocks were pointed out to me in the stream, about thirty feet apart, called the Tiger's Leap. I made many inquiries about these animals. They insist that eight came to their country,—that they were not tiger cats as I had suggested. If such animals were ever here, they might have escaped from cages in the capital, as it was a common custom among the far Eastern Princes to keep these ferocious creatures, though I never heard of Bornean princes doing so. I have read somewhere that formerly there were a few tigers on the North-east coast, probably let loose by strangers, as the ancestors of the elephants were."—St. John's *Life in the Forests of the Far East*, ii. 115.

‡ Everest, in "Annals of Natural History," vol. viii. p. 327. 1842.

§ Gustav Radde, "Reisen im Suden Von Ost-Siberien in den Jahren 1855–59." St. Petersburg, 1862.

‖ Blyth, op. cit., p. 55.

Mr. Windsor Earl thus describes this character of the New Guinea Coast: "The sea-coasts of alluvial regions are invariably lined by belts of mangroves, which sometimes extend into the sea for miles beyond the level of high water; and in New Guinea, as well as on the northern coasts of Australia, the mangroves assume the character of forest trees about the upper parts, while the lower consists of a network of strong fibrous roots, which is absolutely impenetrable without the aid of the axe, and even then it is impossible to proceed unless the mud has sufficient consistency to support the weight of the body, which is rarely the case, except at dead low water. As the coast tribes, who derive their chief sustenance from the sea, have to cross this belt almost daily, they naturally prefer scrambling through the upper branches, which are strong enough to afford secure footing, while at the same time they entertwine with each other in so peculiar a manner, that with a little practice this singular mode of travelling can even be adopted by Europeans. Indeed, the writer on more than one occasion has seen a file of marines, with muskets on their shoulders, steadily making their way over mangrove swamps in this manner, although they certainly did not display the monkey-like agility that M. Modera has so graphically described."

The graphic account by M. Modera to which Mr. Earl refers, is as follows: "On the afternoon of the day in which the encounter took place, the naturalists, well armed, returned to the creek at high water, and saw a spectacle which was also witnessed by those on board with the aid of telescopes: namely, the trees full of natives of both sexes, who, with weapons on their backs, sprang from branch to branch like monkeys, making the same gestures as in the morning, and shouting and laughing in like manner, without our people being able to tempt them out of the trees by throwing presents towards them, so that they returned on board again."*

Although there are lofty mountains in Borneo (probably all volcanic), the greater part of that immense island is low and flat, and the mountains may have risen too late to have saved from extinction the animals which required solid footing and dry land for their existence.

An examination of the Mammalian fauna of Borneo shows, that, with a very few exceptions (which may perhaps be capable of individual explanation), the mammals are either arboreal in their habits, or amphibious, or flying, or in some way or other capable of subsisting in a half-drowned land. On analysing its Fauna I find nine monkeys, all arboreal; three lemurs, all arboreal; twenty-seven bats, which may also be called all arboreal, at least none of them terrestrial; four Cladobates, small insectivorous animals which live like squirrels, and are known by the same name (Tupaias) by the Malays (also arboreal); one shrew-mouse; the Ptilocercus Lowii and Hylomys Suillus, the latter small insectivorous animals, found about 1500 or 2000 feet above the sea, are arboreal; the Bornean bear (arboreal); one polecat (also arboreal); two otters (amphibious); a Cynogale (web-footed and amphibious); either the leopard or a small panther,† and one or two small felines

* "Verhaal van eene Reize naar de Zuid-west Kust van Niew-Guinea," door I. Modera. Haarlem, 1830.

† Schmarda, in his "Geographische Verbreitung der Thiere," vol. ii. p. 504, does not mention the Leopard as one of the Bornean felines, and before I looked particularly into the question I trusted to his authority, and supposed that my hypothesis was at fault so far as regarded it; for it is an expert climber, and resorts to the branches of trees either in pursuit of game or when it is itself pursued,—in fact, passes much of its life on the branches of trees; consequently there was no reason why it should be excluded like the Tiger, which cannot climb. It turns out, however, that Schmarda is wrong in omitting it. Mr. St. John, op. cit. ii. p. 252, mentions a small Panther among the principal animals which frequent the forests of Borneo, and gives something like circumstantial evidence of its presence. "I never saw," says he, "the Tree Tiger in its wild state; but, as I have before noticed, its skin is large enough to form a fighting jacket for a man. The Tiger Cat and other felines are not uncommon." Mr. Blyth quotes a paper in the "Singapore Chronicle," for December, 1824, in which it is stated that "a species of Leopard, but not the royal Tiger," is found in the northern peninsula of the Island.

(arboreal); two civet cats and two PARADOXURI, allied animals, which, like most of the cat tribe, are at least good climbers, and so may be regarded as arboreal; one dog, which may have been introduced by man, and afterwards become wild; eleven squirrels and flying squirrels (arboreal); one porcupine; one manis (arboreal); one elephant (introduced and disputed as aboriginal); one rhinoceros (disputed); one tapir (disputed and half amphibious); one sow (possibly introduced and degenerated into a wild variety); one musk deer; three small deer, and one ox (probably introduced).

We have here eighty-two species, of which sixty-six are arboreal, and four amphibious, leaving only ten terrestrial animals, of which two are disputed, and four probably introduced, so that there remain only four small deer, a porcupine, and a shrew, which can be said not be to independent of actual dry land. Deducting the doubtful (disputed or introduced) species, we have thus only to account for the presence of six small animals, four of which have the lightest tread for their size of any order of animals, and might be able to skip over quaking bogs or shaking swamps which would not support heavier creatures, and none of which would require any great space of solid land for their preservation. It is different with the large Pachyderms, the elephant, rhinoceros, and tapir. If these really did exist there, large tracts of country would be required for their sustenance, and my hypothesis would have its feet knocked from under it. But their presence is disputed or capable of explanation. It is not, indeed, disputed that the Indian elephant is now found there, but it is known to have been introduced, and it is more than doubtful whether it was ever aboriginal, and the same doubt extends both to the rhinoceros and the tapir. The arguments for and against their aboriginal existence in Borneo, &c., will be found in the chapter which treats of the distribution of these animals. The sow is the only one of the larger animals which is not recorded as being found in some of the neighbouring islands, and this in itself is an argument for its being a wild variety of the domestic kind, which may have been introduced, especially as, with two exceptions, the different species of sow described as found in the various islands of the Indian Archipelago may all be varieties of one species descended from escaped individuals of the domestic sow of these countries.

The inquiry suggests a comparison of the proportion between the arboreal and terrestrial species of Borneo with that of the neighbouring islands, as well as the mainland of India, but as these countries also may have originally undergone something of the same phase which I suppose Borneo to have passed through before it acquired its present form, a further comparison with some other countries which are not liable to this objection is necessary to obtain a fair view of the relative character of their inhabitants. The following table shows this approximatively :—

	Permanently Arboreal.	Bats.	Occasionally Arboreal or of Doubtful Habits.	Total Arboreal or Aerial.	More or less Aquatic.	Terrestrial, not disputed or introduced.	Total.	Proportion of Terrestrial to the whole.
BORNEO	32	27	7	66	4	6	76	One-thirteenth.
SUMATRA	24	27	9	57	2	20	82	One-fourth.
JAVA	17	35	3	60	1	21	77	One-fourth.
EAST INDIES	33	17	11	57	2	85	148	Four-sevenths, or more than one-half.
WEST AFRICA	41	15	5	61	1	53	114	Five-elevenths, or more than one-half.
MIDDLE and SOUTH AFRICA	9	18	2	29	2	128	159	Thirteen-sixteenths, or more than three-fourths.

MAP XV.

LEOPARDS & JAGUARS

Leopards

Jaguars

MAP XVI.

PUMA OR

AMERICAN PANTHER.

The most striking thing in this table is, not the greater number of arboreal and aerial forms in Borneo, for that we see is quite equalled in India and West Africa, but the absence of terrestrial species. Whilst the terrestrial species form only a thirteenth of the whole in Borneo, and a fourth in Java and Sumatra (which, by the way, shows that these islands have been subjected, in a certain degree, to the same controlling influences as Borneo), in India and West Africa, they amount to a half, and in Middle and South Africa to more than three-fourths of the whole. It is as if the number of arboreal species had not been increased beyond what would appear to be the normal proportion under similar conditions (as why should it?), but that the number of the terrestrial species was diminished; swept away or never gained a footing.

Leopards (Map 15). The great Spotted Cats have an especial interest from the existence of living representatives in the New as well as in the Old World. The Old-world Leopard or Panther has many varieties, there being no fewer than nine synonyms attached to its name; there are, however, only two now recognised as sufficiently distinct to merit separation,—the Leopard and the Panther, the former being supposed to range over Africa, India, the Malayan region, Java and Sumatra, the latter to be confined to the Asiatic districts, and not to be found in Africa; and the opinion of many naturalists is that there is in reality only one species. The chief character relied on by those who admit two species is the relative length of the tail. The distribution of both (if they be two) is general throughout Southern Asia, and in the Indian region is almost the same as that of the Tiger. Unlike the Tiger, it inhabits Ceylon and Borneo.

A distinct species of Leopard is said by Mr. Swinhoe to be found in the island of Formosa.

Remains which cannot be distinguished from those of the common leopard have been found in the diluvium of Middle Europe.

Felis Irbis. The Ounce or Snow Leopard represents the Leopard in the high regions of Thibet, being, along with Felis Manul and Canis Corsac, the most characteristic animals of the district. It extends into Amourland, but is not so common there as the Tiger. It is also found in the island of Saghalien. Herr Radde states that it is rather abundant in Western Siberia. It is less so in Eastern Siberia, although occasionally met with in the Bureja Mountains.

Felis Onca (Map 15). The Jaguar is the representative of the Leopard in America, and their physical resemblance to each other is too great to allow any one to doubt that they have been derived either from a common ancestor or one from the other.

How, then, are we to account for their being found on opposite sides of the Atlantic or Pacific! The closeness of their resemblance naturally suggests a recent divergence from the common stock, and we might expect that their distribution is due to the ancestors of the one or the other having found their way across from Europe to America, or from America to Europe, after the retreat of the glacial cold, and before the bridge afforded by the miocene Atlantis had been broken down. But unfortunately for this view we know that this bridge was severed before mammals had become established sufficiently far north to avail themselves of it. It is only northern plants and insects which have found their way from Europe to America after the return of warmth. If it had been open for the Leopard, it was also open for the Cave Lion and the Cave Hyæna; and their absence in America is a strong presumption against such a bridge being then open. We are thus driven to refer the origin of these Leopards, in both hemispheres, to a period antecedent to the glacial epoch. Lund referred one or two of the bones found by him in the Caves of Brazil to the Jaguar. This determination has been questioned, but if true, it would not affect the question, as the bone deposits in these caves are of pliocene date, that is, post-glacial.

Felis Concolor. (Map 16.) I notice the Puma here on account of its size, although it is, perhaps, more nearly related to the Lynx than to the Lion, Tiger, or Leopard, and forms the passage between the large cats and lynxes. It is confined to the New World, but its range there is extensive, reaching from the Straits of Magellan to about 50° or 60° north latitude, especially in the line of the mountains.*

It has been recorded as also extending into Tierra del Fuego.† But although there seems no reason why it should not, I can find no trustworthy record of its having been actually found there. Most of the larger Cats swim across rivers, or arms of the sea, with ease. The Jaguar crosses the Amazon; the Leopard takes readily to the water; and Tigers have often been taken by the fishermen at Singapore, entangled in their nets while swimming across during the night.

Felis jubata. The Chetah, or Cheetah, is found in Syria, Arabia, Mesopotamia, Persia, South Siberia, West and South India. It is a moot question whether the Cheetah is found in Ceylon or not. Kelaart‡ and Sir E. Tennent§ say no; the Panther is there known by that name, but they distinctly state that the Cheetah is not found in any part of Ceylon. Baker, again,‖ speaks of

* "United States General Report on the Zoology in the Explorations for a Railroad Route from the Mississippi to the Pacific," vol. viii. p. 84. 1857.

† Captain Fitzroy, in his "Voyage of the Beagle," refers to the following passage from Byron's "Loss of the Wager," as proving that the Puma inhabits Tierra del Fuego:

"In one of my walks, seeing a very large bird of prey upon an eminence, I endeavoured to come upon it unperceived with my gun, by means of the woods which lay at the back of that eminence: but when I had proceeded so far in the wood as to think I was in a line with it, I heard a growling close by me, which made me think it advisable to retire as soon as possible. The woods were so gloomy I could see nothing; but as I retired this noise followed me close till I had got out of them. Some of our men did assure me that they had seen a very large beast in the woods; but their description of it was too imperfect to be relied on."

"As this tent was not large enough to contain us all, I proposed to four of the people to go to the end of the bay, about two miles distant from the bell-tent, to occupy the skeleton of an old Indian wigwam which I had discovered in a walk that way upon our first landing. This we covered to windward with sea-weed; and, lighting a fire, laid ourselves down in hopes of finding a remedy for our hunger in sleep: but we had not long composed ourselves before one of our company was disturbed by the blowing of some animal at his face, and upon opening his eyes was not a little astonished to see, by the glimmering of the fire, a large beast standing over him.

"He had presence of mind enough to snatch a brand from the fire, which was now very low, and thrust it at the nose of the animal, who thereupon made off . . . . In the morning we were not a little anxious to know how our companion had fared, and this anxiety was increased upon our tracing the footsteps of the beast in the sand in a direction towards the bell-tent. The impression was deep and plain of a large round foot, *well furnished with claws*. Upon acquainting the people in the tent with the circumstances of our story, we found that they too had been visited by the same unwelcome guest, which they had driven away by much the same expedient."—*Byron's Narrative of the Loss of the Wager.*

This reference, however, gives no support to the notion of the animal alluded to having been a Puma. In fact, the description of its footprints, which I have italicized, clearly shows that the animal could not have been a Puma. None of the Cat tribe leave any trace of a claw in their footprints. The claws being retractile, are furled back out of all risk of being blunted when the animal walks, and are only extended when used as weapons of offence. The Dogs, on the other hand, leave a very well-defined claw-mark. The Hyænas, which partake of the characters of both Dogs and Cats, and are transitional between them, leave a very faint trace. Dr. Kirk, by whose great experience in Africa I have desired to fortify my abstract opinion, tells me that "it is well known to old hunters that the only *distinction* between the spoor of a Lion and Hyæna is to be found in the mark of claws. The two are of the same size (nearly); but the Hyæna shows to the skilled eye the imprint of a claw, which the Lion never does."

Commodore Byron and his party, therefore, had suffered a false alarm. The creature which had disturbed them was, doubtless, one of the harmless domestic dogs of the natives.

‡ Kelaart, "Prodromus Faunæ Zeylanicæ," 1852.

§ Tennent, Sir J. E., "Ceylon."

‖ Baker, "Eight Years' Wanderings in Ceylon," 1855.

both, and Blyth thinks that he clearly distinguishes between them.* It is either found also in Africa, or represented there by an almost identical species (Felis guttata), which is found in Abyssinia and Senegal, and to the south of both.

It has been made into a separate genus under the name of Cynailurus.

Smaller Cats,—Ocelots, Serval, Lynxes, &c. The smaller Cats are nearly equally distributed between Southern Asia and South America. In the former they assume much of the appearance of the common domestic Cat, which probably took its origin in Nepaul, and are doubtless the relations of the Leopard, while the Ocelots are equally clearly connected with the Jaguar. The Ocelots are all from tropical America, some species reaching as far north as Texas. The Cats, with the exception of the Serval, which is found in Africa, are from tropical Asia, extending through the islands of the Malayan Archipelago as far as Timor.

Remains of some species about the size of the Panther have been found in the miocene and pliocene beds of Europe.

Lynx. The Lynxes are, with three or four North American exceptions, all Old-world species. There are three European species; the more common of which is found in all the northern parts of the Old World; and there is difference of opinion as to whether the European species is the same as the Canadian or not, and to which the latter should be referred, supposing it to be the same as one of them. Thunberg's Scandinavian species, F. borealis, has been thought to be it, but the preponderance of opinions seems opposed to this. If it is the same as any, it is with F. cervaria, the larger and not the commonest, that it should be amalgamated. In the time of the Romans the Lynx appears to have been tolerably frequent in France, whence considerable numbers were brought for the games of the Circus at Rome. Nowadays it is very rare, if not extinct there; it is said, indeed, that it may still be met with in the Alps and the Pyrenees, whence it sometimes descends into the southern departments of France. It likewise occurs in Spain, but is commoner in Germany, and still more so in the countries of the north, where its fur forms an article of commerce. It also inhabits the forests of Caucasus and Asia. The third and rarer species (F. pardina) is found in the warmer countries of Europe, such as Portugal, Spain, Sicily, Sardinia, Turkey, &c.

There are four species of Lynx in North America. The large Lynx Canadensis ranges across the whole of the north of that continent; then a smaller species, the Bay Lynx (L. rufus) stretches from the Atlantic to the Pacific, throughout nearly the whole latitude of the United States, and is replaced in Oregon and Washington territory by the Red Cat (L. fasciatus); a more southerly band of territory, reaching from Texas to Southern California, is inhabited by another species, the Texas Wild Cat (L. maculatus), which however may prove to be only a variety of the Bay Lynx. No lynx has been found in South America.

The Caracal and the Chaus are found in South Asia and Africa. Two species, F. manul and F. isabellina, inhabit Thibet.

Hyænas. (Maps 17 and 18.) As the Hyæna has points of resemblance both with the Dogs and the Cats they were for long bandied about from the one to the other, but Mr. Waterhouse's determination, by which he places them next the Civet Cats, is that most generally adopted.

Like the other carnivores, the Hyæna, although now confined to the warm regions of Africa and

* Blyth on Asiatic Felidæ, in "Proc. Zool. Soc.," 1863, p. 182.

Asia, had a much more northern range during the earlier recess of the glacial epoch. The remains of a large Cave species, HYÆNA SPELÆA, are found often in England, France, and Germany, in the same caves as those of the Cave Tiger or Lion, and the other extinct animals associated with it. It was most nearly allied to the fierce Spotted Hyæna (HYÆNA CROCUTA) of the Cape, and therefore may, like it, have been a spotted one. It seems not to have extended further south than the middle of Europe.

The two species now living in Africa, the Striped Hyæna (H. VULGARIS) and the Spotted Hyæna (H. CROCUTA), are supposed to have inhabited Europe at that time; some fossil remains found in the Pyrenees, and also in Auvergne, having been referred with doubt to the former; and the latter advanced probably as far north as the south flank of the Pyrenees. Fossil remains of it have been found in Sicily and Algiers. There is nothing in the climate of the south of Europe to prevent it living there now. This would give a range of the existing Hyænas south of the Pyrenees and Alps, leaving the more northern parts of Europe for the cave species; according to some palæontologists many extinct species have existed in Europe, but on a rigid examination they have by others been reduced to three. It therefore was probably unknown in Africa proper until after the elevation of the Sahara.

Lund found bones which he referred to this genus in the caverns of Brazil, but this is now ascertained to have been an erroneous determination. With this exception (which is no exception) I am not aware of any statement of the Hyæna having been found in the New World. It does not occur amongst the extinct species which have been detected in the Nebraska and Niobrara Miocene deposits; remains of the HYÆNODON, indeed, have been found in the Niobrara deposits as well as in Europe, but that is an animal which, although it bears a name akin to the Hyæna, has no more relation to it than to any other feline or carnivorous species of the same size, if it even belongs to them at all. De Blainville classed it among the dogs; but the opinion of Cuvier and Laurillard was, that it was rather allied to the opossums.

Remains of a fossil species of Hyæna have also been discovered in the Himmalayahs. All trace of the Cave Hyæna and Cave Lion disappears in the upper deposits of diluvium; as M. Lartet points out, none are cited by M. Desnoyers among the bones of the Reindeer, the Spermophiles, the Hamster, and Lagomys, which he collected in the wells around Paris.

Deducting varieties or doubtful species there are only three existing species of Hyæna. Of these the Striped Hyæna ranges through India, Persia, Turkey, Abyssinia, Egypt, Nubia, Libya, Algeria, Barbary, West Africa, and the Cape of Good Hope. In Johnston's "Physical Atlas," the range of this Hyæna is made to extend far up into Independent Tartary, on the east of the Caspian, but not to reach India. I cannot find any evidence of its being found so far to the north as it is there represented, and it is certainly found everywhere in India, with the exception of the lower part of Bengal, near Calcutta, which it now rarely reaches.* It is even found in the Himmalayahs, although very rarely. Mr. Everest mentions that he met with it there. The other two, the Brown and the Spotted Hyænas, are both from the Cape of Good Hope.

There is an animal (PROTELES CRISTATUS, or LALANDII), the Aard Wolf, or Earth Wolf of the Cape Colonists, whose proper place seems to be here. It is an aberrant form, which partakes of the characters both of the Civets and the Hyænas. It looks like a small Hyæna, with the teeth

* BLYTH, "Catalogue of Mammalia," in Museum of Asiatic Society, 1863, p. 44.

MAP XVII.

DISTRIBUTION OF FOSSIL HYÆNAS.

- *Cave Hyænas*
- *Striped, (H. Striata)*
- *Spotted, (H. Crocuta)*
- *H. Sivalensis.*

MAP XVIII.

EXISTING HYÆNAS.

- *The Striped Hyæna*
- *" Spotted Hyæna*
- *" Dº & the brown Hyæna & Proteles Lalandii*

Day & Son (Limited) Lith

of a Civet, and Dr. Gray, consequently places it with the VIVERRIDÆ.* It inhabits the Cape, Natal, and other parts of South Africa.

The LYCAON PICTUS or VENATICUS, which occupies an intermediate position between the Hyænas and Dogs, I place among the Dogs.

VIVERRIDÆ—CIVET CATS, ICHNEUMONS, &c. (Map 19.) With one solitary exception, the Civets are confined to the Old World. The exception is, the Cacomixle, BASSARIS ASTUTA of Lichstenstein, from Mexico, which has been placed by most naturalists among the VIVERRIDÆ. It is a puzzling aberrant form, and being the only Viverra found in the New World, its right to a place in that family has been viewed with suspicion by naturalists. There is, however, little doubt that it truly belongs to it. Its feline character is recognised by the American miners, who call it the "Civet" and Mexican or Ring-tailed Cat.

"This beautiful animal," says Dr. Newberry, "which was formerly supposed to be peculiar to Texas and Mexico, has since been found somewhat abundantly in California. The district in which it occurs, if not exclusively, certainly most abundantly, is that including the foot-hills of the Sierra Nevada, on the eastern side of the great trough of the San Joaquin and Sacramento. In this half-wooded region, the home of the gold-hunter, it is well known. The miner calls it the 'mountain cat;' it frequently enters his tent, and plunders his provision bag. When caught, as it often is, it becomes so familiar and amusing, and does so much to relieve the monotony of the miner's life, that it is highly valued and commands quite a large price.

"The Bassaris is, perhaps, equally efficient as a mouser with the common cat, is much more playful, and, to a large number of the members of every community who are cat-haters, might be a desirable substitute."†

Putting aside this animal there is not a single Civet in the New World, while of Weasels and Martens there are plenty.

Dr. Gray has lately published a careful revision of the Viverridæ,‡ containing the result of much study and observation, the group having for long been a favourite one with him. He divides it into no fewer than thirty-six genera; but for our present purposes it will be sufficient to divide them into two groups, which Dr. Gray distinguishes as cat-footed and dog-footed. The former contains the Civets, best known from the perfume secreted by one or two of them, from which the whole group has been named, and the PARADOXURI, so named in reference to their habit of carrying the tail curled up, which justifies the meaning of its derivation, "unexpected-tailed;" and the latter the ICHNEUMONS, celebrated for their exploits in destroying venomous snakes and the eggs of crocodiles.

Fossil remains of both groups have been found in miocene strata in the south of France. The living species are nearly equally divided between Asia and Africa, but no species is found in both, unless the animal called the Tunga, which is common on the island of Anjuan, one of the Commoro Islands, near Madagascar, should prove to be the same as the Javan VIVERRA RASSE of Dr. Horsfield, which Dr. Gray mentions that Dr. Peters, of Berlin, considers probable.§ Dr. Peters observes that the fauna of these islands agrees more with that of Madagascar and India than with that of

* GRAY, in "Proc. Zoolog. Soc.," 1864, p. 507.

† NEWBERRY'S "Report on Mammals, in U. S. Pacific Railroad Exploration," vol. vi. pp. 40, 41.

‡ GRAY, in "Zoological Society's Proceedings," 1864, p. 502.

§ Ibid. p. 515.

Continental Africa.* So far as regards the neighbouring Commoro Islands and Madagascar, it does not appear that there is any such preponderance in favour of India. They seem to be equally allied to India and Africa. A strong current certainly runs from India to the Commoro Islands, and east coast of Africa, and, as might be expected, a number of Indian plants are found there which are undoubtedly due to this source; individual specimens of one sex only, and growing solitary on the sea-shore, being sometimes the sole examples found.† The presence of such fragments of the Indian flora can of course be only accounted for by colonization from India. But so far as regards the Mammals, with one exception (the Indian and Australian Fox-bat, PTEROPUS EDWARDSII), which is found in the Commoro Islands and Madagascar, and not on the Continent of Africa, the affinities of all the types are as much African as Indian.

The locality of the true Civet is the north of Africa, extending as far south and west as Fernando Po. With the exception of it, all the true Civets inhabit India, China, and the Malayan Archipelago. The other African Civets belong to the section called Genettes, and they are met with from the Cape of Good Hope to Egypt, occurring in Abyssinia on the east and Gambia on the west. Genettes are not found in Asia, and only one species, G. FELINA, occurs in Europe.

The CYNOGALE is a web-footed, amphibious, otter-like Civet, found in Borneo. An animal from the Gabon, first doubtfully referred by M. Du Chaillu to this genus, proves to be a new Insectivore.

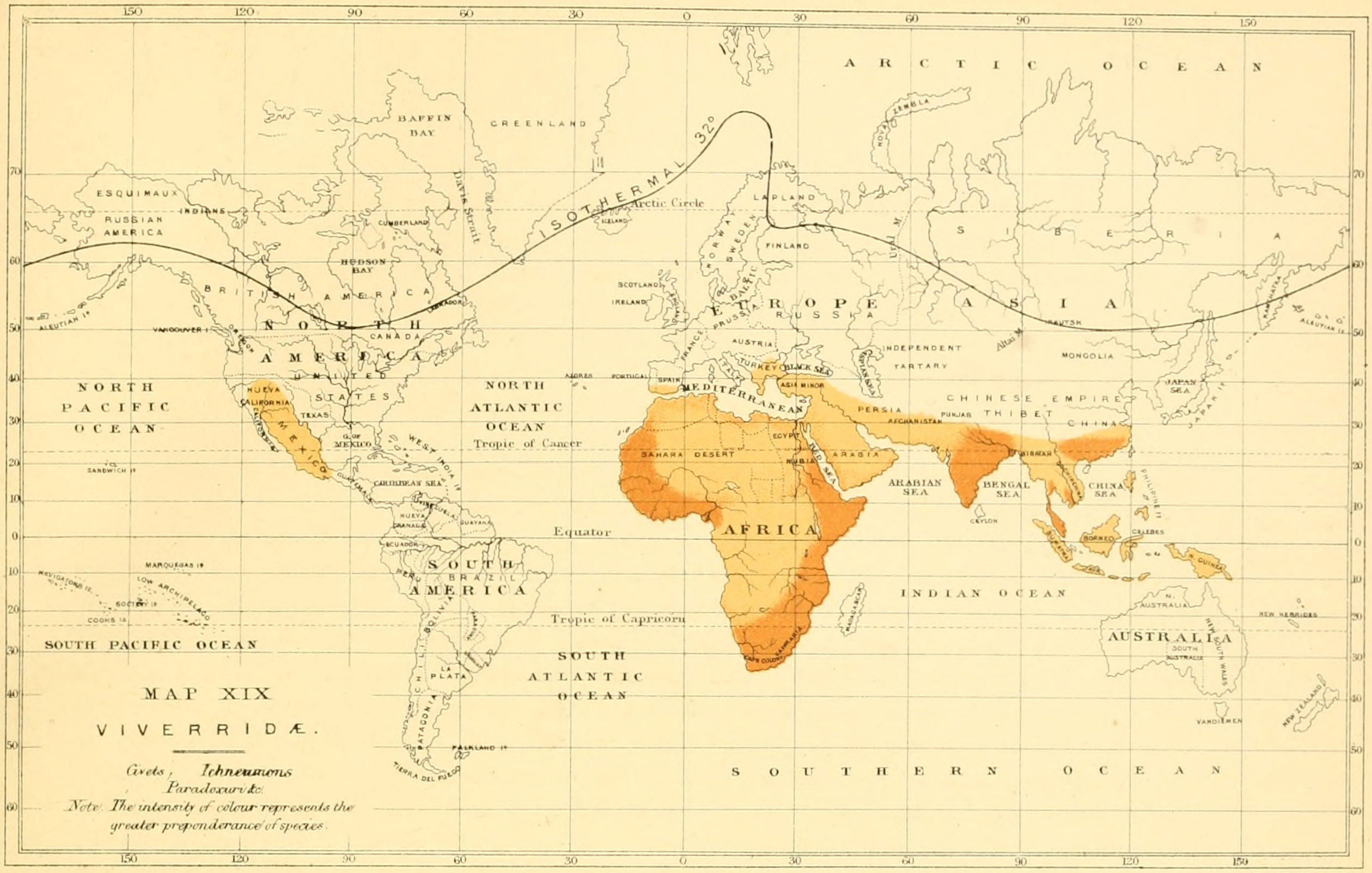
Two genera, GALIDICTIS and GALIDIA, which have been thought to belong to the Pole-cats, but are now properly included by Dr. Gray in this family, are confined to Madagascar. Four species of these are all that are yet known.

The PARADOXURI are, with one exception from West Africa (P. BINOTATUS), entirely Asiatic, and limited to India, China, and the Malayan Peninsula and Archipelago; some six are confined to continent of India.

The HERPESTES, or Ichneumons, have the same distribution, as the Civets, upwards of forty occur in Africa, and of these more than thirty are only recorded as having been met with in East and South Africa and Madagascar. To the African portion of them no doubt belongs a small species, a straggler into Andalusia (H. WIDDRINGTONII). The remainder are distributed over the Indo-Malayan region, with the exception of two which reach Persia and Cashmere. The well-known species (H. ICHNEUMON), which destroys the eggs of the crocodile, is found in Egypt and the north of Africa. The enemy of the Cobra (H. GRISEUS) is found from Nepaul to the south of Hindostan.

* PETERS, "Reise Nach. Mozamb.—Mammalia," 113.

† Dr. Kirk, for example, mentioned to me the instance of four solitary trees of an Indian CYCAS (I think he said), all females, growing on the shore near the mouth of the Zambesi, and no males.



MAP XIX

VIVERRIDÆ.

Civets, Ichneumons
Paradoxuri &c.

Note. The intensity of colour represents the greater preponderance of species.

Day & Son (Limited) Lith.

MAP XX

WOLVES (TRUE).

Day & Son (Limited) Lith.

CHAPTER XIII.

DOGS AND FOXES, EXTINCT AND LIVING.

Canidæ: (Maps 20–23).—Extinct species. Fossil remains of animals belonging to this family have for nearly one hundred years been known to exist, Esper having first recognised them in remains from the caverns of Franconia in 1772. But it is at a much more recent date that the remains of genera have been distinguished. The skeletons of the Dog and the Wolf are so nearly alike, that it is scarcely possible in dealing with remains belonging to an unknown canine species to say to which of them it belongs. It has, however, been pretty satisfactorily established by M. Schmerling, that certain bones belonging to an animal weaker than the Wolf and larger than the Fox, which were found in caves in the neighbourhood of Liege, belonged to the domestic Dog; and this determination is of the more value that it was made in 1833, long before the present views regarding the antiquity of man had begun to be accepted. The domestic Dog so discovered was at that time supposed to be a wild animal from which the "friend of man" was afterwards derived. A different signification is now placed on its occurrence. It is now supposed to have been a specimen of our existing Dog,—a domestic Dog belonging to the savage man of the period; and its presence is adduced as one of the proofs of the then existence of man, as it is assumed that where the domestic Dog was, its master, man, would not be far off. But the separation of the Dog from the Wolf is not the only difficulty which palæontologists have had to overcome in dealing with the fossil remains of this family. When certain bones were recognised as belonging to the Wolf they were at first referred to an extinct species, which was named C. spelæus, or the Cave Wolf, but more careful examination has since shown that they do not differ from those of the existing Wolf. That animal was therefore already in existence at that period, a circumstance which strengthens the probability of the Dog, too, being the same as the existing Dog. It is a remarkable circumstance that none of our truly domestic animals have ever been found but in company with man; it is as if they have not appeared until he was ready for them, and that when they did appear they came endowed with such a craving for his society that the process of domestication was short and easy.

Probably no objection will be taken by any one to the assumption that in whatever way the domestic breeds have come under the control of man, a certain amount of modification has been its result. But the chief point on which a difference of opinion will occur is whether the original progenitor of the modern animal was a distinct species, or is merely a captured and tamed individual of one of the wild species which are still in existence.

So far as regards the Dog, the authorities in favour of its being a tame variety of the Wolf or the Jackal chiefly depend on the numerous peculiarities which are common to both, and on their coupling together and having fertile progeny. The authors who have taken an

opposite view are divided in opinion as to whether all are the descendants of one species, or whether they have not been derived from several. Their variability, their universal commixture, the perfect fertility of the produce of the most widely separated varieties, are arguments in favour of their being only one species. The remarkable difference between some of the varieties is the argument usually most relied on for the plurality of stocks.

Remains of the Dog have been discovered by Lund in the caverns of Brazil, and it is interesting to find that the extinct species (SPEOTHOS PACIVORUS) to which they belong has much analogy to species now living in the same country, viz., C. CANCRIVORUS and C. PRIMÆVUS,—not the Nepalese C. PRIMÆVUS of Hodgson, which, by the way, on the strength of native traditions, he thinks, may be the original from which the domestic Dog has descended.

EXISTING DOGS AND WOLVES. The distribution of existing species is pretty equally divided between Asia, North America, and South America: Africa has fewer, and Europe least of all. The difference of opinion as to what constitutes species in this family is so great that it is not easy to make a fair estimate of their number. But, according to my reckoning, Asia possesses fifteen; North America, ten; South America, nine; and Africa, eight. And a number of these species are found in more than one of these countries. Europe has five, four of which are also found either in Asia, Africa, or America. Australia has only one, the Dingo, which, being the sole placental animal of any size in that country, has been supposed to have been introduced by man;—not an untenable proposition, if we admit the existence of a great Pacific Continent peopled by men far back in geological time; it is thoroughly wild, but approaches the domestic Dog, and is probably more nearly allied to the Jackal of India and the Indian Archipelago than any other species. It, or a variety of it, is also found in New Zealand; and, according to Polack (i. 320), "it has been an inhabitant there some two or three centuries;" but it is said to have been introduced from Australia. "The Dog of the natives," says Dieffenbach, "is not the Australian Dingo, but a much smaller variety, resembling the Jackal, and of a dirty yellowish colour. It is now rarely met with, as almost the whole race of the island has become a mongrel breed."*

Professor M'Coy, in a recent comparison between the ancient and modern natural history of Victoria,† states that he had identified remains of the CANIS DINGO in the bone caverns lately opened beneath the basalt flows at Mount Macedon. They were found associated with those of MACROPUS TITAN, and of recent species of HYPSIPRYMNUS and HYDROMYS. He infers from this and other arguments that the Dingo is an indigenous animal. But, as Mr. Falconer says, there is no evidence that man may not then have been an inhabitant of Australia, and the Dingo introduced along with him, long anterior to the eruptions at Mount Macedon.‡

The range of the Wolves stretches quite across Europe and Asia, from the German Ocean to the Pacific. Temminck describes a species in Japan as distinct under the name C. HODOPHYLAX, but it will, no doubt, be also found in Eastern Asia. The true Wolves are confined to the northern portion of the northern hemisphere.

The common Wolf (C. LUPUS) was, until a comparatively late period, a denizen of the forests in England. In the early history of England there are various laws relating to them which testify

* DIEFFENBACH, "Travels in New Zealand," p. 184.

† M'COY on "Ancient and Modern Natural History, 1860," in Ann. "Nat. Hist." 3rd Series, 1862, vol. ix. pp. 145, 147.

‡ FALCONER, in "Natural History Review," January 1863, p. 96.

MAP XXI.

CANIDÆ.

Both Wolves & foxes — *Jackals*

Dog-Wolves — *Dingo*

Note. Where the colours mingle both are found

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ESQUIMAUX

RUSSIAN AMERICA

INDIANS

BRITISH AMERICA

NORTH CANADA

UNITED STATES

NUEVA CALIFORNIA

TEXAS

MEXICO

G. of MEXICO

WEST INDIA IS

CARIBBEAN SEA

SOUTH AMERICA

NUEVA GRANADA

VENEZUELA

GUAYANA

ECUADOR

PERU

BRAZIL

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND IS

BAFFIN BAY

GREENLAND

DAVIS STRAIT

ICELAND

LABRADOR

HUDSON BAY

CUMBERLAND

VANCOUVER I.

ALEUTIAN IS

SANDWICH IS

NAVIGATORS IS

MARQUESAS IS

LOW ARCHIPELAGO

SOCIETY IS

COOK'S IS

AZORES

PORTUGAL

SPAIN

MEDITERRANEAN

EUROPE

SCOTLAND

IRELAND

ENGLAND

NORWAY

SWEDEN

BALTIC

PRUSSIA

FRANCE

AUSTRIA

ITALY

TURKEY

BLACK SEA

ASIA MINOR

RUSSIA

LAPLAND

FINLAND

NOVAIA ZEMBLA

SIBERIA

IRKUTSK

KAMTSCHATKA

ALEUTIAN IS

INDEPENDENT TARTARY

Altai M.

MONGOLIA

JAPAN SEA

JAPAN IS

CHINESE EMPIRE

PERSIA

AFGHANISTAN

PUNJAB

THIBET

CHINA

HINDOOSTAN

BIRMAN

CHINA SEA

PHILIPPINE IS

CELEBES

BORNEO

SUMATRA

JAVA

N. GUINEA

CEYLON

CASPIAN SEA

BENGAL SEA

ARABIAN SEA

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

AFRICA

CAFFARIA

CAPE COLONY

MADAGASCAR

AUSTRALIA

NORTH AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW HEBRIDES

NEW ZEALAND

Day & Son (Limited) Lith.

not only to their number, but also to the injury which they inflicted on the inhabitants. King Edgar commuted the punishment of various crimes into the delivery of a certain number of wolves' skins; and he cleared Wales of them by commuting a tax of gold and silver imposed on the Welsh princes by Athelstane, into an annual tribute of 300 wolves' heads. They must have been felt to be a serious scourge before this step would have been taken, and we are through it enabled to ascertain how many wolves go to make a serious scourge, for in four years they were all rooted out; therefore there must then have been 1200 Wolves in Wales. I suspect a less number turned loose in the principality nowadays would be thought a very sufficient scourge. In England, however, they flourished for long afterwards. In Edward I.'s reign they were so bad that a wolf-hunter-general was appointed; and it would appear that the counties which were most overrun with them were Gloucester, Worcester, Hereford, Salop, and Stafford; for, on the 14th May, 1281, a mandamus was issued commanding all bailiffs in those counties to assist "Peter Corbet," the wolf-hunter-general, in their destruction. Various estates are still held on the tenure of hunting and keeping the neighbouring districts free of Wolves; Wormhill in Derbyshire, and Harbottle Castle, and Otterburne, in the north, are so specified. In the reign of Athelstane they had so abounded in Yorkshire that a retreat was built at Flixton in that county, "to defend passengers from the Wolves that they should not be devoured by them." The date of their final extirpation in England is not known, but they still infested Sherwood Forest in the reign of Henry VI., for in the eleventh year of his reign Sir Robert Plumpton obtained a bovate of land called Wolf-hunt Land, in the county of Nottingham, "by service of winding a horn and chasing or frightening the Wolves in the forest of Sherwood." The last Wolf in Scotland was killed by Sir Ewen Cameron of Lochiel, in 1680. They also inhabited Ireland, and seemed to have lingered longer there than in either England or Scotland. The last presentment for killing them in the county of Cork was made in 1710.

Whether the European Wolf is the same as the North American Wolf is a much-vexed question. The preponderance of opinion in former times was rather in favour of their identity, while nowadays the opposite view prevails. The same difficulty occurs with regard to all the Wolves found in North America. There is no middle ground between considering them all distinct species or all varieties of one species. There is the pure white Wolf of the Upper Missouri; the dusky, blackish, plumbeous Wolf of the Missouri; the entirely black Wolf of Florida and the Southern States; and the entirely red or rufous Wolf of Texas, all varying in shape as well as in colour, the more southern ones appearing usually more slender and standing higher on the legs, partly perhaps in consequence of the comparative shortness and compactness of their fur. These, however, are local in their distribution, the more common and generally distributed colour being grey, which is found all over North America, from the Gulf of Mexico to the Arctic regions. How far it extends into Mexico we do not exactly know. Dr. Spencer Baird is of opinion that, putting aside the Prairie Wolf or Coyote, which he thinks intermediate between the Wolf and the Fox, there is only one species of Wolf in North America, and that distinct from the European Wolf.*

The whole of the South American Canidæ belong to the Dogs and not to the Foxes, as some naturalists have thought. This is proved, not only by their not possessing the foxy smell of the latter, but by anatomical distinctions, such as the conformation of the post-orbital process of the frontal bone, pointed out by Burmeister as one of the most characteristic differences between the Wolves and the Foxes. Like the Wolves, too, they have the pupil of the eye circular, while in the Fox it is

* Baird in "United States' Pacific Railroad Exploration," 1857 vol. viii. p. 105.

elliptical. On the other hand, they have the character of tail of the Foxes, their tails being even longer than theirs, but this is not a point of importance as a character, many of our domestic Dogs having bushy, long, fox-like tails.

Of the South American species the C. JUBATA of Brazil is the largest and fiercest. It is provided with a mane, and has points of resemblance to the Hyæna. Burmeister* describes a new dog C. ENTRERIANUS, of the section Lycalopex, apparently peculiar to the province of Entre Rios, isolated in form as in position by the two great rivers which form the natural boundaries of that province. After passing the southern tropic we find a new form of Dog—the Antarctic Wolf, C. MAGELLANICUS—which lives in holes like a fox, and subsists chiefly on birds. It is found throughout Patagonia and in the Falkland Islands.

The Jackals range over the whole of Africa and the southern parts of Asia. It is to this section, too, that any species of Dog found in the Indian Archipelago are to be referred. To it also belongs the Australian Dingo.

DOG-HYÆNA: LYCAON VENATICUS OR PICTUS. This is a very remarkable animal, which inhabits South Africa, and partakes of the characters both of the Hyæna and the Dog, but, as already said, approaches most nearly to the Dog. It has the teeth of a Dog with the feet of a Hyæna, four toes on both anterior and posterior legs, instead of five on the anterior and four on the posterior as in the Dog. It has the Hyæna's taste for foul feeding as well as the Dog's for fresh game. It hunts by the scent like Dogs, and in packs like Wolves.† They have more than one cry—one like the bark of a Dog, and another like the laughing chatter of the Hyæna.‡ It has the ears and the transversely-striped coloration of the Hyæna, and a similar remarkable admixture of the characters of the two animals in other respects. They live in holes in desolate open plains. The advocates of the formation of species by hybridization could not find a more satisfactory illustration for their purpose; while those who, like myself, do not admit hybridization as *a direct* instrument in the formation of species, will see in this animal one of those instances which are occasionally, but not often, to be met with, where a species seems to stand exactly midway between animals which are still existing. It does not follow that it is the descendant of the one and the parent of the

* BURMEISTER, "Reise durch die La Plata staaten mit besonderen Rücksight auf die Physische Beschaffenheit und die Culturzustand der Argentinischen Republik-ausgeführt in den Jahren 1857-1860," 2 vols. 8vo. Halle, 1861.

† "These animals invariably hunt together in large organized packs, varying in number from ten to sixty, and by their extraordinary powers of endurance and mode of mutual assistance, they are enabled to run into the swiftest, or overcome the largest and most powerful antelope. Their pace is a long, never tiring gallop, and in the chase they relieve one another, the leading hounds falling to the rear when fatigued, when others, who have been husbanding their strength, come up and relieve them. Having succeeded in bringing their quarry to bay they all surround him, and he is immediately dragged to the ground, and in a few moments torn to pieces and consumed."—GORDON CUMMING, *A Hunter's Life in South Africa*, vol. i. p. 169. The description might also do for an account of the doings of a pack of hungry Wolves.

‡ "Their voice consists of three different kinds of cry, each being used on special occasions. One of their cries is a sharp angry bark, usually uttered when they suddenly behold an object which they cannot make out. Another resembles a number of monkeys chattering together, or men conversing when their teeth are chattering violently from cold. This cry is emitted at night, when large numbers of them are together, and they are excited by any particular occurrence, such as being barked at by domestic dogs. The third cry, and the one most commonly uttered by them, is a sort of rallying note to bring the various members of the pack together when they have been scattered in following several individuals of a troop of antelopes. It is a peculiarly soft and melodious cry, yet nevertheless may be distinguished at a great distance. It very much resembles the second note uttered by the cuckoo, which visits our island during the summer months; and when heard on a calm morning echoing through the distant woodlands it has a very pleasing effect."—GORDON CUMMING, op. cit. vol. i. p. 170.

MAP XXII.

ALLEGED DISTRIBUTION OF

AMERICAN RED FOX.

C. FULVUS

Day & Son (Limited) Lith.

MAP XXIII.

OTTERS

Lutra vulgaris .....

Other species .....

Day & Son (Limited) Lith.

others. The homologies of an allied species may be reproduced along with the qualities of the direct progenitors of the species.

Foxes. The Foxes are a well-marked section of this family, differing from the Wolves and Jackals in various characters, but always at once recognisable by the peculiar odour which they emit. No Dog ever has the foxy smell, no Fox is without it. All the stories as to crosses between Dogs and Foxes I believe to be unfounded.

The range of the Foxes is very similar to that of the common Wolf; in fact, it is the same, with the addition of a more southerly extension, which, in the Old World, does not go further south than the Mediterranean district, including North Africa, and in the New not beyond Central America. The Arctic fox is found in the boreal or arctic regions of Europe, Asia, and America, being one of the very few circumpolar animals whose characters are everywhere identical. It occurs in Spitzbergen and in Iceland,* as well as upon all the Arctic mainlands. This and the Leeming are the only mammals which can be considered aboriginal in Iceland, but it is fully as likely that they may have crossed from Greenland by means of sea-floes or icebergs.

A doubt similar to that entertained regarding the Wolves exists as to the identity of the common red Fox of Eastern North America with the common Fox of Europe. Dr. Giebel considers them the same,† but in this family, perhaps, even more than in others, I think he carries the suppression of species to an excessive extent. He throws together no less than twenty supposed species. Some from the lofty Himmalayahs and the frozen Steppes of Central Asia, and others from Nubia and Durfour. I cannot agree with him in this. Such differences in localities are almost sure to be attended with a difference in character; and although in some families the distinction of characters is slighter than in others, when we know that they are so we must make corresponding allowances. As to the American Red Fox, for instance, although very much alike, there are, certainly, appreciable differences between it and our common species. In the American Fox, the texture of the fur is longer, softer, and silkier; its tail is more bushy, and its longest hairs are three inches instead of two inches long; its colour is brighter, and has more of a golden hue, which gives the American species much beauty; the muzzle is shorter, and the eyes closer set, and there are a number of other distinctions of about the same value. Wagner refuses to admit the distinction of species, and asserts that the differences are owing to the climate, the specimens which he examined having been boreal; but the distinctions, such as they are, are found in examples from all latitudes, and it is always easy to separate the American from European specimens. Notwithstanding this, so close are the two species, that there is a prevalent impression that the American species is the descendant of individuals of the European red Fox, imported into America many years ago, and allowed to run wild and overspread the country; an impression which receives unexpected support from the fact that there have been as yet no remains of the red Fox detected among the fossils derived from the Carlisle and other bone-caves. The grey Fox is abundantly represented there, but not a trace of the other.‡

* Mr. Newton makes the following remark upon the colour of the Arctic Fox in Iceland:—"I have never seen it remarked, though it is unquestionably the case, that nearly all the Icelandic examples of *Canis lagopus* are blue' foxes; that is to say, their winter coat is nearly the same colour as their summer coat. This fact, I think, must be taken in connexion with the comparatively mild climate which Iceland enjoys in winter, and if so, is analogous to the circumstance of the Alpine hare (*Lepus timidus Linn. non auct.*), always becoming white in winter in Scandinavia, generally so in Scotland, but seldom in Ireland."—Alfred Newton, in "Proc. Zool. Soc." Dec. 1864, p. 497.

† Giebel, "Saugethiere," 1859, p. 827.

‡ General Report on Zoology in "United States' Pacific Railroad Exploration," vol. viii. p. 130, Washington, 1857.

Dr. Newberry mentions some other facts regarding the distribution of these two species. He says, "that in Ohio, Kentucky, and Michigan, the most densely wooded of the middle States, the pioneer settler found only the grey Fox, or at least that species occupied the territory so nearly exclusively that they considered any others as, like themselves, interlopers. As the forest gradually fell before the axe of the woodman, and broad and continuous stretches of waving grain replaced the thickly-set trunks of oak, ash, and hickory, the grey Fox became gradually more rare, while the swifter, stronger, and more cunning red Fox by degrees almost entirely usurped its place. Hence the farmers supposed they had themselves introduced this farm-yard pest, and that it had been the companion of their migration from the east; and as it was then confounded with the common Fox of Europe (*V. vulgaris*) it was supposed to be an importation, which ultimately would drive off its weaker relative and possess the continent.

"Since, however, the red Fox has been found in various places in the Far West, and spread over all the region west of the Rocky Mountains, and the red Fox of America has been pronounced different from the red Fox of Europe, this theory falls to the ground, and we must look for some other cause to account for the usurpation of the habitat of the grey Fox by the red.

"The grey Fox is evidently best fitted by nature for the occupation of a wooded country; he even has to a certain degree the power of climbing trees not possessed by the Red Fox, while he rarely or never forms burrows, having no cover but such as the forest furnishes, and thus is comparatively unprotected in an open country, where the red Fox would be quite at home. To these differences of habit, rather than to any other cause, I would attribute the change of distribution noticed in the two species." *

On the subject of the red Fox being possibly of recent introduction, Dr. Baird remarks that the fact of their present abundance and extent of distribution is no barrier to the reception of this idea, as the same has been the case with horses brought over and set at liberty by the Spaniards, after the discovery of America. As is well known the immense herds of these animals in Mexico, Texas, and the Western plains, are the lineal descendants of the imported horse. Nor is there any serious difficulty to be met with in the different characteristics of the American animal, as the finer fur, brighter colour, narrower and more delicate head, sharper muzzle, &c., as it is in precisely such peculiarities that the Anglo-American race differs from its English stock.

The establishment and spread of the common brown rat, wherever man has gone, might be cited as another instance of rapid colonisation, but neither of them is quite a parallel case. It is not as if there were no other North American species similar to our Fox, from which the American species might have been derived. There is another species very closely allied to it, which is found in Central America, and is not imagined by Dr. Baird to be other than a good native species. He calls it a magnificent Fox, "the finest species known," but so like the common species "that it is difficult to describe it intelligibly except by comparison with the other species." Another difficulty is that C. FULVUS, the species supposed to be derived from the English Fox, is said to be also found in Japan, where certainly the English Fox was never imported nor turned loose. It may be that the determination of the Japanese species by Temminck is erroneous, the rather that he records it under the name of C. ARGENTEUS (which is that of the silvery variety of the American Fox), and moreover specifies the common English Fox as

* NEWBERRY, Report, in op. cit. vol. vi. p. 39.

also found in Japan. It is proper to add, however, that while the fact of the same species being found in Japan is not entirely free from doubt, a similar doubt, although one of greatly less weight, applies to its absence on the west coast of America. Lewis and Clarke, who, however trustworthy as explorers, can scarcely be cited as authorities in natural history, do state that the red Fox is found on the coast region of Oregon. Dr. Baird, however, has satisfied himself that the species to which they refer is different.

There is another American fox which possesses some interest in regard to distribution—the small Kit Fox, C. VELOX, from nearly the very centre of North America, viz. the region about the Nebraska and Missouri district. Its peculiar habitat is the dry desert-like country lying on either side of the Rocky Mountains, extending to the Cascade range on the west, and to the timbered lands of the lower Missouri on the east. In the basin of the Upper Columbia it is more common than any other species. It is said to be possessed of great swiftness, whence its name, but this is now found to have been greatly exaggerated. It is no swifter, indeed it is not so swift as the red or grey Foxes.* This is the nearest approach to the Jackals which occurs in either North or South America. It is, however, a true Fox.

Its analogue in the Jackals is the Corsac or Adive, which inhabits similarly elevated regions in Central Asia. It is not quite so large as the domestic cat, but a little larger than a stoat, and is a very handsome animal, so that in the reign of Charles IX. of France it was the fashion for the Parisian ladies to make a pet of it instead of little dogs;† and it is said to have been then common in Paris, although brought from Asia at great expense. The American C. VELOX is a little larger, being about two feet in length. If the central position on highlands in the heart of the two great continents were anything more than an analogical resemblance, we might apply the phenomena of the glacial epoch to explain their occurrence, but it is not called for. The distinction between the Dogs (that is to say, the Dogs, Wolves, and Jackals) and the Foxes, is too well marked to allow of the circumstance being regarded as more than a coincidence.

To this section belongs the Zerda or Fennec from North Africa, which Mr. Tristram describes as an amiable and interesting pet.‡

Prince Charles Lucian Bonaparte described a Fox from Italy, under the name of CANIS MELANOGASTER. He considered it to resemble the American C. FULVUS more nearly than any other Fox,‖ but it is not generally accepted as more than a variety of our common Fox. The limits of its habitat are not yet very exactly defined, but would appear to comprise the northern half of the

* NEWBERRY, in "United States' Pacific Railroad Exploration," 1856.

† CHENUE, "Encycl. d' Hist. Nat." Carniv. vol. ii. p. 75. 1853.

‡ "This little animal burrows throughout the whole of the rolling sand deserts which extend from Waregla to Souf, in the north of Africa. We used to see them brought into market by the Arab boys at Waregla, Tuggurt, and Souf. I had two for some months which became very tame, and nestled every night by my side. No pet can rival the Fennec in grace and interest. Not above half the size of a cat, it has all the wiles and actions of a fox; and when alarmed by the sight of a stranger will run under a chair or into a corner, and vociferously give forth its tiny bark. My little favourites were fed on milk and morsels of meat, but showed great fondness for dates. The large ears and long bushy tail of this lovely creature give it somewhat the appearance of a squirrel."—TRISTRAM, H. B., *The Great Sahara*, p. 383, 1860.

‖ "Iconographia della Fauna Italica," di Carlo Luciano Bonaparte, Principe de Musignano, Fol. Rome, 1837.

Mediterranean district, viz. Italy south of the Apennines, Greece, the south of Spain, and the islands of the Mediterranean. It might have been expected that, as is the case with many other animals, it should, seeing it extends over so much of the Mediterranean district, have also ranged over the whole; but this is not the case, for C. Niloticus of the French Institute takes its place on the south of the Mediterranean. That species, although very like it, differs from it in the osteology of the head.

CHAPTER XIV.

CARNIVORA *continued*—MUSTELIDÆ—WEASELS, POLECATS, OTTERS, BADGERS.

It has been proposed to divide this family into various sections, which, when limited to the more marked species, are excellent divisions, but when other (transition) species are taken into account will not answer, as the transition species fill up the intervals between the proposed sections so completely as to destroy the characters on which they are founded. De Blainville, for instance, proposed to separate the Badgers, the Polecats and Weasels, under the name of *Subursini*, or little Bears. This looks very natural, the Badger having much more resemblance to a Bear than a Weasel, but then, by means of the genus Mephitis, or the Skunks, the Badgers glide imperceptibly into the Polecats, so that it becomes a better arrangement to keep them all in one group. That group for our present purposes, however, may be conveniently divided into the Otters, the Weasels, the Polecats, the Skunks, the Badgers, and the Wolverenes or Gluttons.

About half of this family is found in North and South America; a sixth in Southern Asia, that is to say, in India, Malacca, and the Indian Archipelago; a ninth is found in Europe and North Asia, or Asia and North America; another ninth is confined to North Asia; and the remaining ninth belongs to Africa and the Mediterranean district. None are peculiar to Europe alone; but about nine species are spread over the whole extent of the north of Europe and Asia. One species is found both in Europe and North America, and two in both America and Asia. The family is better represented in cold and temperate climates than in warmer countries, and even in the latter many of the tropical species are only found in mountainous districts or at high elevations, or in some way or other indicate that they are not naturally tropical in their character.

Fossil remains of extinct species have been found in recent deposits both in the Old and New World in the same districts as are now inhabited by existing species.

Otters. (Map 23.) The common English Otter is found all over Europe and the north of Asia as far as Japan, but is becoming scarce, it being much sought after for its fur; a good skin is worth as much as 3*l.* or 4*l.* on the spot. It must have abounded in former times in Ireland, as we read of their skins being an article of commerce, felting forming a large part of the exports of Ireland in very early times.* Besides the common Otter and the Sea Otter, Enhydris marina, which is

* "In 1408 we find John, son of Dermod, charged with two otters' skins for his rent of Radon (Rathdown) for the same year; five otters' skins for the two years and a half preceding; and one hundred and sixty-two otters' skins for the arrears of their rent for many years then past, making a total of one hundred and sixty-nine otters' skins. This, which is the last entry accessible relative to the family of Gillamocholmog, is recorded in an unpublished Pipe Roll of 10 Henry IV."—See the "History of Dublin," by J. T. Gilbert, quoted in a paper by Mr. Wilde, on the Unmanufactured Animal Remains belonging to the Academy, in "Transactions of Royal Irish Academy," May, 1859.

confined to the northern shores of Asia and North America, there are five or six species from China, India, or the Indian Archipelago (one, if not two, of which are from Sumatra and Borneo), three from Africa, two good species from North America, and eight, some of which are doubtful, from Central or South America.

We know of none from New Guinea, and, of course, none from Australia; but some years ago Mr. Walter Mantell called attention to the possibility of an indigenous quadruped called by the natives "Kaurcke," which he supposed to be either a badger or an otter, existing in New Zealand; and a naturalist in that country lately announced the fact that although he had not seen the animal in question, he had observed certain tracks on the mud flats near the source of the River Ashburton, which exactly resembled those of the Otter of Europe, and which he considered to afford indications that such an animal existed in the Alpine lakes and rivers of New Zealand.*

Such a discovery would be of the greatest interest. As yet no terrestrial mammals have been found in New Zealand with the exception of a small rodent; and in whatever direction the affinity of this other animal might lead, it would be sure to throw light on the past history of that quarter of the globe. It would be especially interesting if it should confirm some of the deductions, already drawn from peculiarities in the fauna and flora of New Zealand; if, for instance, it should be found most nearly allied to one of the Peruvian or other South American Otters. That it should turn out to be a Badger is opposed to all probabilities, the Badger being confined to the north of Europe, Asia, and America.

Weasels, Polecats. (Map 24.) Of the genus Mustela, the Weasels are the most northerly section. The common Weasel of this country is found all the way to the Amour, although in fewer numbers on the high Steppes, but has not been noticed in Japan. It formerly inhabited Ireland, but is no longer found there. The Stoat, or Ermine, has the same range, but is not found to the south of the Middle Amour. Whether it extends into North America or not has been a question. Dr. Baird† says that none of the specimens collected in America and sent to the Smithsonian Institution were of this species, and he doubts whether it is found in America even in the highest latitudes.

The Polecats, although they also inhabit high latitudes, have a greater number of tropical or sub-tropical species than the Weasels. This, however, is more the case in the Old World than in the New. The Polecats in tropical America are mostly, if not all, mountain species. Six different species stretch across the whole of Europe and Asia, and there are about as many more that are found in Asia and not in Europe. The European Polecat has been supposed not to extend entirely across the Asiatic continent, but to be replaced in southern Russia and the Caucasus by a species named by Lichtenstein M. Eversmanni, and further on, in eastern Siberia, by another brighter-coloured species; but Radde‡ maintains them both to be mere climatal varieties of the common species. His inclination, however, appears to be to swamp all species which approach closely to each other, and to treat them as varieties. Knowing his proclivity, we understand what we have to deal with, and looking at species as they are regarded by nine-tenths of living naturalists, we should hold the species of Polecat which he has here suppressed as distinct species

* Haast Julius, "Report of a Topographical and Geological Exploration of the Western Districts of the Nelson Province, New Zealand." Nelson, 1861. Cited in "Natural History Review," January 1864, p. 30.

† Baird in "Report on the Zoology of the United States Pacific Railroad Explorations and Surveys." Washington, 1857, p. 166.

‡ Gustave Radde, "Reisen im Süden von Ost-Siberien." St. Petersburg, 1862.

ARCTIC OCEAN

ISOTHERMAL 32°

Arctic Circle

BAFFIN BAY

GREENLAND

Davis Strait

ESQUIMAUX

RUSSIAN AMERICA

INDIANS

CUMBERLAND

HUDSON BAY

ICELAND

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

S I B E R I A

BRITISH AMERICA

NORTH CANADA

ALEUTIAN Is

VANCOUVER I

OREGON

CALIFORNIA

SCOTLAND

IRELAND

BALTIC

EUROPE

RUSSIA

ASIA

AUSTRIA

PRUSSIA

FRANCE

INDEPENDENT TARTARY

MONGOLIA

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

AZORES

PORTUGAL

SPAIN

ITALY

CHINESE EMPIRE

PERSIA

AFGHANISTAN

PUNJAB

THIBET

CHINA

JAPAN SEA

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

Tropic of Cancer

UNITED STATES

NUEVA CALIFORNIA

TEXAS

G. OF MEXICO

MEXICO

WEST INDIA Is

CARIBBEAN SEA

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BIRMAH

SANDWICH I

Equator

NUEVA GRANADA

VENEZUELA

GUAYANA

ECUADOR

SOUTH AMERICA

PERU

BRAZIL

BOLIVIA

CHILI

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND Is

AFRICA

CAPE COLONY

MADAGASCAR

INDIAN OCEAN

Tropic of Capricorn

SOUTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

MARQUESAS Is

NAVIGATORS Is

LOW ARCHIPELAGO

SOCIETY Is

COOKS Is

BORNEO

CELEBES

N. GUINEA

PHILIPPINE Is

N. AUSTRALIA

NEW HEBRIDES

AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW ZEALAND

SOUTHERN OCEAN

MAP XXIV.

MUSTELIDAE.

POLE CATS, WEASELS, OTTERS &c.

NOTE. *Intensity of Colour denotes preponderance of Species.*

ARCTIC OCEAN

ISOTHERMAL 32°

Arctic Circle

BAFFIN BAY

GREENLAND

Davis Strait

ESQUIMAUX

RUSSIAN AMERICA

INDIANS

CUMBERLAND

HUDSON BAY

ICELAND

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

S I B E R I A

BRITISH AMERICA

NORTH CANADA

ALEUTIAN Is

VANCOUVER I

OREGON

CALIFORNIA

SCOTLAND

IRELAND

BALTIC

EUROPE

RUSSIA

ASIA

AUSTRIA

PRUSSIA

FRANCE

INDEPENDENT TARTARY

MONGOLIA

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

AZORES

PORTUGAL

SPAIN

ITALY

CHINESE EMPIRE

PERSIA

AFGHANISTAN

PUNJAB

THIBET

CHINA

JAPAN SEA

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

Tropic of Cancer

UNITED STATES

NUEVA CALIFORNIA

TEXAS

G. OF MEXICO

MEXICO

WEST INDIA Is

CARIBBEAN SEA

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BIRMAH

SANDWICH I

Equator

NUEVA GRANADA

VENEZUELA

GUAYANA

ECUADOR

SOUTH AMERICA

PERU

BRAZIL

BOLIVIA

CHILI

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND Is

AFRICA

CAPE COLONY

MADAGASCAR

INDIAN OCEAN

Tropic of Capricorn

SOUTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

MARQUESAS Is

NAVIGATORS Is

LOW ARCHIPELAGO

SOCIETY Is

COOKS Is

BORNEO

CELEBES

N. GUINEA

PHILIPPINE Is

N. AUSTRALIA

NEW HEBRIDES

AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW ZEALAND

SOUTHERN OCEAN

MAP XXV.

Mephitis

Mydaus
Helictis

Day & Son (Limited) Lith

and not varieties. It is not altogether a matter of no importance; for we shall find, more than once, that it depends upon how we regard this point, whether the same species inhabits both Asia and America or not. The Sable and two other species are confined to the limits of Eastern Siberia, where a considerable number of skins are annually taken by the hunters: Radde says 6000 to 8000 of the Sable alone. In North America the place of the Sable is supplied to the furrier by the Mink, M. Vison, and by what is reckoned its more valuable congener the little black Mink, M. nigrescens; which, however, according to Mr. Bernard Ross, is nothing but the young of M. Vison;* whichever it be, however, there is no fur which approaches so near to that of the famed Russian Sable as it does. A good skin yields the hunter from twenty to twenty-five shillings. Although, however, the Minks replace in North America the Sable of the Old World, so far as the fur is concerned, they are not its true substitute in point of affinity, that being M. lutreola, (which owes its name to its resemblance to a small otter), a European species which is exceedingly rare, in marked contrast to the American species, which in North America, from its numbers and depredations, is well known to every farmer as the pest of his existence. Nepal, India, and the Indian Archipelago, possess seven or eight species of Polecat. The Mediterranean and Nile district have two, but Africa proper, that is, south of the Sahara, none.

There is a peculiar form (Rhabdogale or Zorilla) found in Africa which there supplies the place of the Mustela; only two or three species of it are known. The genera Galidictis and Galidia have been thought to replace them in Madagascar; but, as has been already said, these rather belong to the Viverridæ.

Sand Bears. (Map 25.) The Sand Bears, composing the genera Helictis and Mydaus, are peculiar to India and the Indian Archipelago. They have some connexion with the Badger, in the form of the head and nails, as well as the style of coloration, and the nature of the hair; but their teeth and other characters show greater affinity with the Polecats. They are placed by Van der Hoeven as the transition between them and the Badgers. Geoffroy St. Hilaire, who first described the genus with care, considers that it has some analogy with the Coatis, a genus restricted to South America.

Skunks. (Map 25.) The genus Mephitis, which has the bad pre-eminence of emitting probably the worst and most fetid odour of any beast in all the earth, is entirely confined to the New World, and is represented in North America and South America in nearly equal numbers,—eight in the North and ten in the South. Their appearance sufficiently indicates that they have relations both with the Badgers and the Polecat. They are found all through South America down to the southern extremity of Patagonia, but they do not appear to have crossed the Straits of Magellan into Tierra del Fuego.

Badgers. There are three species of Badger now known, possibly five. There is the European Badger, whose range extends from the Atlantic, through Europe and Asia, to the Pacific; and there are two species in North America, which, although outwardly almost identical in appearance with the Old-world Badger, differ so materially in dentition from it that a new genus, Taxidea, has been established for their reception. Besides the European form of the Old-world Badger,

* B. Ross, in "Nat. Hist. Rev.," 1862, p. 273.

there is in Eastern Siberia a larger variety; it is confined to the high Steppes, while the common species, also found in Siberia, is restricted to the woodlands.* This larger variety may perhaps be a distinct species. There is another in Japan, which Temminck† has described under the name of MELES ANAKUMA. The figure given of it looks distinct, but both Schrenck and Radde are of opinion that it is only another variety. It has been supposed by others to be nearer the North American species. This, however, can hardly be the case, for, if so, the fact could have been at once determined by examination of the teeth, the distinction being sufficiently marked. Of the two American species, one (the Carcajou) occurs in the northern parts reaching from the Atlantic on the east to Wisconsin on the west, extending far to the north, but not further south than Texas, or latitude 35°, where it is replaced by the other species, the Mexican Badger.

The RATEL, which is in many respects allied to the Badger, extends along the eastern coast of Africa, and through Arabia and Persia, from the Cape of Good Hope to the north of India.

GULO. The GLUTTON, or Wolverene, is generally believed to be found in all the three continents of Europe, Asia, and America, although there are still some authors who are disinclined to admit the identity of the Old-world and the New-world specimens. It is a boreal, almost an arctic animal, coming in the category of those which compose the circumpolar zone of life, and yet its remains have been found in the caves of Gaylenreuth, Liege, and Voidon,‡ near Joyeuse (Ardèche), and in the caverns of Germany.§ These remains have been supposed to belong to an extinct species (G. SPELÆUS), but both Baron Cuvier and De Blainville were of opinion that they were those of the existing species. Another extinct species has been described by Kaup from Epplesheim, under the name of G. ANTEDILUVIANUS, but it may belong to the living species. If they belonged to the present species we cannot escape from the inference that either it has changed its nature so far as to require now a colder climate than it did formerly, or else that the climate of Europe was much colder when the individuals whose bones are found in the caves in question roamed through France and Germany, than it is now.

* RADDE, GUSTAV, "Reisen im Süden von Ost-Siberien," 1862. SCHRENCK, LEOP. VON, "Reisen, &c. im Amurlande," 1858.

† SIEBOLD and TEMMINCK, "Fauna Japonica," 1833.

‡ SCHMERLING, "Oss. Foss." ii. 167. GERVAIS, "Zool. and Palæont. Franc.," 1859, p. 117; and MALBOS in "Bull. Soc. Geol. Fr.," t. x., p. 360.

§ BLAINVILLE, "Osteog." G. Mustela, pl. 14.

CHAPTER XV.

CARNIVORA *continued*—ARCTOCYONIDÆ.

This is a small group of extinct animals, partaking (as its name indicates) of the characters of the dog and the bear.

They have all, with one exception, been found in the miocene beds of Europe—the exception being from the Sevalik miocene formations—and, as conjectured of the Feline Carnivores, may have been brought into the Sevalik beds from their northern side.

The most characteristic member of this family is the genus Amphicyon. It occurs with the remains of the Marsupial (?) Hyænodon in the miocene deposits of the south of France, and Professor Owen regards it as the forerunner of the plantigrade family; and something more of its nature may be guessed at from another smaller species from the miocene at Epplesheim, having been first referred to the Wolverene genus, under the name of Gulo diaphorus *Kaup*. It had a long tail, therefore probably was more allied to the Wolverene and the Badger than the Bear.

CHAPTER XVI.

CARNIVORA *continued*—BEARS.

URSIDÆ. As already said, the place of the Bears in a natural arrangement has been the subject of considerable difference of opinion. The resemblance of their plantigrade feet to the pedimanous limbs of the Quadrumana, in virtue of which they have in most systems been placed at the head of the CARNIVORA, and immediately after the Monkeys, is, however, more of the nature of an analogy than an indication of affinity, and, as was pointed out by Professor Owen in his paper on the Classification of Mammals, their affinities are clearly greater with the Seals than with any of the other Digitigrades. In particular, the resemblances in their renal and genital organs, the form of their under jaw, and their broad flat foot, which is nearer to the flippers of the Seal than is the more perfect retractile-clawed, long and narrow hind foot of the feline quadruped.*

On physiological grounds, therefore, the removal of the Bears from the head of the Carnivora to a position between the Badgers, Skunks, Otters on the one hand, and the Seals on the other, seems an improvement.

We have seen that the AMPHICYON and other members of the dog-bear family lived in the miocene epoch, and it is not improbable that they may have been the source whence the Bears were derived. Like the Cave Lion and other boreal forms, whose development I attribute to the glacial cold, the Bears themselves did not begin to appear until the pliocene epoch. During that period they flourished in great numbers. One species, known as the Great Cave Bear (U. SPELÆUS), was especially abundant in Central Europe and South Russia. Some of the heads in the British Museum are of very great dimensions, and show that it must have been an enormous beast, considerably larger than the present Polar Bear. It and the Cave Hyæna (H. SPELÆA) have also been cited as found in the caverns of Tcharych and of Khankhara in the government of Tomsk in Siberia. It has been thought that these identifications may require to be verified, for, according to some palæontologists, these species appear to have been absent in the vast region intermediate between Germany and Northern Asia. As a very great part of this space was then under water, there seems to be a very good apology for their absence. Remains of the Bear, however, are mentioned by Nilsson as found in a gravel bed below a peat deposit in Scania.

A small number of fossil remains of Bears, obtained from Spain, belong to a different species, and one nearer the present Bear of the Pyrenees.

The existing species are generally divided into two sections, the common Bears (URSUS), and the Arboreal, or Sun Bears (HELARCTOS); but it is difficult to find good characters for this separation, especially when we come to the most nearly allied species of each. The former extends all over Europe, the north of Asia, North America, and the Cordilleras of the Andes. The latter is almost

* OWEN, in "Linn. Soc. Proc.," ii. p. 32, 1857.

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

BAFFIN BAY

GREENLAND

ESQUIMAUX

INDIANS

RUSSIAN AMERICA

HUDSON BAY

CUMBERLAND

ICELAND

BRITISH AMERICA

NORTH AMERICA

UNITED STATES

NUEVA CALIFORNIA

TEXAS

MEXICO

G. OF MEXICO

WEST INDIA IS

CARIBBEAN SEA

SOUTH AMERICA

BRAZIL

PERU

BOLIVIA

CHILI

PATAGONIA

LA PLATA

FALKLAND IS

TIERRA DEL FUEGO

EUROPE

ASIA

SIBERIA

LAPLAND

FINLAND

NORWAY

SWEDEN

BALTIC

SCOTLAND

IRELAND

FRANCE

PRUSSIA

RUSSIA

AUSTRIA

ITALY

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

INDEPENDENT TARTARY

MONGOLIA

CHINESE EMPIRE

PERSIA

AFGHANISTAN

PUNJAB

THIBET

CHINA

JAPAN SEA

AFRICA

SAHARA DESERT

EGYPT

NUBIA

ARABIA

RED SEA

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BORNEO

CELEBES

N. GUINEA

AUSTRALIA

NEW HEBRIDES

NEW ZEALAND

VANDIEMEN

MADAGASCAR

CAPE COLONY

AZORES

PORTUGAL

SPAIN

ALEUTIAN IS

SANDWICH I.

MARQUESAS IS

LOW ARCHIPELAGO

SOCIETY IS

COOKS IS

NAVIGATORS IS

VANCOUVER I.

NOVA ZEMBLA

OBI R.

YENISEI R.

LENA R.

KAMTSCHATKA

JAPAN IS

PHILIPPINE IS

MAP XXVI.

BEARS.

Polar bear

Black & brown bears

Day & Son (Limited) Lith.

MAP XXVII.

RACOONS, COATI-MUNDIS, KINKAJOU, BINTURONG

Day & Son (Limited) Lith.

confined to the Indian region, including the Philippine Islands and the Indian Archipelago, Formosa, China, and Japan; but a species from Hungary, one from Mount Atlas, and another from the Cordillera of the Andes, Sweden, have also been reckoned Sun Bears, so that no geographical limit can be given for them different from that of the other Bears.

If close affinity of species be a mark of high organization, the Bears must stand high, and they furnish illustrations more suited for Mr. Darwin's views of gradual change by variation than any others which occur to us. If the same consolidation of species which some authors practise in plants were carried out in animals, we should have but one species for the whole northern hemisphere. On the other hand, authors who have a different constitution of mind have multiplied instead of diminishing the number of species. Dr. Gray, in a recent monograph of the Bears, has not only preserved Ursus arctos as distinct from the American brown Bear, but has recorded four named varieties and eight named sub-varieties of it, an evidence of instability in the species which certainly, at least, cannot be said to be unfavourable to the other view. But while admitting the Brown, Black, Norwegian, Pyrenean, Polish, and Siberian Bears, to be mere varieties, Dr. Gray has gone still further in the opposite direction, for he has adopted the views of Eversmann,* who held that there were two species of Bear confounded under the name Ursus arctos,—the Carrion Bear, feeding much on flesh, and the Ant Bear, feeding chiefly on insects; and has divided them into two separate genera,—the old genus, Ursus, for the Carrion Bear, and a new genus, Mymarctos, for the Ant Bear. The differential characters, as stated by Eversmann and Gray, are drawn entirely from the skull; and one is rather surprised at finding the doctor give so much weight to them after the caution he gives us at the commencement of his monograph to distrust such characters. He says, "The examination of the series of skulls of Bears in the Museum, like the examination of the series of bones of the Viverridæ, has strongly impressed me with the uncertainty that must always attend the determination of fossil bones, or indeed of bones of all animals, when we have only the skulls or other bones of the body to compare with one another. There can be no doubt that the study and comparison of the bones of the different species is very important;—that the skull and teeth afford some of the best characters for the distinction of genera and species; but few zoologists and palæontologists have made sufficient allowance for the variations that the bones of the same species assume. In the Bears I have observed that there is often more difference between the skulls of Bears of the same species from the same locality than between the skulls of two undoubted species from very different habitats and with very different habits." And he adds, as an illustration of the caution which should be used in dealing with such characters, "the fact that M. de Blainville considers the Californian Grizzly Bear, after a very careful study and comparison of its bones, to be only a variety of the common European Bear, shows how a most experienced and accurate osteologist may be misled by placing too much confidence in a single branch of study."† But other naturalists, who are not open to the objection of being solely devoted to a single branch of study, say the same thing as De Blainville. Middendorf does so. According to him the species found in Europe and Northern Asia and the Grizzly Bear of North America are all varieties of the Ursus arctos; and he gives a series of minute measurements and comparisons in support of his conclusion. And although Dr. Gray rather disables his judgment because he has not distinguished between the Ant Bear and the Carrion Bear, I

* Eversmann, in "Bullet. de la Soc. Imp. des Nat.," 1840, p. 8.

† Gray, in "Proc. Zoolog. Soc." 1864, p. 684.

cannot go along with him in doing so, for to me it is plain that he *has* distinguished between them, because he has given figures of both as sub-varieties; and his error, if any, has been in estimating the differences as of less value than Dr. Gray thinks they deserve, rather than not perceiving them at all. As to the distinctions between the Ant Bear and the Carrion Bear, without going so far as Pallas, who long ago noticed the supposed distinction, and disposed of it briefly as being supported "*nullo solido argumento*," * I should prefer to reserve my judgment. Fortunately no immediate decision is called for on the question. We understand the nature of the differences, and how we name them is of less consequence.

Similar difficulties occur with regard to several of the other species. Many naturalists look upon the Syrian Bear and the URSUS ISABELLINUS as mere varieties of each other. They are nearly identical in appearance, but the skull is different. So perhaps may the Thibet Bear (URSUS TORQUATUS) and the Japan Bear (URSUS JAPONICUS) prove to be. If we might judge of the extreme East from what we see in the extreme West of the great European and Asiatic continent, we should have little hesitation in supposing the species not to be distinct. Japan lies on the east very much to the mainland as Britain lies on the west, and we know that, in all probability, there is not a single species of any animal found in Britain which is not also found in greater plenty on the Continent; and the same may be said of plants, with the exception of one or two extraordinary instances of American species, whose presence gives rise to such speculations as those we have already described. TETRAO SCOTICUS, PRIMULA SCOTICA, and other species, so specifically named under the supposition that they were peculiar to Scotland, are now known to be misnomers; and any species which have been found in Britain and not on the Continent are minute minims which in all probability have merely not yet been detected there. Whether the case is the same with Japan and its adjoining continent is not known. There may be some specialty in its ancient connexions and separations which have produced a different state of things. Temminck and Siebold's work on the fauna and flora of Japan discloses a number of undescribed species; but I lay no great stress upon that, because these may all yet be found in the neighbouring continental regions when they are sufficiently explored. Some of them, however, have an affinity with American types; in the case before us, Dr. Sclater, dealing only with it descriptively, remarks that "the Japanese Bear seems almost intermediate between URSUS TORQUATUS (the Indian species) and URSUS AMERICANUS."†

Temminck records, apparently without hesitation, the Grizzly Bear (URSUS FEROX) as inhabiting Jezo and Krafto, the northern islands of Japan. A chief objection to its being admitted as a Japanese species, is that it has been thus recorded without doubt. The doing so implies want of careful examination; for the disregard of the doubts which were sure to arise regarding its identity, infers as little care in ascertaining that they were unfounded. It seems also very probable that Temminck may have made a mistake, for he mentions it as found of various colours, brown, yellow, and red,—colours which occur in the varieties of the Old-world species, U. ARCTOS, but not in the American "Grizzly."

On only one small part of Africa is any Bear found, viz., in Mount Atlas, and it seems by no means improbable that this may be a modification, if not the descendant, of the extinct species, of which remains are now found in Spain. It belongs to the genus named HELARCTOS; or rather, I should say, it belongs to the artificial section so named. Arboreal, as distinguished from

* PALLAS, "Zoographia Russo-Asiatica."

† SCLATER, in "Proc. Zoolog. Society," 1862, p. 261.

terrestrial, was the original idea of the genus HELARCTOS, but it has since been made to admit species which have not this title to distinction, and in particular this African Bear, which is not a good climber. It is, however, said to be very different-looking from the common Bears. In South America, in the Peruvian Cordillera, two non-arboreal species are found (URSUS ORNATUS and U. ERUGILEGUS), the former of which at least has a skull so like the Malayan arboreal species as to be almost identical. The latter has not been subjected to the same examination as it. This animal may have been modified out of the Malayan arboreal Bear into a mountain species. It may perhaps be one of the traces proving a former connexion between Peru and the sunken Pacific continent, which was connected on the other side with India and the Indian Archipelago. In this instance the form of the skull seems to lead us to that view rather than to the other alternative that it was derived from Bears driven south by the glacial epoch; but in that case, we must derive it from the true Bears (for which, however, there is no necessity): if they did not appear until that epoch had commenced, it may indicate that the submergence of the continent, uniting Peru to India, did not take place until a more recent period than at first sight we might imagine.

The opinion which is now most generally received regarding the North American Bears is, that they are different from the European; that the Grizzly is different from the Bear west of the Rocky Mountains, and that it again is distinct from the Mexican species. It is undeniable, however, that they are excessively close to each other, and it is probably only because the differences are more constant in America than in Europe and Asia, that the former are admitted as specific, while the latter are regarded only as varieties.

Originally the Brown Bear inhabited Britain,—so long ago, however, that historical evidence of their having done so is not easily procured; but, in the first place, Professor Owen says that the most recent formations in England contain remains which can scarcely be regarded as fossil, and which, if not perfectly identical with, indicate only a variety of, the same species, which is still common in many parts of the European continent.* In the next place, we learn from classical, at least Roman authors, that they were imported from Britain for the tragedies of the Roman Circus. Then Ray quotes authority for its being one of the Welsh beasts of chase; and, according to Pennant, it infested the mountainous parts of Scotland up to the year 1057. In an ancient Gaelic poem, ascribed to Ossian, the hero, Dermid, is said to have been killed by a bear in Beinn Ghiel binn, in Perthshire.†

There is, however, a later tradition, which I have little doubt is mythical or post-dated, viz. that one of the Gordons in Scotland, so late as 1457, received the king's commands to carry three bears' heads on his banner as his reward for his valour in slaying a fierce bear in Scotland.‡ The Bear also occurred in Ireland. Skulls and remains have been met with in peat-bogs and other superficial deposits. One fine cranium, $13\frac{1}{4}$ inches in length, was obtained in cutting a new channel for the river Boyne, in the barony of Carbury and county of Kildare, and is of peculiar interest from its resemblance to the Pyrenean variety of the URSUS ARCTOS, to which it has been referred by Dr. Carte, an eminent Irish osteologist, who examined it. The reader will remember that a portion (the south-western) of the Irish flora has a certain affinity to that of the Asturias in

* Owen's "British Fossils, Mammals, and Birds." 1846.

† "Statistical Account of Kirkmichael in Banffshire," by Rev. J. GRANT.

‡ "History of the Gordons."

the north-west of Spain: and that this is one of the grounds on which so much of the miocene Atlantis, as is implied in a western extension of Europe connecting these two lands, has been founded. The county of Kildare, however, is quite out of the line of the Spanish plants; but, on the other hand, we must remember that a Bear is more locomotive than a plant, and the variety of Bear which inhabited one part of the country would doubtless inhabit all.* It has long since been driven into the more inaccessible parts of the most mountainous districts in Europe. It was still found in Corsica in the sixteenth century.

The Racoon (Map 27), with one exception, Procyon cancrivorus, found in tropical America, is a North American plantigrade. Six species are known. It is replaced in South America by the Kinkajou (Cercoleptes caudivolvulus), and the Coatis, of which there are three. Three genera (each represented by only one species) represent those smaller plantigrades in the Old World, viz. the Binturong in Java, the Ailurus in Nepal, and the Osmotectes in the East Indian peninsula.

* Wilde "On the Unmanufactured Animal Remains belonging to the Royal Irish Academy," in "Transactions of the Royal Irish Academy," May, 1859.

MAP XXVIII.

SHOWING THE DISTRIBUTION OF SEALS.

Phoca Earless Seals.
Otaria &c Eared Seals
Both together

ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN

NORTH AMERICA
SOUTH AMERICA
EUROPE
ASIA
AFRICA
AUSTRALIA

GREENLAND
BAFFIN BAY
HUDSON BAY
ESQUIMAUX
RUSSIAN AMERICA
BRITISH AMERICA
UNITED STATES
MEXICO
CARIBBEAN SEA
PERU
BRAZIL
LA PLATA
PATAGONIA
LOW ARCHIPELAGO
SCOTLAND
IRELAND
ICELAND
LAPLAND
SWEDEN
NORWAY
FINLAND
RUSSIA
PRUSSIA
BALTIC
FRANCE
AUSTRIA
TURKEY
BLACK SEA
ASIA MINOR
PERSIA
INDEPENDENT TARTARY
MONGOLIA
MANDCHOURIA
CHINESE EMPIRE
THIBET
CHINA
JAPAN SEA
OKHOTSK SEA
KAMTCHATKA SEA
YELLOW SEA
HINDOOSTAN
ARABIAN SEA
BENGAL SEA
CHINA SEA
BORNEO
NEW GUINEA
NEW IRELAND
CAROLINE I.
MARIANA I.
NEW HEBRIDES
NEW CALEDONIA
FIJI I.
NORTH AUSTRALIA
WEST AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
TASMANIA
SOUTH GEORGIA
SOUTH SHETLAND
SOUTH ORKNEY
SOUTH SANDWICH I.
ASCENSION
ST HELENA
TRISTAN D'ACUNHA
MADAGASCAR
MAURITIUS
CAPE OF GOOD HOPE
CAPE DE VERDE I.
AZORES
CANARIES
MADEIRA
SAHARA DESERT
SOUDAN
ABYSSINIA
NUBIA
EGYPT
ARABIA
BENGUELA
BECHUANA
CAFFRARIA
ZANZIBAR
MOZAMBIQUE
ZULULAND
NATAL
KAFFRARIA
HOTTENTOTS
BOUCA
FEZZAN
ALGIER
MOROCCO
PORTUGAL
SPAIN
NUEVA GRANADA
ECUADOR
GUIANA
CALIFORNIA
TEXAS
NUEVA
GALAPAGOS I.
MARQUESAS I.
SOCIETY I.
SANDWICH I.
LOW ARCHIPELAGO
CAROLINE I.

Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn

ISOTHERMAL 32°

Day & Son Lithrs to the Queen.

CHAPTER XVII.

CARNIVORA *continued*—SEALS—EXTINCT SPECIES—EXISTING SPECIES—SEALS IN CASPIAN SEA AND LAKE BAIKAL—WALRUS.

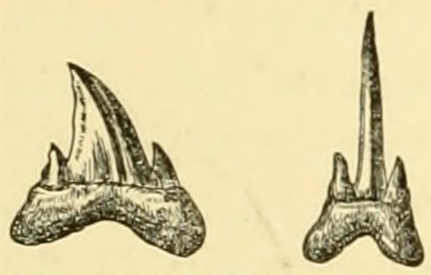
PHOCIDÆ.—SEALS. (Map 28.) The origin of marine mammals by descent, in other words their derivation or parentage, has always appeared to me one of the most difficult problems to solve. How a terrestrial animal could ever give birth to a Seal or a Whale,—how it could ever nurse it or feed it, naturally makes us pause and wonder. The very first and most essential qualification, of a common medium in which to live, seems wanting. The solution undoubtedly is to be arrived at through those terrestrial animals which are amphibious. When we come, however, to think of the steps and processes by which this creation may have been effected we find ourselves wholly at sea without compass or rudder. We do not even know at which end to commence our speculation. Were the aquatic animals descended from the terrestrial or the terrestrial from the aquatic? Although the probabilities seem in favour of the former, there is no fact known which wholly shuts out the possibility of the Seals having been in existence before the other carnivora. If they really were so, we might have to reverse the most natural theory, and make them the parents, instead of the descendants, of the land carnivora. The latter is the more natural theory, because it seems to stand to reason that the exceptional form should be derived from the normal rather than the reverse; although if pressed for a reason why one should be considered more normal than the other, I must candidly confess that I have none to give, except the very lame one that now the one is more numerous in species than the other.

I scarcely think it necessary to discuss the possibility of the Seals being allied to the Whales, although they are placed by many authors together.* Their plan of structure seems too decidedly distinct to allow us to regard them as belonging to the same stock.

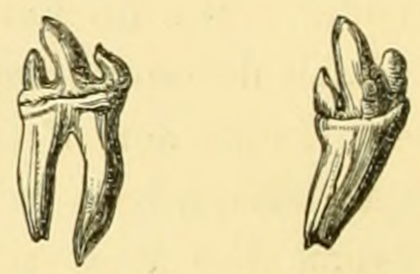
The first thing to guide us to a true understanding of the matter is to ascertain when the particular aquatic mammals inquired after first appeared on the face of the globe. If before other mammals related to them, the probability would be increased that they were the progenitors of their relations on dry land. But in the Seals we have not sufficient information to enable us to start even from this point. In the secondary formations mammals appear to have been merely starting into life; a few small marsupials in the Purbeck beds and trias being all that are known. And in the immense chalk deposits which succeeded these formations it is usually said that no mammalian remains have ever been found, and it is not easy to see how any remains of terrestrial mammals ever could have been found. These formations are all marine deposits, not even estuaries, but beds deposited out at sea in blue water. It would surely be a most extraordinary chance by which a terrestrial animal should be preserved in such circumstances; and a still more extraordinary chance that should allow us to lay our fingers upon such a waif. Seals, Whales, and Sirenia, are the only mammals whose remains we might (if these animals were in being at that epoch) reasonably expect to find traces of; and curiously enough the two former are the only two, remains of which have been ascribed to the secondary formations. A vertebra of a Dolphin and a tooth of a Seal are re-

* GIEBEL, "Die Saugethiere," &c. See Systems of Classification in the Appendix, No. I.

ported to have been found in the secondary greensand of New Jersey, in North America. Both are attended with very grave doubt, the specimen of the tooth of the Seal having gone a-missing; and the authentication of the locality of the other having been questioned, apparently on good grounds. The former was described and figured by Dr. Leidy under the name of STENORHYNCHUS VETUS, not from personal inspection but from a drawing of Conrad's.* The fossil was found by Samuel R. Wetherill, Esq., in the greensand, a mile and a half south-east of Burlington. Sir Chas. Lyell† tells us that that gentleman related to him and Mr. Conrad, in 1853, the circumstances under which he met with it, associated with *Ammonites placenta*, *Ammonites Delawarensis*, *Trigonia thoracica*, &c.; and he adds that although the tooth had been mislaid, it was not so until it had excited much interest, and been carefully examined by good zoologists. The doubt in the case of the cetacean applied to the locality where it was found, not to the determination. Here it is the reverse. There seems no reason to doubt that the tooth was found where Mr. Wetherill said it was, nor is there any question here of misplaced labels, but there is certainly room for doubting its determination, because we see where and how an error might easily enough have arisen. In the first place, it is referred to a living genus of mammals, and we know of no genus which has subsisted through so many cycles. The presumption is therefore against it on that score. In the next place, there is a certain resemblance between the teeth of Sharks and some Seals, and it is precisely in the genus STENORHYNCHUS that the resemblance is most marked. Figs. 1 and 2 represent the teeth of Sharks from the chalk; and figs. 3 and 4, teeth of the living STENORHYNCHUS LEPTONYX. Those of which I speak both have the molars compressed, with the crown divided into three conical spikes, of which the middle one is the largest. It is possible, therefore, that the supposed Seal's tooth may have been a very much rubbed and worn Shark's tooth; and although Lyell says it was carefully examined by good zoologists, the only one of known competence whom he mentions as having had to do with it is Dr. Leidy, who did not see it, but described it from a drawing.



Figs. 1 and 2.—Shark's Teeth.



Figs. 3 and 4.—Seal's Teeth.

The objections to the supposed mesozoic Seal's tooth, therefore, appear to be too well founded to require us to devote much time to a speculation founded upon its authenticity. The next most ancient deposit in which the remains of Seals have been found is the miocene. Assuming, then, that the genus dates from these more recent beds, we may adopt, as a starting-point, that the Seals have descended from terrestrial carnivora. From which then? From animals that are already half aquatic, or from others that are not so? Our first inclination certainly would be to look to species which had already performed the journey half-way from terrestrial to marine. There are two other carnivora which are in this position;—the Otter and the Polar Bear are amphibious, and we can easily conceive of either nourishing and bringing up an aquatic family. The claims of the Otter, although it bears some slight facial resemblance to a Seal, need not occupy so long. It is a modified Polecat, and to develope it into a Seal, we should require not merely to alter its habits of life, but to effect other modifications in its structure and, what also appears to me of importance in these questions, in its size. Size is an element in determining affinities which, although tacitly allowed a good deal of weight, is, I think, scarcely sufficiently recognised. As a rule giants do not beget dwarfs nor dwarfs giants. We would rather go to Brobdignag than to Lilliput to look

* See "Proceedings of the Academy of Natural Sciences of Philadelphia," 1853, p. 377.

† LYELL's "Elements of Geology," sixth edition, London, 1865, p. 336.

for the family circle of a Goliath. A mouse with the form and structure of an elephant would be an anomaly in nature. The machinery would not be adapted to the work to be done. The course of nature would have to be reversed, and a new flora developed to suit such an animal, instead of the animal having been modified to suit the flora. Bulk, therefore, may fairly be admitted to go for something in weighing affinities. What amphibious carnivora have we then of bulk approaching the Seal? None but the Bear. The Seal has been compared to the Dog; but we must remember that it is only the smallest species of Seal that we are familiar with. The Walrus and the majority of Seals are far beyond the dimensions of any dog. In addition, we have the resemblance in the various structural peculiarities already glanced at in alluding to Professor Owen's classification of the Bears and Seals. But, on the other hand, remains of Seals have been found in miocene formations, whereas those of the true Bears have not been found antecedent to the pliocene. No doubt the supposed ancestor need not have actually been a Bear. It may have been another animal allied to them, such as the AMPHICYON, which dates back in geological history at least as far as the Seal.

Although I have not refrained from hazarding a suggestion on this point, it is only as a speculative fancy, that I have done so; for, as already mentioned, the fossil remains hitherto found give us little information on the subject. They are scarce, and confined to the miocene and pliocene deposits. Six or eight extinct species are said to have been found, but, as is often the case, some of them may prove on closer examination not to be distinct. Dr. Mantell mentions that considerable numbers of bones and teeth of two species of Seal have been found in the superficial ornithic bone-beds of the north and middle island of New Zealand, which, although not examined by competent authorities are probably the remains of the two species STENORHYNCHUS LEPTONYX and PHOCA LEONINA, which now frequent the coasts of the islands,† in the same way that remains of the common Seal of our own seas, PHOCA VITULINA, occur in various recent local beds in Britain. It is rather remarkable that the tooth of a species named PH. OCCITANA by Gervais, which has been found in the pliocene marine sands of Montpelier, bears most analogy to the corresponding tooth of this same S. LEPTONYX of the Southern Seas.

The number of existing species is also few—not exceeding thirty in all—which have been divided by Dr. J. E. Gray* into thirteen genera. With the exception of two species that have been found in the West Indian Seas, the whole are confined to the colder regions of the globe. With one or two doubtful exceptions, those found in the southern hemisphere are different from those of the northern, and they are not only of different species, but belong to different sections. For our purposes, the following subdivision will suffice—1st. The Walrus, an aberrant form with semi-herbivorous habits.‡ Then the remainder may be divided into two sections—those with visible ears and those without them; the former being confined to the southern hemisphere and the northern Pacific; the latter to the Arctic regions and the Atlantic and European seas, with one or two outliers extending through Bhering's Straits and down by Kamschatka to Japan, and three or four forms peculiar to the Antarctic Seas, along with which, however, falls to be placed a species (MONACHUS ALBIVENTER) found in the Mediterranean, or rather in the Adriatic.

* MANTELL, G. A., "Petrifactions and their Teachings," 1851, p. 113.

† GRAY, J. E., "Catalogue of Mammalia in British Museum," 1850, ii. Seals.

‡ "I have frequently opened the stomachs of Walruses and found their food to consist of sand-worms, star-fish, shrimps, and of the shells of clams and cockles. I believe they also eat sub-marine algæ or sea-weeds; and Scoresby mentions having found the remains of young Seals in their stomachs."—LAMONT, *Seasons with Sea-horses*, 1861, p. 142.

Perhaps the most interesting circumstance in the distribution of the Seals is the existence of a species in the Caspian Sea, and another in Lake Baikal, notwithstanding that the latter is wholly fresh water, and that the former does not contain one-fourth of the usual saline contents of sea-water. The species in the Caspian (PHOCA CASPICA) is described as very nearly allied to our common PHOCA VITULINA, and that in Lake Baikal as equally close to PHOCA FŒTIDA (*Ph. annellata*, Nilss.), a species found in the North Atlantic; and but for their geographical position, no one would think of separating them from these species. In fact, the one *is* the PHOCA VITULINA, and the other the PHOCA FŒTIDA. Nilsson and Gray no doubt both consider them distinct, but I do not apprehend that either of them does so from actual observation, and it is scarcely possible to doubt that the peculiarity of the locality must have had some influence on their minds. On the other hand, Pallas, Gmelin, Fischer, and Radde, regard them as belonging to the two species they resemble, and Radde's personal experience must outweigh any foregone conclusion arrived at by others who have not had the advantage of seeing the animals themselves.

One's first impression is so much opposed to the possibility of such an occurrence as a marine animal inhabiting permanently a fresh-water lake, that we naturally expect that there must be some mistake about it, and that it may turn out that the animal is an otter, or some unknown species; but there is no room for doubt about the matter; it is notorious as a commercial fact, and your ledger is a sore destroyer of your theoretical assumptions. A regular seal-fishery has for long been carried on in both waters, and in Pallas' time the Baikal seal-fishery was of great importance, and, although much diminished since then, still, so late as 1859, forty individuals were killed at one village; and, to crown all, Herr Radde brought home with him a specimen from it; and no specific differences can be discovered between it and PHOCA ANNELLATA. The only difference is that it is of a uniform grey colour, instead of being more or less spotted. This variation, however, is also found in specimens from the North Atlantic.

Similar instances of other marine animals accommodating themselves to fresh water might be cited. There are species of Dolphins (essentially a marine genus) peculiar to fresh water. There is a species which is confined to the Ganges and another to the Indus, both wholly fresh-water rivers; another inhabits the Amazons; and the DELPHINAPTERUS LEUCAS ascends the Amour regularly on the breaking up of the ice, and penetrates to a distance of 400 miles up the stream. Mr. Spencer St. John mentions a similar fact as occurring with the Shark.*

Although the Seals are marine animals, they are not so absolutely so, as to render it abstractly improbable that they might accommodate themselves to a life in fresh water. The common Seal has been taken in the Firth of Forth above Alloa, where the water is no longer salt, and also far up in the estuary of the Tay. Another Seal, CALLOCEPHALUS NUMMULARIS, which is found in the North Pacific, ascends the mouth of the Amour. Dr. Bennett speaks of a STENORHYNCHUS LEPTONYX having been killed in 1859, in the fresh-water of Shoalhaven River in Australia, several miles above the influence of the salt water.† The HALICHŒRUS GRYPHUS, or Grey Seal, is found in the Baltic, as well as in the Northern Seas; and I have already noted the existence of a peculiar

* "It is a curious fact, that far as we are above the influence of the flood-tide, and with so many rapids below us, yet sharks are found here in fresh water. I call it a fact, because native testimony is unanimous. I remember hearing Mr. Crookshank say to the Datu Patinggi, the principal native chief, that he considered it a very curious thing that a fish supposed to live only in the sea should frequent these interior waters. 'Not at all,' answered the Datu; 'not more curious than seeing you English abandon your own country to come so far and live among us Malays.'"—SPENCER ST. JOHN, "Life in the Forests of the Far East." Second Edition, 1863, i. p. 147.

† BENNETT, GEORGE, "Gatherings in Australia," 1860, p. 167.

species in one part of the Mediterranean. We have thus instances in the Seals of species living in all the gradations between ordinary sea water and fresh water; first, those in the Atlantic itself, where the water is wholly salt; next, one in the Mediterranean, where it is scarcely less so; then another in the Baltic, a sea much less salt than the Northern Ocean outside the Cattegat; then one in the Caspian, which is still less salt; and, lastly, one in Lake Baikal, which is wholly fresh. The inference which one can hardly fail to draw from this, is that Lake Baikal and the Caspian were formerly bays of the Arctic Sea;* and that by an elevation of the land these bays were cut off from the open sea and converted into inland lakes, in which were respectively shut up the Common Seal and the PH. FŒTIDA, the one without any communication at all with the sea, the other with an outlet for its waters, but with barriers preventing the escape of the Seals.

When these salt-water bays were thus converted, that which had an outlet (Lake Baikal) must have continued salt until, in the course of time, from the constant inpouring of fresh water by streams and rivers falling into it, the water must have become fresher and fresher, until it has become what it now is; but the process has been so gradual, and the change from salt to fresh so imperceptible, and spread over so immense a period of time, that the animals have undergone a change in physical condition of life without ever being aware of it, or being affected by it, and they have become fitted for their new medium as imperceptibly, and by as slow degrees, as it itself has come into existence. Had the change been more rapid, according to my view, we should have had a new species instead of merely the old one. The process in the Caspian, which has no outlet, must have been still simpler, because the water continues salt, although somewhat altered in its chemical constituents,† and greatly fresher than the sea.

If the reader will look at the Map 2, which shows the countries that would be submerged by a depression of the land to the extent of 600 feet, he will observe how completely the Caspian Sea and Lake Baikal would in that event be continuous with the Arctic Ocean; and if by the rise of the land which is now going on in Denmark and Sweden, the Cattegat should be obliterated, and the Baltic turned into an inland lake, there might then be a repetition of what has taken place in Lake Baikal and the Caspian, and the HALICHÆRUS GRYPHUS be turned into a fresh-water specimen of the marine species.

The geographical distribution of the Seals is somewhat complicated by the fact that some, if not all of them, make periodical migrations, returning year after year, like birds, to their former abode. Speaking of a species of OTARIA, or Sea Lion, common near San Francisco, Dr. Newberry mentions having identified one, by a bullet found in it when killed, which had been shot at it the previous year at the same place.‡

Periodical migration thus takes place in these mammals as well as in birds; besides the Seals,

* It is but fair to point out that so high an authority as the late Dr. Falconer looks with doubt on such a connexion. He says, "It still remains to be proved that the Arctic Ocean of the glacial period ever invaded the Aralo-Caspian province, of which the Sea of Azof was a part. We have the authority of Woodward for the fact that the Aralo-Caspian basin contains only a single species (CARDIUM EDULE, var. RUSTICUM), common to it and the White Sea." (Manual of Mollusca, p. 431.) See FALCONER in "Nat. Hist. Rev." No. 9, Jan. 1863, p. 75.

† M. Eichwald states that sulphate of magnesia is a common salt in the waters of the Caspian Sea.—DE LA BECHE'S "Researches in Theoretical Geology." 1834, p. 14.

‡ "This specimen is of interest as illustrating, in one particular, the habits of these animals. The left zygomatic arch has been perforated by a bullet, and the lower part of the left inferior maxillary bone shattered by another; both these injuries having been received so long since that the action of the absorbents has almost smoothed the splintered edges of the bones. Inside of the wound of the zygoma was found the piece of lead which had caused it, and which was at once recognised, from certain peculiarities of form, as one which had been fired, without fatal effect, at a Sea Lion, on the same rocks, in the sum-

it occurs also in the American Bison, in the Lemming and some Rats. How far the phenomena are at all of the same nature in mammals as in birds we do not know; that of the Seal seems likest to the migration of birds, but its migrations, like that of the others, may be a mere matter of commissiariat.

Walrus (Map 28 *).—The Walrus is an animal essentially peculiar to the regions of the North Pole. It has never been seen alive further south than 60° N.L.; and 80½° N.L. is believed to be their highest latitude. Hamburg is the most southerly point on any part of the coast of the Atlantic where fossil remains of it have yet been found. Near that city these have been found in superficial deposits. It must have reached further south on the other side of the Atlantic, for remains have been obtained in New Jersey, Virginia, and Massachusetts. It has been said to have occurred in beds anterior to the present epoch, and Baron Cuvier has given to that last assertion the authority of his name in his great work: "After a fresh examination of the bones found at Angers, I have myself recognised a rib and a vertebra of a Walrus," &c.* But Gervais† has pointed out that there is reason to doubt this, as the only portion of these remains which is still accessible has been found to belong, not to the Walrus, but to the Halitherium (an extinct form of Sirenian).

It is one of the animals which, like the Rhytina and the Dodo, seem doomed to extinction at the hands of man; and, according to all appearance, the execution of the doom will not be long delayed. In former times its numbers in the localities which it frequented seem to have been very great. We learn from the voyage of Ohthere, which was performed about a thousand years ago, that the Walrus then abounded on the coast of Finmarken itself; it has, however, abandoned that coast for some centuries, although individual stragglers have been occasionally captured there up to within the last thirty years. After they left the Finmarken coast, Bear Island‡ became the principal scene of their destruction, but it in its turn was deserted, and none have been found there for upwards of thirty years; and now the Thousand Islands (south-east of Spitzbergen), Hope Island (a little further north, but still in the south-east corner), and Ryk Yse Island (still further north, but not half way to the northern extremity of the Islands), in their turn, after being frequented for years, have become very inferior hunting ground to the banks and skerries lying to the north of Spitzbergen.

Witsen mentions that in the year 1690 "Steuerman Iwanow (Steersman or Pilot,—I suppose equivalent to Captain Ivanoff) suffered shipwreck on the Schaparow Bank, in 71° N.L., near the coast of the peninsula which is bordered on the west by the Gulf of Obi, and was compelled to remain with his crew a year on the bank. They killed so many Walruses that their bodies formed a pile of 630 English feet in length, and as much broad, and six feet high; and they got 160 pounds weight of teeth from them."§

mer of 1854. We have thus a demonstration that these huge Seals return, in some instances at least, year after year to the same localities. They leave the Farallones in November and return in May, being absent about six months. How far they migrate during that interval, we have, at present, no means of determining. Newberry's "Report United States Pacific Railroad Exploration," vol. vi.; Zoology, p. 51. 1857.

* Cuvier, "Ossem. Foss."

† Gervais, "Zool. and Palæont. Français," 1859.

‡ Bear, or Cherie, or Cherry Island, is a diamond-shaped island, about ten miles long, composed of secondary rocks, principally sandstone and limestone, lying about 280 miles north of the North Cape. Its names are said to be due to some of the early Dutch navigators, on their way to China, once having seen a bear here, and to an English expedition sent out by Alderman Cherie, of London, afterwards erroneously fancying that they were the discoverers of the island, naming it after their patron.

§ Witsen, "Noord en Oost Tartarye," pp. 913, 915.

MAP XXVIII*

WALRUS

RHYTINA

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

GREENLAND

BAFFIN BAY

DAVIS STRAIT

HUDSON BAY

ESQUIMAUX INDIANS

RUSSIAN AMERICA

BRITISH AMERICA

NORTH CANADA

ALEUTIAN IS

VANCOUVER I

OREGON

NUEVA CALIFORNIA

UNITED STATES

TEXAS

G. of MEXICO

MEXICO

WEST INDIA IS

CARIBBEAN SEA

GUATEMALA

VENEZUELA

NUEVA GRANADA

GUAYANA

ECUADOR

PERU

BRAZIL

BOLIVIA

PARAGUAY

CHILI

PATAGONIA

LA PLATA

TIERRA DEL FUEGO

FALKLAND IS

SANDWICH IS

MARQUESAS IS

NAVIGATORS IS

LOW ARCHIPELAGO

SOCIETY IS

COOKS IT

ICELAND

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

SCOTLAND

IRELAND

ENGLAND

BALTIC

PRUSSIA

RUSSIA

FRANCE

AUSTRIA

TURKEY

BLACK SEA

ITALY

SPAIN

PORTUGAL

AZORES

MEDITERRANEAN

ASIA MINOR

CASPIAN SEA

PERSIA

AFGHANISTAN

PUNJAB

INDEPENDENT TARTARY

IRKUTSK

Altai M.

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

JAPAN IS

KAMTSCHATKA

ALEUTIAN IS

EGYPT

SAHARA DESERT

NUBIA

RED SEA

ARABIA

HINDOOSTAN

BIRMAH

ARABIAN SEA

BENGAL SEA

CEYLON

COCHIN CHINA

CHINA SEA

PHILIPPINE IS

BORNEO

CELEBES

JAVA

N. GUINEA

NEW HEBRIDES

NORTH AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW ZEALAND

CAFFRARIA

CAPE COLONY

MADAGASCAR

Day & Son (Limited) Lith

Kotzebue records that he saw thousands at the East Cape, in 51° N.L.* Cook saw "an inconceivable number on the ice." In Purchas "His Pilgrims," it is mentioned in an account of the voyage of the ship "God Speed," in 1608, to Bear Island, that they were found there "lying like hogges upon heaps." Mr. Lamont's account of a pack of them on ice shows how true a description of them this is: "13. At 3 A.M. this morning we were aroused by the cheery cry of 'Hvalruus paa Ysen' (Walruses on the ice!). We both got up immediately, and from the deck a curious and exciting spectacle met our admiring gaze! Four large flat icebergs were so densely packed with Walruses, that they were sunk almost awash with the water, and had the appearance of being solid islands of Walruses. . . . The monsters lay with their heads reclining on one another's backs and sterns, just as I have seen rhinoceroses laying asleep in the African forests, or, to use a more familiar simile, like a lot of fat hogs in a British straw-yard. I should think there were about eighty or a hundred on the ice, and many more swam grunting and sporting around, and tried to clamber up among their friends, who, like surly people in a full omnibus, grunted at them angrily, as if to say, 'Confound you! don't you see that we are full?'"† On another occasion he says, "There cannot have been less than three hundred in sight at once."‡

These crowds of animals are, however, the mere ordinary herds in which they habitually congregate, and doubtless they are much thinned from what they were in former times; but towards the end of the summer they pack like grouse. About the end of August, Mr. Lamont says, they usually congregate together in vast herds, sometimes to the number of several thousands, and all lie down in a mass in some secluded bay, or some rocky island, and there they remain in a semi-torpid sort of state for weeks together, without feeding or moving. I am tempted to quote a passage from Mr. Lamont's work, which gives one a better idea of their immense numbers than anything I have met with elsewhere, but it is too long, and I must refer the reader to the work itself. It will well repay perusal. It is the account of a massacre of one of these packs by two sloops' crews a few years ago. It appears that a pack of between three and four thousand Walruses—fancy three thousand or four thousand animals, as large as elephants, lying crowded along the beach!—had gathered together in a protected corner, in the south-westernmost island of the Thousand Islands. The two sloops found them there, got between them and the sea, and the crew deliberately set to work to slaughter them. They attacked them with lances, and after a long day's murderous work, they had killed nine hundred of them. It was wanton slaughter, because the two ships could not have carried away the produce of so many; but during the night, heavy ice made its appearance, cutting them off from the shore, which prevented their securing more than about two hundred. Seven hundred were lost, and their carcasses left on the beach. There they rotted, and there their bones still lie, and notwithstanding the distance of time, there the smell still lingers. Mr. Lamont says it would be a good speculation to freight a vessel for the bones.

Mr. Lamont calculates that about a thousand Walruses, and twice that number of bearded Seals, are annually captured in the seas about Spitzbergen, exclusive of those which sink or die of their wounds; so, he adds, it is clear that they are undergoing a rapid diminution of numbers, and also that they are gradually receding into more and more inaccessible regions farther north.

* KOTZEBUE, "Entdeckangsreise in die Sud See." I. S. 157.

† LAMONT'S "Seasons with Sea-horses," 1861, p. 74. ‡ Ibid. p. 66.

Mr. Alfred Newton, who has visited Spitzbergen still more recently, states that their numbers continue to decrease with woeful rapidity, being now almost confined to Spitzbergen and the Archipelago of Islands about it. "Now they are hemmed in by the packed ice on the one side, and their merciless enemies on the other. The result cannot admit of a doubt."* "Fortunately for the persecuted Walruses, however," says Mr. Lamont, "these latter districts (those to the north of Spitzbergen) are only accessible in open seasons, or perhaps once in every three or four summers, so that they get a little breathing time there to breed and replenish their numbers, or undoubtedly the next twenty or thirty years would witness the total extinction of Rosmarus Trichechus on the coasts of the islands of Northern Europe." He adds that there is no doubt that many of the Seals and Sea-horses frequenting the east part of the Spitzbergen coast come down from the north-east, and I have often suspected that Gillies' Land (a hilly country like Spitzbergen, which lies sixty or seventy miles to the north-east of Spitzbergen), or some other unknown country in that direction, must be the grand emporium which supplies them. A great many are known to exist about the north-east corner of Spitzbergen, which is rarely accessible. No vessel has ever succeeded in circumnavigating Spitzbergen; and although separate voyages have been made which overlap each other in this direction, still very little indeed is known about those parts of the Spitzbergen Archipelago marked in the charts as Nord ost Land and New Friesland.†

Like other Seals the Walrus migrates each year. Little is known as to the course of their migration, beyond that it is to the north in summer, and to the south in winter.

The most remarkable fact regarding their distribution is that it is not circumpolar. It is a common belief that the animal inhabits all the northern coasts. It is not so, however. Von Baer, who made a minute inquiry into the subject, and published the result‡ with a chart noticing every spot where they had been found (from which I have borrowed the map of their distribution—Map 28*), showed that they have two habitats widely separated from each other. Speaking roughly, these habitats are the part of the Arctic Sea north of the Atlantic, and the part of it north of the Pacific, leaving two great blanks, one on the north of Asia, and the other on the north of America. They are met with in the north of Hudson's Bay and in Baffin's Bay, and at the eastern entrance to Lancaster Sound, but they do not appear ever to make the north-west passage, or to penetrate by it to the northern shores of North America. No one has ever seen them there. They occur rather sparingly on the east and west coasts of Greenland. They are not found in Iceland, although an occasional wanderer has sometimes come to it as a guest. They never come near the north coast of Europe now. Bear Island knows them no more. We have seen how far they still frequent Spitzbergen and its islands. They are found, also, all along the western, or rather north-western, coast of Nova Zembla, but not on its inner or south-eastern shores; but, what is curious enough, they have penetrated round the south of the island, and occur along the northern coast of Asia, facing the south-eastern exposure of Nova Zembla, where, however, they are not met with. They do not follow this coast, however, further than the River Jenesei; beyond that there is an immense tract without them. They reappear, however, at the East Cape, or Cape Vostotchni, near Bhering's Straits and facing Point Barrow (the two Capes, Cape Vostotchni and Point Barrow forming respectively the eastern and western door-posts of Bhering's Straits on the north), and are there found occupying

* Newton, in "Proc. Zool. Soc.," 1864. p. 500.

† Lamont, op. cit. pp. 177, 182.

‡ Von Baer, in "St. Petersburg Mem. Acad. Scient. Imp. 6th Ser. vol. iv.

the straits and the shores between these capes, as well as the shores to the south of the Straits, as far as the Aleutian Islands. Their numbers are perhaps greater about Bhering's Straits now than anywhere else, as they appear to form the chief resource of the inhabitants from Point Barrow to Bhering's Straits. They do not resort to the Aleutian Islands themselves, they having been there—at least on those of the islands next to Asia—replaced by the RHYTINA; and although that Sea Cow has ceased to exist, the Walrus seems to have respected former boundaries, and not to have intruded on its neighbour's territories, although the proprietor could never again come to maintain his rights or resist encroachment, a respect for the rights of property not always found in animals higher in the scale of life.

CHAPTER XVIII.

HOOFED-MAMMALS—(UNGULATA).—CLASSIFICATION.

The old-fashioned classification of the hoofed animals with which the older reader is familiar is—1. the Pachyderms, including Elephant, Rhinoceros, Tapir, Hippopotamus, Sow, &c.; 2. the Solidungula, or Horses; and 3. the Ruminants. Professor Owen, following the idea originally expressed by Cuvier, and confirmed by De Blainville, has in his new classification considerably modified this arrangement. He has in it separated those which have an odd number of toes and nineteen dorso-lumbar vertebræ from those with an even number of toes and a greater number of dorso-lumbar vertebræ than nineteen. The latter he styles Artiodactyla, and the former Perissodactyla, —equivalent to Cuvier's Paridigitata and Imparidigitata.

As an artificial arrangement nothing could be better. It combines simplicity and clearness to such a degree that any one who is sufficiently advanced in arithmetic to be able to count two, or to know odd from even, may range every species in the section allotted to it the moment he sees its feet.

The result of the arrangement is to separate the aberrant forms of Pachyderms (the Hippopotamus, Peccary, and Sow), from the typical (the Elephant, Tapir, Rhinoceros, and Horse), and to unite them to the Ruminants through the Chevrotains and Camels.

This seems in accordance with Nature, but when Professor Owen in subdividing the Artiodactyles commences with what he calls the Omnivora (the Swine and Hippopotamus),—a qualification (omnivorous), by the way, quite inappropriate to the Hippopotamus, which is in no respect omnivorous, but entirely vegetarian,—he separates by the intercalation of the Ruminants two closely allied groups; his arrangement being thus, Hippopotamus, Ruminants, Horse, Rhinoceros, Elephants, &c. The points of relationship which the Omnivora have to the Ruminants, however important, are not more numerous nor important than those with the true Pachyderms; and it is with reluctance that I see the Hippopotamus, Peccary, and Sow, carried away to a distance from the Rhinoceros and Tapir. I have considerable faith in outward appearance as a guide to affinity. No doubt appearances are often deceptive; but it is the exception when they are so, not the rule. For once that they deceive, they hundreds of times tell the truth.* I cannot

* Such a superficial *ad-captandum* resemblance is a monstrosity which is not uncommon in Swine, and which is very suggestive of affinity between the Proboscidean Pachyderms and the Sow. In it the snout is separated from the face, and grows out from the forehead immediately above the eyes, somewhat like an elephant's trunk. It absorbs the skin between the eyes, which thus stand hideously goggling close to each other without separation, or sometimes become united into one, making the poor beast a cyclops. Although a physiological monstrosity which, for aught that appears, might occur equally well in the human fœtus, or any other animal, it does not happen to any that I know of but the Sow: and I have observed that such an illustration as this impresses the mind of the non-scientific observer with greater conviction of affinity than more legitimate physiological reasons.

make up my mind to separate these so-called Omnivora from the rest of the old Pachyderms. But if I escape from Scylla (this difficulty), by reversing the order in which Owen has placed the Artiodactyles, and putting the Ruminants at their head instead of the Hippopotamus, taking them in the order of Ruminants, Hippopotamus, Rhinoceros, Elephant, Horse, I fall into Charybdis (another difficulty with the Horse), which ought not to be separated far from the Ruminants. Owen escapes Charybdis by placing the Horse at the head of the Pachyderms, as above noticed, and the Ruminants at the end of the Artiodactyles, by which means he brings these two families (Horses and Ruminants) together, but then the result of doing so is that he separates the two tribes of Pachyderms. I see no way of escape from this dilemma but by reverting to the old arrangement, and keeping the Horse as a separate and distinct family of equal value to the Ruminants.

It is to be remembered that we are at the commencement of a new thread, and are not hampered by the necessity of reconciling anything to the past. Between the Seals and the hoofed-mammals there is an absolute break. We may therefore commence with what we please, and I have taken that group which I think gives the best and most uninterrupted connexion with those which follow.

The arrangement which I adopt is the following, viz.:—

Ungulata.

1. Monodactyla—(*Solidungula*) Horses, &c.
2. Artiodactyla.
    1. *Ruminants* — Camels — Oxen — Sheep — Antelopes — Cameleopards — Deer — Musk-Deer and Chevrotains.
    2. *Anoplotheridæ.*
    3. *Non-Ruminants*—Swine—Hippopotamus.
3. Multungula.
    1. *Palæotheridæ.*
    2. *Nesodontidæ.*
    3. *Tapiridæ.*
    4. *Nasicornia.*
    5. *Proboscidea.*

CHAPTER XIX.

HOOFED-MAMMALS *continued*— HORSES.

First Group.—Monodactyla.—Horses and Asses (Solidungula).—(Maps 41 and 42.) Some authors (as Col. H. Smith) maintain that there still remains sufficient authority for the presence of wild Horses in a state of nature, under one or other of their primæval forms, eastwards from the south and west of Europe, where they assume in their characteristics the same preference for opposite habitations in plains or in woody mountains, which we now perceive to be the leading distinction of the Zebra and the Dauw.* He himself, however, admits that some of the accounts on which he depends as a warrant for the accuracy of his statement refer to the Wild Ass; others to the Koomrah; and the whole seems too misty for any reliable conclusion to be drawn from it. The general opinion no doubt is, that the Horse is of African or Arabian parentage, although, as Col. H. Smith says, it is strange, if that be the case, that none are noticed in Morocco, Arabia, Persia, or India. The truth is, that the origin of the Horse, like that of every other domesticated animal, is involved in obscurity. We know that Horses existed in the Old and the New World both previous and subsequent to the glacial epoch; but neither physical resemblance, nor past history, warrant us in pointing to one race more than another of these tertiary species as the origin of the existing Horse.

Setting aside the domestic Horse, and looking at the various other species of the genus, inclusive of the extinct fossil species, we find that the only parts of the world where Horses or their remains have not been found, are Australia and the Oceanic Islands.

Extinct species are known belonging to three genera of Horses (Hipparion, Hippotherium, and Equus). Two of these are confined to the tertiary strata; and the third, containing species which approach most to the living Horse, is found in the drift or post-glacial deposits of a recent period.

Three extinct species of Equus, E. Namadicus, E. Sivalensis, and a third not distinguishable (according to Giebel) from Hippotherium gracile, have been found in the miocene Sevalik deposits by Falconer and Cautley.

With regard to the genus Hippotherium, Professor Owen remarks, "that it links on Palæplotherium with Equus."†

The post-glacial species have been described under many names; as Equus fossilis, E. Adamiticus, E. priscus, E. brevirostris, E. pristinus, E. magnus, E. juvillaceus. But Dr. Giebel states, that after a careful comparison of very rich materials,‡ he had become perfectly convinced,

* Ham. Smith, in "Naturalists' Library." † Owen's "Palæontology," p. 344.
‡ Giebel, D. C. G. "Die Saugethiere," p. 382. Leipzig, 1859.

MAP XLI.

HORSES & ASSES.

Wild Ass — *Common Zebra*

Hemionus — *Quagga*

Ghorkar — *Burchell's Zebra*

Kiang

MAP XLII.

HORSES & ASSES.

BOTH LIVING & EXTINCT.

Extinct Species

Living Species. where not introduced

Day & Son (Limited) Lith.

that not only all these supposed species belonged to one and the same, but that that one was the common domestic Horse.

The occurrence of distinct species in America is very interesting, considering their subsequent extinction, and the rehabilitation of the common species by man both in South and North America. More than one species has been described, but at least one lived, both in North and South America. The first trace of it was discovered by Darwin. In his "Journal of a Naturalist," he mentions having discovered, in the Pampean deposit at Bajada, one tooth of a Horse in the same stained and decayed state as the remains of a Mastodon and Toxodon, as well as of a gigantic armadillo-like animal. This tooth greatly interested him, for it was well established that no Horse was living in America at the time of Columbus, and no remains of any had previously been found; and he was not then aware that amongst some other fossils which he had himself procured at Bahia Blanca, there was a Horse's tooth in the matrix; nor was it then known that the remains of Horses are common in North America. Mr. Lyell (now Sir Charles) had, however, then lately brought from the United States a tooth of a Horse; and it is an interesting fact, that Prof. Owen could find in no species, either fossil or recent, a slight but peculiar curvature characterizing it, until he thought of comparing it with Mr. Darwin's specimen from the Pampas,—when he found the two to correspond. He named this American Horse Equus curvidens. Certainly, as Mr. Darwin says, it is a marvellous fact in the history of the Mammalia, that in South America a native Horse should have lived and disappeared, to be succeeded in after ages by countless herds, descended from the few introduced by the Spanish colonists.

Certainly it is so; but that is not the only noteworthy thing about it. It is remarkable that it should be found in North America, and is one of the proofs that there must not always have been such a barrier against the mutual intercommunication of species north and south of Mexico as appears to have at one time existed. The history of the species interred in the Mauvaises Terres cemetery have already taught us to expect this, and the Horse is only one of many other instances proving it.

Another curious fact, looking to the South American habitat of the Equus curvidens, is, that the nearest existing species to it, after the domestic Horse, is the Quagga, which inhabits the most southern parts of South Africa. More than one instance of affinity between species found in the south of South America and the Cape of Good Hope, have already made us think of how the space between them could be best bridged over.

In addition to the Equus curvidens above mentioned, there is an E. Americanus, and Lund discovered in the caverns of Brazil remains of two species, E. principalis and E. neogeus, and a doubtful one.

The number of the living species of this family is very limited. Besides the domestic Horse Giebel allows only five species; but Mr. Edward Blyth, who has paid much attention to the family, gives pretty strong arguments for admitting seven,* besides the domestic Horse. Without going into the grounds on which he rests his opinions, I shall simply recapitulate the results at which he has arrived, and the limits which he assigns to the range of each, adding another species not noticed by him, which was discovered by Henglin in Abyssinia.

1. Equus Quagga. The Quagga from South Africa, scarcely found northwards of the Gariep or Orange river; but still in great herds southwards, associating with the white-tailed Gnu, as

* Blyth, Ed., "On the different animals known as Wild Asses," in "Journal of Asiatic Society," vol. 28, 1860, p. 229.

the next species does with the brindled Gnu, and both with Ostriches (as in Xenophon's time the Asinus hemippus did in Mesopotamia.)

2. Equus Burchellii, *Gray*, may be called the Zebra of the plains, in contradistinction to the next, which is a mountain species. Extensively diffused over Africa, even to Abyssinia and to Congo, and southward to the Gariep river.

3. Equus Zebra, *Auct.* The Zebra of modern nomenclature, more properly the Mountain Zebra, and more completely striped than any of the rest—known only to inhabit South Africa.

4. Equus vulgaris, *Gray*. The True Onager, or aboriginal Wild Ass. Indigenous to North-East Africa, if not also to the southern parts of Arabia, and Island of Socotra.

5. Equus hemippus, *Is. St. Hil.* The Hemionus or Hemippus of the ancients; inhabits the deserts of Syria, Mesopotamia, and the northern parts of Arabia.

6. Equus onager, *Pall.* The Koulau or Ghorkur. Inhabits West Asia from 48° North Lat. southwards to Persia, Beloochistan, and West India.

7. Equus hemionus, *Pall.* The Dshiggetai or Kiang. It inhabits Thibet, and thence northwards through the Gobi Desert into Mongolia and Southern Siberia, and as far eastwards as the Sea of Japan. Major W. E. Kay * states that they are to be met with in all the level country between Ladak and Lassa, or in the valleys between the various ranges. He himself saw them only north of the Himmalayah range, first upon the Rupcher plains, and in the neighbourhood of the salt lakes, often in company with the Ovis Ammon. They affect plains and undulating hills at from 15,000 to 16,500 feet above the sea; if found in steeper country they have been driven there.

8. Equus taeniopus, *Hengl.* Abyssinia and the highlands of Eastern Africa.

9. Equus caballus, *Auct.* Domesticated everywhere.

* "Proc. Zool. Society," 1859, p. 354.

MAP XXXIX

CAMELEOPARDS

Living Species

Extinct Species

MAP XL.

CAMELS.

Extinct Species

Existing Species

Day & Son Limited Lith.

CHAPTER XX.

HOOFED-MAMMALS *continued*—RUMINANTS—CAMELS—OXEN.

Second Group.—Artiodactyla.—Ruminants.—I shall not occupy much of the reader's time in discussing the classification of the members of this family. Professor Owen has not spoken. But of the various authors who have expressed an opinion upon it, I think I have derived most benefit from some brief remarks by Dr. Leidy, in his "Extinct Fauna of Nebraska,"* and a recent paper on the Moschidæ and Tragulidæ, by Dr. Alphonse Milne Edwards, in which he has incidentally discussed the affinities of the different groups,† I shall not, however, adopt the exact arrangement of any one.

I shall commence with the Camels for the sake of their points of connexion with the Horse, then take the Oxen; pass from them to the Sheep and Goats, to the latter of which I unite the Caprine antelopes; from them to the Antelopes proper, commencing with the Bubaline species, and so through that family to the Camelopards and Deer, the separation of the former of which from its allies, the Deer and Antelopes, is, I think, one of the objectionable points in Alphonse Milne Edwards' arrangement (he placing them between the Camels and the Oxen). I then lead through the Chevrotains to the Anoplotheridæ, which furnish a natural transition to the Swine in the next family.

On inquiring into the distribution of the Ruminants we find a remarkable difference between their numbers in the Old World and in the New, as they abound in some parts of the former, and are almost totally absent in the latter. The same peculiarity is observed in the non-ruminant Artiodactyles (Owen's Omnivora), a circumstance which strengthens the view that they should not be far separated from each other.

Camels (Camelidæ). (Map 40.) We should be sadly at a loss to explain the distribution of this family were it not for the assistance of the Palæontologist. The range of the different existing species is so restricted, and separated by such vast distances, that we should never have been able to connect the different links together but for the happy discovery of fossil remains of extinct species.

One of the existing species, or two, according as the Dromedary is reckoned distinct or not, is confined to the heart of the Old World, in the very centre of the land, and the remainder of the family is shunted off to the extremity of South America and the range of the Andes; the one restricted by its conformation and constitution to dry and sandy deserts, the other fitted for a temperate if not a cold climate, for lofty elevations, and rejoicing in the drenching mist, and

* Leidy, Joseph. "Extinct Fauna of Nebraska," 1853, p. 17.

† "Récherches anatomiques, zoologiques, et palæontologiques sur la famille des Chevrotains," par Alphonse Milne-Edwards, in "Ann. des Sciences Naturelles." Ser. 5, Vol. iii. Paris, 1864.

bracing air of snowy peaks. The fossil remains which enable us to reconcile the affinities of these members of the same family with their distribution, and to explain how they come to occupy such widely separated and dissimilar positions, to do so are few and far between, and occur a long way back in the history of the globe, but, like the twinkling of a little candle, throw their beams far into the darkness of the night.

The Camel is a very ancient beast, one of the oldest, if not the oldest, species of mammal now living on the face of the earth, and it has apparently always been, as at present, a servant of man. Other domesticated animals,—the dog, the elephant, the horse, the ox, and the sheep—have, with greater or less success, been referred by naturalists to their original wild types; but all attempts to do so with the Camel have stopped short at the threshold, from the simple fact that it is sole and singular, and has no allies in the hemisphere in which it is found, nor have any wild examples of its own genus ever been met with. The first accounts of it in, perhaps, the oldest book in the world (Job) speak of it as domesticated, and there are no records of its ever having been otherwise. But Sir Proby Cautley and Dr. Falconer discovered in the Sevalik formations in the Himmalayahs remains of it or of species (they think there are two) so closely allied to it as to be scarcely distinguishable from it. As the difference is so slight, it pleases us to think that we may have here, in this most ancient animal, a species which saw the miocene epoch, and which has survived all the chances and changes which have taken place since then.

Subsequent to that time another well-marked species also existed—the huge Merycotherium, a monster, a giant, a Camel as big as a Camelopard. Possibly it may have been contemporaneous with the Camel during the miocene epoch, but traces of it have only been met with in the Siberian drift. This may fairly be held to extend the range of the Camelidæ to the eastern bounds of Asia, and we find it taken up on the other side of the Pacific by the genus Camelops, found in Kansas, and the genera Pro-Camelus and Leptauchania, from the Mauvaises Terres on the Missouri, and carried down into Brazil by extinct species of the Guanaco, remains of which were found by Dr. Lund in the caverns of Brazil.

The two existing Camels affect somewhat different climates and countries. The single-humped Camel, or Dromedary, also known as the Arabian Camel, is used over the whole of the south-west of Asia and north of Africa, and as far south and west as the river Niger. The two-humped, or Bactrian Camel, is the prevailing species in the somewhat colder regions to the north and east of the country of the Dromedary. It extends across Asia to China, has been introduced into India, and reaches as far north as the Caspian Sea, and as far west as the Black Sea and the Crimea. Both species occur in Persia, Bokhara, &c., and they are there crossed with each other, and the offspring is said to be sometimes fertile. It has been also introduced into Australia, where it has been found less useful than was expected.

The Llama, &c. The existing South American representatives of the Camel consist of four species,—the Llama, the Paco or Alpaca, the Guanaco, and the Vicuna. The Llama and Alpaca are kept as domestic animals,—the former perfectly, the latter partially, tame. They have continued so from the time of the Incas, who held them in the highest esteem. They are found all along the Andes, from the Straits of Magellan to the north of Peru; but the Guanaco, which is the largest, and has been erroneously supposed to be the wild ancestor of the domesticated Llama, dwells also in herds on the desert plains of Patagonia, and in the south-eastern parts of Tierra del Fuego. It was not known that they extended farther south than the Straits of Magellan until the expedition of the Beagle; and the officers of that ship first had their attention drawn to

them by finding the natives of the southern part of eastern Tierra del Fuego, well supplied with Guanaco skins, and with the bones of these animals made into spear-heads. Where they got the Guanaco skins was a question not easy to answer. Was there a passage to the northward, by which they could trade with the people living there? or were there Guanacoes in the southern part of Tierra del Fuego? Both the bones and skins seemed abundant; but the people made signs that they came from the eastward; none pointed towards the north. One native showed how they ran, and their shape, and how they were killed, also the kind of noise they made;* and not long after, on landing at Windhond Bay on Navarin Island, they saw four fine Guanacoes feeding close to the water. They appeared to be much larger than those they had seen on the Patagonian coast, their bodies being far heavier, and their tails longer and more bushy.† They killed one, but do not seem to have examined it or preserved it in order to see whether it was not a new species, which it might very well be, considering the difference in the conditions of life between the dry desert plains of Patagonia and the rainy and snowy climate of Tierra del Fuego.

The Alpaca has been introduced into Australia in spite of almost insuperable obstacles in getting them out of Peru and transferred to Australia. The greatest difficulty, however, has, I fear, yet to be overcome, namely, that of naturalizing an animal in a country and climate the conditions of which are not suited to his constitution.

The Vicuna is the rarest, and frequents the most lofty ridges of the Cordilleras, avoiding, however, the naked rocky summits, for its hooves are soft and tender and suited only to the springy turf of the upland pastures.

Remains of two species of another remarkable extinct genus, the Macrauchenia Patachonica and M. Boliviensis; which were at first thought to have a certain amount of affinity to the Guanaco, have also been found in the country now inhabited by that animal. Its supposed affinity, however, is now considered by palæontologists to be an error. According to Burmeister the animal was a Pachyderm, and the connexion with the Camels is only analogical, or distant.

Oxen. (Bovidæ.) (Map 37.) The distribution of Oxen furnishes a noteworthy instance of the rule that two species of powerful mammals in the same group are rarely found in the same district. In the Bovine animals this rule seems without exception. I have thus been able, in the map of this family, to define tolerably distinctly, by different colours, the limits of each different species—(under deduction always of the Domestic Ox and its varieties, which is now found over the whole world).

The different recognised species of cattle and their ranges are the following:—

1st Section. Musk Ox. (Ovibos.) (Maps 36 and 37.)

The Musk-ox, is now confined to Melville's Island, and the neighbouring country in the Arctic regions, and the plains bordering on Hudson's Bay, but not reaching its shores. Hearne observed the tracks of one near Fort Churchill, in 59° N. lat., and many in lat. 61°. They are rarely to be seen in any number further to the south than lat. 67° N. Although so completely an Arctic animal, it is restricted to North America, and does not extend to Greenland, notwithstanding that country is so near its natural habitat. At the same time it is to be noted, that although not an inhabitant

* Fitzroy's "Voyages of the Beagle," April, 1830, vol. i. p. 430.

† Op. cit. p. 439.

of Greenland, the Musk-ox *has* reached that land. Otho Fabricius records the Yak, "Bos GRUNNIENS," as having once occurred on the ice in the Greenland Seas; but from his description it is plain that the animal was a Musk-ox. "I myself," says he, "once saw the injured cranium (one horn only remaining), the hooves, and very long black hair, woolly at the base, of this animal, which had been found upon fragments of ice in the Sea of Greenland. Certainly, however, it has not its domicile in Western Greenland, nor perhaps in Eastern, but I should suppose it rather to have come with ice from the shores of Northern Asia, the remains having been eaten by the Polar Bear."* He does not say on which side of Greenland the specimen was met with, but from his residence at Disco, as well as from the terms in which he speaks of it, it would rather appear to have been on the west side, that is, the side nearest to its native habitat. It is as if he said, "Notwithstanding the circumstance of this specimen having been found on the western side, I can vouch for its not being an inhabitant of that side, but I cannot speak with the same confidence of the east, with which I am less familiar, but I should suppose," &c. It had doubtless been floated off on a detached floe from America, and been killed and eaten by Polar Bears.

Reichhardt† states that the Musk-ox comes rarely from Melville Island to Greenland, but as, like Fabricius, he gives it the name of Bos GRUNNIENS, it is perhaps not uncharitable to suspect that he says so on the authority of the instance given by that author.

It must have existed in the Old World long after the glacial epoch, and has left evidence of its existence in England, France, Belgium, Germany, and most of middle Europe. Its presence in these countries is fair evidence that the climate must have been colder there than now. Skulls have been found in the drift at Merseburg, on the Lena, and at Ob, Tundra, &c. In America it occurs fossil at Eschscholtz Bay, and remains have been found on the Mississippi and other southern localities, but in no deposits older than the glacial epoch. Besides the present, another fossil species (Bos PALLASI, *Dekay*) (some authors say several fossil species) has been found in various parts of North America, Siberia, and westwards, into Middle Europe. Some fossil remains of Oxen found in various parts of the United States, approximating in many respects to the Musk Ox, have received from Dr. Leidy the generic name of BOOTHERIUM.

2nd Section. BISONS. (BISON.) (Map 37.)

The NORTH AMERICAN BISON is found on the slopes and plains east of the ridge of the Rocky Mountains. According to Dr. Newberry, its range does not now extend beyond the Rocky Mountains; but there are many Indian hunters who have killed them in great numbers to the west of the mountains, on the headwaters of Salmon River, one of the tributaries of the Columbia. In his "Zoological Report," already cited, he says, "While I was at the Dalles, the party of Lieut. Day, U.S.A., came in from an expedition to the Upper Salmon river, and I was assured by the officers that they had not only seen Indians who claimed to have killed Buffaloes there, but that in many places great numbers of Buffalo skulls were still lying on the prairie.

"This is another instance of the penetration of animals, characteristic of the Upper Missouri through into the basin lying between the Rocky Mountains and Cascades. The Mule and White-tailed (Virginian?) Deer, the Musk-rat, Townsend's Hare, the Striped Spermophile (*S. lateralis*), &c.,

* FABRICIUS, OTHO, "Fauna Grœnlandica," p. 28. 1780.

† REICHHARDT, "Isis," 1848, s. 248. SCHMARDA'S "Geograph. Verbreitung," 1853, 370.

MAP XXXVII.

BOVIDÆ

Musk Ox ..... *Gaour* .....
Bison ..... *Gayal* .....
Auroch ..... *Bentang* .....
Bosbrachyceros .....

ARCTIC OCEAN
BAFFIN BAY
GREENLAND
ISOTHERMAL 32°
Arctic Circle
ESQUIMAUX
RUSSIAN AMERICA
INDIANS
CUMBERLAND
HUDSON BAY
Davis Strait
ICELAND
LAPLAND
NOVAYA ZEMBLA
NORWAY
SWEDEN
FINLAND
Ural M.
SIBERIA
BRITISH AMERICA
NORTH CANADA
ALEUTIAN Is
VANCOUVER I.
OREGON
NORTH AMERICA
UNITED STATES
NUEVA CALIFORNIA
TEXAS
GULF OF MEXICO
MEXICO
WEST INDIA Is
CARIBBEAN SEA
NORTH PACIFIC OCEAN
SANDWICH Is
NORTH ATLANTIC OCEAN
Tropic of Cancer
SCOTLAND
IRELAND
EUROPE
RUSSIA
PRUSSIA
BALTIC
FRANCE
AUSTRIA
TURKEY
BLACK SEA
INDEPENDENT TARTARY
MONGOLIA
AZORES
PORTUGAL
SPAIN
MEDITERRANEAN
ASIA MINOR
CASPIAN SEA
PERSIA
AFGHANISTAN
PUNJAB
THIBET
CHINESE EMPIRE
CHINA
JAPAN SEA
SAHARA DESERT
EGYPT
NUBIA
RED SEA
ARABIA
ARABIAN SEA
BENGAL SEA
CHINA SEA
CEYLON
BIRMAH
BORNEO
CELEBES
PHILIPPINE Is
NEW GUINEA
Equator
AFRICA
NUEVA GRANADA
GUAYANA
ECUADOR
PERU
BRAZIL
SOUTH AMERICA
BOLIVIA
CHILI
LA PLATA
PATAGONIA
TIERRA DEL FUEGO
FALKLAND Is
Tropic of Capricorn
SOUTH ATLANTIC OCEAN
MADAGASCAR
CAPE COLONY
CAFFARIA
INDIAN OCEAN
N. AUSTRALIA
AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VANDIEMEN
NEW HEBRIDES
NEW ZEALAND
MARQUESAS Is
LOW ARCHIPELAGO
SOCIETY Is
COOKS Is
NAVIGATORS Is
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN

Day & Son (Limited) Lith.

MAP XXXVIII.

SHOWING DISTRIBUTION OF BUFFALOES.

(INCLUDING THE YAK)

Cape Buffalo
Indian Buffalo (original habitat)
D° *D°* *spread by introduction*
Yak

ARCTIC OCEAN
BAFFIN BAY
GREENLAND
ISOTHERMAL 32°
Arctic Circle
ESQUIMAUX
RUSSIAN AMERICA
INDIANS
CUMBERLAND
HUDSON BAY
Davis Strait
ICELAND
LAPLAND
NOVAYA ZEMBLA
NORWAY
SWEDEN
FINLAND
Ural M.
SIBERIA
BRITISH AMERICA
NORTH CANADA
ALEUTIAN Is
VANCOUVER I.
OREGON
NORTH AMERICA
UNITED STATES
NUEVA CALIFORNIA
TEXAS
GULF OF MEXICO
MEXICO
WEST INDIA Is
CARIBBEAN SEA
NORTH PACIFIC OCEAN
SANDWICH Is
NORTH ATLANTIC OCEAN
Tropic of Cancer
SCOTLAND
IRELAND
EUROPE
RUSSIA
PRUSSIA
BALTIC
FRANCE
AUSTRIA
TURKEY
BLACK SEA
INDEPENDENT TARTARY
MONGOLIA
AZORES
PORTUGAL
SPAIN
MEDITERRANEAN
ASIA MINOR
CASPIAN SEA
PERSIA
AFGHANISTAN
PUNJAB
THIBET
CHINESE EMPIRE
CHINA
JAPAN SEA
SAHARA DESERT
EGYPT
NUBIA
RED SEA
ARABIA
ARABIAN SEA
BENGAL SEA
CHINA SEA
CEYLON
BIRMAH
BORNEO
CELEBES
PHILIPPINE Is
NEW GUINEA
Equator
AFRICA
NUEVA GRANADA
GUAYANA
ECUADOR
PERU
BRAZIL
SOUTH AMERICA
BOLIVIA
CHILI
LA PLATA
PATAGONIA
TIERRA DEL FUEGO
FALKLAND Is
Tropic of Capricorn
SOUTH ATLANTIC OCEAN
MADAGASCAR
CAPE COLONY
CAFFARIA
INDIAN OCEAN
N. AUSTRALIA
AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VANDIEMEN
NEW HEBRIDES
NEW ZEALAND
MARQUESAS Is
LOW ARCHIPELAGO
SOCIETY Is
COOKS Is
NAVIGATORS Is
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN

Day & Son (Limited) Lith.

seem to indicate that the Cascades present a more formidable barrier for the limitation of species than the Rocky Mountain chain."*

A closely allied fossil species, B. BOMBIFRONS, has been found in the post-glacial and recent deposits on the Ohio.

The Old-world representative of this species—the URUS or AUROCH,—formerly extended all over Middle Europe, the Caucasus and the Carpathian Mountains, but is now restricted to a district in Lithuania, where its existence is prolonged solely by the care of the Russian Government.

A fossil species allied to this (Bos PRISCUS), and intermediate between it and the American Bison (perhaps the ancestor of both), has been found in various localities in the post-glacial deposits of the North of Europe and Siberia. Information as to its existence in Eastern Siberia is wanted. There is a wide gap between the habitats of the two living species.

3rd Section. BUFFALOES (BUBALUS). (Map 38.)

The Buffalo belongs to the Africano-Indian region, there being two African and two Indian species, and the intimate connexion between those known as the Cape and Indian Buffaloes, is a powerful argument in favour of there having been a former connexion between these two countries.

INDIAN BUFFALO.—Although now to be met with in various other parts of Asia, the Buffalo is believed to have originated in India,—according to Mr. Blyth, in the sub-Himmalayan forests, whence he thinks it has spread into other suitable localities, such as the great swampy jungles of India. I do not know the ground on which he rests this opinion, nor do I see why it may not as well have spread from the swampy jungles of the Peninsula into the sub-Himmalayan districts.

Its present (secondary) distribution, chiefly by domestication, now extends into China, Thibet, Persia, Armenia, even to the Caspian and Black Sea, over Arabia, Syria, and the whole of the North of Africa.

CAPE BUFFALO.—This species inhabits South Africa, reaching as far north as Abyssinia on the one side of the Continent, and Guinea on the other.

It by no means falls behind its Indian brother in size, and much exceeds it in ferocity, being one of the most dangerous animals to hunt (probably the most dangerous), on the face of the earth. Its habits, as well as its form, correspond closely with those of the Indian species. Like it, it delights in water and marshy places; but the Cape species is irreclaimably wild, at least has never been tamed, while the Indian is a valuable domestic animal; and the coarse, lean flesh of the Cape species beats anything but the undiscriminating appetite of a Hottentot to swallow it, while the flesh of the Indian species furnishes good food.

Bos BRACHYCERUS.—This is a West African species, found from Senegal to the Gaboon. It has two or three rings or wrinkles on the base of its horns, which remind us of its Bubaline connexion as well as of the connexion between the Oxen and wrinkle-horned Antelopes.

YAK.—(Bos GRUNNIENS.) I have some hesitation in following Dr. Giebel in including the Yak among the Buffaloes. Still if it owes its peculiar form (which it probably does) to change of condition from the swampy jungles of the Peninsula of India to the neighbourhood of the eternal snows of the loftiest mountains of Thibet, when these mountains were gradually raised, it is reasonable to expect that some extraordinary modification would be produced.

It is spread over Upper Ladak, Thibet, Northern China, Mongolia, and the Himmalayahs, at an elevation of from 10,000 to 17,000 feet above the level of the sea.

* NEWBERRY, op. cit. vol. vi. p. 72.

4th Section. Oxen (Bos.) (Map 37.)

Common Ox—(Bos taurus.)—Like all domestic animals, the domesticated Ox has many varieties; the extreme steps of which, if unconnected by transition links, might readily be considered distinct species. The humped Zebu of India, which is found in many of the warmer parts of Asia, and also on the east coast of Africa, looks very distinct from our common Ox, and by some is regarded as a distinct species; but there is no osteological difference, and we can trace steps of transition through other breeds; for example, the Italian breed is something like it in colour, and in it a thickening on the shoulders, indicating a tendency to a hump, begins to show itself.

Banteng (Bos Sondaicus).—Through the observations of Mr. Blyth, this species is now known to be found all through the Malayan Peninsula, from Singapore northwards into Birma; it occurs also in Cambodia, Siam, and Cochin China. It is not found in Sumatra, but occurs in Java, Borneo, Bali, and Lombok, and would appear to be extensively domesticated in Bali. Its general domestication is one reason why I think it may have been introduced into Borneo, although now found there in a feral state.

Gaour and Gayaul (Bos gaurus, and Bos frontalis).—Two Indian species which are considered by many authors to be the same, or at the utmost merely varieties. The Gaour is found over most of the Peninsula of India, wherever a suitable habitat occurs. It also extends into the Indo-Chinese region and throughout the Malayan, but its range does not extend to the Great Eastern Islands.

The Gayaul is confined to the Hill regions east of the Brahmaputra, and extends thence northwards to the sub-Himmalayan districts, and southwards into the Tennasserim provinces.

An extinct species, B. primigenius, inhabited Europe during the post-glacial epoch, and from its close resemblance in size and strength to the strongest races of the domestic Ox, is reckoned to have been the original stock from which the latter sprung. Its remains have been found in many places in England, France, Germany, Italy, &c., both in the drift and in peat-bogs.

With this was associated in Britain and Ireland another extinct species (Bos longifrons, *Owen*), which continued to exist until the historical period, and, according to Professor Owen, was probably the source of the domesticated cattle of the Celtic races before the Roman invasion.

MAP XXXV.

SHEEP

Ovis .....

Tragelaphus .....

MAP XXXVI.

SHEWING PROBABLE DISTRIBUTION OF BOTH FOSSIL & LIVING MUSK OX

Fossil .....

Living .....

Day & Son (Limited) Lith.

CHAPTER XXI.

RUMINANTS *continued*—SHEEP AND GOATS—ANTELOPES—CAMELOPARDS.

(CAPRIDÆ.)—SHEEP AND GOATS.—It may be a question whether it would not have been better to have begun the Ruminants with the Sheep and Goats, instead of the Oxen, so as to have allowed the latter to come before the Bovine Antelopes, instead of being separated from them by the Sheep and Goats, but this is a difficulty that cannot be overcome by any mode of arrangement, for although we should not wish to separate them from the Bovine Antelopes, we should like as little to have the Caprine animals, such as the Ibex and the Chamois, separated from the true Antelopes by the interpolation of the Buffaloes. It will be sufficient always to bear in mind that the different families of the Antelopes diverge at different points and in different directions, so as to render a correct linear arrangement impossible.

The Sheep and Goats may be well separated as genera, but it is impossible to break them into two families.

SHEEP.—(Map 35.) There is some difficulty in arriving at the real number of species of Sheep. Mr. Edward Blyth published, in 1841, a paper giving an account of the different species with which he was acquainted. These amounted to fifteen. Dr. Giebel, on the other hand, in his "Saugethiere," diminishes these perhaps unduly. He does not allow more than five, considering the characters relied on by Mr. Blyth to be too insignificant to constitute species. It matters little to us, however, which view be adopted, because Mr. Blyth's additional species, with one exception, which he is doubtful about himself, all come from the same districts as the already recognised species.

According to Giebel, his five species are thus distributed: one (the Mouflon, or MUSIMON) is European, or rather Mediterranean, (being found in Corsica, Sardinia, Cyprus, the Grecian Archipelago, Macedonia, Servia, and the Persian Mountains. Another (O. TRAGELAPHUS), (almost generically distinct) to North Africa. Another (the ARGALI) belongs to Middle North Asia; a fourth (O. BURRHEL) to the Himmalayahs; a fifth (the Big-horn, or O. MONTANA) to the Rocky Mountain range. Mr. Blyth's additional supposed species come from Bokhara, Thibet, Caucasus, Armenia, Cyprus, &c.

The greatest interest attaches to the distribution of the North American and the Asiatic species. We have seen that the ruminants are most sparingly represented in North America. Eight deers, two antelopes, one sheep, and two oxen, are all that are now found in that country. Whether any of these are also found in the Old World is a point in dispute. In Map 35 I have shown what I consider the distribution of the European Mouflon, the Asiatic Argali and the American Big-horn; but there is a mountain sheep found in Kamschatka (O. NIVICOLA of

Eschscholtz), which from Eschscholtz's description would appear to be a variety of the Argali. Cuvier conjectured that the North American species might be an Argali which had wandered over the ice to North America. I shall consider the probability of this migration by and bye, when we come to still closer affinities, as in the Spermophiles. Dr. Giebel remarks that they certainly come very close to each other. "Two other species of Sheep," says he, "have lately been distinguished: O. CALIFORNICA *Douglas* and O. NIVICOLA *Esch.* The latter certainly, through its abode in Kamschatka, would appear to mix the Siberian with the American species. The distinction of both lies in the peculiar smallness of the horns, the colour, and the larger proportions."*

I think Dr. Spencer Baird has arrived at a juster conclusion. After pointing out the differences between them which he regards as specific, and which are chiefly differences in the spiral of the horns, and their greater divergence at the tip—thirty-six inches in the Argali and only eighteen in the Big-horn—he continues, "While considering the Big-horn as distinct from the Argali, I am far from considering it the same with the Kamschatkan OVIS NIVICOLA of Eschscholtz, as asserted by most authors. It is with the Argali that the latter is to be compared, both having the same peculiarity of an excessive twist outwards and upwards of the ends of the horns, which also curve over a greater number of degrees. Judging from the figures of Eschscholtz, the tips of the horns must be at least three feet apart, instead of the twenty inches of our species. All these peculiarities are those of the Argali; and without pretending to decide whether the Kamschatkan or Siberian species are the same, I will only state that they are so considered by Pallas, who gives the measurement, description, and figure of a young ram from Kamschatka in the work noted below.† The same remarks will apply in great measure to the supposed horn of O. MONTANA, figured and described by Middendorf, from the Sea of Okotsk. I am far from admitting that any of our North American Mammals occur in Eastern Asia, unless it be the SPERMOPHILUS PARRYI, although some authors have attempted to prove an identity for the beaver, the brown bear, the sable, the large marmot, as well as the large sheep." ‡

On the whole, my inclination would be to go along with Dr. Baird in his latter proposition, as well as the former, were its terms a little less sweeping. He has forgotten the white bear, the walrus, the seals, the lemming—not to speak of the more doubtful cases of the lynx, moose, glutton, &c.

Schrenck agrees with Middendorf in looking upon the Argali or its northern form (O. NIVICOLA *Esch.*) as the same as OVIS MONTANA, for he regards the Mountain Sheep of Amourland as that species. § On this point a well-informed writer in the "Natural History Review" makes the following remarks: "We are very much disposed to question the fact of this *Ovis* being identical with the *Ovis montana* of North America. It is *Ovis nivicola* of Eschscholtz. Middendorf gives the Spruce partridge of Canada (*Tetrao Canadensis*) as occurring in Northern Asia; but his examples, on further investigation, were proved to belong to quite a different species (*Tetrao falcipennis*). The forms of the higher northern latitudes of the eastern and western hemispheres, though very similar, are, except in the Polar regions, usually specifically distinct." ‖ It will go near to be thought so shortly.

The range of the Big-horn extends from the region of the Upper Missouri and Yellow Stone to

* Giebel, "Saugethiere," i. 282 (Note), 1859.

† PALLAS, "Naturgeschichte merkwürdiger Thiere," Samml. xi. 1779, p. 1. Tab. i. ii.

‡ BAIRD, "Report on Zoology in United States, Pacific Railroad Explorations and Surveys," vol. viii. p. 678. 1857.

§ SCHRENCK (Dr. VON LEOPOLD) "Reisen und Forschungen im Amurland." Band I. 1858.

‖ "Natural History Review" (Jan. 1861), I. p. 1.

the Rocky Mountains, and the high grounds adjacent to them on the eastern slope as far south as the Rio Grande. They are said to be abundant on the Mauvaises Terres, but are not found to any considerable distance east of the Black hills. Westward they extend as far as the Cascade and coast ranges of Washington, Oregon, and California, and follow the high lands of the mountains some distance into Mexico.

A supposed species, O. SIBIRICA *Meyen*, which inhabits the Altai range, is disallowed by Giebel, who regards it as a synonym of the Argali, but Radde has recently given full descriptions which show that it is a distinct species.* No extinct species have been satisfactorily determined.

GOATS.—(CAPRA.) (Map 34.) These are usually divided into Ibexes and Goats proper, both of which are confined to the Old World. I have added to the group the Caprine Antelopes, or Chamois. These occur in Europe, Asia, and North America, but not in Africa or India. Their habitat is thus opposed to their being regarded as Antelopes, which are essentially an African and Indian form; and various other, more or less important, characters,† confirm the view that they do not properly belong to them. The family is almost wholly composed of mountain animals.

Of the Ibexes there are eight species, chiefly belonging to the European district, although species also extend into Syria and Abyssinia, as well as into the Caucasus and Siberia. The species found on the Alps is different from that found on the Pyrenees, which, again, is different from another which lives in the mountains of Andalusia. There are two species in the Caucasus, one in Siberia, one in Syria, and another in the mountains of Abyssinia. A fossil species has been found in the caves of the Cevennes, and it comes nearest to its living neighbour, the Pyrenean species.

The Goats proper are few in number. Besides the domestic Goat, which is very variable in appearance, we know only two from the Himmalayahs and one from the Caucasus.

The Chamois or Caprine Antelopes are eight in number. One species occurs in Europe, one in North America east of the Rocky Mountains, one on both sides of the Rocky Mountains, one in Japan, one in Formosa, two in Nepaul, and one in Sumatra.

The two species found in North America are the American Antelope (ANTILOCAPRA AMERICANA) and the Mountain Goat (APLOCERUS MONTANUS). The latter is not distantly allied to the Chamois. The former, although further removed, is still nearer to it than to anything else; and a circumstance to be noted, is, that the European Chamois, so far as regards structure, stands between these two American species, and that American species which lives more nearly under the same conditions of life as the latter, is nearest to it in organization, while that which differs most in organization is also further removed from it in habits and conditions of existence. The Mountain Goat (APLOCERUS MONTANUS), which may without impropriety be called the American Chamois, lives in the most inaccessible and rocky parts of the Rocky Mountains, while the American Antelope lives in the valley of the Missouri and other more level and accessible places.

ANTELOPES. (ANTILOPIDÆ.) (Map 33.) The number of ANTELOPES is very great, no less than one hundred and fifty-two species having been described, which, however, are reduced by Giebel in his "Saugethiere" (edition, 1859) to the more manageable number of fifty-five species. The resemblance which certain groups of them bear to Deer, Oxen, or Horses, have led to their being divided into corresponding sections, — as Cervine Antelopes (the Oryx), Equine Antelopes (the Gnu), and Bovine Antelopes (the Eland).

* RADDE (GUSTAV,) "Reisen im Suden von Ost-Siberien." BAIRD, I. 1862.

† The hair of these Caprine Antelopes is not that of the Antelope, but of the Deer.

The family is essentially African, five-sixths of the species composing it being natives of that country, and more than two-thirds coming from parts of it lying to the south of the Sahara.

After Africa the Indian district has most species. All not found in Africa south of the Sahara, with the exception of a few species in North Africa, and three from trans-Himmalayan Asia belong to the Indo-Malayan region.

Strictly speaking, there is no recent European species of Antelope. The Antilope Saiga, which is found in some of the eastern parts of Europe, being rather an Asiatic species which has overflowed into Russia than a European extending into Asia. It is a true Gazelle, but a larger and less attractive animal than the gentle, graceful, little, dark-eyed beauty of Arabian poetry.

Looked at solely by the light derived from the distribution of the existing species, it would appear that Africa was the birth-place of this family; that they had come into existence before the ancient connexion between Africa and India was wholly cut off, but after it had been considerably restricted; that after a communication had been opened between North and South Africa by the elevation of the Sahara, and between India and northern Asia by the rise of the Himmalayahs, and obliteration of the barrier of the Sevalik Sea, the species now found in North Africa and Asia had made their way into these districts.

As at present recorded, fossil remains have been found in various parts of France, in the fahluns of Touraine, the caverns in the department of L'Aude, in the miocene deposits of Auvergne, and at Sansans,—all, I believe, in the most recent part of the upper miocene deposits, suggesting the idea that it was only at the termination of this epoch that the Antelopes found their way into Europe. It is always to be remembered that the determination of Antelopes, especially from imperfect fragments of bone, which is all that we have had to rest on, is very difficult and uncertain. Another important fact, if well founded, is the discovery in America, where no Antelopes are now found, of a species (Antilope Mariquensis) in the bone-caves of Brazil by M. Lund, and in the Mauvaises Terres by Dr. Leidy,—at least of fragments which are referred to this family. I do not venture to dispute the correctness of the determination, by such eminent authorities, of the fossil remains referred to Antelopes from the deposits of Europe and America, merely because they run counter to my anticipations; but I may be allowed to be so far sceptical as to beg those palæontologists who may have the opportunity, to subject the remains to the severest scrutiny, and withal not to assume that similarity to the Chamois is identity with the Antelope; and I may add that if this is done I shall be in no way surprised to learn that no fossil Antelopine remains whatever have yet been found in either of these countries.

On a review of the whole species as separated into sections by Giebel,* whose arrangement, or I should rather say, the contents of whose sections are very much the same as those of Dr. Gray and other authors who have made a special study of the family, we find the affinities of the species to correspond pretty nearly with the localities whence they come; that is, the members of each section are, for the most part, inhabitants of the same district. For example,—

Group 1. Bovina.—There are two species in this group,—one (Anoa depressicornis, *Smith*) found in Celebes, the other (Damalis Oreas, *Pallas*) in South Africa. This is a remarkable

* Although I here for convenience sake adopt, without qualification, Giebel's determination of the species, it will be seen from the synonymic list in the Appendix, that I admit a greater number as good species than he does. None of these, however, seem to affect any general conclusion which may be drawn from the smaller number accepted by Giebel.

MAP XXXIII.

ANTELOPES

Preponderance of Species indicated by intensity of Colour.

Day & Son (Limited) Lith.

MAP XXXIV.

GOATS.

American Antelope
Chamois & Ibex
Ibex alone
Goat (exclusive of the Domestic goat)

Day & Son (Limited) Lith.

instance of closely allied species occurring in two of the most widely separated portions of the former great Africano-Indian continent.

Group 2. Catoblepas.—Two species. The two Gnus, both South African.

Group 3. Bubalus.—Four species. Two peculiar to North Africa, one to East Africa (Mozambique) and two to South Africa.

Group 4. Oryx.—Four species. Two of them are found in the Nile district, one of which extends eastwards into Arabia and Persia, and the other southwards to the Cape of Good Hope; the two others are also African, one being found in Senegal and the other in South Africa.

Group 5. Gazella.—Eight species. These, like the last group, belong to the district connecting Asia and Africa, and are found partly in both; one is Persian, two are Arabian, three belong to the Nile district, Nubia, Sennaar, and Abyssinia, and two to South Africa. This distribution may have been the result of an extension of species from South Africa, subsequent to the land and water having assumed their present configuration.

Group 6. Tragelaphus.—Four species. Two in the Nile district, two pretty generally distributed from Abyssinia to the Cape, one of them also in Guinea, and another species peculiar to West Africa.

Group 7. Antilope.—Five species. These, with one exception, are Asiatic species; one being Indian; two Thibetan or Chinese, and the range of another already mentioned (A. Saiga), extending from Poland to Altai and Irkutsk. There is, however, one species from South Africa (Bechuanaland) (A. melampus, *Licht*), whose presence there is anomalous.

Group 8. Redunca.—Nine species, strictly African, and chiefly south and east African. The east coast of Africa seems to have had much more unrestricted communication with the Cape than the west coast, at any rate, greater affinity exists between the species of the two. In all classes the majority of species which are found at the Cape extend their range up to Natal, Mozambique, and even further, while on the west coast it is the exception to find them reaching Gaboon, Guinea, or Senegal. It is so in this group. One species is found in Senegal, and another extends across the Continent, and is found both in Senegal and Abyssinia, while, on the other hand, there are four Cape species, and four Abyssinian, including the species which is also found in Senegal.

Group 9. Oreotragus.*—Three species. All from the Cape and referred to three genera,—Oreotragus, Tragulus, and Calotragus.

Group 10. Cephalolophus.—Twelve species. This is a group, composed chiefly of diminutive species peculiar to Africa, and remarkable from their a good deal resembling not only in their external appearance, but also in having a long extensile tongue, the Muntjacs and Chevrotains of south-east Asia. Blyth thinks that the resemblance extends to the American Rodent Agoutis, if not also to the smaller fossil Pachyderms, of the genus Lophiodon; and there undoubtedly is a certain similarity in the pig-like form and short, slender limbs, which probably may indicate affinity with the Lophiodons; but if there is any with the Agoutis, it must be very distant and through the Pachyderms themselves. The type is West African, six of the twelve species being found in Guinea, Senegal, and Fernando Po, three on the east coast of Africa, viz. Abyssinia, Mozambique, and Natal, two in South Africa, and one (the Nylghau), (which should perhaps scarcely be placed in the same group as the smaller species) in North India. This, again, is another instance of an African form being found in the Indian district.

* Giebel uses the name Tragulus for this section, being that of one of the genera; but as that name is also employed for the Chevrotains, I have taken another of the genera (Oreotragus) for the type of the group.

Group 11. TETRACERUS.—One species, inhabiting Nepal, Bengal, &c.

CAMELOPARDS. (CAMELOPARDALIDÆ.) (Map 39.) The only existing representative of this family is the well-known Giraffe, which ranges from Nubia and Abyssinia on the east, and Senegal on the west, southwards through Central Africa, avoiding the highlands on the east, until it meets the outposts of the white colonists at the Cape of Good Hope. I can find no account of its ever having extended so far south as the Cape itself, and the mountainous nature of much of the old settled country would probably act as a barrier against its progress if the climate did not. Sparrman, about 1772, speaks of it as inhabiting the interior in the north-west.*

M. Duvernoy has discovered fossil remains of what he considers a well-marked extinct species at Issoudun, in the department of Indre in France, and a tooth was also found in Switzerland by M. Agassiz. Remains of two extinct species of a remarkable colossal genus named SIVATHERIUM, and nearly allied to the Camelopard, have been found by Falconer and Cautley in the Sevalik formations in the Himmalayahs. I do not know whether M. Duvernoy's and Agassiz' determinations of the European remains have received the endorsement of other palæontologists, but it is a case where careful inquiry seems more than usually required. The genus is African and allied to the Antelopes, and is not one whose existence in Europe should be readily admitted, while we should feel as little disposed to question its having lived on the southern bank of the Sevalik Sea.

Nothing at all similar to the Giraffe has been found, either living or fossil, on the American Continent.

* SPARRMAN, ANDREW, "Travels in Africa," 1787.

CHAPTER XXII.

RUMINANTS *continued:* DEER—REINDEER—INQUIRY INTO THEIR ORIGIN IN NORTH AMERICA, GREENLAND, SPITZBERGEN, &c.

Cervidæ. Deer. (Map 32.) The fossil remains of Deer are numerous. Upwards of sixty species, including one or two extinct genera, of Deer, have been described, but a very large deduction must be made from this number for double, treble, and quadruple employment of the same species. The oldest remains are from the fresh-water miocene in the department of Loiret, and nearly correspond with the Muntjac of the Sunda Archipelago; but although some remains have been found in the miocene formations, it is in more recent deposits that the greatest number have been discovered. Lund discovered remains of a species in the caves of Brazil, and the caves of Europe have yielded abundant remains of different species, among which those of the Red Deer the Fallow-deer, the Roebuck, the Moose, and the Reindeer, are most frequent. Of the latter in particular, numerous bones have been found in Europe as far south as the south of France, in post-glacial deposits of an age contemporaneous with man.

In Austria remains have been found of a large deer somewhat similar to the Reindeer, but different from it in not having a brow antler,—and Owen supposes it to have been intermediate between the Reindeer and the Elk (Moose). Two other extinct species also, without the brow antler, but in which the antler is not palmate, have been described by Gervais from beds of volcanic alluvium in the south of France.

The existing species of Deer are chiefly confined to the northern hemisphere, and most of them frequent forests. There are none in Australia, nor are any found in Africa Proper, *i.e.* south of the Sahara. The Fallow Deer, indeed, is found in North Africa in the Mediterranean District, but that cannot be reckoned anything but a part of Europe located in Africa. There are nine in South America; North America has eight or nine; Europe and Northern Asia, six; and the East Indies and the Indian Archipelago, nineteen or twenty (Java two, Sumatra three, and Borneo three). In these three islands, too, is found the Muntjac, a small deer with largely developed upper canines, which forms the natural passage from the true Deer to the Musk-Deer.

Irish Elk. (Cervus Megaceros.) This extinct species was probably the finest cervine animal that ever existed. Its horns have been found to measure ten feet apart from tip to tip. Notwithstanding its name, it is not peculiar to Ireland, but is found in England as well as on the Continent.

It is now very generally believed, although good authorities still demur to it, that whether the former inhabitants of Ireland actually came in contact with it or not, it lived at a time when man was already in existence. It may be, nevertheless, and probably was the case, that if it was a contemporary of man, it had become extinct before the Irish had a knowledge of letters; at any rate, they have not left us the only indication of their acquaintance with it which we could

expect, viz., a name for it. Singularly enough, notwithstanding this, Mr. Wilde tells us that, while the opinion of naturalists is unfavourable to its co-existence with man, that of antiquarians is favourable.

Its primitive origin seems to have been European; at least its remains have not been found beyond the limits of Europe. If I am right in supposing nearly the whole animal and vegetable life of Europe to have been extinguished by the glacial epoch, and to have been replaced by immigration from Asia, it is possibly a modified descendant of one of the Asiatic species. From the appearance of the horns, we should most readily look to the Reindeer or Fallow-deer for its relatives; it is not an Elk, but a true deer, intermediate between the Fallow and the Reindeer, and, according to Owen, is most closely related to the latter, both it and the Irish Elk having more developed brow snags than any other species.*

In Ireland remains have been obtained from the counties of Fermanagh, Cavan, Leitrim, Monaghan, Roscommon, Meath, and from the Shannon. They have usually been found in one of two kinds of localities, either in peat-bogs, or in a blue clay or a marl below the peat, and it has been observed that the largest specimens have all come from the latter, leading to the inference that this animal had been degenerating and diminishing in size as it approached our times. Professor Owen† recognises a bone of the left antler of this deer among some mammalian remains from the red clay of Suffolk, which he considered of modern date. This is a solitary instance, and may not be well founded.

Moose. (Cervus Alces.) The Moose, or Elk, is found in the North of Europe, the North of Asia, and the North of America; so is the Reindeer, and as regards both we are met by the old difficulty, viz. that of determining whether the individuals found in the Old World are of the same species as those found in the New or not. It is well ascertained that the Elks found in Europe and Asia are the same, and whether the Old and New-world animals are actually distinct or not, they are undoubtedly very close to each other; but the impression seems gaining ground that they are distinct. Sir John Richardson has instituted a very elaborate comparison between them,‡ and finds among other specialties that the breadth of the face is greater in the European than in the American individuals. Remains of this species, as well as of the Reindeer, are found in Ireland.

Fallow Deer. (Cervus dama.) The native habitat of this beautiful little ornament of many of our English parks is the Mediterranean district,—Spain, Sardinia, Italy, Greece, Asia Minor, Syria, Egypt, North Africa. Pennant says that it was introduced into this country by James I. from Norway, where he passed some time when he visited his intended bride, Anne of Denmark; and that he brought it first to Scotland, and thence to Epping Forest and Enfield Chase, to be near his favourite palace Theobalds. But seeing that its native country is so far removed from Norway, it is probable that if it was introduced by James I., it must have been from some other country than Norway. No fossil remains of this species have been found in Ireland or England.

Reindeer. (Tarandus rangifer.) Fossil remains of the Reindeer are found throughout the whole of mid Europe. As I have mentioned in speaking of the Cave Lion, some authorities think the fossil Rein different from the living. The remains, however, correspond very closely, and there seems no sufficient reason for doubting their identity. That remains of the fossil species have been

* Owen's "Palæontology," p. 373.

† Owen in "Proc. Lond. Geol. Soc." vol. xii.

‡ Richardson on the Fossil Mammals in the "Zoology of the Herald," 1854.

ARCTIC OCEAN

ISOTHERMAL 32°

Arctic Circle

BAFFIN BAY

GREENLAND

ESQUIMAUX

INDIANS

RUSSIAN AMERICA

CUMBERLAND

HUDSON BAY

ICELAND

LAPLAND

NOVAYA ZEMBLA

SIBERIA

FINLAND

NORWAY

SWEDEN

BRITISH AMERICA

NORTH AMERICA

CANADA

SCOTLAND

IRELAND

EUROPE

RUSSIA

BALTIC

PRUSSIA

FRANCE

AUSTRIA

ALEUTIAN IS

VANCOUVER I

NORTH PACIFIC OCEAN

UNITED STATES

HUDSON

CALIFORNIA

TEXAS

G. OF MEXICO

MEXICO

NORTH ATLANTIC OCEAN

Tropic of Cancer

AZORES

PORTUGAL

SPAIN

MEDITERRANEAN

TURKEY

BLACK SEA

ASIA MINOR

INDEPENDENT TARTARY

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

PERSIA

AFGHANISTAN

PUNJAB

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BIRMAH

SUMATRA

BORNEO

CELEBES

PHILIPPINE IS

SANDWICH IS

WEST INDIA IS

CARIBBEAN SEA

NUEVA GRANADA

GUIANA

ECUADOR

PERU

BRAZIL

SOUTH AMERICA

BOLIVIA

CHILI

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND IS

Equator

Tropic of Capricorn

SOUTH ATLANTIC OCEAN

AFRICA

CAPE COLONY

MADAGASCAR

INDIAN OCEAN

N. AUSTRALIA

AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMENS

NEW ZEALAND

NEW HEBRIDES

N. GUINEA

MARQUESAS IS

LOW ARCHIPELAGO

SOCIETY IS

NAVIGATORS IS

COOKS IS

SOUTH PACIFIC OCEAN

SOUTHERN OCEAN

MAP XXXI.

TRAGULIDÆ AND MOSCHIDÆ

(MUSK DEER, &c.)

Moschus Moschiferus

Tragulidæ

Hyomoschus

Day & Son (Limited) Lith

ARCTIC OCEAN

ISOTHERMAL 32°

Arctic Circle

BAFFIN BAY

GREENLAND

ESQUIMAUX

INDIANS

RUSSIAN AMERICA

CUMBERLAND

HUDSON BAY

ICELAND

LAPLAND

NOVAYA ZEMBLA

SIBERIA

FINLAND

NORWAY

SWEDEN

BRITISH AMERICA

NORTH AMERICA

CANADA

SCOTLAND

IRELAND

EUROPE

RUSSIA

BALTIC

PRUSSIA

FRANCE

AUSTRIA

ALEUTIAN IS

VANCOUVER I

NORTH PACIFIC OCEAN

UNITED STATES

HUDSON

CALIFORNIA

TEXAS

G. OF MEXICO

MEXICO

NORTH ATLANTIC OCEAN

Tropic of Cancer

AZORES

PORTUGAL

SPAIN

MEDITERRANEAN

TURKEY

BLACK SEA

ASIA MINOR

INDEPENDENT TARTARY

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

PERSIA

AFGHANISTAN

PUNJAB

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BIRMAH

SUMATRA

BORNEO

CELEBES

PHILIPPINE IS

SANDWICH IS

WEST INDIA IS

CARIBBEAN SEA

NUEVA GRANADA

GUIANA

ECUADOR

PERU

BRAZIL

SOUTH AMERICA

BOLIVIA

CHILI

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND IS

Equator

Tropic of Capricorn

SOUTH ATLANTIC OCEAN

AFRICA

CAPE COLONY

MADAGASCAR

INDIAN OCEAN

N. AUSTRALIA

AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMENS

NEW ZEALAND

NEW HEBRIDES

N. GUINEA

MARQUESAS IS

LOW ARCHIPELAGO

SOCIETY IS

NAVIGATORS IS

COOKS IS

SOUTH PACIFIC OCEAN

SOUTHERN OCEAN

MAP XXXII

DEER *all the coloured part*

REINDEER

AMERICAN REINDEER

Day & Son (Limited) Lith

chiefly, if not entirely, found in mid Europe, is probably due rather to the more favourable location for preserving and finding them, than to the extinct species not having also lived more to the north, as it does now.

It now inhabits the whole of the boreal regions of the Northern Hemisphere. Its southern limit is very nearly the isothermal line of 32° Fahr. more frequently extending a few degrees to the south of it, than to the north. Its most southerly limit now is 50° N.L. viz. the southern point of Kamtschatka, and its most northern is probably Spitzbergen.

It is also a native of Greenland, and used to be, and probably still is, plentiful there,—both on the east and west coast. Otho Fabricius especially mentions it as an inhabitant of the island of Disco, far up on the west coast. It is also found in Iceland, but not as an aboriginal inhabitant. Sir G. Mackenzie informs us that in the year 1773 thirteen Reindeer were exported from Norway for Iceland, only three of which reached the island. These were turned loose into the mountains of Guldbringe Syssel, where they multiplied so greatly in the course of forty years, that in various districts it was not uncommon to meet with herds consisting of from forty to one hundred.* A happy future was anticipated for these animals. It was thought that although in Lapland they were losers by their connexion with man, Iceland should make up for all. There is in the interior a tract which Sir G. Mackenzie computed at not less than forty thousand square miles, without a single human habitation, and almost entirely unknown to the natives themselves. There are no wolves; the Icelanders would keep out the bears; and the Reindeer, being almost unmolested, by man, would have no enemy whatever, unless they had brought with them their own tormenting gad-fly.† The anticipation has not been realized. Lord Dufferin speaks of them as any thing but common.‡ And Mr. Baring-Gould says that they are almost confined to the north-eastern part of the island, where they are in some numbers.§

Iceland is a fair illustration of what would be the result if immigration were alone relied on for the peopling of islands. The only indication of its having possessed an aboriginal mammalian Fauna, is the Arctic Fox and a so-called economic Mouse, which I anticipate will turn out to be the Greenland Lemming. These are the only mammals which are not known to have been introduced; but as scarcely a year passes in which several Polar Bears do not arrive on the north coast brought by icebergs or floes, there is no difficulty in supposing that a sufficiency of Foxes to stock the island might have come with them. They could scarcely have come alone, because, not being able to take their prey by swimming, they must have starved on the way. But if they made the voyage on a large hummocky floe along with Polar Bears, they might have beeen able to keep out of their grasp, and yet feed on any remains of fish or seals which the Bears may have caught and left on the passage. The Lemming may have come in the same way. It thus appears that three circumpolar animals are the only species which, unaided by man, have ever found their way to this island; and but for the exceptional advantages of transit by icebergs (which, of course, are not enjoyed in warmer regions), the island must probably have remained as desert and unpeopled by mammals as it had ever been.

It is a disputed point whether more than one species of Reindeer exists. But there are several

* Mackenzie's "Travels in Iceland, in 1810-11," p. 342.

† Lyell's "Principles of Geology," first edition, 1832, ii. 154.

‡ Dufferin, Lord, "Letters from High Latitudes," 1856.

§ S. Baring-Gould, "Iceland," 1863.

varieties—how far some of these deserve to be reckoned species, and if so, which of them, is a more difficult question.

There is first the fossil variety; next the Lapland Reindeer, which is nearest to the fossil type; then the Siberian, which, although very close to the Lapland, differs in the character of the horns; moreover, there are two varieties in North America; and one in Greenland and Spitzbergen. I believe all these to be altered forms developed out of one stock, modified to an extent corresponding with the degree of deviation of their respective climates from the original conditions of existence of that stock. The following woodcuts represent the typical character of the horns of the different kinds.

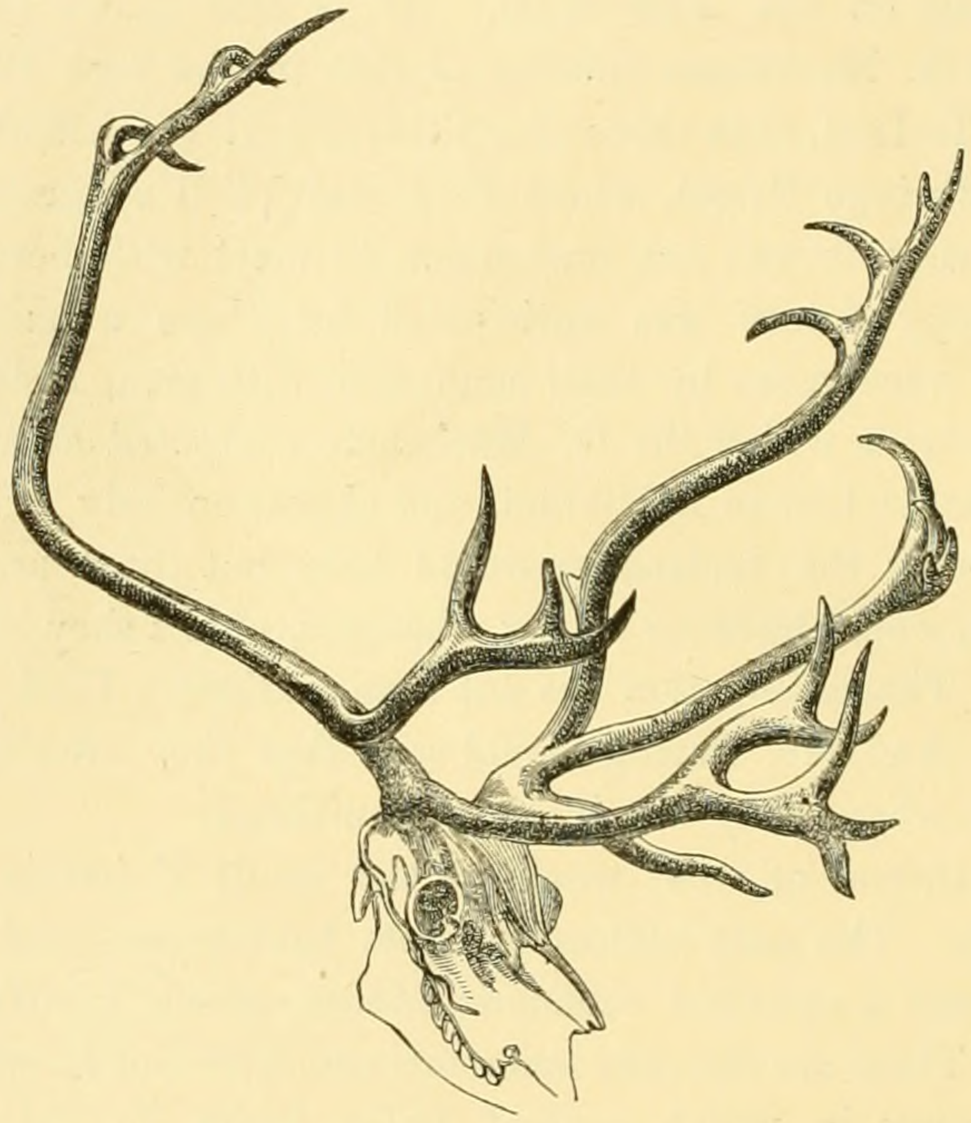


Fig. 1. Fossil European Reindeer (*Owen*).

Fig. 1 represents a specimen of the fossil species found in "pleistocene till," at Bilney Moor, East Dereham, in Norfolk, copied from a figure given by Prof. Owen.*

Mellin, so long ago as 1780, pointed out the difference between the Lapland and the Siberian individuals,† and gave us very good figures of both. Fig. 2 is a copy of one of his representations of the Lapland Deer; it seems to be that of a female, but full-grown, and may therefore be assumed to be characteristic. The most of his and Schreber's figures give the brow-snags as in this figure, only more horizontal in the males, but the majority of the figures, from the undeveloped palmation of the upper tynes, were probably taken from young animals. Fig. 3, however, is copied from a figure by Schreber,‡ which he says was taken from an animal six years old. He does not say whether it is from Lapland or Siberia, but making allowance for the greater development which might be expected in an older animal, I should imagine it to be a Lapland individual.

Fig. 4 is a head, copied from Mellin's figure of the Siberian type; and fig. 5, which is

* Owen's "Palæontology," p. 374, 1860.

† Mellin, Zur Naturg. Rennthiere in "Gesellschaft Naturforschen, der Freunde." Schriften, 1780–3.

‡ Schreber "Saugethiere," 1805, and "Saugethiere fortgesetzt" von A. Goldfuss and Wagner, 1826.

taken from the illustrations of the Reindeer, in Sir W. Jardine's "Naturalists' Library," is obviously another figure of the Siberian form.

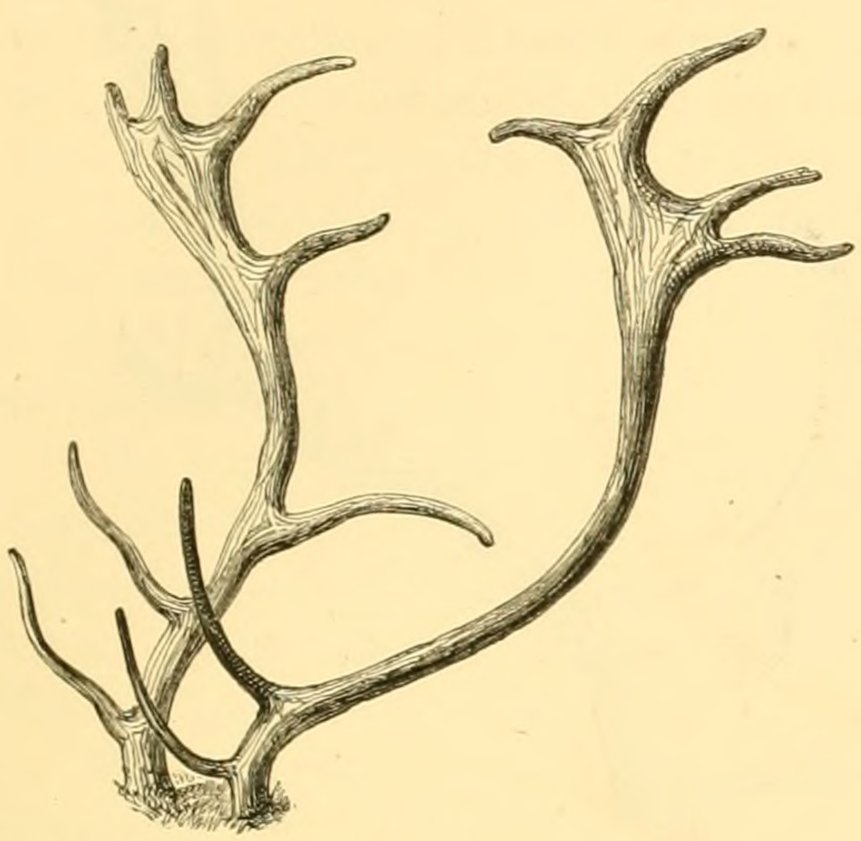


Fig. 2. Lapland Reindeer (*Mellin*).

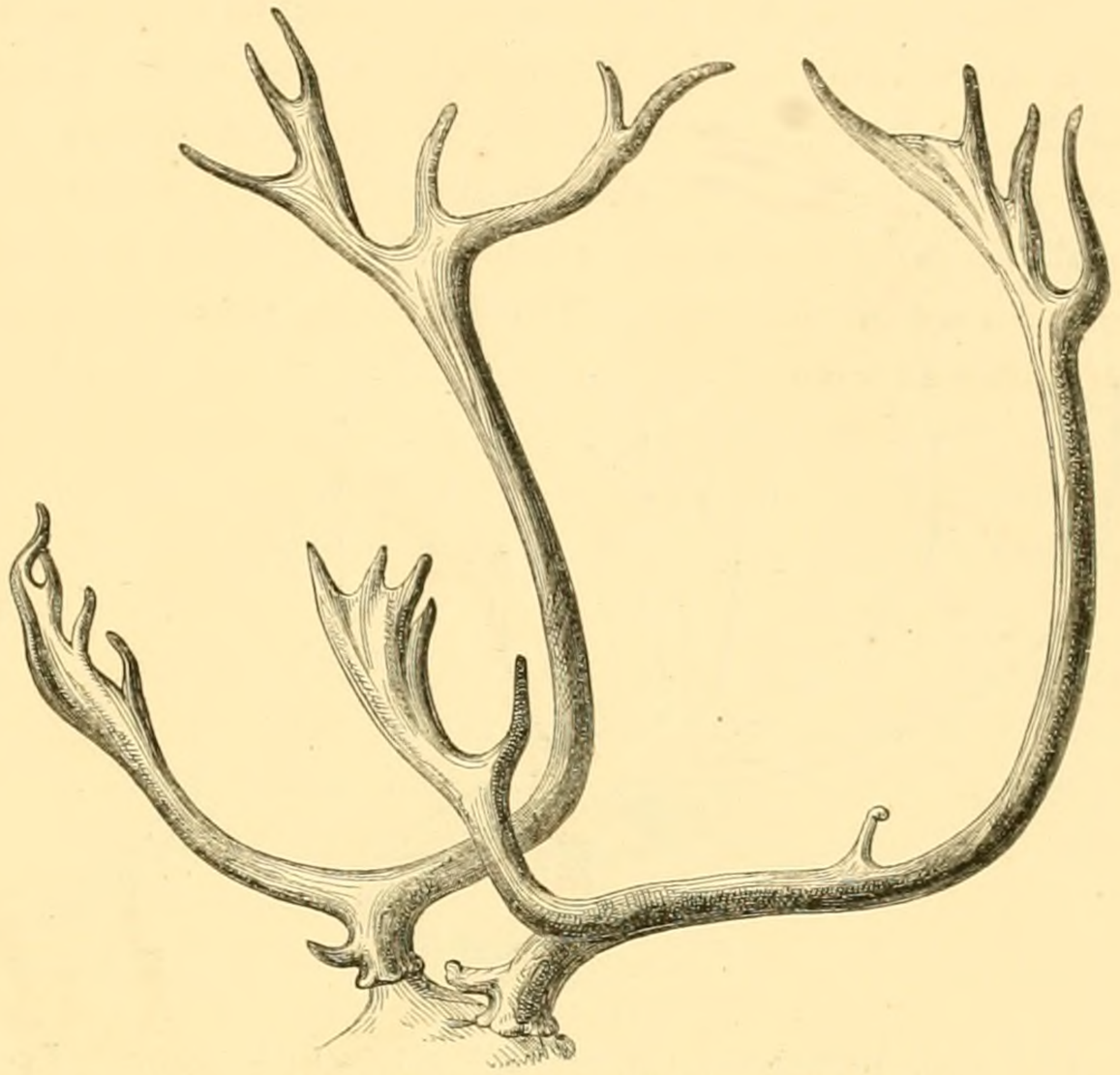


Fig. 3. Probably Lapland Reindeer (*Schreber*).

Fig. 6 is copied from Sir John Richardson's* sketch of the Barren-Ground Caribou, CERVUS TARANDUS var. *Arcticus* very slightly altered to make it agree with specimens in my own possession.

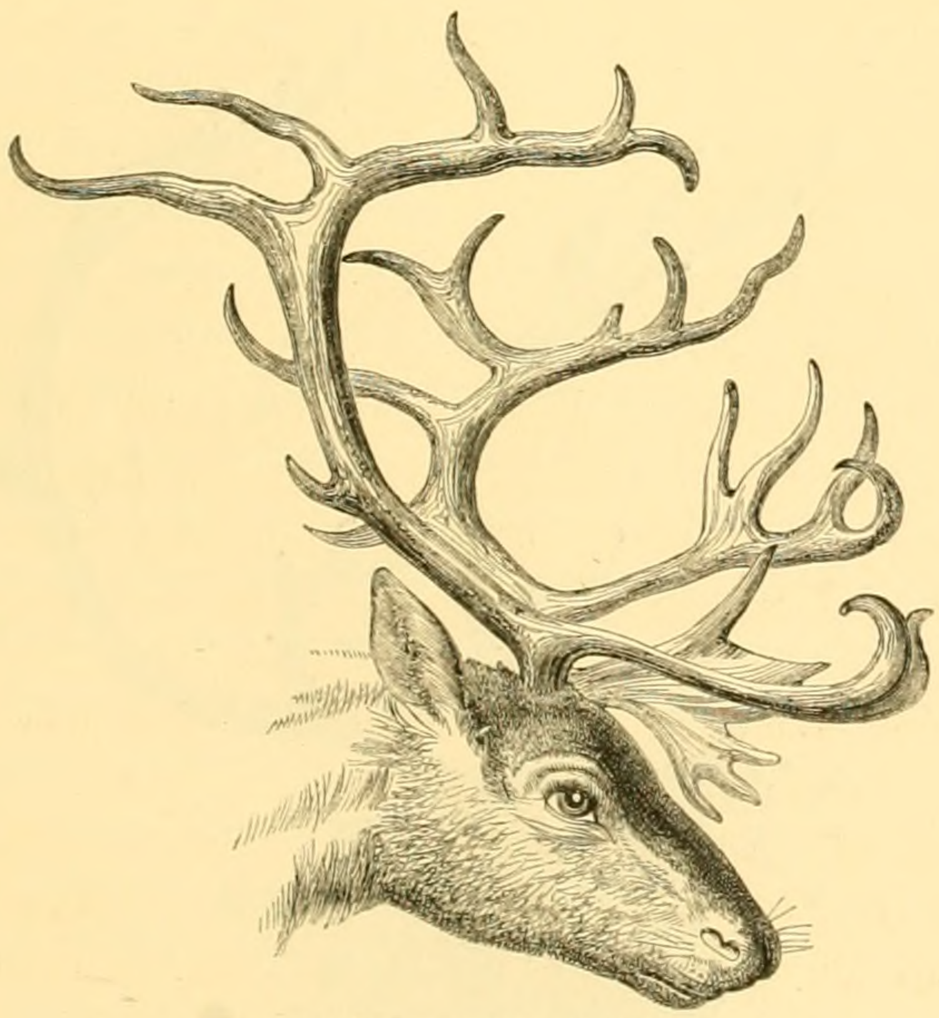


Fig. 4. Siberian Reindeer (*Mellin*).

Fig. 5. Siberian Reindeer (*Jardine*).

* RICHARDSON'S "Fauna Boreal. Amer." Part I., Mammals, 1829.

Fig. 7 represents the horn of the Woodland Caribou, and is copied from Professor Baird's "Mammals of the United States."

Fig. 6. North American Barren-Ground Reindeer (*Richardson*).

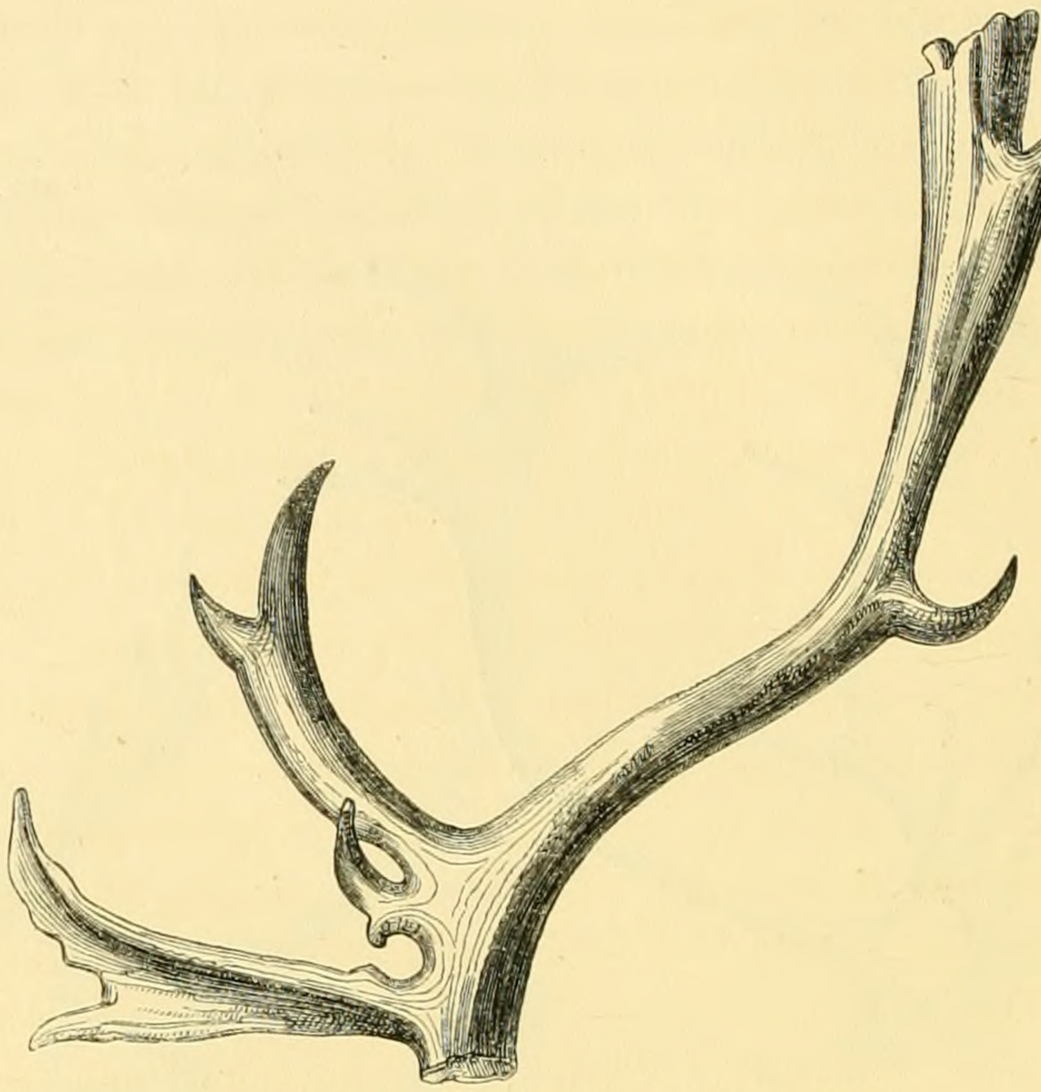


Fig. 7. North American Woodland Caribou (*Baird*).

Fig. 8 is also copied from that work, and represents the horn of a specimen from the north of Greenland.

Fig. 9 is copied from Mr. Lamont's "Seasons with Sea-horses" and represents the Spitzbergen type.

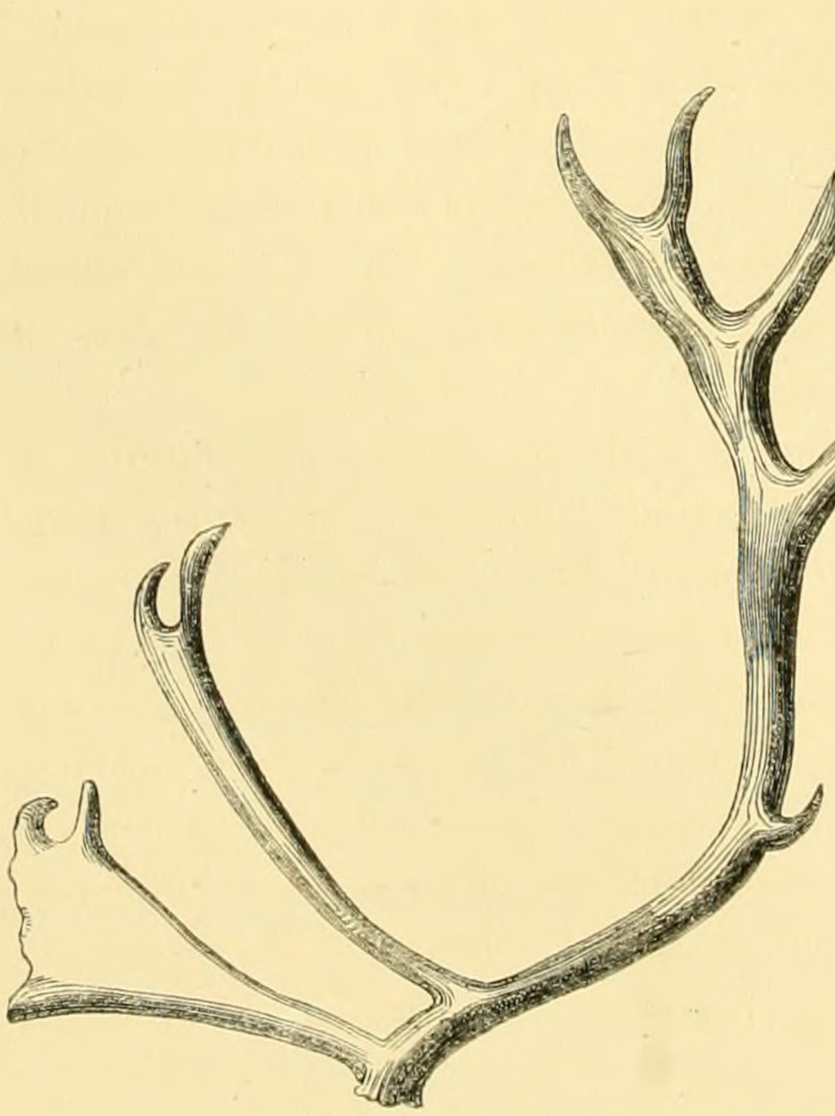


Fig. 8. Greenland Reindeer (*Baird*).

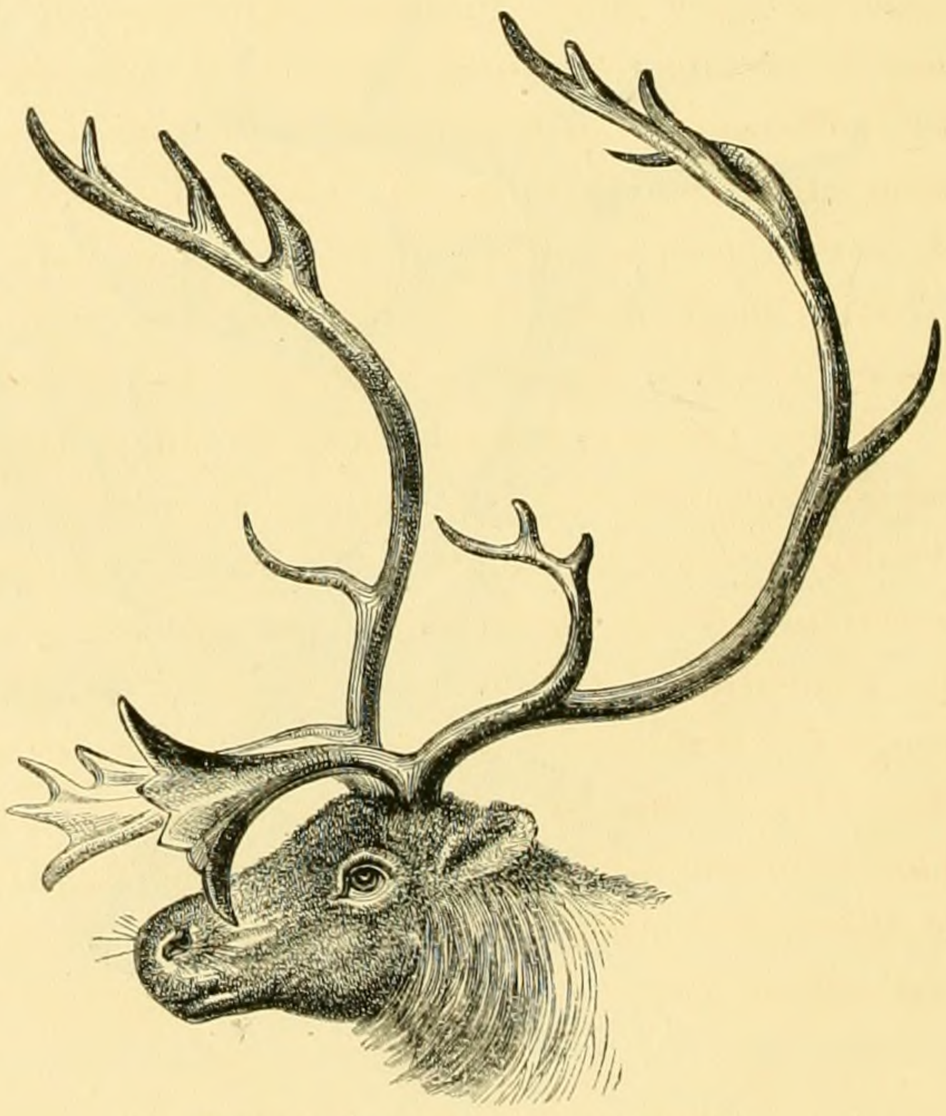


Fig. 9. Spitzbergen Reindeer (*Lamont*).

The fossil and Lapland types are similar in the absence of palmation and number of snags.

The Siberian differs from the Lapland in a greater breadth of horn, a greater number of snags, and a general disposition to palmation, not shown, as in the American and Greenland types, by a broad flat ploughshare, but by curved and flattened snags.

The American Reindeer are now admitted by most naturalists to be not only distinct from the Lapland Deer, but also to form two distinct species between themselves. These are the Barren Ground Reindeer, or Caribou, and the Woodland Reindeer. The chief distinction between these two is, that the adult Barren-Ground Caribou has a flat, triangular, vertically projecting brow antler, while the brow-antler of the Woodland Caribou is shorter, stronger, and less flattened. In the Barren-Ground species the flat-bladed brow-antler springs sometimes from the right horn, sometimes from the left. In many there is a blade from each side, and in a considerable number it is altogether absent; the plate is in general widest at its extremity, and is set with four or five points which are sometimes slightly recurved.*

The individuals inhabiting Greenland have brow antlers midway between those of the Barren-Ground Caribou and the Woodland Caribou. They are not exactly the same as either, but liker either than either the Lapland or the Siberian form. They have the triangular projecting blade; but its handle is longer and the blade smaller than that of the Barren-Ground Caribou, while the blade is larger and the handle thinner and longer than that of the Woodland species.

The Reindeer found in Spitzbergen has the same kind of brow antler as the Greenland specimens, but with the blade more developed and curved.

Mr. Alfred Newton, speaking of the Deer which he saw on his visits to Spitzbergen, says, "These Deer are tolerably abundant. They are certainly smaller than the Lapland Reindeer, whether wild or tame; and though I can hardly profess to speak generally on the subject, yet all the antlers which I saw in Spitzbergen seemed to me to be slighter in the beam than the Continental race; nevertheless, the points being in old Stags considerably elongated, the expanse of antler was not much inferior. The average type of a good Spitzbergen head is very well represented by the first figure in the 'Fauna Boreale-Americana' (vol. i. p. 240), of the so-called Barren-Ground Caribou (CERVUS TARANDUS, var. ARCTICUS *Richardson*), and it is probable that the same causes which influence the development of the antlers in the Reindeer of the Barren Grounds of North America, affect in like manner those of their Spitzbergen brethren." Mr. Lamont, whom I have consulted on the subject, agrees with Mr. Newton in the resemblance which the horns of the Spitzbergen Reindeer bear to those of the American species.

Now, the resemblance between them is too constant, and, as will be seen by the figures, is too considerable to be a matter of accident or coincidence. I cannot adopt the idea of the same physical causes in different countries influencing the development of the antlers in the same direction. I can understand cold or heat adding thickness to a fleece, or reducing or increasing the dimensions of a horn, but shape and form are things which do not fall under the same category. Similarity of form is, according to my view, to be accounted for by affinity and nothing else. Upon this principle, there must be nearer affinity between the Greenland and American than between the Greenland and the Lapland deer, a circumstance which indicates a difference in the distribution of plants and of mammals in Greenland. Had it been (as one would at first expect from the position of Greenland) that its flora was more allied to that of America

* RICHARDSON, "Faun. Bor. Amer." 1839.

than to that of Europe, we should have received without surprise the additional fact that its fauna and that of Spitzbergen also bore the American type; but when we know that Greenland bears a flora of a Scandinavian type, while the mammalian fauna of both it and Spitzbergen are more allied to America, the explanation of such a concurrence of circumstances becomes beyond measure puzzling, except upon the hypothesis of the geological changes which I have already endeavoured to explain.

No other point of resemblance between America and those lands has until recently been observed. Nothing is said to indicate such in Dr. Hooker's essay on the "Arctic Flora;" on the contrary, the flora of Spitzbergen is there treated by him as Scandinavian throughout, and his lists bear him out in doing so. Dr. Malmgren,* however, has made a fresh comparison of the plants of Spitzbergen, from a list which his own researches, added to the materials already published by the late Sir W. Hooker and others, have enabled him to make more complete than any that previously existed; and his comparisons show a greater degree of affinity between the flora of Spitzbergen and North America than had previously been supposed.

According to him, ninety-three phanerogamous plants have been found growing in Spitzbergen, to which two noted by the translator of his paper may be added, making ninety-five, and on a collation of the species found in Greenland, in Scandinavia, in Asia east of the White Sea, and in the North American Arctic Islands, Melville's Islands, &c., he arrived at the following conclusions, viz., Firstly, that the Spitzbergen flora is most nearly related to Greenland. Secondly, that the flora of the north coast of Spitzbergen (latitude 80° north), is very different from that of the west coast, and is most nearly related to the flora of the islands in Lancaster Sound, Barrow's Strait, and Melville Sound (latitude 74° north), the two having nearly an equal number of species and almost seventy per cent of them common to both.

Of the 95 species hitherto found in Spitzbergen, 73 are found on the north coast, and 80 on the west coast, and of the 73, 60 are also found on the west coast.

The flora of Spitzbergen contains 71 species that are also found in Northern Scandinavia, and 58 that are found in the American Arctic Islands; but most of these are circumpolar species, and found both in Scandinavia and North America. The real test of affinity between Spitzbergen and the North American Islands is that all the 24 species not found in Scandinavia are with the exception of 3, also found in the Arctic-American Islands, and whilst 5 of these are also found on Nova Sembla and the land of the Samoyedes in Northern Asia, and 6 in the Taimyrland, there remain 7, which seem to be found in Greenland as well as Arctic America; and 6, which are peculiar to the Arctic-American Islands and Spitzbergen, being according to Malmgren found nowhere else.

The question, therefore, in reality very much depends upon these 6 species; but before cross-examining them I shall note another fact which may perhaps be brought forward in favour of the American connexion with Spitzbergen, and that is, that there is a possibility of a great land stretching between them, commencing at Gillies' Land, which lies about fifty or sixty miles north-east of Spitzbergen, and ending at Cornwall Land, north of Melville Island. Little is known of this Gillies' Land except that it is a mountain land like Spitzbergen, and much frequented by Walrus. Mr. Lamont thinks it probable that some rolled boulders of red granite which he ob-

* Newton in "Proc. Zool. Soc," 1864, 495.

† Dr. Malmgren in "Olfers af Konigl. Vetenskap Acad· Forh." 1862, pp. 229–268, translated in Dr. Seeman's "Journal of Botany," 1864, p. 130.

served in Spitzbergen in positions which he could not reconcile with their coming from any other quarter, must have come from that land, and that it may form part of a more extensive continent, and the fact of all these special American species as well as the majority of the American species which are found in other lands as well as America and Spitzbergen, occurring only on the north coast of Spitzbergen, is a striking circumstance in favour of the possibility of the one country having derived its species from the other.

Let us now see what is to be said *ab altera parte*. The six test species found nowhere but in Spitzbergen and Arctic-America, are PARRYA ARCTICA, DRABA PAUCIFLORA (which Malmgren says, although cited from the Taimyrland, is not found in the Old World); DRABA MICROPETALA, ARENARIA ROSSII, POA ABBREVIATA and HIEROCHLOA PAUCIFLORA. Now, three of these, ARENARIA ROSSII, PARRYA ARCTICA, and HIEROCHLOA FLEXUOSA, are quoted by Dr. Hooker, as found in the north-east of Asia as well as America, although he does not seem to have been aware of the fact of their being found in Spitzbergen. He may be wrong in giving these localities, but until the point is cleared up, it is plain that these three cannot be received as only found in America and Spitzbergen. Next, while Malmgren reckons DRABA MICROPETALA, DRABA PAUCIFLORA, and POA ABBREVIATA, as distinct species, Hooker records them as mere synonymes (not even as varieties) of Scandinavian species, the two former of DRABA ALPINA, and the latter of POA FLEXUOSA. "Who shall decide when doctors disagree?" It is, however, to be remembered, that a distinct variety found in two places should carry nearly the same significance as to its common derivation as a distinct species does. If these three are struck out, there remain none of the special species to countenance the supposed relationship between America and Spitzbergen. Or if a composition is struck by "dividing the difference," we shall then have something like the proportion which I have pointed as the probable amount received by Australia from India, by flotsam and jetsam, not quite two per cent.

Reverting to the Greenland and Spitzbergen Reindeer, let us see if their claim of kindred to the Barren-Ground Caribou stands on any better foundation.

The figures of the horn show us that those of the Greenland and Spitzbergen Deer certainly resemble the North American species more than any of the rest, and furnish a fair ground for speculating on a derivation from America; and if the reader will allow me, I shall state the speculation on this point a little more in detail than I could well do in discussing the general question of a miocene Atlantis.

1. The Reindeer came into existence at the glacial epoch.

2. Europe on the retreat of the ice being very nearly wholly without life, and North America entirely so except at her south-western corner, it is probable that the Reindeer, and those boreal species which are widely distributed in Asia and Europe, drew their origin from Asia.

3. The Siberian form of Reindeer I suppose to be the primitive type, at least the oldest of those we know. It is half-way between the European and the American, which is what we might expect if it gave off these types, one to the right and the other to the left.

4. The type which established itself in Europe in the early days after the glacial epoch was the Lapland form, as is shown by the fossil horn from Norfolk, which bears only such trifling deviations from the normal Lapland type as might be expected in the same animal inhabiting the same district, at some distance of geological time.

5. I have already explained, in speaking of the miocene Atlantis, the distribution of land and sea which I supposed to have existed at the close of the glacial epoch. So far as it concerns us here, I

would only remind the reader that I gave reasons for holding that Greenland was then united to Britain by Iceland, and the Faroe and Shetland Islands, and the continent by Denmark, and thence southwards. It is plain that when Europe began to assume its present appearance the great northern rivers which now fall into the Baltic Sea and German Ocean must have had an outlet; and the inequalities of the bottom of the sea show that this must have been by a continuation of the Baltic along the western shore of Norway. When we reach the north of Norway it was at first a matter of doubt to me whether the then Baltic most probably emptied itself into the Arctic Ocean between Greenland and Spitzbergen, or by rounding the North Cape and passing between Nova Zembla and Spitzbergen. At that time I did not know of the identity of the Spitzbergen and Greenland Reindeer, I only knew that Greenland, Spitzbergen, and Scandinavia, had all one flora, which proved nothing, but now we have circumstances in which Greenland and Spitzbergen agree, and in which they differ from Scandinavia, and that turns the scale in favour of the outlet being to the east of Spitzbergen. In support of the connexion of Spitzbergen with other lands — not specially to Greenland, but generally—we have the fact mentioned by Mr. Lamont that the sea for a considerable distance round Spitzbergen is very shallow, about twelve to twenty fathoms being the ordinary depth in which the walrus were hunted.

6. The fact of Greenland possessing a European flora proves that its connexion with Britain and Denmark continued sufficiently long after the close of the glacial epoch to allow plants to spread from Britain to it.

7. The dispersal or spread of plants is more rapid than that of animals, at all events it must always precede that of animals. Until plants have established themselves there is nothing on which herbivorous animals could feed; and until herbivorous animals come there is nothing for carnivorous animals to feed on. It is quite in rule, therefore, that Europe, and Greenland as a part of it, must have received its flora before its fauna.

8. The character of the flora of Greenland and Spitzbergen being in the main European, it follows that the connecting stretch of dry land between Europe and Greenland was still above water when the plants from the south colonized Greenland.

9. The character of the fauna is not European. It is circumpolar, or, more properly speaking, Polar North American. There is the above modified connexion with the Reindeer. It has been ascertained that American examples of the Polar Hare (Lepus glacialis) can be distinguished from Scandinavian and Siberian examples by differences in the relative proportions of some of the parts, as of the tarsus; and on examination of specimens from Greenland they have been found to correspond with the American proportions, rather than with the Old-world dimensions. An American Lemming, Myodus Hudsonius, has been taken in Greenland, and the other animals found in Greenland, also occur in America. More particular examination of individuals from Greenland of every species, found both in the Old World and the New, is very desirable; but with the information which we have, we must take the facts as preponderating in favour of a connexion with America, so far as regards the mammals. Moreover, as already said, the birds are American; and although birds can fly where plants and terrestrial mammals cannot, we know that even migratorial birds discern and keep their own boundaries.

10. I therefore infer that the connecting land between Greenland and Britain sunk before any mammal had reached the former; and that the break first took place between Iceland and the Faroe Islands. The latter seem to have continued long enough united to Britain to allow its mammals to reach them. Shetland and they both possess a British mammalian fauna on a reduced scale, as the

reader will see if he turns to the Appendix and examines their special faunas there given. Iceland, on the other hand, has not a single mammal which has not been introduced by man except the Arctic Fox and the supposed Lemming, and they, after having made their way from America to Greenland, doubtless introduced themselves by travelling on ice-floes from Greenland.

11. The fauna not having come from Europe, and being most intimately related to American types, how did it reach Greenland? First, how did it get from Siberia to America? We have seen, while speaking of the distribution of plants in America subsequent to the miocene epoch, that there is reason to believe that a channel of communication by dry land in the line of Bhering's Straits and the Aleutian Islands existed subsequent to the close of the glacial epoch. If that was good as a bridge for plants to cross, it was equally good for mammals. The Siberian type, with a broader brow antler than the Lapland type, may have sent across a host of its species, which, in North America became, by the effect of the altered condition of life, changed into the Woodland Ground Caribou, a form nearer the Siberian than the Barren-Ground Caribou, whose range runs obliquely from Bhering's Straits to Lake Superior, in the direction of the isothermal line. That species underwent another change when it passed out of its woodlands into desolate grounds to the north-east of Slave Lake and west and north of Hudson's Bay, and gave rise to the typical Barren-Ground Caribou with the triangular-bladed brow antler.

12. Although Greenland had by this time been effectually separated from America by Baffin's Bay, in its southern parts, it is not so plain that a connexion may not still have existed to the north. The space between Grinnell Land in America, and Washington Land in Greenland, at the head of Baffin's Bay, in 80° North longitude, is separated at Kennedy Straits by the most trifling distance; and we can well understand that if at a former time there was a land communication thereabouts it would prove very useless to plants, few of which could live so far to the north, but still might admit the passage of those which could bear the cold, as well as of the Reindeer, and all the other American mammals which are found in Greenland. And such plants are precisely the kinds which are found on the north coast of Spitzbergen, and which we should now expect to find in the extreme north of Greenland. They are all of an extremely polar character, and combined as they are with the strong infusion of species also found in America, I have come to the conclusion that we must regard Greenland as having had an extreme northern communication with America after the glacial epoch. If we admit that, we should then find nothing more abnormal in the character and distribution of its vegetation than we do now in America, where polar species are gradually replaced as we go south by more temperate forms.

Red Deer. (Cervus Elaphus.) The range of this noble animal extends over the whole of Europe, and over the north of Asia as far as Lake Baikal and the Lena. Its distribution was equally extensive in the post-glacial epoch, its remains being not rarely found in the drift; in peat-bogs, bone-caves, bone-breccias, and recent loam and marl deposits. In Britain it is now limited to the Highlands of Scotland, and a few parks or forests in England, where it is protected; as Whittlebury and Saulcey forests. It was formerly plentiful in all the royal forests, and it was it which furnished sport to our ancient kings. At Dartmoor Forest, in Devonshire, its numbers were so great in the days of the present Duke of Bedford's grandfather, that the farmers petitioned his grace to rid them of them on account of the injury they did to the crops. The Duke sent down his stag-hounds from Woburn, the forest chases took place, and the deer were

extirpated. So glutted was the neighbouring town of Tavistock with venison at the time, that only the haunches were saved, and the rest given to the dogs.*

In Ireland, the Red Deer still roams through its native woods of Kerry, and was known in parts of Galway, especially among the Twelve Pins, and in Erris in the county of Mayo, within the memory of the last generation. We gather that in ancient times it must have been very abundant, not only from the traditions of the country but from the curious corroborative fact mentioned by Mr. Wilde in his paper above referred to, that immense quantities of the tips of stags' horns have been discovered both in the great Crannoge of Dunshaughlin, and also in Dublin itself in sinking a sewer in the High Street. These bits of bone, which are from three to five inches in length, were sawn off from the remainder of the horn, which was in all probability manufactured into sword and knife handles, the antlers of the Stag having been largely used in the manufacture of these objects, and for spears and other purposes.†

Roe Deer. (Cervus Capreolus.) The range of the Roe extends over all Europe with the exception of the greater part of Russia. It is scarcer in the northern countries, and is fast disappearing in Scandinavia and Britain. It is more plentiful in the south, as in Italy, Greece, &c. It is said, I know not with what justice, to be now extinct in England. It certainly is not so in Scotland. Until within the last hundred years, it used to be not unfrequently met with on the wastes near Hexham in Northumberland, but at last dwindled down to a single animal, which is said to have been killed by Mr. Whitfield, of Whitfield, in Northumberland, about ninety years ago.‡

There are six North American Deer besides the Moose and the Reindeer, respectively, peculiar to different districts of that Continent. There is the Canadian for the north, the Virginian for the east (east of the Missouri and south of Maine to the Gulf of Mexico). The Missouri or old tertiary Nebraska sea again acts as a barrier here. The Virginian Deer does not cross it, but it is replaced by something else which may prove to be only one species for the whole west, or perhaps three species; one or two for the district between the Missouri and the western side of the Rocky Mountains; and the other for the coast or Columbian district west of the Cascade Mountains.

* "English Forests and Forest Trees," 1853, p. 116.

† Wilde, op. cit. in "Transactions Royal Irish Acad.," May, 1859.

‡ "English Forests and Forest Trees," p. 286.

CHAPTER XXIII.

RUMINANTS *continued*—MUSK-DEER—CHEVROTAINS—ANOPLOTHERES.

Musk-Deer (Moschidæ). (Map 31.) In his monograph of the Musk-deer and Chevrotains Dr. Alphonse Milne-Edwards* has satisfactorily shown that the species of which they have usually been composed should be divided into two sections, the one consisting of the true Musk-deer of Northern and Central Asia, the other of a small group of ruminants of Tropical Asia, which he has denominated Tragulidæ, after the genus Tragulus, of which they chiefly consist. Of the true Musk-deer, which is distinguished by secretion of the musk of commerce, there is only one species (Moschus moschiferus). It is allied to the true Deer, but is distinguished from them by the absence of horns and the presence of the musk-bag. Several species have been described, but these are all referred by Dr. Milne-Edwards and Professor Brandt to one species, of which they are climatal varieties. Its range extends throughout Central Asia, from the Altai to the basin of the Amour and shores of the Pacific, and southwards through Tartary and Mongolia, Cashmir, Thibet, to the interior of Siam. It seems a question whether the extinct genus, Dichobune, remains of two or three small Species of which have been found in the eocene beds of the Paris basin, should be placed in this family, or among the Anoplotheridæ. I have placed it amongst the latter, but there are sufficient points of resemblance to both to allow it without much imputation of error to be placed in either. We have seen that there was probably a passage from Europe to Australia, by south-east Asia in the eocene times, by which the eocene flora spread all the way from the one to the other. Here we seem to have an eocene mammalian form reaching almost, but not quite so far, stopping at the Indian Archipelago and subsisting there until the present age. It seems to have sent off a shoot (Hyomoschus) which had reached Africa. It may have lived in numbers in Asia until the glacial epoch swept them away, and only one altered type, the Moschus moschiferus, remains to show where they had been.

The representative of the Musk-deer in Africa is an aberrant species named Hyomoschus aquaticus; inhabiting the west coast of tropical Africa from Senegal to the Gaboon. Its name implies that it is supposed to be an animal with aquatic habits, but this seems doubtful, for the late Earl of Derby, who had living specimens in his menagerie at Knowsley, found that they took no notice of the water.† Another species inhabited the south of France in the miocene times, remains of which have been found in the miocene formations of Sansans in the department of Gers. The chief structural peculiarity of the Hyomoschus consists of the metacarpal bones not being united, as in other ruminants, to form the cannon bone, an additional point of resemblance

* Dr. A. Milne-Edwards, op. cit. See also "Nat. Hist. Rev." Oct. 1864, p. 495.

† "Knowsley Menagerie," p. 22, 1850.

of this family to the Suidæ, for, as Dr. Milne-Edwards observes, if an isolated foot had been the first portion found of the fossil animal without its living ally being known, it would certainly have been referred to a form allied to the Peccaries (Dicotyles), a reference which might have led the students of geographical distribution to the erroneous inference that species of the South American Peccary, in former days, also inhabited Europe. The corrected inference is, that an animal, not a Peccary, but having certain relations to the Peccary, did then inhabit Europe.

Chevrotains (Tragulidæ). The distribution of the genus Tragulus is different from that of the Musk-deer. It embraces five representatives, all found in the southern part of Continental Asia and the adjacent islands. None of the Tragulidæ are found in Africa.

Anoplotheridæ. (Map 43.) This family, although separated *longo intervallo* from both, forms a transition between the Pachyderms and the Ruminants, and has been placed in the one order by some authors, and in the other by others. The opinion of the majority seems now pretty decided that they were Ruminants. As compared with the Pachyderms, they were slender, and supported upon long thin legs, having two hooves like other Ruminants—in addition to which, some of them had a small third hoof at the back of the foot. The dentition was peculiar and remarkable in this, that as in the human species, and in it alone of living animals, the molar teeth come close after the canine teeth without any interval. They had a tail nearly as long as themselves, varied greatly in size, and are supposed to have affected marshy places, their remains being found in places and in company which suggests this idea.

The genera into which the family has been divided, are the following, viz. :—

1. Hoplotherium,* *Laiz*, which contains among its species some of the smallest hoofed-mammals known, animals no larger than a rabbit. Remains of species of this genus have been found chiefly in the middle tertiaries in France (Auvergne, Bourbon, &c.), but also in Switzerland and Germany.

2. Chalicotherium, *Kaup*. Probably synonymous with part of Cainotherium. It contains two species about the size of a Rhinoceros, which have been found in the middle tertiary beds of Eppelsheim.

3. Dichodon, *Owen*. Found in England, in tertiary sand at Hordle.

4. Anoplotherium, *Cuv*. Animals of various sizes from that of a sow to that of a horse, and in each extreme suggesting by their form a connexion on the one hand with the Tapir, and on the other with the Musk-deer. Their remains have been found in the tertiary Paris basin, also here and there in England, and Germany, and in the miocene beds of Sevalik, where Cautley and Falconer found two species.

5. Xiphodon, *Cuv*. Slim Anoplotheres, with a long head, and long slender legs; they have the stature of the gazelle, and it has been thought probably lived after the same fashion. One species has been found in the Paris gypsum, and another (doubtful) at Montpelier.

6. Dichobune, *Cuv*. Small, three-toed species of Anoplothere. Their size may be inferred from the names given to the different species, one being called Cervinum, another Leporinum, and a third Murinum, after the Deer, Hare, and Mouse. I have already said that various authors think

* *Synon.* Cyclognathus, Microtherium, Hyægulus, and part of Cainotherium.

that this genus does not belong to the Anoplotheres, but to the Musk-deer. De Blainville is of this mind. They also have been found in the same formations as the above.

Two other doubtful genera come here, ACOTHERULUM and APHELOTHERIUM. They probably belong to the genus DICHOBUNE.

Dr. Leidy has detected in the remains from the Mauvaises Terres species which may be referred to this family. They belong to his genera, AGRIOCHÆRUS and OREODON, which are remarkable and very peculiar forms occupying a position in the wide interval between the recent Ruminants and the Anoplotheres.

CHAPTER XXIV.

ARTIODACTYLIAN NON-RUMINANTS—SWINE—PECCARY—HIPPOPOTAMUS.

THE non-Ruminants consist of the SWINE, (viz., the PECCARY, the SOW, the WART HOGS (PHACOCHÆRUS and POTAMOCHÆRUS), and the BABIRUSSA) and the HIPPOPOTAMUS.

(SUIDÆ.) SWINE, BABIRUSSA, AND PECCARY. (Map 30.) This family, with the exception of the Peccary, is confined to the Old World. Indeed, it is to be observed that not the Ruminants alone, but the whole group of Pachyderms, whether in the past or the recent epochs, have always been poorly represented in the New World.

There are several species of Hog, some of which may be distinct and good species, but on the whole they are very doubtful. The Indian Wild Boar differs from the others in the number of its dorso-lumbar vertebræ; but others are probably the wild offspring of the common Hog altered by climate. The head-quarters of this family seem to be the East Indies and the Indian Archipelago in which there are found in Celebes the BABIRUSSA, in New Guinea the SUS PAPUENSIS, in Java the SUS VERRUCOSUS, in Java and Sumatra the SUS VITTATUS, and in Borneo SUS BARBATUS, besides two other wild species according to Mr. St. John. In Africa are found the Wart Hogs, forming the sub-genus PHACOCHÆRUS. They occur in South Africa, and also in Abyssinia and West Africa; but not north of the Saharan desert. The Swine when they break out into new species seem to indulge the most grotesque vagaries—the Babirussa and the Wart Hogs being two as abnormal and extraordinary-looking creatures as one would wish to see. The fact of Africa and the Indian Archipelago being alike the scene of these saturnalia, is another grain of evidence that an ancient connexion once existed between them.

PECCARY.—(DICOTYLES.) Swine are represented in America by the Peccary. The genus contains two species only,—DICOTYLES TORQUATUS, the Collared Peccary, and D. LABIATUS, the white-lipped Peccary. Dr. Baird mentions that the former has a much wider range in America than is supposed by European systematic writers. In Johnston's "Physical Atlas" its most northerly limit is marked at Guatemala; but it extends all through Mexico (one of its provincial names being the Mexican Hog), and even as far north in the United States as the Red River of Arkansas, in latitude 34° North. Its western limit in North America is not ascertained, although it is said to be found in part of California. It extends through South America from the Caribbean Sea to the Straits of Magellan. I can find no notice of its having been seen west of the Andes, south of Guayaquil; north of that port it occurs on both sides of the mountains. The other species, D. LABIATUS, or white-lipped Peccary, is confined to the forests of South America, and does not reach so far south as the open plains of La Plata.

America is better supplied with fossil forms of this family than with recent. They are chiefly,

ISOTHERMAL 32°

MAP XXIX

HIPPOPOTAMUS.

FOSSIL

EXISTING

MAP XXX.

SWINE.

Wild Boar

Dicoteles

Phascochoerus

Other species of Swine

Day & Son (Limited) Lith.

if not all, from miocene formations. In the Old World the following fossil genera are of most importance, viz. ENTELODON, CHÆROPOTAMUS, HYOTHERIUM, ADAPIS, besides fossil species of the present genus SUS. Of some of these, representative genera have been found in the fossiliferous beds of the Mauvaises Terres.

HIPPOPOTAMUS. (Map 29.) The Common HIPPOPOTAMUS (H. AMPHIBIUS) is found in the Nile, the Niger, the Senegal, and most of the rivers of South Africa. Many of them are separated from each other by vast tracts of arid desert, across which it is not easy to conceive how an animal, so dependent upon water for existence, could ever have passed, unless at some former period what is now sandy plain were plashy marsh, a metamorphosis which we know to be periodically occurring in similar ground, and under not very dissimilar circumstances in some parts of Central Africa, and in Australia at the present day. Attempts have been made to separate the Hippopotamus of the South of Africa from that of Abyssinia and Senegal, but the separation has not been adopted by naturalists. Another smaller but quite distinct species has been found in the River St. Paul, a few degrees north of the Equator, in Liberia, West Africa. It has only one pair of incisors in each jaw instead of two, and has been described by Mr. Morton, of Philadelphia, under the name of H. MINOR. The species rests upon two crania, which are all that have yet reached the hands of osteologists, but the characters are so marked that the species has since been erected into a separate genus by Dr. Leidy under the name of CHŒROPSIS LIBERIENSIS. A species, spoken of under the name of SUCCATYRO, has been at various times talked of as still existing in the Sunda Isles. Marsden mentions it in his "History of Sumatra;" but there seems no ground for the statement. It is, doubtless, a perversion of the Tapir.

The range of the Hippopotamus in past times was more extended than at present. No trace of it, however, either living or fossil, has been found in America. Fossil remains of several species have been found in the Sevalik miocene beds, and in pliocene and post-pliocene deposits over the greatest part of Mid and South Europe. It appears to have been plentiful in France, and not scarce in Belgium and the south of England. Great numbers of remains have been found in Algeria, in Sardinia, Corsica, Italy, more especially in the Val d'Arno, but the quantity found in Sicily vastly surpasses that found anywhere else; in fact, such enormous quantities of the bones and teeth occur there, that for a time they were exported in ship-loads to France and England for making lamp-black and manure, until it was discovered that they were so far fossilized as to have lost their gelatine. "In 1829," says Dr. Falconer, "there was a great demand for the manufacture of lamp-black for sugar-refining. The superficial bones of the San Ciro cavern* were collected in large quantities, and exported to England and Marseilles. Professor Ferrara states that within the first six months four hundred quintals were procured from San Ciro. The great majority belonged to two species of Hippopotamus. In one heap out of several ship-loads sent to Marseilles, De Christol, an able palæontologist, had found that in a weight of thirty quintals all the bones belonged to Hippopotami, with the exception of a few of *Bos* and *Cervus*."† Dr. Falconer believed these immense quantities to be the accumulations of a series of generations. An interesting circumstance connected with the remains of the Hippopotamus in Sicily is that Dr. Falconer and Baron Anca found some of them in

* "Grotto di San Ciro," or "Mare Dolce," at the foot of Monte Griffone, about two miles from Palermo.

† FALCONER, in "Journal of the Geological Society," 1860, 101.

company with flints in forms evidently worked by the hand of man, and with the remains of the existing African Elephant. These were discovered in the Grotto de Maccagnone, near Palermo; and it is an almost inevitable inference, that the Hippopotamus and other extinct animals found there were contemporaries of man. The presence of the bones of these animals in Sicily seems to imply the existence of dry land between Sicily and Africa at a period when man was already an inhabitant of Europe. There is a subaqueous bank between Sicily, Malta, and Cape Bon, which is doubtless the remains of such a former connexion. As Mr. Horner put it, in his anniversary address as President to the Geological Society in 1861, "There must have been a continent now submerged, with the exception of those parts of it that now form Sicily, Malta, and Gozo, through which a great river flowed, in whose waters vast herds of these monstrous animals swam, and on whose marshy banks they bred for successive generations."*—Perhaps there is no necessity to say "a continent now submerged," but certainly there was dry land.

The species of Hippopotamus which lived in these countries is thought by De Blainville to be the same as the existing H. AMPHIBIUS. It is generally known, however, under the name of H. MAJOR, the name given to it by Cuvier, who, however, made the mistake of describing it three times under different names, his species H. MAXIMUS and H. ANTIQUUS being now regarded as mere varieties referable to age or nutriment. The species found in the Sevalik formations are perfectly distinct species (H. SIVALENSIS, *Falc.*, &c.) among which number either the H. MAJOR or a closely allied species also occurs; and a fossil tusk has been received from Madagascar, where no Hippopotamus now occurs.

When information as to the fossil fauna of Darien was first received, remains both of the Hippopotamus and Sow were said to have been found there. This was afterwards negatived; so that the Hippopotamus still remains peculiar to the Old World.

* "Proc. Geo. Soc.," 1861.

CHAPTER XXV.

PALÆOTHERIDÆ. This family is the antecedent race to, and partakes of the characters of both the Tapir and Rhinoceros. It makes its appearance at the beginning of the tertiary epoch, when neither Tapir, nor Rhinoceros, nor Horse existed, and these latter appear to succeed the PALÆOTHERIDÆ as their representatives. The family does not extend beyond the middle tertiary epoch, and exactly here occur the first traces of the living genera which are allied to it and have replaced it. It is as if these forms were developed out of it.

The bones of the face furnish indications that the animals possessed a short proboscis, and perhaps chiefly on that account they have usually been placed in the same family as the Tapirs; but if that is to be done, the Rhinoceros must follow, and as it is desirable to break the order up into one or two families, I have followed Burmeister, and placed the PALÆOTHERIDÆ as a distinct family beside its descendants. The genus PALÆOTHERIUM was originally founded by Cuvier on remains discovered in the eocene beds of the Paris basin; and it and the ANOPLOTHERIUM are better known to the general public than most extinct species, from his restorations of the animal, having, as it were, infused life into the dry bones, and placed the idea of it before their minds invested with a local habitation, instead of leaving it, like most others, an empty abstraction and a name. A number of species (ten or twelve in all) have been found in the older and middle tertiary deposits of Middle Europe.

Until the discovery of the miocene deposits of Nebraska, the PALÆOTHERIDÆ were supposed to be confined to Europe. In these beds, however, have been discovered the remains of an animal which undoubtedly belongs to the family, if not to the genus, and which is still more remarkable than any species that have been found in the Old World. It is named TITANOTHERIUM by Leidy, and well deserves its name, for although only portions of the skeleton have been found, if the animal preserved the same relations of size in its parts as PALÆOTHERIUM MAGNUM, it must have been twice the height of the Rhinoceros of Java. Its head alone must have been six feet in length. Dr. Evans states of one specimen, "A jaw of this species was found, measuring, as it lay in its matrix, five feet along the range of the teeth, but in such a friable condition that only a portion of it could be dislodged."* And "a nearly entire skeleton of the same animal was discovered in a similar position, which measured, as it lay imbedded, eighteen feet in length and nine feet in height."†

In the same group, three or four other extinct genera are placed, viz., LOPHIODON, *Cuv.* (eight species), CORYPHODON *Cuv.* (one species), ANTHRACOTHERIUM, *Cuv.* (four species), which embrace several other genera which by some are thought to have been proposed on insufficient grounds; such as TAPIROTHERIUM, PACHYNOLOPHUS, TAPIRULUS, LISTRIODON, &c., &c.

* LEIDY, "Extinct Fauna of Nebraska," p. 77. † LEIDY, op. cit. p. 78.

The species of these are all from the middle tertiaries of Europe or one or other of them, and have been found in England, France, Germany, Spain, and Italy.

Nesodontidæ. The reader may here expect to find two peculiar animals, the Toxodon and Hyrax, which are usually ranked among the Pachyderms. They appear to me to belong to the Rodents, and I have placed them as distinct families in that order. The grounds for doing so will be found stated under the Rodents. During the expedition of the "Beagle" Mr. Darwin discovered some remains at Bahia Blanca and on the banks of the Sarondis, a small stream entering the Rio Negro about one hundred and twenty-one miles north-west of Monte Video, in South America. Nothing but skulls, more or less imperfect, were found, but there were sufficient remains of these to enable Professor Owen to characterise two genera, the first of which he named Toxodon, with one species; and the second, Nesodon, with four species.

Professor Owen combined these two into an order which he called Toxodontidæ, but Burmeister has detached the genus Nesodon from it, and proposes to establish it as a separate order, and in a different position in the arrangement. The Toxodons as just mentioned I carry to the Rodents. The genus Nesodon I keep here. It has a very different dentition from Toxodon, viz., three incisors and a small canine in each side of the jaw, and is considered by Burmeister, who has lately published his views on the subject, as more akin to the genus Macrauchenia. I have adopted his suggestion, but we know so little of them, that whatever course we take regarding them is almost certain to be disavowed by Nature when we are at last fortunate enough to hear her speak, that is, when more perfect remains of the species are discovered. This has been eminently the case with the Macrauchenia, mentioned below, and will always be so where we attempt to supply a scarcity of facts by an abundance of conjectures.

Although four species of this genus have been described our knowledge of them is almost entirely confined to the teeth. There is a small canine tooth, and three incisors, and seven grinders on each side of each jaw. One species, N. imbricatus, appears to have been of the size of a Lama; another, N. Sullivani, of that of a Zebra; N. ovinus, of that of a Sheep; and N. magnus, of that of a Rhinoceros. Some of these dimensions, however, are calculated from very imperfect materials, the last for example, from a molar tooth.

Macrauchenia. Professor Owen, who first described this animal from some vertebræ and other fragmentary portions of a skeleton, obtained by Mr. Darwin at Port St. Julian, in Patagonia, referred it to the order Pachydermata, but he thought that its cervical vertebræ showed marked affinities to the Ruminants, and especially the Camels.* M. Gervais, in the "Zoologie" of Castelnau's expedition, did not see any resemblance to the Camelidæ, but regarded it as a Perissodactylian Pachyderm, the structure of the foot being nearly the same as that of the Rhinoceros and Tapir. Mr. Darwin himself partly adopted both views. He says that it is fully as large as a Camel, and belongs to the same division of the Pachydermata as the Rhinoceros, Tapir, and Palæotherium; but in the structure of the bones of its long neck shows a clear relation to the Camel, or rather to the Guanaco and Llama.†

Subsequently to this, remains of another species, consisting, however, of only two very imperfect

† Owen, "Zoology of the Beagle." § Darwin's Journal, second edition, p. 172. 1845.

MAP XLIII.

ANOPLOTHERIUM

(EXTINCT)

MAP XLIV.

TAPIR

PALÆOTHERIUM &c.

Hoary Tapir
American Tapir
Dº fossil remains of the living species
Indian Tapir
Fossil remains of Extinct Tapir & allied genera.

Day & Son (Limited) Lith.

and mutilated portions of the skull, were discovered in 1859, in the copper-mine of Santa Rosa, in Bolivia. This species has been named by Professor Huxley MACRAUCHENIA BOLIVIENSIS. From the remains examined by him, he conceived that it proved "that when they were imbedded, there lived in the highlands of Bolivia a species of MACRAUCHENIA, not half as large as the Patagonian form, and having proportions nearly as slender as those of the Vicugna, with even a lighter head: and it is very interesting to observe that, during the probably post-pliocene epoch, a small and a large species of a more or less Auchenoid mammal ranged the mountains and the plains of South America respectively, just as at present the small Vicugna is found in the highlands, and the large Guanaco in the plains of the same Continent."*

Meantime, M. Bravard, well known for his palæontological labours, had, in 1856, been fortunate enough to obtain a perfect skull of the animal, as well as some other portions of the skeleton, from near Buenos Ayres. This has formed the subject of a memoir by Professor Burmeister, after Bravard's untimely death in the fatal earthquake of Mendoza had arrested a work on the fossil fauna of La Plata, on which the latter was engaged.

Professor Burmeister's better materials have enabled him to unravel its affinities, and he considers that its place is between the PALÆOTHERIDÆ and the TAPIRS. Notwithstanding this, however, I imagine osteologists will not readily abandon the idea, suggested by the ruminant character of its cervical vertebræ and long neck, of its having a certain amount of connexion with the CAMELIDÆ. A pachyderm with a long neck is an anomaly, and seems inconsistent with the typical idea of the animal. It is entirely in deference to Prof. Burmeister's opinion that I place the genus here.

TAPIRS. (TAPIRIDÆ.) (Map 44.) There are three existing forms of TAPIRS, all formed in the same mould, and yet readily distinguished by external characters.

The first species (TAPIRUS AMERICANUS) is entirely of a brownish-black colour. It has a very wide distribution in South America, extending from east to west, from the foot of the Andes, that is, the inner or eastern range (the range known by the name of Cordillera being the western), to the Atlantic Ocean, and from north to south, from Central America to Buenos Ayres.

Another smaller South American species, T. ROULINI (T. VILLOSUS, *Fisch.*) also brown-black, inhabits the higher regions of the ranges of the Andes at an altitude of seven or eight thousand feet, and possesses peculiar interest from being clothed with long, thick, close, felted, blackish-brown hair, giving us an instance exactly corresponding to the warm coating of the species of Pachyderms which have been adapted for living in cold climates. The Mammoth had a ponderous fleece of long hair and felted wool; and the northern Rhinoceros was also woolly-haired. And here, where the conditions of its life call for the provision, we have their congener, the Tapir, similarly protected.

The third species, T. INDICUS, distinguished by the posterior half of the body being white, is confined to Sumatra, Malacca, and the south-west province of China. It has been said to be found in Borneo. Mr. Spencer St. John, indeed, classes it with the Elephant and Rhinoceros as there found, but I can find no sufficient warrant for this. I shall discuss the value of his statement when we come to the Elephant.

Fossil remains of species of Tapir have been found both in America and Europe. Lund found one in the bone-caverns of Brazil. In Texas and Kentucky remains have been found, called by

* HUXLEY, in "Journal of Geolog. Society," xvii. p. 83.

Harlan and others T. MASTODONTOIDES and T. GIGANTEUS, but which, according to Leidy, cannot be distinguished from the bones of the living species of South America.

In Europe, the tertiary sands of Eppelsheim and the brown coal of Breber in Croatia, have produced remains of a species named T. PRISCUS. Teeth and fragments of other supposed species have occurred in the Swiss Molasse; and the tertiary deposits of Montpelier, the Issoire, Puys de Valay, &c., have furnished another (T. ARVARENSIS).

CHAPTER XXVI.

MULTUNGULA *continued*—NASICORNIA (RHINOCEROS).

RHINOCEROS.—(Map 46.) The distribution of the species of Rhinoceros corresponds with their structural affinity. The characters chosen for classification by some authors no doubt fail to show this, but that is the fault of their selection of characters, and is not due to the absence of good structural distinctions. For example, Dr. Giebel * divides them into species with two horns, species with one horn, and species without horns; an arrangement which has the effect of making a jumble of all the species, Asiatic and African together, and, moreover, has no good structural foundation on which to rest. No doubt the bones of the skull have a certain relation to the horn, being formed so as to support it; but the number of horns does not materially affect this; the horns are mere agglutinations of hair; and in very old individuals of the two-horned species, both in Africa and Asia, a third smaller horn sometimes makes its appearance. Classification on such a basis could not be expected to lead to any true combination of affinities.

Characters such as the possession of "permanent incisors in both jaws," and "no permanent incisors in the upper jaw," have a very different significance and value, and separate the Asiatic species entirely from the African; the Asiatic having incisors in the upper jaw, and the African none, or only milk teeth, which disappear early.†

Of living species, five African and three Asiatic are known. The African are three black ones and two white. 1. The RH. AFRICANUS (*olim* BICORNIS, the Borelé of the Cape colonists). 2. The RH. KEITLOA *Smith*, a second black species. 3. RH. CUCULLATUS *Wagner*, from the Highlands of Ethiopia. 4. The White Rhinoceros, RH. SIMUS *Burch.;* and 5. A second white species, RH. OSWELLII *Elliot;* all with two horns. These African species fall naturally into two groups —those which browse on trees and those which graze, distinguished readily by a prehensile or non-prehensile upper lip. There may be a sixth with only one horn. Mr. Edward Blyth, in his paper "On the Living Asiatic Species of Rhinoceroses," says, "Sir Andrew Smith assured me that he had been repeatedly told by the natives that such an animal occurred in the regions northward of the tropic of Capricorn."‡ And Mons. F. Fresnel, then Consul of France at Jidda (Djidda),§ some time since published an elaborate letter, "Sur l'existence d'une espèce Unicorne de Rhinoceros dans la partie tropicale de l'Afrique," the information in which may very possibly be well founded.

* Giebel, D. C. G. "Die Säugethiere in Zoologischer Anatomischer and Palæontologischer Beziehung."—Leipzig, 1859, vol. i. 197.

† VAN DER HOEVEN, "Handbook of Zoology." Clarke's Translation, 1858, p. 634.

‡ E. BLYTH, in "Journ. Asiat. Soc." 1862. Separate copy, p. 3.

§ FRESNEL, in "Comptes Rendus," tom. xxvi. (1848), p. 281.

These are all found in Africa proper, that is, south of the Sahara. None are found in North Africa. The Borelé ranges over the whole of the west and south of Africa, from the Sahara, through Congo, to the Cape. It does not appear to extend into Abyssinia. The other species, so far as yet known, more affect the east and centre of the continent than the west.

The Asiatic species are—1. The great one-horned species, Rh. Indicus (*olim* Rh. unicornis*), which, according to Mr. Blyth, is now limited to the *Terai* region at the foot of the Himmalayahs and valley of the Brahmaputra (or province of Assam). 2. A smaller one-horned species, which was formerly believed to be confined to Java (Rh. Sondaicus, *Horsf.*, *olim* Rh. Javanicus, *Cuv.*), but has been lately satisfactorily shown by Mr. Blyth to extend from the mainland by Malacca to Burma into India. It appears, indeed, from his investigations, that the species usually supposed to be the Indian Rhinoceros, in contradistinction to the Javanese, has, in point of fact, been all the time the latter species, while the true large Indian species is confined to the limited sub-Himmalayan territory above mentioned. The third species is the Rh. Sumatranus, formerly thought to be confined to Sumatra, but now ascertained by Mr. Blyth to range alongside the Rh. Sondaicus in the Indo-Chinese country, keeping towards the east, while the latter holds more to its west or Burman side.

Whether the Rh. Sumatranus occurs in Borneo is a disputed question. Mr. Blyth treats it as perfectly proved, but he himself has no personal knowledge on the subject. So slight is the evidence in support of it that Mr. Spencer St. John† only says, "Among the principal animals which frequent the forests of Borneo may be mentioned the Elephant, Rhinoceros, the Tapir," &c., "the first three have not been seen by Europeans," and again, "The Rhinoceros is a rare animal, though it is reported in some of the wilder parts of the country, and the existence of the Tapir rests upon *the same testimony!*"‡ What testimony? He has just said that there is none. "*It is reported*" is usually considered the reverse of *testimony*. I can find no better authority, and until I do I cannot agree with Mr. Blyth in admitting that either the Rhinoceros or the Tapir are inhabitants of Borneo.

While I render all homage to my friend Mr. Blyth's admirable powers of discrimination in matters falling under his own personal observation, I do not think him nearly so safe a guide in questions depending upon testimony or report. Nothing delights him more than to get hold of some old tradition or natives' report, or to untomb some black-letter notice of antiquity regarding some unknown animal, and to bring his great knowledge to bear in expiscating its meaning and determining the species thereof. I rather demur to some of his determinations of this kind because I think nothing but deliberate examination by a competent naturalist ought to be received, and that it matters little whether a report comes from a native or a European, if they are not conversant with the subject on which they speak. An instance illustrative of the idiosyncracy which leads Mr. Blyth to swallow with zest everything that comes seasoned with obscurity and natural history, occurs in his "Memoir on the Living Asiatic Species of Rhinoceros" above referred to, so excellent in all that has come within his own personal observation. It is with

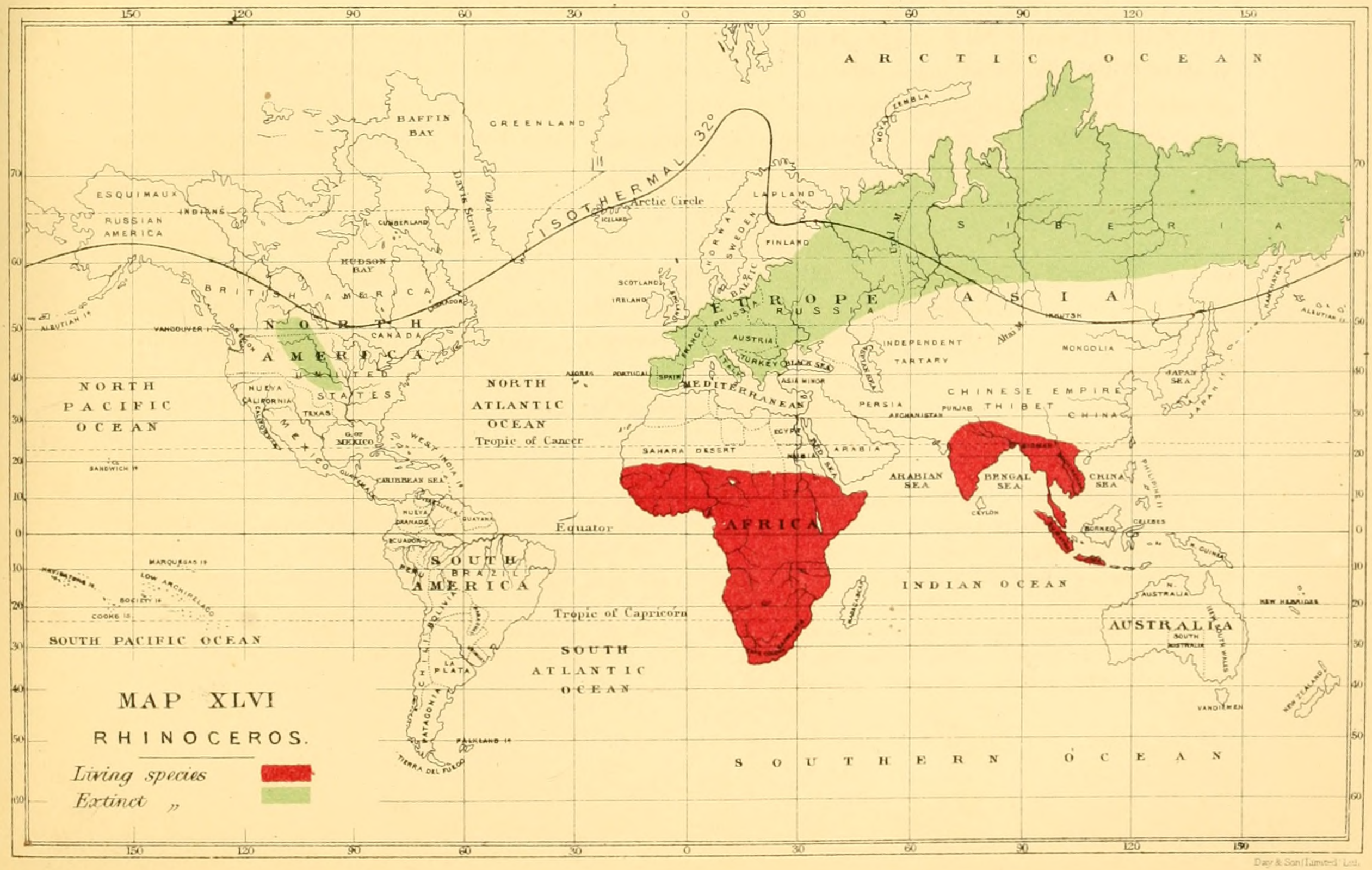
* Although I follow the nomenclature now in general use, I must acknowledge that I see no good reason for altering the old well-known names *unicornis* and *bicornis*, merely because we now know more than one one-horned or one two-horned species, or to alter a geographical name because its range proves wider than was supposed—names have long ceased to be scientific descriptions, and are now simply *cognomina rerum*. If, indeed, a name embodies an untruth (as *Chrysomela Americana* for a Mediterranean species), that is a different thing. Although we cannot have the whole truth, let us at least have nothing but the truth even in *cognomina rerum*.

† "Life in the Forests of the Far East," by Spencer St. John, vol. ii. p. 244. London, 1863.

‡ Spencer St. John, op. cit., vol. ii. p. 246.

MAP XLV.

HYRAX.



MAP XLVI

RHINOCEROS.

Living species ■

Extinct „ ■

Day & Son (Limited) Lith.

regard to another species of Rhinoceros said by Sir Stamford Raffles to exist in the forests of Sumatra. "There is," says Sir Stamford, "however, another animal in the forests of Sumatra never yet noticed, which in size and character nearly resembles the Rhinoceros, and which is said to bear a single horn. This animal is distinguished by having a narrow whitish belt encircling the body, and is known to the natives of the interior by the name of *Tennu*. It has been seen at several places, and the descriptions given of it by people quite unconnected with each other coincide so nearly that no doubt can be entertained of the existence of such an animal. It is said to resemble in some particulars the Buffalo, and in others the Badah or Rhinoceros. A specimen has not yet been procured, but I have several persons on the look out, and have little doubt of soon being able to forward a more accurate description from actual examination. It should be remarked that the native name *Tennu* has until lately been understood to belong to the Tapir. It is so applied at Malacca and by some of the people at Bencoolen. In the interior, however, where the animals are best known, the white-banded Rhinoceros is called *Tennu*, and the Tapir *Gindol*, and by some *Babi-alu*," &c. Mr. Blyth sets himself to work to account for this animal never yet having been found, but it never seems to have occurred to him to question its existence or to doubt Sir Stamford's judgment on the subject, and yet what does his statement come to? That in Sumatra there is an animal something between a Buffalo and a Rhinoceros, with a band of white round the body, and called by the natives a Tapir. Why, what on earth should it be but a Tapir? One is surprised at Sir Stamford Raffles accepting the fable, and still more at Mr. Blyth following his example.

All the three Asiatic species are shown by Mr. Blyth to possess two typical forms or characters, a broad and a narrow-skulled variety; and it is to the existence of these two varieties that he ascribes the misapprehensions as to the range of the *true* Rh. Indicus and Rh. Sondaicus. However that may be (and his inferences seem very fair), I draw attention to this variation in their characters for another purpose. He suggests, seeing the amount of variation which exists in the living species, extending into other points besides the breadth or narrowness of the head, as, for example, the horns —the remarkable horn in the British Museum on which Dr. Gray had founded his species Rh. Crossii, turning out to be merely a magnificently-developed specimen of the anterior horn of Rh. Sumatranus—that probably *all* the fossil species may not be good species, and that possibly the enormous remains found by Falconer and Cautley in the Sivalik formations may in point of fact be the vestiges of "magnificently-developed" individuals of the still living Indian and Sumatran species. He says, "The affinity of the extinct European species with Rh. Sumatranus has been long ago remarked by Cuvier and Owen. The Sevalik Rh. platyrhinus of Cautley and Falconer is just Rh. Sumatranus enormously magnified; and the Rh. Sivalensis of the same naturalists comes exceedingly close to the existing Indicus with the narrow form of skull, and their Rh. palæindicus to the same with the broad form of skull. Can it be the identical species which has lived down to the present time? The discrepancy is, at least, not greater than subsists between Bison priscus and the modern Zubr, which are considered by Owen to be one and the same."*

Besides the fossil species found by Cautley and Falconer in the Sivalik formations, remains of the fossil Rhinoceros have been found in vast numbers all over Europe and Asia. No other animal, unless perhaps the Mammoth, has left so many traces of its existence. From the Siberian shores of the Icy Sea, southward to the Sevalik Hills, they have been found in greater or less abundance, as well as from the Straits of Gibraltar on the east, at least as far as the banks of the Lena, on

* Blyth, op. cit. p. 7

the west. Mr. Dawkins, in an article in the "Natural History Review" (July, 1865), while in the text he gives 72° N. Lat. as the northern limit of these remains, seems disposed in a note to admit that their range probably extended, as I have put it, to the actual shores of the Polar Sea, wherever that might be; for we must remember that in the days we are speaking of, it rested probably more to the south of its present limit. He says, "Probably also in the higher northern latitudes of the islands of New Siberia and the Lächow group, the remains of the Tichorhine Rhinoceros are to be found in the vast accumulation of organic remains, of which, as the energetic Russian explorer Sannikow writes, the *whole soil* of the first of the Lächow Islands appears to consist. The occurrence of large quantities of the bones and skulls of Oxen, Buffaloes, Horses, and Sheep, associated with the Mammoth on the hills of the interior of New Siberia (Lat. 75°·6), led him to infer that, at the time when the island supported such vast herds of these animals, the climate must have been much milder than at present, when the icy wilderness produces nothing that could afford them nourishment. See Wrangel's 'Siberia and Polar Sea,' 1840. Edit. Major Sabine. Introduction."*

Whether there may have been a warmer climate in these icy regions at some former period or not is a question on which these heaps of bones throw no light, for it is plain that they are not the quiet graveyard of parishioners who lived and died upon the spot, but accumulations brought from elsewhere by ice and rivers or floods. The very vastness of the accumulations composing the whole soil forbids the idea of their being remains of the animals that lived and fed where they died, and the fact that frozen carcasses have been found in these places of deposit, shows that since the animal died no material change can have taken place in the climate, because the flesh has kept all that time locked up in ribs of ice. On such a supposition the change from heat to cold must have followed death within a few hours; and had we only one to deal with, we might admit that, however improbable it might be, such a sudden change was at least possible. But in these regions there are more carcasses than one in the same condition, and at different depths; these could not have all died on the same day; but as they are preserved alike, the cold must have been permanent and continuous.

In 1771 (thirty years before the discovery of the Mammoth by Adams, which did not take place until 1801), a carcass of the extinct Rhinoceros, since called the woolly-haired Rhinoceros (Rh. tichorinus), was found on the banks of the Vilni, a branch of the Lena. Fortunately, Pallas heard of it, and by his exertions the head and feet were secured, and have been preserved in the Museum of St. Petersburg; and these have been latterly carefully examined and described by Brandt. When found, it was considerably advanced towards decay, imbedded in a sandy bank, six feet above the water. It measured about eleven feet in length and ten feet and a half in height. The carcass of the animal, in all its bulk, was still covered with skin; but it was so far gone that only the head and feet could be removed. "I saw the parts," says Pallas, "at Irkutsk, and at the first glance perceived that they belonged to a Rhinoceros fully grown; the head especially was easily distinguished, since it was covered with the hide, which had preserved its organisation, many short hairs remaining upon it. The country watered by the Vilni," he adds, "is mountainous, and the strata horizontal: they consist of sandy and calcareous schists and beds of clay, mixed with great quantities of pyrites. Near the spot, and close to the river, there is a little hillock of about ninety feet elevation, and which, though sandy, contains beds of grind or millstone. The body of the Rhinoceros was buried in a coarse sandy gravel near this hillock; and the nature of the soil,

* Mr. Boyd Dawkins on the Dentition of Rhinoceros megarhinus in the "Natural History Review," No. xix., p. 399, July, 1865.

which is always frozen, must have preserved it. The ground is never thawed to any great depth near the river. In the valleys, where the soil is half sand and half clay, it is still frozen at the close of summer two feet below the surface. Had it not been for these circumstances, the skin and other soft parts could not have been so long preserved." It would be unfair to quote his further speculations as to this animal having been necessarily transported from the torrid zone to the frozen regions at the time of the Deluge. They correspond to the ideas of his time, and, where erroneous, his age is more in fault than he. His description is what we have really to do with.

From Brandt's examination,* it appears that the dried skin is of a dirty yellowish colour. He gives a fac-simile coloured figure of it with his paper, which is extremely interesting. The flesh of the muscles is reddish. The eyes are lost (dried out); the lids beset with short stiff bristles; the ear-muscles are entirely gone; and the whole of the anterior part of the snout is unfortunately so much injured, that the form of the nostrils and of the anterior margins of the lips cannot be ascertained, so that we cannot tell whether it had a prehensile snout or not, one fitted for browsing or grazing. The skin does not form callous folds on the head. The mouth is much smaller than in the living species. The skin is of considerable thickness, about half-an-inch deep at the throat; its surface smooth, granulated at the lips; densely covered all over with reticulated or roundish pores, arranged quincunxially. The head and feet are clothed with hair. The hairs stand closely together in tufts in these pores; some are long, stiff bristles; others are softer and shorter; without any peculiar microscopic structure. The single horns which have been found in Siberia have the structure of the horns of the living species. Their length does not appear to exceed three feet. The auditory passage is clad with short fine hairs. The muscles found on the head show neither in their arrangement nor in their intimate structure any deviation from those of the living species, nor has any peculiarity worthy of notice been observed in the vessels or nerves. The food appears to have consisted principally of the leaves and young shoots of pine-trees. Brandt extracted from the pits of the molar teeth of Pallas' frozen specimen part of the albuminous seed of a polygonous plant, portions of pine-leaves, and minute fragments of coniferous wood, characterized by the distinctive porous cells.†

This Rhinoceros lived during the post-glacial epoch in the middle and North of Europe and North Asia. It was, with the Mammoth, one of the commonest pachyderms of our part of the world. Its bones, teeth, and even entire skeletons, have been found in Siberia, also in Russia, in Europe, in Poland, Germany, England, and France. In the bone-layers of Seveckenberges, near Quedlinburg, alone, the remains of upwards of a hundred individuals have been collected. It does not follow, however, from the extensive district over which the bones of this animal are found that it lived over the whole of it at the same time. I imagine it to have been a boreal animal, always hanging upon the outskirts of the Arctic regions as the Reindeer and Elk do now, and that its remains left in countries whose climate is now mild are only proofs that at the time the animal died, the glacial cold had not retreated farther north than that latitude.

Rh. leptorhinus, *Cuv.*, is another extinct species, whose remains occur all over Europe—in the more recent tertiaries of the South of France, Italy, England—more particularly at Montpelier, Pisa, the Issoire, &c.

Another species, Rh. megarhinus of *De Christol* (allied to Rh. leptorhinus), has been found

* Brandt, in "Mem. Acad. St. Petersb." 6th ser. tom. vii. 1849.

† Leonhard and Bronn's "Jahrbuch," 1846, p. 378; and Bronn's "Lethæa Geognostica," III., p. 855, 1851.

in the tertiaries of Montpelier, but is distinguished by its larger size and the enormous development of its nasal bones, whence it may be supposed to have had a nose approaching the dimensions of a small trunk. It comes nearer in structure to the unicorn Rh. Sondaicus and the bicorn Rh. Sumatranus, than any other living species.

Remains of a species, supposed to be without a horn, Rh. incisivus, *Cuv.*, have been found in the middle tertiary deposits at Sansan, in the South of France; at Eppelsheim, Georgensmund, and other localities in Mid Europe.

Multitudes of other extinct species have been described, but on so slight grounds, that De Blainville was at last driven to exclaim that the authors "seemed to consider the bones as mineral masses without biological or physiological relations; so that species were created by them, so to speak, by the compass."* Species so described are mere names; *Vox et prætera nihil:* and as such may without impropriety be disregarded.

Until the discovery of the extinct animals in the Nebraska beds of the Mauvaises Terres, it was supposed that the Rhinoceros was peculiar to the Old World. Palæontologists and zoologists reasoned upon the fact, and many a false theory was propped up by it, and many a sound argument perilled. But by all the fact was accepted as beyond dispute.

It was, therefore, with no ordinary interest that the scientific world learned about 1831 (twenty years before Nebraska was heard of), that a fragment of a jaw, containing two incisor teeth, of an animal closely allied to the Rhinoceros, had been found in Pennsylvania. This had "nothing of the nature of bone about it except its form, the whole substance, teeth included, being constituted of an aggregate of quartzose particles, and presenting the appearance, not of a gradual substitution by mineral infiltration to osseous matter, but of a cast of part of a jaw and teeth formed of small quartzose grit, and giving a semi-translucency to the teeth, which is wanting to the more opaque jaw." † The American geologists received it with some doubt. Dr. Harlan regarded it as in all probability a mere *lusus naturæ* of the mineral kingdom, having a very close resemblance to a portion of the animal skeleton.‡ Dr. J. Hays and Mr. J. Lea regarded it as a mere mineral fragment.§ The specimen was sent to London, and the geologists who there examined it considered it of too doubtful a character to be admitted as a fossil remnant. Lastly, when it came under the penetrating investigation of De Blainville, he spoke out. "This is not the place," says he, "to discuss this at least very questionable point; but as the specimen now forms part of the collections of the museum" (I presume the Museum of the Jardin des Plantes), "we can give our assurance that it does not resemble the least in the world a fragment of the jaw of a Rhinoceros, neither as regards the body of the bone, nor the pretended teeth. It is without doubt an artificial piece, a gross cheat. It is, therefore, truly to be regretted that the expression of the thought has been hazarded, and that all the Catalogues of Palæontology have recorded a species of fossil Rhinoceros from America without even a mark of doubt."‖

The regret need no longer be felt. We have now two species of extinct Rhinoceros from America, of whose authenticity and correctness of determination no doubt can be entertained. (Rh. occidentalis and Rh. Nebrascensis, both described by Dr. Leidy.)

Both are from the Nebraska beds. They were smaller than the Old-World species, the largest

* De Blainville, "Osteographie," Osteo. Gen. Rhinoceros, p. 212, 1845–54.

† Featherstonhaugh, in "Monthly Americ. Journ. Geology," 1831, p. 10.

‡ Harlan, "Med. and Phys. Researches," p. 268, 1835.

§ Leidy, "Extinct Fauna of Nebraska," p. 29. 1852.

‖ Blainville, op. cit. p. 212.

being about three-fourths the size of the Rh. Indicus, that is, about the size of Cuvier's Rh. minutus, which is regarded by De Blainville as a small variety of the Rh. incisivus. The other was less than two-thirds the size of the former species, and is much the smallest Rhinoceros which has yet been discovered.

I have adopted the division of the genus into two groups (which prove respectively African and Asiatic), according to their possessing or not possessing permanent incisors in the upper jaw. The reader may wish to know how this applies to extinct species, and more especially to the new-found American ones. No particular inferences can be drawn from this character as regards them, for at the epoch when they existed (the upper eocene or lower miocene), all the species of Rhinoceros appear to have had incisors in the upper jaw, and so had the Nebraska species. It is only when we come to more recent times, to the period of the drift and diluvium, when the woolly-haired Rhinoceros (Rh. tichorhinus) flourished, that the type now peculiar to Africa begins to appear. The Rh. tichorhinus belongs to it, as well as numerous so-called species of the same epoch, and found over the same ground, which probably are only varieties or individuals of that species.

No remains of any species have been found in America in deposits subsequent to the glacial epoch.

A remarkable extinct animal, the Elasmotherium of Fischer (E. Fischeri, *Meyer*), should be here noticed. It is placed by Cuvier between the Horse and the Rhinoceros, and has been found in the Siberian drift. The lower jaw was two feet in length, and four inches high.

CHAPTER XXVII.

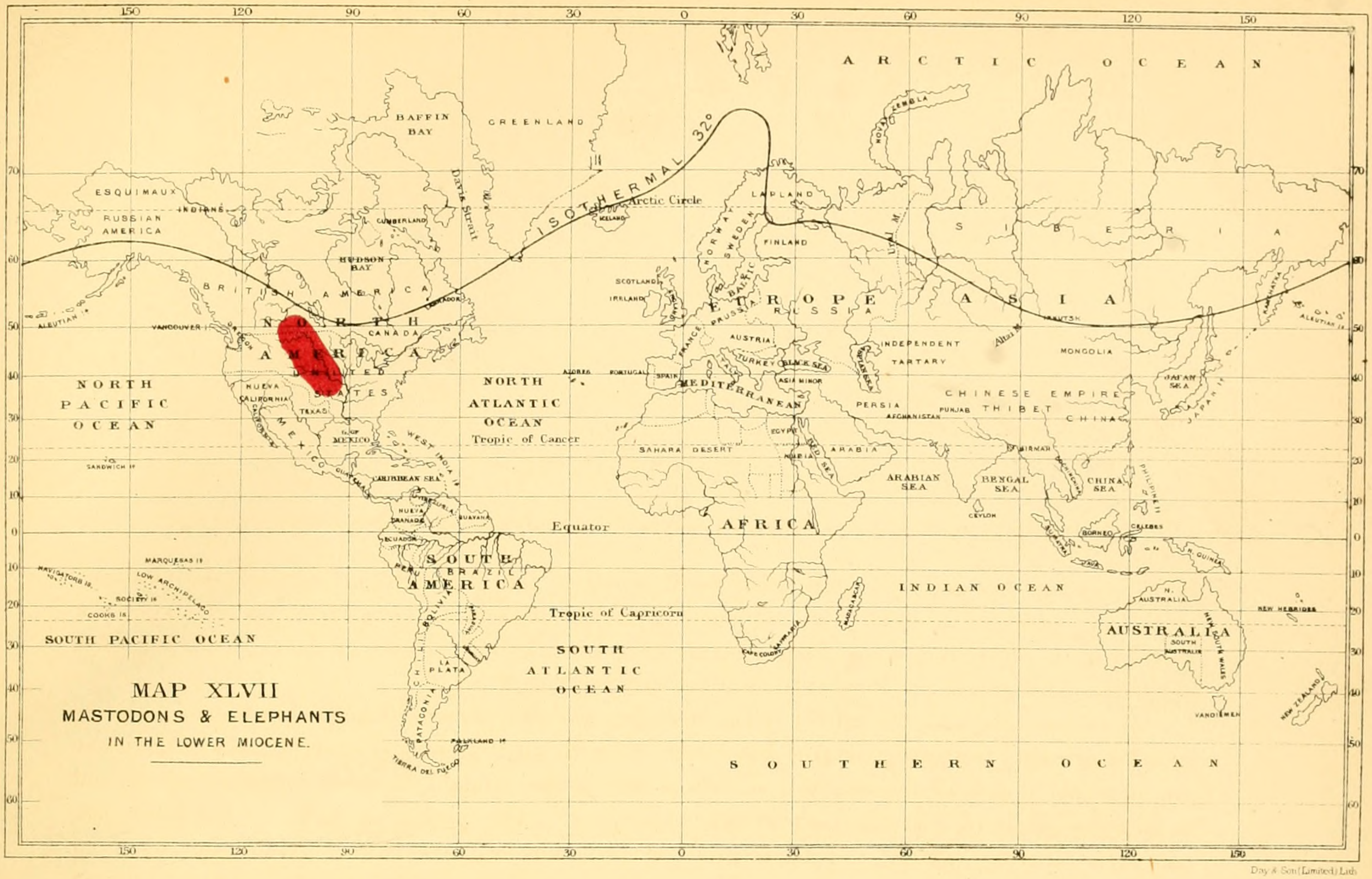
MULTUNGULA *continued*—PROBOSCIDEA—EXTINCT ELEPHANTS—MASTODON—MAMMOTH, ETC.

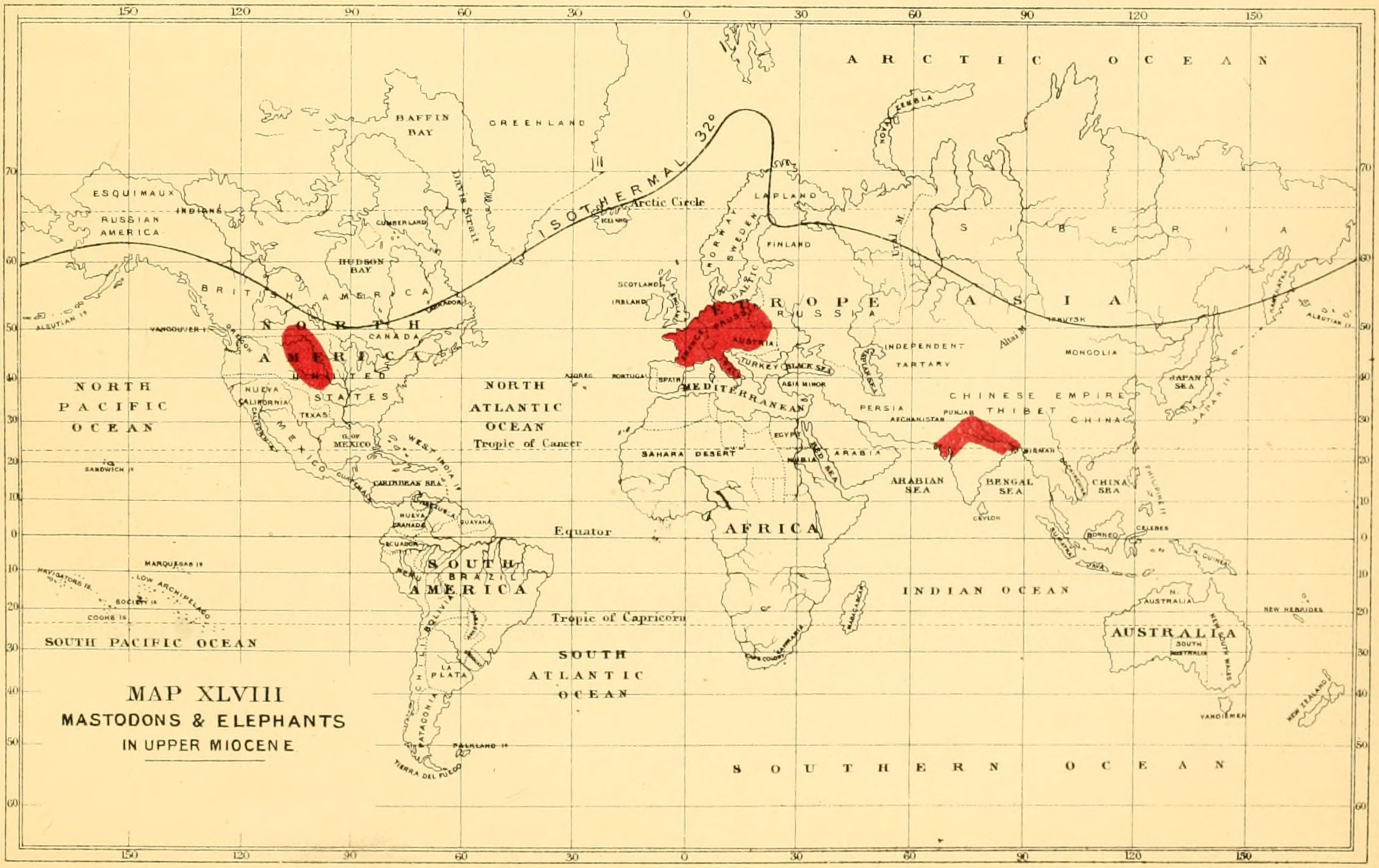
So far as can be gathered from their fossil remains, the Proboscideans entered on existence at the earlier miocene epoch; no particular form can be said to have taken precedence of the rest, for in the oldest beds where their remains have been found, evidence of the existence of species of the Mastodon and of the Elephant has alike been discovered.

Mastodon (Maps 47, 48, and 49).—The Mastodon was an enormous Elephant-like animal with less complex grinding teeth than the true Elephants, and with small projecting straight tusks in the lower jaw in some (if not all the species), as well as with tusks, straight in some, curved in others, and as large as those of the Elephant in the upper jaw. The projecting tusks in the lower jaw remind us of those of the Hippopotamus, and still more of an enlarged type of the Kangaroo form of incisor in the Diprotodon. Nor is this resemblance limited to the tusks or incisors; it extends to the molars and other parts of the skeleton. Prof. Owen first referred the femur of the Diprotodon to the Mastodon, and, in speaking of the molars observed, "The analogy of the close mutual similarity which exists in the molar teeth of the Tapir, Dinothere, Manatee, and Kangaroo, suggests the surmise, that the mastodontal type of molar teeth might also have been repeated in a gigantic Marsupial genus, which has now become extinct; and such an idea naturally arose in my mind after having received evidence of the marsupial character of the Diprotodon and Nototherium, two extinct Australian genera, with the tapiroid type of molars represented by species as large as Rhinoceros."*

The best characters for distinguishing the Mastodon from the Elephant are derived from the teeth, which are more durable and more frequently met with than the other bones. The tusks in the lower jaw, although not so useful for sectional characters as the molars, are perhaps the most interesting and remarkable part of their structure. It was not until the year 1830, that any suspicion appears to have been entertained, that the Mastodons more than the Elephants possessed tusks in the lower jaw, but early in that year a memoir by Dr. Godman was read to the American Philosophic Society, upon a mastodontoid lower jaw with two small tusks, which he described as characterizing a distinct proboscidean genus named by him Tetracaulodon. That name has not been adopted, because it was afterwards found that this character belonged to all Mastodons, or at any rate was as constant a character in them as the possession of tusks in the upper jaw is in Elephants. In some Mastodons these tusks in the lower jaw are absent, and in others only one is strongly developed; but this appearance or absence is a sexual, an individual, or at most a specific, and not a generic character. On its first discovery, however, it gave rise to much

* "Annals Nat. Hist." xiv. p. 271, 1844.


ARCTIC OCEAN
BAFFIN BAY
GREENLAND
ISOTHERMAL 32°
Arctic Circle
ESQUIMAUX
INDIANS
RUSSIAN AMERICA
HUDSON BAY
BRITISH AMERICA
NORTH AMERICA
UNITED STATES
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
Tropic of Cancer
Equator
Tropic of Capricorn
SOUTH AMERICA
SOUTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN
INDIAN OCEAN
EUROPE
ASIA
AFRICA
AUSTRALIA
MAP XLVII
MASTODONS & ELEPHANTS
IN THE LOWER MIOCENE.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INDIAN OCEAN
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ASIA
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MAP XLVIII
MASTODONS & ELEPHANTS
IN UPPER MIOCENE

discussion both in America and England; and the true nature of the osteology of the Mastodon was not known until ten years later, 1841, when Koch made a public exhibition of the entire skeleton and other remains of the North American Mastodon, which has since been bought for the British Museum, and is now preserved there. The ingenious exhibitor had contrived a fanciful reconstruction of the skeleton, inconsistent with the principles of animal mechanics; the huge tusks, instead of being placed with their points directed upward, as in the Elephant, or downwards as had formerly been suggested by Mr. Rembrandt Peale,* were spread out horizontally, with diverging curves, so as to resemble two great sickles. Other corresponding extravagances were exhibited in the opposition of the limbs, and for the grotesque form so constructed, Mr. Koch proposed a distinct generic place under the name MISSOURIUM. These blunders have been rectified since the specimen passed into the national collection, and with their removal the genus MISSOURIUM has disappeared too.

The molar teeth have prominent mammillæ, or colliculi, as Dr. Falconer designated them, while the molars of the Elephant are characterized by parallel lamellæ, or plates. This character, although apparently a very marked one, does not serve for all species. While it is scarcely possible to see any resemblance between the molars of the extreme species, the characters become imperceptibly less defined as the species approach, until it is almost impossible to say of some which have been raised into a sub-genus, under the name of STEGODON, whether they are Mastodons or Elephants. If we suppose the molar teeth of the Mastodon to be compressible, and their substance to be pressed between front and back, and so that the colliculi are squeezed thin and flat, we should convert the teeth of the Mastodon into teeth of the Elephant, only much shorter, and having fewer lamellæ; but the number of these colliculi differ in different species. In the simplest form, they bear a series of double rows of three mammillæ, separated from each other by a hollow with a ridge in the middle. In the next stage, they have a series of four mammillæ in a double row. Then we come to a series of five in a double row. At next stage, the hollow between the two rows begins to disappear, so that, instead of each two mammillæ being separated by a hollow, they are turned into single transverse ridges; and we have then the sub-genus STEGODON, with a series of six and more rows, forming the transition to the Elephants.

Dr. Falconer has well monographed the species of Mastodon and Elephant,† and has appended to his paper a useful synoptical table of species; according to this, there are thirteen species of Mastodon,‡ and fifteen Elephants, including the two living species of the latter. Dr. Giebel reckons only seven Mastodons and eleven Elephants. Other authors have made as many as nineteen Mastodons and thirty-four Elephants. Probably the true number lies between Dr. Falconer and Dr. Giebel. Dr. Falconer recognises six Mastodons as having lived in Europe (five of them in France), three at one time in the upper miocene, and two at another in the pliocene; four in India, one of which has only been found in North India (Sivalik Hills), and three in South India, two of which also inhabited Burmah; one from North America, and two from South America (the Andes). Bones and teeth of the Mastodon are, according to Humboldt, so abundant in a locality near Santa Fé de Bogota, in Columbia, that it bore the name of "the field of giants."

* CUVIER, "Oss. Foss." i. 239.

† FALCONER, in "Geolog. Soc. Quarterly Journal," vol. xiii. p. 319, 1857.

‡ While the material was still greatly inferior in amount, Prof. Grant also made thirteen species, but his species were very different, as the differential marks pointed out by him are now known to indicate nothing more than the individual and sexual varieties of the same species.

Although it is now generally admitted, that all the remains found in recent deposits in North America belong to one species (the M. GIGANTEUS, *olim* M. OHIOTICUS, *Blum.*), remains have been brought from the miocene beds of the Mauvaises Terres, which there cannot be a doubt will prove distinct. The common species extends as far south at least as Honduras, for Dr. Leconte found that the bones in a Mastodon bed there, near the village of Tambla, in a pass leading to the Pacific, belonged to that species.

In South America the Mastodon ranged along the whole line of the Andes, from 5° N.L. to 40° S.L. It has been found at great elevations; in 34° S.L. at the height of 1400 feet above the level of the sea; and at Quito, Humboldt found it at the height of 7200 feet; Mr. Darwin says it has appeared on the limits of perpetual snow. In that case the land may have been elevated since the deposition of the remains.

A tooth has also been found at Shanghai, and it was described by Prof. Owen at the meeting of the British Association at Cambridge in 1862.

For long (that is, ever since 1845) it has been accepted as a fact, that the Mastodon also lived in Australia, but this belief is now abandoned, or at all events judgment is held in abeyance upon it until further evidence be procured. It originated with Count Strzlecki, who, after having travelled over North America, South America, Australia, and the Indian Archipelago, and made collections in all these places, on his arrival in England in 1844, placed in Prof. Owen's hands the tooth of a Mastodon, which he stated he had purchased from a native near the Wellington Valley caves in Australia, the well-known locality from which so many extraordinary fossil remains have been obtained. Prof. Owen described it, and at various times has dwelt at greater or less length, on the inferences which such a discovery suggests; and, notwithstanding that various objections had been taken to its authenticity, he maintained it down to 1862, when at the meeting of the British Association at Cambridge, the repetition of his belief in it met with so much dissent, that he surrendered to the general expression of opinion, and acknowledged that until further evidence appeared it must be held that some error had taken place in regard to the place whence the tooth came. The reader will find a full and interesting account of the whole circumstances connected with the reputed Australian origin of this tooth, in a paper by Dr. Falconer, in the "Natural History Review," January 1863. The gist of it is, that the tooth has all the characters of one of the species from the Andes; that the matrix has none of the character of the Wellington Valley bones; the latter having a reddish ferrugineous colour, which Dr. Falconer mentions that this has not;* and that there is every reason to believe that some misplacing of labels had taken place, Count Strzlecki having to all appearance put into Prof. Owen's hands a specimen from South America instead of one from Australia. Count Strzlecki's own account of how he procured the specimen adds probability to the idea of there having been some mistake. He speaks of the native having brought him *a bone*, and saying that *larger bones* were to be had in the interior; language which is less applicable to a tooth than to a bone from some other part of the body. The *à priori* arguments against this large animal having been found solitary and alone of all placental mammals (except a few small rats, and the probably introduced dingo), in the country of Marsupials, are strengthened by the improbability, that if they then existed, not a trace of any other elephantine remains should ever have been found since 1843 to the present time, notwithstanding that the district where it was supposed

* I may add from personal examination of the specimen, that the matrix in which it has lain does not at all resemble the Wellington Valley matrix, but has a whitish grey calcareous appearance.

to be found has been more completely settled since then, and that where the remains of Proboscideans do occur, they are generally found in abundance. The absence of Proboscidean remains in Australia gives us an additional date for its separation from the Indian Continent. Proboscideans first appeared in the miocene epoch, therefore Australia has remained separated from the continent at least ever since then. For how much longer before that date we have a good guess from other sources.

To the great numbers of bones and teeth which have been collected of these extinct giants (believed by our ancestors to be Goliaths of our own species), we owe a more perfect knowledge of the Proboscideans than of any other extinct animal. But our knowledge has not been wholly derived from piece-meal discoveries of separate bones. Like the woolly-haired Rhinoceros, carcasses of the Mammoth, centuries,—nay, perhaps thousands of years old,—possibly millions, have been found preserved in, and obtained from, the frozen sandy river-banks of Siberia, and thus furnished materials for scientific examination. It is true that no discovery of the carcass of the Mastodon, preserved in that way, has ever been made (it was, perhaps, a less boreal animal); but discoveries of no small interest regarding it, too, have been made notwithstanding. In North America, in draining or digging out marl or fertilizing mud from small ponds, which, in the days of the Mastodons, were, no doubt, quaking marshes, remains of several entire skeletons have been found undisturbed, lying in the attitudes in which they died; they had undoubtedly become mired in the bogs, and had perished miserably. The most perfect of these are described by Dr. Warren in his monograph of the Mastodon of North America.* In Warren County, New Jersey, no less than six were found at about six feet below the surface; one specimen found in the town of Newbury, New York, was twenty-five feet in length, and twelve feet high, and with tusks ten feet long. Fancy six of these stupendous creatures; huddled together in the sinking mire. Imagine their trumpeting and shrieking, their bewildered dismay, their unwieldy efforts to move their limbs, only to sink deeper after every fresh exertion; their terror—marked by five of the six having been found quite close together (the sixth was at about ten feet distant); they had rushed together for mutual support only to add to their danger by concentrating the weight on one spot. They had struggled long, no doubt, and died hard. The attitude of one of them is described as having the legs spread abroad, and with the fore-legs in the position of making an effort to raise itself. Of course, all the soft parts had long since disappeared, their being no ice to protect them. But there was found what both Pallas and Adams overlooked in their ice-bound specimens,—the contents of the stomach. In one of these American examples, there was taken from the clay in the interior, within the ribs, where the stomach must have lain, no less than seven bushels of vegetable matter, consisting of leaves and small twigs more or less bruised and comminuted, which have been ascertained by microscopical examination to belong to a coniferous plant, probably the white cedar (Thuya occidentalis), one of the North American cypresses. These elephantine animals therefore browsed upon the common conifers of the country, in the same way as the woolly-haired Rhinoceros did on conifers in Siberia; evidence that they, like it and the Mammoth, and the trees on which they fed, were all adapted for a cold or temperate climate.

Such an adaptation seems to have been common to the whole section of Mastodons to which they belong. The remains of the trilophodont species are, with one imperfectly known exception (M. Pandionis), all found in the northern countries or regions, which we know to have been cold. One, or perhaps two—we have two names and two descriptions—have been found on the Andes in South

* Warren, J. C., "Description of the Skeleton of the Mastodon Giganteus," 1855.

America. These, from their position, may reasonably be supposed to have been adapted to cold climates; and as the remains are found only on the range of the Andes, it does not seem improbable, that, when the glacial epoch advanced in North America, it forced the M. GIGANTEUS or some other species south before it, driving it along the ridges of the Mexican mountains to the Andes. Many a bitter freeze and sore extremity they may have borne before they left their pine-covered land, but ere trees and vegetation had quite disappeared before the advancing ice, they must have turned their broad backs to the blinding snow and heavy drift and, crashing through the mountain forests of Mexico, have made their way southwards. Was their way taken through unwonted timber, and did they taste strange food on the road, or did their native woods migrate with them, and accompany them, *pari passu*, southwards in the slow progress of their journey,—a journey not of days or years, but of centuries and ages? Probably both. Probably the pine found itself growing side by side with the aloes, so long as the temperature allowed them to live; and we have now in the numerous pines and firs, which clothe the Mexican mountains the descendants of those North American species, which were driven with the Mastodon before the glacial cold; and both, after undergoing modification by process of development and altered conditions, have left evidence of their stay there, the Mastodon in the remains of M. ANDIUM and M. HUMBOLDTII, now found on the range of the Cordillera, and the conifers in the LIBOCEDRI and SAXEGOTHEAS.

The other section of Mastodons (Tetralophodonts) were apparently suited to a warmer climate, at least they are chiefly found in India, Ava, &c. Some, however, inhabited Europe,—more especially the southern countries.

MAMMOTH.—The Mammoth is, on many accounts, the most interesting of the Elephants, whether living or extinct. It inhabited the northern hemisphere, and apparently our own land long after man had taken his place in creation—occasionally furnishing, there is little doubt, a hard-won meal to our savage and hungry ancestors. Alongside its remains, and in beds proclaiming their simultaneous deposit, flint-knives, hatchets, bone bodkins and needles, obviously the work of man, have been found, and the fact of the co-existence of man and the Mammoth has now almost ceased to be matter of dispute.

It is now felt that the old traditions of the Red Indians of America as to the existence of an enormous animal, with a snout like an arm, may not be idle tales, but the genuine traditions of what actually had been seen by the *predecessors* of the present race (it would be too bold to say ancestors, for many races may have been conquered, and enslaved, died out and been replaced, since a living man in these lands looked on a living Mammoth). The Chinese records too, according to M. Boitard, speak of an animal living to the north, in extreme cold, shaped like a rat, but as large as an Elephant, furnishing excellent ivory; and other nations have similar traditions. Moreover, not only have their scattered bones, and even their perfect skeletons, been found, but the carcasses of individuals have been found congealed in ice in Nature's larder in the frozen regions of Siberia. It is no wonder, therefore, that a special halo of interest surrounds the Mammoth.

Thanks to the discovery of the frozen carcasses, we have a tolerably complete knowledge both of the outward form of this animal, and of its internal organs and structure. Every one knows that the first carcass was discovered by a Tongause fisherman in 1799, in a mass of ice near the place where Pallas' Rhinoceros had been found; and the bones and skin of that specimen, or at

MAP XLIX.

ELEPHANTS & MASTODONS IN PLIOCENE EPOCH.

Known fossil remains

MAP L

EXISTING SPECIES OF ELEPHANTS WHERE EXTIRPATED, LIVING & INTRODUCED

Indian Species
African "
Introduced
Extirpated "

ARCTIC OCEAN
NORTH PACIFIC OCEAN
SOUTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN
NORTH AMERICA
SOUTH AMERICA
EUROPE
ASIA
AFRICA
AUSTRALIA
ISOTHERMAL 32°
Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn

least so much of them as was left by the wolves and white bears, were, when liberated by the thawing of the ice (which it took seven of the short summers of that country to effect), secured by Adams, and deposited in the Museum of St. Petersburg. But the depredations of these beasts of prey had left it imperfect, and some part of the skeleton, as put up, is composed of wooden substitutes for the bones. In fact, so important a point as the number of dorsal vertebræ is even yet attended with doubt, although it is recorded that the spine, a shoulder-blade, the pelvis, and three legs, were still held together by the ligaments to the skin, when the carcass was taken possession of. Full details of what is known on this point will be found in Dr. Falconer's paper, already referred to.* A pleasant writer on Natural History in the present day (Rev. J. G. Wood) tells us that "opinions differ as to the manner in which the animal (Mr. Adams' Mammoth) got into the ice; and the question appears to have puzzled the *savants*, much as the apple dumpling puzzled George the Third. The general opinion (!) appears to be that the creature must have fallen into a cleft in a glacier, and so have been at once frozen up."† Que diable allait il faire dans cette galère? We can hardly imagine a Mammoth capering like a chamois over glaciers from peak to peak.

Another entire specimen of the Mammoth was found by Sarstschew on the banks of the Alascia, which falls into the Arctic Sea to the east of Indigirsha, and had been disengaged from the bank by the action of the river. It stood erect and was still covered with its skin. There are also preserved in the Museum of Paris a morsel of skin and matted hair, and locks of wool, belonging to a third individual, found whole on the banks of the Arctic Sea.

More than one similar fresh carcass has since been met with in Siberia, one of which was discovered about 1846, and its soft parts were transmitted to St. Petersburg, and made the subject of careful histological study by Glebow, who published an account of them.‡ His examination showed nothing new, as why should it? The fibres and cells of the tissues presented the same anatomical characters as those of living bodies to the most minute degree. M. Glebow says,—"One never ceases wondering at the elementary anatomical parts of the tissues of all the soft parts, without even excepting the brain having been preserved in such a degree of integrity, that it is impossible to distinguish them from the same parts of the fresh tissues of living animals. And we see with admiration that a time so prolonged, which ruins the most durable objects, and destroys the most solid things, as metal and granite, has spared the tissues of the animal organism, so tender and delicate, and in their nature so perishable, as the fibres of the brain, the cells of the epithelium, &c."

From the above materials we know that the Mammoth was of stupendous size, covered with an enormous quantity of long black hair, mixed at its roots with a thick fleece of reddish wool, not unlike cow's hair. At the removal of Adams' specimen, thirty pounds weight of finer hair, and coarse long hair like horse-hair, was dug up out of the moist soil, into which it had been trodden by the feet of the white bears and wolves when devouring the flesh. It had a great mane, and the ears bore each a long tuft of hair. The tusks of the upper jaw were of tremendous magnitude, but there were none in the under jaw.

The geographical range of this animal extended from Bhering's Straits, through Arctic Siberia

* Falconer, "Nat. Hist. Rev." Jan. 1863, p. 92.
† Rev. J. G. Wood, "Sketches and Anecdotes of Animal Life," 1855, p. 82.
‡ Glebow in "Bulletin of the Imperial Society of Moscow," tome xix. p. 109.

to the west of Europe; and in some of the isles in the Arctic Sea situated near the mouths of the rivers where the carcasses have been met with, their remains occur in such quantity that the soil is a mixture of sand, ice, and Mammoth bones. It stretched across the steppes of Russia, through Germany and France, to England. Its remains have also been found in Italy, although much more sparingly south of the Alps than to the north of them. The great accumulations on the shore of the Arctic Sea are doubtless the result of carcasses having been floated by floods from the higher lands down the rivers.

It is usually said that it flourished in as great numbers in North America, but Dr. Leidy, and some American palæontologists, have thought that it was a different species which existed there, and that the Old-world Mammoth was confined to Europe and Asia. At any rate plentiful remains of a species of Mammoth are found all over North America, and in especial numbers on its Polar shores, in similar conditions and places to those in Siberia, where the other species occurs. Most other palæontologists, however, think the species identical, Dr. Falconer,* admitting that there is a sufficient difference (although a very trifling one) to enable him to distinguish American specimens from those of Europe or Asia. It is interesting to see that the same causes which have have produced the variation between closely allied North American and European existing species were already in action in the time of the Mammoth. The bridge at Bhering's Straits must have been already sunk.

One of these differences is the comparative closeness of the laminæ of the molar teeth. Dr. Falconer gives an interesting comparison of the food used by the different species, and the adaptation of their teeth to its consumption, which suggests an additional argument for the formation of new species in new countries where the food may differ from that in the country whence they first came. Their molar teeth consist of broad tables composed of parallel transverse vertical plates consisting of successive layers of cement, enamel, and ivory—each of different degrees of hardness; and different degrees of power are given to these implements by the number of plates in each tooth, and by the extent of each tooth which is brought into operation at the same time; the greater the number of plates working, the more powerful the triturating surfaces. Estimated according to this principle, the African Elephant has less powerful grinders than the Indian Elephant and the Mammoth. The number of plates in the teeth of these two are the same (sixty-four ridges), while in the African species they are only half as many (thirty-two ridges), and the Mammoth, although it has the same number of ridges, has them thinner, straighter, and more regular. As the powers of trituration are feeblest in the African species, so its food is, in point of fact, softest, consisting partly of roots and in a great measure of succulent plants, such as the Portulacaria Afra or Spekboom. The food of the Indian Elephant consists more of branches, and is more siliceous, often containing a greater proportion of foreign matter, as sand about the roots of grasses, and young bamboos (Saccharum spontaneum); and its molars are the most powerful grinding instruments of any. The difference between its teeth and those of the Mammoth is that between a strong coarse file and a fine one. The food of the Mammoth, again, was probably the young twigs of soft-wooded Conifers, and required a less powerful apparatus. Falconer

* "The result of my observation is that the ancient Mammoth of the pre-glacial 'forest bed' of the Norfolk coast differs less from the later form occurring on the banks of the Lena, than does the latter from the comparatively modern Mammoth of the superficial bogs of North America, which I regard as being only a slight geographical variety of the same species."—Falconer, op. cit. p. 79.

maintains that we do not yet know what its food was; but although it has not been actually demonstrated, as in the Mastodon, there can be little or no doubt that it was much the same as the food of that animal, only probably consisting of the smaller and more tender twigs of the same trees as it fed on. It would not do, therefore, to suppose that an Elephant might be transplanted from any one country into another if only the climate suited it. The climate of Africa might suit the Indian Elephant, but still it might not be able to thrive in it. The molar teeth are not adapted to its food. It may be said that this might be true of the African Elephant if transported to India, as its teeth might not have been sufficiently strong to suit the harder food it would have to chew there, but that it would not apply to the Indian Elephant coming to a country where the food was more succulent than it required, and where of course there would be an excess of power instead of a deficiency. But the maxim that the greater includes the less will not always apply to the adaptations of nature any more than to those of machinery. The very thing here supposed has been tried. The Indian species has not, indeed, been transported to and turned loose in Africa, but it has been made to live upon more succulent and softer food than is natural to it. This is to a certain extent done when it is domesticated in India, but most so when in captivity in menageries in this country, where it is fed upon carrots and turnips, corn and hay, instead of upon hard branchlets and silicious grasses. The result is that the grinders fall out of repair. The cement or setting in which the enamel rests is not worn away, and instead of being like a coarse rough file, the tooth degenerates into a smooth surface like polished marble. The anterior portion of the tooth is not worn away as it should be; the next tooth presses forwards at the rate of growth allotted to it, and which corresponds to the normal detrition of the tooth before it, each lamina of which breaks off and falls out as it reaches the front of the jaw, but as that has been unnaturally retarded, the capsule of the back tooth, instead of remaining distinct, becomes united with the uncalcified back portion of the capsule of the tooth in action, and the two separate molars are fused into one unwieldy mass covered by a continuous shell of cement. Of course disease and its attendant death follow in the train. Speedy extinction, instead of wide extension, would be the result of introducing an animal to a new country under such circumstances, whether the teeth were too powerful or not sufficiently so, unless nature had the power contended for, of remedying the defect by altering her machinery; that is, by developing all the individuals exposed to the new condition into a new species.

The Mammoth is said to have lived in two epochs (and to have been the only one of the family which did so, whence the name proposed for it by Geoffrey St. Hilaire, DICYCLOTHERIUM—beast of two cycles—*i. e.* before the glacial epoch and after it; and notwithstanding that Dr. Falconer thinks this a happy appellation, "one of the bright inspirations of his (St. Hilaire's) later years," I shall venture to question its fitness. M. Lartet argues that it occupied different countries during the two cycles, and that it was an Asiatic animal in Asia before the glacial epoch — a European after. Tertiary (that is, pliocene), in the one — Quaternary in the other. But in the pliocene the glacial epoch had already commenced, and its occurrence in England, in the forest bed of Norfolk, below the drift shows that it had found its way into England before that land was wrapped in its winding-sheet of ice. The reader, however, will see that the idea of its entrance into Europe from Asia after the glacial epoch corresponds well with my explanation of the course of action subsequent to that epoch.

Dr. Falconer thus sums up what is known of the geographical distribution of the Mammoth.

"The state of our exact knowledge, at the present time, regarding the duration, geographical range, climate, habits, and food of the Mammoth, appears to be thus:

"The species existed before the glacial period in Europe, and survived long after it in Europe or America. The constitutional flexibility, which is implied by its dicyclotherian term in time, is equally evinced in its vast geographical range of habitat; extending from the valley of the Tiber to the Lena, and from Eschscholtz Bay to the shores of the Gulf of Mexico. Making due allowance for the interference of the glacial phenomena, the extremes of north and south latitude, in which undoubted remains of this ancient Elephant have been found, necessarily imply, that his constitutional flexibility was like that of man, capable of adaptation to very great differences of climate. In Siberia, he was enveloped in a shaggy, thick covering of fur, like the Musk-ox, impenetrable to rain or cold. But we are not obliged to suppose, that in his southern habitat he was thus clad. The dermal appendages are very variable, and adaptive according to climate. The fine silky fleece, from which the Cashmere shawls are woven, is abundantly developed at the roots of the long hairs of the domestic goat in the plains of Tibet, at, and upwards of, 16,000 feet above the level of our sea, where a highly rarified atmosphere is combined with severe winter cold. It grows, also, on the Kiang, the Yak, *Cervus Wallichii*, the Brown Bear of high elevations in Himalayah, and on the Mastiff Dog of Thibet. But it disappears entirely from the same Goat, and from the Dog, in the Valley of Cashmere. The short, crisp wool, of the Siberian Mammoth, which seems to have been the most protective portion of his fur, may, in like manner, have disappeared from the variety that lived in the Valley of the Tiber, while the bristles and long coarse hair were more or less retained; and it is in the highest degree probable, that the species presented varieties of external form, dependent on the nature of the dermal clothing, far exceeding those which are seen in existing Elephants. That the Siberian Mammoth migrated periodically from the more southern forests, towards the Polar sea, during summer, as his surviving contemporaries the Musk-ox and Reindeer now do, is also highly probable; but we have no grounds to believe that the Mammoth of Southern Europe ever made migrations to the north of the Alps."

There are one or two points in this view which seem to me open to question. In the first place, as to the migration of the Mammoth from the southern forests to the Polar seas in summer; if Mr. Falconer meant no more than is implied in the migrations of the species which he cites in illustration —the Musk-ox and Reindeer—perhaps a couple of hundred miles—I have nothing to say, but if, as the context implies, he imagines a migration of such extent that a dying Mammoth would in summer leave his bones on the shores of the Arctic Sea, and in winter in the Valley of Cashmere—that he wore in winter the coat we wot of, while in summer he was bare as my hand, then I should wish to express my dissent. Neither do I think that the facts warrant the assertion that his constitutional flexibility was like that of Man, capable of adaptation to very great differences of climate, or the attribute of a vast geographical range of habitat accorded to it, so far as that implies a simultaneous range through many degrees of latitude. I attribute the occurrence of his bones over the vast extent of latitude through which we find them to a different cause. No one disputes that the retreat and advance of the glacial epoch were gradual, and I imagine the occurrence of the bones of the Mammoth and its usual contemporaries—the Musk-ox, the Reindeer, and Cave Bear—in localities where the climate is now mild to have been due to the climate having been polar there when the bones were deposited. I think all these were circumpolar animals, that is, all habitually living, like the Reindeer, at or a little to the south of the margin of the Arctic Circle, for as regards this point the Arctic Circle might

* Falconer, op. cit. p. 112.

be at the Equator if the cold were great enough. When the Arctic Circle stood in the latitude of Paris, the bones of the Mammoth would be left over a little to the south of that latitude; when the Arctic Circle had moved on to Brussels, the band on which the bones would be left would be shifted northwards in a corresponding degree; so when it reached Copenhagen, or Hammerfest, a successive advance would be made by the animals that lived in its temperature. This is, I think, the general principle on which the dispersion of the remains of these animals is to be accounted for.

Next I demur to the term "dicyclotherian." It is perhaps true to the letter, but I do not think it is true in spirit. If I ask a man to dinner, and he comes in time for the soup and stays until after the dessert, he has no doubt been with me both before and after dinner; but no one would say that it was a *bonâ fide* account of his visit so to express it. He was with me at dinner-time, not before dinner, nor after dinner. It was so with the Mammoth. Elephants existed in the miocene time, but polar Elephants were not known until the glacial epoch brought them into existence. Their cycle was the glacial epoch. So far from their constitution being flexible and capable of adaptation to great differences of climate, I imagine it to have been the very reverse. They came in with the extreme cold and have gone out with the extreme cold. They did not "by a miracle of Providence" survive the two epochs. The glacial cycle is a cycle itself, not a line separating two cycles. They are essentially "Monocyclotherian," and were strictly "Monothermal." The law which has presided over the creation of species of Mammals remains undisturbed. There is still no well-established instance of any species of Mammal having lived in two epochs. There seems, however, no physical necessity that it should be so. It is only that a new cycle implies a change of condition, and consequent change of form in species. If the change in condition were only partial on the globe, or trifling, we should have plenty of "dicyclotherian" species, and a proof of it is that in the depths of the sea, where the changes of condition going on above, are of course less felt, we *have* dicyclotherian animals.

As to the clothing of the Mammoth varying we of course can only indulge in conjecture. Bishop Heber, indeed, mentions seeing a young Elephant in the Himmalayahs as shaggy as a poodle, but this does not go far. We do not find the full-grown Elephant putting on a shaggy coat on ascending the Himmalayahs, and putting it off again when it comes down. The instances given by Mr. Falconer are not pertinent. A Thibet dog taken into the Vale of Cashmere does not at once discard his fur. It is only after a course of years that the difference of climate begins to tell.

It is especially noteworthy that the same slight degree of difference which we see in existing semi-circumpolar animals in their different countries also occur in this extinct species. It lived undoubtedly for a very extended period, and yet the American species deviated as little from the Old-World form as does the existing SPERMOPHILUS PARRYI from S. EVERSMANNI. This, I think, shows—1st. That it was an Arctic species, always living in a boreal land; 2nd. That, as already mentioned, during the latter part of the life of the species (that is, subsequent to the return of warmth), the conformation of America and its relations to the Old World were not materially different from what they are now, because we see the Mammoth had an American type as the reindeer, moose, polar hare, and marmots have now; 3rd. That the change consequent upon exposure to different conditions of life having been once effected, no further alteration takes place through mere lapse of time, but the species remains persistent through future ages, so long as the conditions continue the same.

OTHER EXTINCT ELEPHANTS.—South of the Alps in Europe, a species named ELEPHAS MERIDION-

ALIS, becomes the more usual representative of the Mammoth, although remains of that species are sometimes found there too. South of the Apalachian range in North America, another species, E. COLUMBI, *Falc.* acts the same part in that continent.

Dr. Falconer thus describes the country which seems to have been the chief abode of this more southern species: his description will be of use in relation to other families as well as this:—Between the Apalachian Mountains and the Atlantic there is a wide stretch of horizontal tertiary strata forming three terraces, each about twenty miles wide. The lowermost or littoral platform rises from ten to forty feet above the level of the sea, and stretches at least 400 miles northward to Newbern and the Neuse, in Carolina. The deposit is fluvio-marine resting upon eocene strata. Although mainly marine, it contains beds of fresh-water origin, in which the Mammalian remains occur. Lyell considers it to be very analogous to the great Pampean formation of South America, as described by Darwin, and to be of pleistocene age. The bones are found between four and six feet below the surface, imbedded in clay, resting on yellow sand, and belonged to Megatherium, Mylodon, Mastodon, Elephant, &c.*

The E. COLUMBI extends from Mexico to Georgia, including 18° of longitude and 12° of latitude between the parallels of 20° and 32° N., and Falconer adds that there are grounds for suspecting that it ranged into South America.

No other species of the more recent epoch have been found in America, but a fragment of a stupendous tooth, obtained from the upper miocene beds of Niobrara, has enabled Dr. Leidy to announce another somewhat older species under the name of E. IMPERATOR, which, although the fragment is insufficient for description, Dr. Leidy, with perfect warrant I think, assumes to be distinct from the Mammoth, on the strength of the locality and deposit where found. No Elephant has been found in any part of South America, except perhaps in Guiana, where remains of E. COLUMBI are thought to have been found.

In the Old World the great metropolis of their kind has been India; no less than eight species being reckoned as discovered in it by Falconer, and all (except the existing species and one other) belonging to the early miocene. Except a Mastodon from the Mauvaises Terres, we know of no other species of Proboscidean but the Indian ones belonging to the lower miocene. And, with one exception, we have not yet obtained evidence that any of these survived, down to the upper miocene or pliocene.

When the rigour of the glacial epoch had passed and Europe had thrown off her shroud, the Proboscideans returned from Asia into Europe. In Europe alone Dr. Falconer reckons six Mastodons and five Elephants, probably most of them Arctic. All these species may not be good; but even, although they were restricted in number, sufficient would remain to show the extension into Europe of several species.

It is natural that the great size of these most remarkable animals should add to the interest with which we view them, and equally natural that when we have once got immense size fully established in our minds as the typical character of the race, we should feel no less interest in meeting with a species contradicting its normal attributes, and while still an Elephant, possessing in mature age no greater size than a young one. Remains of a pigmy of this kind have recently been found. Dr. Falconer, in his paper on Fossil Elephants, to which I have already repeatedly referred, gave a short notice of it under the name of E. MELITENSIS. This pigmy

* FALCONER, op. cit. p. 60.

species was obtained not long since by Capt. Spratt in the ossiferous caves of Malta. In size it stood between a large Tapir and the small unicorned Rhinoceros of Java. To show that there is no error in the case, such as mistaking a young one for an old one, he tells us, that the remains he discovered of numerous individuals, which included nearly the entire dentition, from the new-born calf up to the adult animal.* It falls into the section to which the existing African Elephant belongs.

Another species, not much larger than the E. MELITENSIS (neither of them exceeding five feet in height), and from the same source in Malta, has since been described by Mr. Busk under the name of E. FALCONERI, in commemoration of the highly honoured and much-lamented naturalist, from whose labours I have drawn so largely.

I may shortly say that Dr. Falconer divides the Elephants into three sections, according to the number and closeness of the lamellæ of the molar teeth. First, the sub-genus STEGODON, with few and broad lamellæ, forming, as already said, the transition between the Elephant and the Mastodon. Second, LOXODON, the type of which is the existing African species; it has molars half-way between those of the Indian Elephant and STEGODON. And lastly, EUELEPHAS, with narrow and numerous lamellæ, of which the Mammoth and existing Indian species are the types.

When and whence did Africa receive its species? We may assume that it was not before the miocene epoch, as no evidence of the existence of any prior to that period has anywhere been found. If at the miocene period, then there must have been some other connexion between Africa and other Continents than what now subsists — for at that time there were Elephants also both in North America and India; and the idea of three separate centres of creation for an animal is out of the question.

It follows that a connexion between Africa and some other country, where Pachyderms were, must have subsisted to allow of their appearance there; and as, for many reasons, a connexion of Africa with India seems more probable than one with any country, the Pachyderms furnish additional confirmation of the hypothesis of a former connexion with it.

Dr. Falconer's views correspond with this in referring to India as the nursery of the European forms both of African and Indian type. He says, that if the asserted facts be correct they seem clearly to indicate that the older Elephants of Europe, such as E. MERIDIONALIS (of the African type) and E. ANTIQUUS (of the Indian type) were not the stocks from which the later species, E. PRIMIGENIUS and E. AFRICANUS, spring, and that we must look elsewhere for their origin; and that the nearest affinity, and that a very close one, of the European E. MERIDIONALIS is with the miocene E. PLANIFRONS of India; and of E. PRIMIGENIUS with the existing Indian species.† That E. PRIMIGENIUS may have sprung from the present or some extinct Indian species seems extremely probable. As to E. MERIDIONALIS, we must remember that if it is near to E. PLANIFRONS, so is E. AFRICANUS, all three belonging to the same section, and E. PLANIFRONS being the only Indian one with the African type.

Another problem still more difficult of solution is the derivation of the Elephant (E. MIRIFICUS *Leidy*), in the miocene beds of Nebraska, of the same type (the Tetralophodont), and of even an older date than the Sevalik beds. Although we may not have fallen upon any older specimens in India than the Nebraska one, still the greater number of species found there suggests that India may have possessed them first. If, then, we assume that the original centre of creation of the Elephant

* FALCONER, op. cit. p. 87.

† FALCONER, op. cit. p. 80.

in India or its neighbourhood, by what route can this species have reached Nebraska? At the miocene epoch we know of no other species except in India. How can the gulf between these two distant regions be bridged over? By Peru, and thence northwards? No; the species found on the Andes belong not to the Elephant, but to the Mastodon, and to its more recent and northern type, and they are more probably the result of migration from the north under the cold of the glacial epoch. No miocene remains of any Proboscidean have been found in South America. By Bhering's Straits or the Aleutian Isles from Asia? By a direct land connexion between China and California, *viâ* the Sandwich Islands? By a continental union between Europe and America? There is little to guide us to a choice between these or other similar contrivances by which an ingenious mind might seek to unite the two lands in question, and it would not be difficult to find arguments in favour of every one of them.

CHAPTER XXVIII.

MULTUNGULA *continued*—EXISTING ELEPHANTS—QUESTION AS TO DISTINCTNESS OF SUMATRAN SPECIES—ELEPHANTS IN BORNEO.

EXISTING ELEPHANTS.—(Map 50.) The natural history and distribution of the existing species are not less interesting than those of the fossil.

It has been ascertained that the African species was not only represented in Europe by the small Malta species, E. MELITENSIS, but that remains of the existing African species itself (E. AFRICANUS) have been found both in Spain (near Madrid) and at more than one place in Sicily. The identity of the Spanish remains with the African species is given by M. Lartet with some doubt, but there is none as to that of the Sicilian, which is vouched for by Dr. Falconer himself. Although that species is no longer found wild in Africa north of the Sahara, its absence there is due to man. In former times it undoubtedly extended over the whole of the habitable parts of the Continent. The Romans and Carthaginians got their Elephants from the north of Africa —and numerous coins and medals prove that their domesticated species was the African one, the form and size of the ears being a sure indication of the species. Schlegel suggests that there may be more than one species confounded under the present African form—a north and a south breed. As he says, most animals from the two chief divisions of Africa differ specifically from one another, or at least show differences in size, &c., as, for example, is the case with the Ostrich of Algeria and that of South Africa. This is scarcely a parallel case, however, for the most northerly Elephants are not north of the Sahara; and in any view we must take them as only one until proved to be more.

If the existing African species extended into Europe there is reason also to believe that the existing Indian species did so likewise—one or two teeth, undistinguishable from those of the Indian species, having been found at the Bosphorus and in Italy. It is an interesting point to be kept in view in future observations, but the evidence in its favour is still too slight to allow this extension of the range of the E. INDICUS to be received as more than a possible supposition. The existing range of that species also furnishes matter for inquiry. If only one species is found in Asia, then that species extends through the East Indies, Assam, Burmah, Tennasserim, the Malayan Peninsula, Siam, Cochin China, and Sumatra. It is not a native of Java, and, although found in Borneo, it is more than doubtful whether it is aboriginal in that island or not.

Until lately it has always been understood and admitted that there was only one Asiatic Elephant, the E. INDICUS; but an attempt has recently been made to separate the Asiatic species into two; and before discussing the question of distribution, it will be as well to see our way clearly as to what distribution we are speaking of. The two supposed species are, 1, the insular, that is, the

animals found in Ceylon and Sumatra, and perhaps in the trans-Gangetic countries; and 2, the continental, limited to those in continental India.

It is the eminent Dutch naturalist, Professor Schlegel, who has first attempted to show that there are two species. He brought the idea forward in a paper read before the Royal Academy of Sciences in Holland, in 1861,* in which he tells us that in August 1845 he had obtained several examples of the Sumatran Elephant for the Royal Museum at Leyden from the district of Palanbang, in Sumatra. "As I was unpacking them, it appeared to me that they differed in several respects from the Elephant of Bengal. I occupied myself therefore with drawing up the characters of these two animals, compared with those of the African Elephant, and gave the results to Herr Temminck, which he afterwards published in the 'Coup d'œil sur les possessions Neder-landaises dans les Indes Orientales,' calling the new species by the name of ELEPHAS SUMATRANUS."

The character of most importance on which Professor Schlegel rests his distinction of species, is the number of the dorsal vertebræ. The ELEPHAS AFRICANUS, according to him, has twenty-one; the E. SUMATRANUS, twenty; and the E. INDICUS, or Bengal Elephant, only nineteen. He thinks that he can point out other differences—more particularly differences in the teeth of the two latter, but they are very slight; and if the difference in the numbers of dorsal vertebræ could be explained away, the grounds for separating the Sumatran from the Indian Elephants would disappear, for a specific difference could hardly be maintained on the strength of such distinctions as that the Ceylonese Elephant has higher fore quarters, and a smaller and lighter head, which is carried more elevated, and a larger terminal fringe to the tail, while the Elephant of the Sal forests has *sometimes* five nails on his hinder feet; characters the most of which were pointed out by Mr. Hodgson many years ago,† and which differ in different individuals from either locality.

Dr. Falconer, however, in his paper‡ to which I have so often had occasion to refer, passes the conclusion arrived at by Professor Schlegel under careful examination, and arrives at the conclusion that there are not two species. I need not follow him in his exposition of the fallacy or irrelevancy of the minor evidences adduced by Schlegel, Temminck, and others who have taken up their views. It will be sufficient to say in regard to the number of the dorsal vertebræ, that he shows that instead of their number in the African species being twenty-one, they vary from twenty to twenty-one; and instead of being in the Indian species nineteen, they vary from nineteen to twenty, and probably it will be found that the Ceylonese animal varies in like manner, but materials for determining this point are still wanting. It follows that the number of dorsal vertebræ is no sure indication of the species. Specimens of all three supposed species can be shown with twenty vertebræ, and as the other characters are insufficient, there seem no adequate grounds to warrant the separation of the species into two.

The settlement of this question by Dr. Falconer helps to extinguish a doubtful speculation as to Ceylon and Sumatra having been formerly continuous, which was brought forward by Sir Emerson Tennent, and adopted by Professor Schlegel. Referring to the supposed identity of the two Elephants, and the differences between the fauna of Ceylon and Southern India, such as the Monkeys being all, or mostly all, different, he suggests the possibility of the former continuity of the islands. A

* Bijdrage tot de Geschiedenis van Elephanten-voornamelijk ELEPHAS SUMATRANUS, "Verslagen en Mededeelingen der koninklijke Academie van Wetenschappen Afd. Natuurkunde," 1861, p. 101, translated by Dr. P. L. Sclater in "Natural History Rev." ii. p. 72.

† HODGSON in "Zoological Soc. Proceedings," 1834, p. 96.

‡ "Nat. Hist. Rev." Jan. 1862, p. 81.

former communication may have existed, but it must have been long before the last adjustment of the relations between land and earth. As Dr. Falconer well says, the range of low hills which forms the spine of the Malay Peninsula, and which is separated by a narrow interval only from the islands of the Archipelago, can be traced north, increasing in height and development till it joins on with the Himmalayah. While Ceylon, as has been often remarked, presents all the physical characters of being a severed portion of the distinct mountain-chain of the Western Ghauts. With certain exceptions, the mammalian fauna, as a general rule, confirms this view, as do also recent investigations on the flora of the mountainous regions of the adjoining Indian Peninsula near to its extremity. That a connexion formerly, and at no very remote period, existed between the the Malay Archipelago and the continuous mainland, is clearly indicated by the species of large Mammalia common to both.* In fact their fauna is the same.

Such a former connexion recalls the consideration of the peculiarities of the fauna of Borneo already partially discussed in speaking of the Great Carnivora, and the reader will remember that I suggested the hypothesis that that island, in its alternations of submergence and elevation, may have had its last submergence, previous to its elevation to its present state, arrested before the actual destruction of all its former inhabitants had been completed, but so very near such a time, that it was only those animals which were more or less independent of *dry* land, (such as arboreal, aerial, or aquatic animals), that did survive. In the enumeration of the exceptions to this fact, I showed that the only large mammals whose existence in the island is beyond question, are the Bos Sondaicus and the Elephant. The statement that the Rhinoceros and Tapir also inhabit Borneo depends on unsupported allegation. No person can be pointed out or referred to who had actually seen them, and I therefore think I am entitled until some evidence is brought forward in proof of their occurrence there, to reject them as natives of Borneo.

The Sunda Ox is a domesticated animal, and is more likely to have been introduced than to be aboriginal. Once introduced, it may easily in such a jungle have escaped and become wild. There, therefore, only remains the Elephant, and, so far as can be ascertained, there seem strong grounds for believing it to have been introduced too.

Professor Schegel has so little doubt on the subject that he commences his paper on the distinctness of the insular from the continental Elephants of Asia in these words: "It is well known that Sumatra is the only island of the Indian Archipelago where Elephants are found wild. Magelhaens has informed us that the Elephants which he saw in Borneo were introduced there, and that the animal is as little indigenous to that island as to Java."†

As already said, however, Mr. Blyth, also well entitled to speak, takes the opposite view, and maintains that the Elephants now found in Borneo are aboriginal.

Mr. Spencer St. John, in his "Life in the Forests of the far East," says, "Among the principal animals which frequent the forests of Borneo may be mentioned the Elephant, Rhinoceros, the Tapir, wild cattle, Deer, Swine, Bears, a small Panther, Otters, and a variety of felines. The first three have not been seen by Europeans. When ascending the River Baram in the north-west coast, one of the guides I had with me said he had frequently traded in the country where Elephants abounded, and that was in the direction of the Kina Batañgan River on the north-east coast. My favourite follower Musa, when pulling up the great River of Kina Batañgan, steered close in shore

* Falconer, op. cit. p. 95.

† Schlegel, op. cit. supra. Sclater's translation "Nat. Hist. Rev." ii. 72.

to avoid the strength of the current, and looking up to find what was moving near, saw a noble tusked Elephant above him, with his proboscis stretched over the boat to pick fruit beyond. 'The paddle dropped from my hand,' said he, 'life left me, but the canoe drifted back out of danger.'

"When we went round to look for that district we failed to find the entrance of the river, so my personal knowledge of the Elephant is limited to noticing their traces on the beach, though I have met dozens of men who have themselves seen these animals wandering in herds, and I have often had their tusks brought to me for sale at Labuan and Sulu; one I measured was six feet two inches in length, including that portion which is set in the head, and this was purchased by Mr. Scott, the Governor of Natal.

"It is generally believed that above a hundred years ago the East India Company sent to the Sultan of Sulu a present of some Elephants; that the Sultan said these great creatures would certainly eat up the whole produce of his little island, and asked the donors to land them at Cape Unsang, on the north-east coast of Borneo, where his people would take care of them. But it is contrary to the nature of the Malay to take care of any animal that requires much trouble, so the Elephants sought their own food in the woods, and soon became wild. Hundreds now wander about and constantly break into the plantations, doing much damage; but the natives sally out with huge flaming torches, and drive the startled beasts back to the woods.

"The ivory of Bornean commerce is generally procured from the dead bodies found in the forests, but there is now living a man who drives a profitable trade in fresh ivory. He sallies out on dark nights with simply a waistcloth and a short sharp spear; he crawls up to a herd of Elephants, and selecting a large one drives his spear into the animal's belly. In a moment the whole herd is on the move, frightened by the bellowing of their wounded companion, which rushes to and fro, until the panic spreads, and they tear headlong through the jungle crushing before them all the smaller vegetation. The hunter's peril at that moment is great, but fortune has favoured him yet, as he has escaped being trampled to death.

"In the morning he follows the traces of the herd, and carefully examining the soil, detects the spots of blood that have fallen from the wounded Elephant. He often finds him so weakened by loss of blood as to be unable to keep up with the rest of the herd, and a new wound is soon inflicted. Patiently pursuing this practice the hunter has secured many of those princes of the forest."*

I am afraid I am of a sceptical turn of mind, but I cannot help saying before I begin to test the real import of Mr. St. John's information, that I find this hunter's tale very indigestible. This, however, is by the way, and it does not affect the fact of Elephants being there to operate upon, that we doubt the truth of the *modus operandi*.

Mr. Blyth doubts the possibility of the few individuals put ashore by the order of the Sultan of Sulu, little more than a century ago, having increased to such an extent as to form the large herds which *are spoken of* as existing in the north-east Peninsula of Borneo. I beg the reader to note, in passing, that these great herds are only *spoken of*, nobody has seen them but the natives. Mr. St. John no doubt says that he has seen "many tusks brought to Labuan for sale," but "many" is a word of such diversity of acceptation that it conveys almost no information. Some men might think a dozen many, others might think a ship-load few; and I rather read "many tusks brought to Labuan for sale" as meaning "tusks brought at many times to Labuan for sale." But let me not be hypercritical,—I only wish to put the drag on our imaginations to prevent us attaching a

* St. John's "Life in the Forests of the Far East," ii. p. 224. London, 1862.

larger meaning to the numbers of the Elephants than is really intended. Mr. Blyth disallows Mr. Darwin's calculation of the probable minimum rate of the natural increase of the Elephant, by which he reckoned that in five centuries the increase of a single pair would exceed 15,000,000; but it was not necessary for his argument to take this objection, because it is all at the end of the centuries that the rapidity of the increase takes place; at the 120th year, according to Darwin's datum of three pair of births in each Elephant's lifetime, the increase of one pair would not have reached 500 individuals; or, supposing three pairs of Elephants to have been turned loose, the increase would not have reached 1500, but another thirty years or two make a great difference, the increase then goes on with giant strides; Mr. Darwin's rate of increase also is probably much too low; supposing the female to produce one calf only at a time (and she has sometimes two), his rate would give only one birth in fifteen years. It would not seem too much to double this, in which case at 120 years after the introduction of three pair they might be 20,000 in number, or if we take 150 years then 60,000, a sufficient number to make some very respectable herds even after making allowance for the patriarchs dying off.

Another objection of Mr. Blyth's to the common account is that the remnant of a wild race of Elephants existed in Sulu within the memory of people now living.* That a remnant of Elephants existed there may be true, but there is no evidence that they were *a wild race*. The following information on the subject is given by Mr. St. John, in his notice of Sulu:—"Remembering Forest's statement that Elephants were found in his time in the forests which clothed so much of the soil of the island, I asked Dater Daniel about it; his answer was, that even within the remembrance of the oldest men then alive, there were still a few Elephants left in the woods, but finding that they committed so much damage to the plantations the villagers had combined and hunted the beasts until they were all killed; I was pleased to find the old traveller's account confirmed." †

Mr. Blyth asks why since there were wild Elephants already on the island, should the few tame Elephants presented to the Sultan of Sulu be landed in Borneo. I would answer his inquiry (*Scotice*) by another, Why should they have ever been presented to him at all if the Elephant was already a native of his own island? The more natural supposition seems to be that he did not dismiss the present of Elephants to Borneo before he had seen them and tried them. Until he had done so, he could scarcely estimate the extent of their appetite, and that it was only after he found it too large for his revenue that he despatched them to Borneo, and that even then he did not send all. It is in accordance with human nature that he should keep one or two as a toy to show. These may very probably have been the progenitors of the Elephants destroyed by the villagers, while those now wild in Borneo are the representatives of the greater number turned loose there.

The probability of the Bornean terrestrial fauna having been at one time entirely arboreal, does not therefore thus far appear to be affected by any of the instances of non-arboreal animals said to occur there.

The Elephant is not now met with in any of the other islands in the Indian Archipelago except Java and Sumatra. It is aboriginal in the latter, but not in the former. In former times, however, it must have been an inhabitant of the Philippine Islands, as the names Gadya (Elephant) and Nangagadya (Elephant-hunting), are preserved in the Tagal language.‡

* Blyth in "Journal of the Asiatic Society of Bengal," 1862.

† St. John, op. cit. ii. 243.

‡ Bowring, Sir John, "A Visit to the Philippine Islands," 1859.

CHAPTER XXIX.

MULTUNGULA *continued*—SIRENIA—DINOTHERUM—MANATEE—DUGONG—RHYTINA.

Following Professor Owen's classification, which is in this respect that of Cuvier, I should now pass on to a new section which he designates "Mutilata," and which is composed of the Sirenia and Cetacea. But the affinity of the Sirenia to the Pachydermata appears to me so much greater than to the Cetacea that I exercise the option I reserved to myself of following a different arrangement from his in cases where my own convictions were very decidedly opposed to the arrangement he adopted. In this case I cannot say that my convictions are opposed to his, because he has in many places * stated that he had arrived at the conclusion that the Sirenia constitute an order of mammals quite distinct from the Cetacea, and in some characters more nearly allied to the Pachyderms; notwithstanding which, he, in his well-considered system of arrangement, removes them from the Pachyderms and places them in the same section as the Whales. In one sense, it may be said that the matter is not of much importance, because, if we bring the Cetacea after the Pachydermata, and place the Sirenia at the head of the former, their position in the arrangement is the same in either view. In another sense, however, it is of very considerable importance, because there is involved in it the question whether they are more nearly allied to the one or the other; to speak in a general way whether they are modified Whales or modified Elephants. I think they are modified Elephants. Moreover, although we may place the Whales after the Elephants, it cannot be said that that is on account any close affinity between them. The Cetacea form a group apart. The thread breaks when we come to them, and we must begin a new piece; but with the Sirenia it is not so, the thread between the Elephants and them is still continuous.

The mal-association in Professor Owen's arrangement is due to greater weight being given to the *form* and *purpose* of the structure of the animal than to the *plan* of the structure. On this point the ideas of Agassiz seem right in principle. The *form* and *purpose* to which they are to be put are subordinate to the great *plan* of the work, and affinities founded upon the congruity of the former should certainly give way to those founded upon the analogy of the latter. Not to speak of more widely separated organisms, the form of the Whale and the purpose for which its form is given is the same as that of a fish, namely, to live in water instead of air, but the plan of their structure is different. The purpose of the structure of the bat is the same as that of the bird, but its plan is different.

Agassiz, in stating his views of the position of classes, orders, and families, takes the *plan* of structure as the character for distinguishing the great divisions of the organic kingdom, called by

* Owen in "Proc. Zool. Soc." 1838, p. 45, &c.

him types or branches; the *combination* of structure, as the test for defining classes; the *complication* of structure, as evidenced in *the degree of organisation*, as that for orders; *form* as the character of families; *ultimate structural peculiarities* as those of genera; *relation of parts* to each other and to the world around them, as those of species.*

Although I quote this, I do not mean that I agree with all that Agassiz lays down on the subject; on the contrary, I dissent from the most of it. He believes in the existence of all these subdivisions in nature. I do not. I see that organised beings exist in groups, but I see no two groups bearing the same rank; and no two equally well defined. It appears to me, therefore, that the practice of naturalists of which Agassiz complains, of using the terms class, order and family, loosely, and often interchangeably or indiscriminately, is quite natural. How can one use a term precisely for things which are never precise, but always irregular and uncertain? But at the same time, I think that most of his propositions, though not founded on nature, will at least prove useful for artificial arrangement. For instance, plan of structure is plainly at the base of all arrangement, and the more nearly the plan on which different organic beings are constructed corresponds, the nearer ought to be their place to each other; such identity of plan is the consequence of nearness of derivation from which all similarity of structure proceeds; and although the difference between combination of structure and complication of structure, savours more of refinement on words than of precise meaning, there can be little doubt that the general principle involved in all his propositions is correct, viz., that before we come to employ the subordinate objects or parts of structure, the more important modifications of its plan ought to be taken into account.

We should go against this principle if we placed the Sirenia in the same section as the Cetacea, instead of with the Pachyderms, because we should then give weight to form in preference to plan of structure. Because it is a swimming fish-shaped mammal, with the anterior limbs turned into fins, and the posterior limbs absent, we should place it beside another swimming fish-shaped mammal, similarly situated as regards limbs. It is the same mistake that used to be made long ago, when the Seals, for the same reason, were placed in the same group; and the parallel to that ornithological arrangement, objected to by many ornithologists, by which the water birds are placed all by themselves instead of being distributed among their congeners, according to their plan of structure—the Gulls beside the Raptores, and so on.

There are, no doubt, one or two other indications of affinity which may have weighed with Cuvier and Owen in inducing them to give the preference to the Cetaceous group as that to which the Sirenia should be referred, such as, that the Rhytina, one of the Sirenia, instead of having teeth has horny plates on the palate, suggestive of the whalebone of the whale; that the cervical vertebræ are only six in the Manatee, so far supplying an apparent coincidence with the Whales, which, sometimes from the effects of anchylosis, usually appear to have fewer cervical vertebræ than seven; and that all the Sirenia have a broad transverse tail-fin like that of the Whales.

On the other hand, the nostrils are not placed as in the Whales, nor do they serve as blow-holes as in them, but they occupy the usual position in front of the muzzle. The larynx is that of the Elephant, not that of the Whale. With the exception of the Rhytina, the form, structure, and number of the teeth, are as in terrestrial pachyderms, and not as in the Whales, which have them conical, numerous, and unlike those of any other mammals; further, in the Sirenia, the molar teeth

* Agassiz, L., "Contributions to the Natural History of the United States," vol. i. p. 137, et seq. Boston, 1857.

are bilophodont (two-ridged), a structure peculiar to some of the Pachyderms, Edentates, and Marsupials, *e.g.*, the Tapir, Megatherium, Diprotodon, and Kangaroo; as in the Elephant, they are packed in a sort of inner case, or matrix, within the bone; and as in it they advance continuously from behind forwards, the foremost dropping out, and the vacant alveoli being gradually absorbed successively, and the roots of the teeth themselves being gradually absorbed as they come to the front, so that they drop readily out.* Their ear-bones are large, like cetolites, but any inference favourable to their cetaceous character which might be drawn from that fact, is negatived by their still greater resemblance to those of the Hippopotamus;† and as in the Pachyderms, the anterior part of the head of the first rib articulates with a fovea on the seventh cervical vertebra. Their generative and renal systems are those of the Pachyderms. The teats are placed on the breast as in the Elephant, and not far back on the belly as in the Whales. They have a neck which the Whales have not. They have thick fleshy lips, and, like the Elephant, the skin carries more or less numerous hairs or bristles. The coat in which the Rhytina is inclosed is a close agglomeration of hairs or horny tubes, so hard as to resist the blows of an axe, reminding us of the horn of the Rhinoceros. The bones, too, are dense and heavy, while those of the Whales are light and spongy.

Dinotherium. Every one must remember the figure of this animal as restored, reposing on the bank of a tranquil lake, with good sturdy Elephant-like limbs ingeniously tucked up beneath it, but with the termination of one which could not be well got out of the way, modestly concealed by a tuft of grass; with enormous tusks in its lower jaw bent downwards like the upper tusks of the Walrus, and clothed in flesh, all but the points, like an old lady's fingers in mittens with the tips cut off; and finished off with a double-chinned proboscis flourishing about in the air in an insane-looking manner. One is happy to think that it was a human artist, not nature, that devised this curiosity.

Professor Owen, resting chiefly on the close relation manifested by this extinct genus to the Mastodon in its molar teeth and its inferior tusks, placed it among the Proboscideans; another proof, by the way, of the pachydermatous relations of this family. He believed it to be a quadrupedal and terrestrial Pachyderm, with thick and stout extremities adapted to the support and progression of the massive frame which characterizes the known Proboscidean Pachyderms. ‡

But De Blainville and Geoffroy St. Hilaire, from a consideration of the whole cranial and and dental system, came to the conclusion, that it did not possess a proboscis, and, from the resemblance of the fore part of the head to that of the Manatee, that it was an aquatic animal

* Cuvier figures the African Manatee with six molars in each jaw on each side, and the American with nine, which are never all in use at one time, the greatest number being seven so in use. Vogel gives the numbers in the Ajah as five, which Owen thinks may be due to the animal being young. I possess two fine heads of M. Senegalensis, from Old Calabar, which I owe to the kindness of my friend the Rev. W. C. Thomson, of the United Presbyterian Mission there. These two differ in the dentition, having respectively nine and ten teeth on each side of each jaw; the teeth fully exposed and in use on the different sides of the jaw are unequal in number—nine and ten in the one, and eight and nine in the other There are still two or three undeveloped teeth stowed away in the rear in the matrix or case which holds them. My specimens were obtained from the Dju-dju of a native chief; the Manatee being, like the sturgeon with ourselves, a perquisite of royalty.

† So great is their resemblance to those of the Hippopotamus, that Dr. Kirk, seeing a pair of these bones lying on my table, from one of the two heads above spoken of, from the Old Calabar river, took them up with the remark, "Hippopotamus' ear-bones?" with which, of course, he was familiar. It was he who drew my attention to the mode of the loss of the anterior teeth — the absorption of the alveoli and of the roots (the posterior roots being absorbed first, leaving the anterior to hold the tooth in its place so long as required).

‡ Owen in "Ann. Nat. Hist." vol. xi. 329, 1843.

MAP LI.

SIRENIA.

Manatus Latirostris
" Australis
" Senegalensis
Halicore Cetacea
" Australis

ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN
SOUTH PACIFIC OCEAN

BAFFIN BAY
GREENLAND
Davis Strait
Behring Strait
ESQUIMAUX INDIANS
RUSSIAN AMERICA
HUDSON BAY
BRITISH AMERICA
NORTH AMERICA
UNITED STATES
NUEVA CALIFORNIA
TEXAS
MEXICO
WEST INDIA IS
CARIBBEAN SEA
NUEVA GRANADA
VENEZUELA
GUAYANA
ECUADOR
PERU
BRAZIL
SOUTH AMERICA
BOLIVIA
PARAGUAY
LA PLATA
PATAGONIA
TIERRA DEL FUEGO
FALKLAND IS
ALEUTIAN IS
VANCOUVER I
LABRADOR
CUMBERLAND
ICELAND
Arctic Circle
ISOTHERMAL 32°
NOVA ZEMBLA
LAPLAND
NORWAY
SWEDEN
FINLAND
SCOTLAND
IRELAND
ENGLAND
EUROPE
PRUSSIA
RUSSIA
FRANCE
AUSTRIA
ITALY
TURKEY
BLACK SEA
CASPIAN SEA
ASIA MINOR
MEDITERRANEAN
AZORES
PORTUGAL
SPAIN
SAHARA DESERT
EGYPT
NUBIA
RED SEA
ARABIA
PERSIA
AFGHANISTAN
PUNJAB
HINDOOSTAN
BIRMAH
ARABIAN SEA
BENGAL SEA
CEYLON
AFRICA
Equator
Tropic of Cancer
Tropic of Capricorn
CAPE COLONY
CAFFRARIA
MADAGASCAR
SIBERIA
IRKUTSK
Altai M.
INDEPENDENT TARTARY
MONGOLIA
CHINESE EMPIRE
THIBET
CHINA
JAPAN SEA
KAMTSHATKA
COCHINCHINA
CHINA SEA
PHILIPPINE IS
BORNEO
CELEBES
SUMATRA
JAVA
AUSTRALIA
NORTH AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
M. QUINEA
NEW HEBRIDES
NEW ZEALAND
VANDIEMEN
MARQUESAS IS
NAVIGATORS IS
LOW ARCHIPELAGO
SOCIETY IS
COOKS IS
SANDWICH IS

Day & Son (Limited) Lith.

without legs and with anterior pinniform extremities or fins; and their view is now generally adopted. According to them, in short, it was a gigantic Dugong with inferior incisors developed into reversed tusks, like those of the Walrus, only developed from the under incisors instead of from the upper canines. As their form and appearance are the same, so doubtless was their purpose: viz., to support the animal's head upon the shore, or to help it in climbing up out of the water. They may also have been of use in tearing up and exposing the roots of aquatic plants for its food.

It would appear to have been at least as large as the Elephant, and probably had a round, long, and plump body like the Manatee; but as nothing but teeth and bones of the head have yet been found, any expression of opinion on these points is mere conjecture.

It was from the Epplesheim beds near Hesse Darmstadt, now ascertained to belong to the miocene epoch, that the fossil which revealed this extraordinary animal to us was first obtained. It was a lower jaw of enormous size, which Cuvier described as a portion of a "Tapir Gigantesque," afterwards named DINOTHERIUM GIGANTEUM by Kaup. Since then portions of the head and teeth have been found in miocene deposits in various parts of Europe, Germany, France, and Switzerland. It has also been found in Perim Island in the Gulf of Cambay, and Prof. Owen in 1843 indicated the existence of a species D. INDICUM in the Sevalik beds in India;* but he makes no allusion to this while subsequently specifying other localities in his "Palæontology."

HALITHERIUM, *Kaup.* The HALITHERIUM is an extinct genus of Sirene, of which several species existed in the time of the later tertiaries in Germany, France, and Italy. Montpelier, Angers, Beaucaire, Etampes, Longjumeau, and Pezenas, have furnished remains.

A number of other genera have been proposed upon remains which, according to Giebel, are referable to species of this genus. There is Christol's METAXYTHERIUM, Meyer's HALIANASSA, Kaup's HALYTHERIUM and PYGMEODON, Bruno's PONTOTHERIUM and CHEIROTHERIUM, and Gervais's TRACHYTHERIUM. He refers them all to four species of Halitherium.

MANATEE. (Map 51.) The MANATEE, or Lamantin, and the DUGONG, or Halicore, are the only SIRENIA now in existence. Three or four species are known of the former, and two of the latter, and, according to Harlan, another species of the former (now extinct) existed formerly in Maryland; remains which he refers to it having been found in the tertiary beds of that district. The Manatee inhabits, although it is not absolutely confined to, the Atlantic; and the Dugong lives in the Pacific.

Until of late years our chief knowledge of the Manatee was derived from specimens of the species from the other side of the Atlantic, but our intercourse with West Africa has latterly so much increased, that specimens of the M. SENEGALENSIS are no longer so rare, and many questions (as, for instance, the number of its cervical vertebræ, now ascertained beyond doubt to be six), which anatomists and physiologists had been discussing in the dark, are now known from that source. This West African species is about eight feet in length.

Although usually said to be confined to the Atlantic, its range extends from Senegal round the Cape of Good Hope, and it has been found as far north on the other side of the Continent as Quillimane, in Mozambique, where it is named by the Portuguese, "peixe mulhim." It lives more especially about the mouths of rivers, where the sea-weeds on which it feeds are more abundant.

* OWEN in "Annals of Nat. Hist.' vol. xi. 7, 1843.

Another species is said to occur in the river Niger and its tributaries. We owe the first notice of this to Dr. Barth, and the first description of it to the unfortunate Dr. Vogel, who was murdered not long after he had sent home an account of it. The following is the gist of what we know about it.

In 1851, while Dr. Barth was journeying towards the country of the Adamawa in Central Africa, he heard from the natives accounts of an animal named by them Ayu (erroneously written Ajah), and which was said to frequent the rivers and marshes. He heard of the same animal under the same name also up the river Kwora or Niger below Timbuktu, and he believes that it also exists in the river Shari, which runs into the marshy Lake Tschad. Dr. Barth not having been able to satisfy himself about this creature, directed Dr. Vogel's attention to it, and the latter gentleman fortunately met with a specimen in September, 1855, in the upper part of the Binué or Tsadda; and an account of this Ayu having been sent by him to England, and read at the British Association Meeting at Cheltenham, Professor Owen thought that it presented sufficient peculiarities to allow of its being distinguished as a new species, which he named MANATUS VOGELII.

From Dr. Vogel's description it appears that it passes its time in the marshes inundated by the river. With the subsidence of the waters the animal retires down the river to the ocean; but reappears in the commencement of the rainy season with the rising waters, bringing with it one or two young, at that period from three or four feet in length. Its food consists chiefly of grass. The Ayah reaches ten feet in length, and becomes exceedingly fat. Its flesh and fat are like those of the hog—very well tasted. Its bones are as hard as ivory, and whips are made from the skin. It appears to be rare, for in the three months it remains on the Binué seldom more than twenty or thirty are taken.

Dr. Balfour Baikie made every exertion to meet with it, but without success. He tells us that he obtained a head of the known species of Manatee from a Dju-dju, or sacred heap, near a miserable village on one of the interminable dreary creeks at the mouth of the Niger; but during the months of September and October when he ascended the river he saw or heard of none. This may have been the time when the beast was absent in salt water. I believe he was more successful afterwards, but his untimely death has prevented any publication of his success, or of his opinion whether it is a good species or not.

The authority for the new species in the meantime is rather meagre—resting entirely on poor Dr. Vogel's description, and unauthenticated by the examination of specimens by competent authorities Professor Owen's endorsation is not very decided; all that he says is that it may be a distinct and somewhat smaller species than the SENEGALENSIS, and that the chief indication of specific distinctness is the closer approximation of the eyes to the nostrils and to the end of the snout, as shown by the admeasurement given by Dr. Vogel.

It may very probably be that the M. SENEGALENSIS ascends the rivers of Africa as the South American species ascends the Amazon and Oronoko.

Should it prove to be a distinct species it will, from Dr. Vogel's account, be found in the same seas as those which the SENEGALENSIS has hitherto been supposed alone to occupy; and we may find on a more careful examination of specimens and their respective localities that, on this as on the other side of the Atlantic one species occupies the more northern ground and the other the more southern.

The interest attaching to this animal would be still greater should the remainder of Dr. Barth's report prove true, and it be found that the animal exists in the river Shari, which runs into the marshy Lake Tschad. This lake, including of course its tributaries, has no communication

with the sea; and if a Manatee exists there we should have what at first sight would appear to be a parallel case to the occurrence of the Seal in the Caspian Sea and Lake Baikal. But it would not be so in reality. It is only a repetition of the lesson which we are constantly receiving not to assume that similar results are always produced by the same causes. If it were so, the only means by which the Manatee could be supposed to have reached Lake Tschad would be by a depression of the land sufficient to allow a water communication between it and the sea. Lake Tschad would then be a gulf of the sea; and if the land rose and converted it into a land-locked lake, the Manatees which happened to be in it would be retained there under new conditions of life. But in Lake Tschad there is no need for such a machinery. The watershed between the Lake and the Sea is not a lofty range of mountains, from one side of which the rivers run into Lake Tschad, and from the other into the Niger, but a flat, marshy tract of land, so nearly level, that it is almost an equal chance by which way the waters will run from it. It is like a large peat-bog, or a gigantic sponge, out of one side of which creeps the Arre and Shari, and out of the other the Binué. The Hippopotamus goes easily from the one to the other, and in the rains, when the country becomes flooded, the natives go about in boats. It is like an inundation, so that the Manatee could with ease come up from the Atlantic, and find its way into Lake Tschad.

The case, therefore, is anything but parallel with the Caspian and Lake Baikal. But in the great system of lakes, on the other side of the African Continent, there may be an instance bearing more relation to them.

Dr. Kirk informs me that the natives of the Zambesi district spoke of a large animal, which was not the Hippopotamus, but as large as it, inhabiting Lake Shirwa. Of course, the natives were familiar enough with the Hippopotamus, and not likely to make any mistake as regards it; but as the animal was not actually seen by any of Dr. Livingstone's party, the statement is only of importance as indicating a point to be inquired into when occasion serves.

The inquiry is of interest in many ways, from the inferences which may flow from it. The fact of a Sirenian existing there might modify the present views of geologists as to Africa having remained above water since the secondary period? Its existence there might compel us to admit that a former communication must have subsisted between the lakes and the sea, as there is no other means by which it could have surmounted the Murchison Rapids which lie between them; and to admit of such a communication the land must have been depressed to a greater or less extent. To what opposite conclusions might we not be led according as the Sirenian there should prove to be a Manatee or a Dugong — a new species, or one already known! If the latter, the course of change must have been slow — if the former, it must have been comparatively rapid and sudden. If the creature were a Manatee, it may have found its way from the south; if a Dugong, it would probably obtain access from the north.

But we must not allow ourselves to luxuriate in such speculations. The whole of our airy vision depends upon "the vain breath of a *Negro* man." But, nevertheless, the Negro's knowledge of species often beats that of the naturalist, and they are very cunning — in some better things than bodiless creations.

Two other species of Manatee are found in Atlantic waters, but they are only found on the coasts on the other side; on the shores of America between the Tropics. The fossil one described by Harlan from the western coasts of Maryland, is scarcely accepted by naturalists, more perhaps, from his determination not having been endorsed by any other Palæontologist, than for any other reason. His determination was made from the ribs and vertebræ, and

if correct, the animal to which they belonged, must have been of colossal size, the vertical diameter of the atlas vertebra having been nine inches, and the transverse diameter eleven inches.

The two living American species inhabit respectively the north and south angles of the Gulf of Mexico. The Northern species, M. LATIROSTRIS *Harlan*, strange to say, is more nearly allied to the African species M. SENEGALENSIS, than to its nearer neighbour, the South American M. AUSTRALIS. It is found about the mouths of rivers, near the capes of East Florida, in 25° N. Lat. Harlan says* that when he wrote (1825) they were found in considerable numbers, so much so that one Indian was able to capture ten or twelve with the harpoon in one season. Like the African species it measures from eight to ten feet in length. It resembles it as well as all the other species in the excellence of its flesh as food, which is thought to resemble veal. Capt. Henderson, in his account of the British settlement of Honduras, speaks thus enthusiastically of the tail as a tit-bit: "The tail, which forms the most valuable part of the Manatee, after laying some days in a pickle prepared for it, with spices, &c., and eaten cold, is a discovery of which Apicius might have been proud, and which the discriminating palate of Elagabalus would have thought justly entitled to the most distinguished reward."†

It may be a question of which species Henderson here speaks, Honduras being about the debateable ground where the Northern species may be expected to terminate, and the Southern to commence. The latter species, M. AUSTRALIS, extends along the shore, down the coast of Brazil, and ascends the rivers Oronoko and Amazon for great distances. It is a little larger than the other species, being about nine or ten feet in length.

One of the species of Manatee has occurred more than once on the shores of Britain. Fleming records it as having been found at Shetland, in 1823, and refers the species to SENEGALENSIS. Baikie also records that species as having been met with in Orkney. I think it more probable that they were examples of the American species M. LATIROSTRIS, which had probably come with the Gulf Stream. They do not appear to have undergone any discriminative examination; and, indeed, none could have been made, for the materials for comparison were awanting. So far from a specimen of M. SENEGALENSIS being accessible in Shetland or Orkney, I do not believe that at that time there was one in all Britain.

DUGONG. — Hernandez mentions a species of Manatee as being found along the coast of Peru. This without doubt must have been the Dugong or Halicore (HALICORE INDICA), by which the Manatee is replaced in the Pacific Ocean. The commonest species, HALICORE CETACEA, ranges from about the mouth of the Zambesi, northwards all along the East African coast into the Red Sea, thence along the Persian shore to the East Indies; round which, and Ceylon, it passes onwards into the Bay of Bengal, descends the Burmese Coast and the Malayan Peninsula into the Indian Archipelago, throughout the greater part of which it is found. It does not appear to be known north of the Indian Archipelago, or on the coasts of China or Japan. Rüppel thought that the individuals found in the Red Sea were distinct from the Indian Dugong, and proposed the name of HALICORE TABERNACULI, for the species found there in case it should prove distinct.‡

The separation of the islands of the Indian Archipelago and New Guinea into a Malayan region and an Australian region, is borne out even by this marine genus, for at the Straits of

* HARLAN, "Fauna Americana," 1825, p. 277.

† HENDERSON'S "Account of Honduras," 1809, p. 106.

‡ RÜPPEL, "Beschreibung des imrothen meere vorkommenden Dugong (Halicore)." 4to, 1833, p. 113.

Timor a new species makes its appearance. This has also been met with by Jukes on the north coast of Australia, at Endeavour Strait, in 22° S. Lat.* It has since been found in considerable numbers in Moreton Bay, but not further to the south. It is, however, plentiful along the north coast. It was figured and described by Professor Owen under the name of HALICORE AUSTRALIS. Records of the Dugong having been found along the northern coast of Australia are numerous, and no doubt belong to this new species, although they are stated as being the old H. CETACEA, for until the new one was ascertained to be distinct, the attention of observers was not drawn to this point, and all who saw it took it for granted that it was the common species. The chief distinguishing character is the development of six teeth in each jaw, while the Indian Dugong has only five; a most insufficient character, if the dentition of the Dugong is at all of the same nature as that of the Manatee, in which the number of teeth is an individual affair dependent upon age, not a specific character. The species may be a good one, notwithstanding. There must have been something in it which first suggested the idea of its being distinct before scientific specific characters were sought for; and if so, they will doubtless still be found; and, moreover, the dentition may very possibly be on a different system, for the adult possesses two incisors in the upper jaw, which the adult Manatee does not. It also greatly exceeds the Manatee in size, reaching as much as eighteen or twenty feet in length.

RHYTINA.—A not less interesting subject than the Manatee and Dugong, is the other section of the Sirenia, named RHYTINA, which is characterised by several remarkable peculiarities. One of these is, that instead of teeth it had a waved or transversely furrowed horny plate on the anterior part of the palate, opposed to a similar one between the lower jaws; these, when the animal was alive, must have been flexible and elastic, for those of preserved specimens became so after being steeped for a few days in water. Another peculiarity was, that what appeared to be the skin was a coat of nearly an inch in thickness, composed of perpendicular horny tubes, analogous to hair, agglutinated together like the horn of the Rhinoceros. This skin *was*—(it is distressing to have to speak of it in the past tense, but it is a hundred years since it was killed and eaten off the face of the earth by gluttonous man),—was blackish brown and rough and wrinkled, especially on the sides, resembling in some respects the rough bark of a tree, and was so hard that the blows of an axe could scarcely penetrate it. The animal was of great size, its length having reached twenty-four feet, and its circumference nineteen feet.

It was discovered in 1741 upon the shores of Bhering's Island, an island lying to the south-west of Bhering's Straits, and near the Asiatic end of the Aleutian Isles. Bhering's second expedition was shipwrecked upon it, and ten months were spent there by his shipwrecked crew, during which they were mainly supported by the food obtained from this animal, which was then so numerous that Steller, who formed part of Bhering's expedition, estimated that they were sufficient to feed the whole population of Kamschatka. This apparently inexhaustible depôt of superior food of course became bruited abroad, and the hunters and whalers soon made a practice of wintering at Bhering's Island and provisioning their ships with these animals, and made such havoc among them that they were speedily extinguished, the last having been killed in 1768.

Steller, notwithstanding the unfavourable circumstances—(enduring the hardships and privations of a shipwreck in that inclement region)—under which he was placed for making scientific observations, or writing scientific treatises, prepared an admirable account of the beast, which was

* JUKES' "Voyage of the Fly," vol. ii. p. 323.

published at St. Petersburg, in 1751.* He did not live to superintend its publication, and the specific name which he had intended to give it was properly altered to RHYTINA STELLERI, in memory and honour of him.

Since then various more or less successful attempts, chiefly by the Russian authorities, have been made to procure the bones of this species from its old haunts; and Professor Brandt has profited by those specimens which have come into the St. Petersburg collection, to publish two excellent accounts of the history and structure of the animal.† More recently, Professor Nordmann, of Helsingfors, has published an account of one which had been obtained by the Imperial university of that place.‡ This had been procured by Professor Nordmann, through a friend, the Governor of Russian America, who got an immature specimen (a baby of only some sixteen and a half feet in length), dug up in Bhering's Island by two Aleutians. The whole skeleton seemed to belong to one individual, the only parts deficient were the hand-bones, some of the caudal vertebræ and the epiphyses of the shoulder-blade, humerus, ulna, and radius. Curiously enough, one of these deficient parts is a part on which information was particularly wanted, viz. the hand-bones. Steller especially notes as a remarkable anomaly, the absence of fingers in the pectoral fins. Nordmann does not seem to accept this as correct, for he simply says that if an expert had been present he would probably have found the missing parts likewise. I doubt it.

The account of this animal is therefore not absolutely complete, and I cannot refrain from echoing a suggestion made in a recent number of the "Natural History Review,"§ that "the crew of one of the vessels of war on the Pacific station might be very usefully employed in visiting Bhering's Island, and obtaining for our national collection a skeleton of this very singular mammal. At present we have not a fragment of it in this country, except two ribs, purchased by the British Museum some two years since from St. Petersburg. A cruise up to Bhering's Island in the summer months, and a little digging, would involve neither hardship nor risk to the vessel selected for the service, and might be the means of much increasing our knowledge of this curious animal."

I would only venture to add to this most excellent suggestion, that ice-bound Mammoths and Rhinoceroses are still to be obtained on the Arctic shores of Asia, and that the cruise recommended might be extended with advantage as far as the mouth of the Lena or Jenesei, with a view of securing one or more of these creatures; suitable preparations, of course, being made for carrying off a specimen should one be met with. A somewhat similar suggestion or proposition has recently been made to the Imperial Academy of St. Petersburg for promoting the discovery of the congealed remains of gigantic mammifers in Siberia.

The only place where the RHYTINA STELLERI was found in any numbers was Bhering's Island, but it appears to have been sparingly scattered along the coast of Kamschatka, and, according to Harlan, the west coast of North America, and among the Aleutian Islands. Can it also have ranged along the whole of the north coast of Siberia and Europe to Greenland? Otho Fabricius quotes it as an inhabitant of Greenland in these terms; "a very rare animal in the Greenland sea, a partially consumed cranium of which was all that I saw, in which were spurious teeth (the horny plates) closely congested, such as Steller describes."‖

* STELLER, G. W. "De Bestiis Marinis." Nov. Comm. Petr. xi., p. 294, 1751.

† BRANDT, "Symbolæ Sirenologicæ, in Mem. Acad. S. Petersb. Sc. Nat." 1849.

‡ NORDMAN, "Beiträge zur Kenntniss des Knochen-baues der Rhytina Stelleri," Acta Soc. Sc. Fennicæ, vii. 1861.

§ "Nat. Hist. Rev.," Jan. 1865, p. 18.

‖ FABRICIUS, O., "Fauna Grœnlandica," p. 6, 1780.

CHAPTER XXX.

CETACEA—WHALES AND DOLPHINS—ZEUGLODON—PLATANISTA.

The few points of analogy which can be specially traced between the Whales and other orders of mammals are chiefly with the Pachyderms; and most of these are rather points of analogy or resemblance than of affinity. Their size is the *greatest* argument for their relationship, and most of the other coincidences are probably only a necessary consequence of the size, as that the transverse diameter of the encephalon exceeds the longitudinal, a proportion observed only in Cetaceans and Proboscideans. There are others which have no apparent connexion with the necessities of the structure, but are more indicative of nature having been working in the same groove, as if the idea which had been already used in the one animal, again occurred to be used in a different form in the other. The whale-bone of the Balæna, for example, may be said to be the same idea, differently expressed, as the horny plates in the mouth of the Rhytina, which we have just left; or the long tusks of the Narwhal may be homologous to the tusks of the Elephant, both growing from a permanent pulp (an organisation, however, shared by the Rodents), or their usual monodont development to a similar heterodox arrangement which seems to have been common in the under tusks of the Mastodon.

The dentition of the Cetacea, however (and a more important part of its structure cannot be cited), differs so greatly from that of the Pachyderms, that only the most distant relationship can be surmised. When we inquired into the probable derivation of the Seals, we had some faint light to guide us, because they undoubtedly belonged to the Carnivora; but we are without any such guide-posts here; although the Cetacea are carnivorous, as well as the Seals, their structure is so different, that they cannot be ranged under the same category as them, any more than along with the Pachyderms. They stand apart a peculiar order. No discovery of extinct animals has ever thrown any additional light upon it. When a new animal, as the Zeuglodon, turns up, it has always fitted readily to a place in one or other of the already recognised sections of the order.

Their first appearance seems to have been at the later eocene, or earlier miocene. There is, indeed, a statement that, like one of the Seals, remains of a Whale had been found in North America, in the greensand of New Jersey, which corresponds to our strata below the chalk.

Their supposed existence in the greensand rests upon the rather slender basis of two questionable vertebræ. These were described by Dr. Leidy* of Philadelphia, as belonging to two species of a new genus of Cetaceans, which he named Priscodelphinus. Sir Charles Lyell saw these in 1853, and afterwards traced one of them to a *Miocene* marl pit in Cumberland County, New Jersey; consequently *it* was put out of court. The other, which had been mistaken for a bone of the

* "Proceedings of Acad. Nat. Sc. Philad.," 1851.

Plesiosaurus by Dr. Harlan, and which in the museum stood labelled "Mullica Hill," would, no doubt, as observed by Lyell, be a cretaceous fossil if really derived from that locality, but he remarks that its mineral condition makes the point rather doubtful. The occurrence of the other vertebra belonging to the same genus, not in a cretaceous but in a miocene deposit, adds to the doubt; for it seems exceedingly unlikely that two vertebræ belonging to the same species or genus of a new animal, should be found at about the same time, the one in secondary, and the other in tertiary strata; the two deposits being, the one far down in the secondary, and the other far up in the tertiary series. It is much less credible that the same form of life should have persisted in a mammal through these two epochs, than that a transposition or error should have been made in one of Harlan's labels, especially when it is considered that the importance attached to the discovery was not anticipated at the time it was made. No other mammal has ever survived from one epoch into another. The Mammoth (almost the only other alleged example of such an event) being, as I trust I have proved, only "dicyclotherian" in name; its so-called "dicyclotherian" life, moreover, being a mere span of time compared to that implied in the space between the deposit of the greensand and any miocene bed.

It is chiefly in the deposits of the miocene epoch (of course the marine) that Cetacean remains are met with. Remains of at least two species of whalebone Whales are known, viz. one belonging to the section Balæna, or right Whale, from the Paris Tertiaries, and the other, a species, or perhaps two, of Balænoptera, "the finner," from Pulgnasco, near Placentia, in Italy. Remains of a Dolphin-Whale, Balænodon gibbosus, occur in vast numbers in the red crag of Suffolk; they chiefly consist of teeth and "cetolites," or ear-bones, and have been washed out of previous strata into the red crag. "These fossils," says Professor Owen, "belong to species distinct from any known existing Cetacea, and which probably, like some contemporary quadrupeds, retained fully developed characters, which are embryonic and transitory in existing cognate mammals. The teeth of these Cetacea were determined in 1840, the ear-bones in 1843. The vast numbers of these fossils, and the proportion of phosphate of lime in them, led Prof. Henslow to call the attention of agricultural chemists to the red crag as a deposit of valuable manure. Since that period it has yielded a large supply, worth many thousand pounds annually, of the superphosphates. The red crag is found in patches from Walton-on-Naze, Essex, to Aldbro', Suffolk, extending from the shore to five or fifteen miles and more inland. It averages in thickness ten feet, but is in some places forty feet. Broken up septarian nodules form a rude flooring to the crag, left by the washing off of the London clay, and are called 'rough stone.' The phosphatic fossils or 'cops,' as they are now locally termed, occur in greatest abundance immediately above the 'rough stone.' Thousands of cubic acres of earlier strata must have been broken up to furnish the Cetacean nodules of the 'red crag.' This is a striking instance of the profitable results of a seemingly most unpromising discovery in pure science."*

A large number of fossil remains of Cetaceans has recently been found in the excavations occasioned by the fortifications of the city of Antwerp. Five or six other distinct species have been described in miocene and pliocene formations in Western Europe; for instance, Professor Owen has named and figured the ear-bones of what he considered four different species, from the red crag above mentioned, but they are imperfect, and the amount of variation on the ear-bones, nay, for that matter, on any of the bones of the Cetacea, is not yet sufficiently known, and must be

* Owen's "Palæontology," p. 343, 1860.

MAP LII

RIGHT & SPERM WHALES.

ACCORDING TO LIEUT. MAURY.

Right Whales _ Green
Sperm do _ Blue
Sargasso Belts

Desolate Region
Mariners report
Few signs of life
in Sea or Air

ISOTHERMAL 32°

Arctic Circle

Equator

Tropic of Cancer

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

GREENLAND

ICELAND

LAPLAND

NOVA ZEMBLA

BAFFIN BAY

DAVIS STRAIT

ESQUIMAUX INDIANS

RUSSIAN AMERICA

BRITISH AMERICA

CUMBERLAND

HUDSON BAY

LABRADOR

VANCOUVER I.

OREGON

UNITED STATES

NUEVA CALIFORNIA

TEXAS

G. of MEXICO

MEXICO

WEST INDIA I.

CARIBBEAN SEA

VENEZUELA

GUYANA

NUEVA GRANADA

ECUADOR

PERU

BRAZIL

CHILI

PARAGUAY

LA PLATA

PATAGONIA

TIERRA DEL FUEGO

FALKLAND I.

ALEUTIAN I.

BARNEVELD I.

MARQUESAS I.

NAVIGATORS I.

LOW ARCHIPELAGO

SOCIETY I.

COOKS I.

AZORES

PORTUGAL

SPAIN

FRANCE

ITALY

AUSTRIA

PRUSSIA

BALTIC

NORWAY

SWEDEN

FINLAND

SCOTLAND

IRELAND

ENGLAND

RUSSIA

TURKEY

BLACK SEA

CASPIAN SEA

ASIA MINOR

MEDITERRANEAN

SAHARA DESERT

EGYPT

RED SEA

ARABIA

PERSIA

AFGHANISTAN

PUNJAB

INDEPENDENT TARTARY

IRKUTSK

Altai M.

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

JAPAN

KAMTSHATKA

ALEUTIAN I.

HINDOOSTAN

BIRMAH

ARABIAN SEA

BENGAL SEA

CEYLON

MADAGASCAR

CAFFRARIA

CAPE COLONY

CHINA SEA

COCHIN CHINA

PHILIPPINE I.

BORNEO

CELEBES

SUMATRA

JAVA

N. GUINEA

NORTH AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW HEBRIDES

NEW ZEALAND

Day & Son (Limited) Lith.

inquired into, before perfect reliance can be placed on species founded on such fragmentary portions of a solitary organ.

The classification and the characters of the existing Cetacea were for long in a most unsatisfactory state, and it is only now that the labours of Gray, Eschricht, Van Beneden, Flower, and others, who have spent much time and given much thought to the elucidation of this most difficult group, have begun to clear up the darkness in which they were enveloped.

The result of their labours has been practically to destroy all confidence in the determination of any of the species hitherto described, which have not undergone the searching scrutiny which they show to be essential to an identification of species. Mr. Flower, for example, has pointed out * that the size of the animal is a very important element in determining its species, and that this is very constant, subject to the variation due to age: and that the difference in age, which for practical purposes may be divided into three stages, is indicated by the state of the bones; being soft and spongy, and with their ends incomplete in the young, more advanced in the middle-aged, and perfect in the adult. The proportions and form of the bones also vary according to age; therefore it is plain, that no description founded upon a skeleton can be of much value unless it mentions the condition of the bones, and the probable age of the specimen,—a thing that has rarely been attended to by describers. The points where variation occurs were also not known, nor which were of specific value, and which might be mere individual aberrations; and indeed, these points are but imperfectly known even yet, and only in a few species.

As may be expected, our knowledge of the geographical distribution of species, whose identification is so difficult, is by no means to be depended on, and the localities which are recorded of many of them must be taken as applying to genera than species.

Whales are divided into two very natural sections,— the Whalebone Whales and the Dolphins; the former with baleen and no teeth (after birth), the latter with teeth and no baleen. To which we may add a third, the Zeuglodontidæ—Extinct Whales with teeth bearing some resemblance to those of Seals.

These sections, again, have been divided by Prof. Eschricht, Mr. Flower, and Dr. Gray, into families, sub-families, and genera. These may be of use for the purposes of systematic classification; for geographical distribution the old genera will be sufficient.

Balænidæ.—Right whalebone whales (Maps 52 and 53.) Whalebone Whales are divided into Right-Whales and Finners. The "right" Whales of the whalers, that is, the right kind to kill, may be briefly characterised as having long baleen, and no dorsal fin; the Finners, by short baleen and a dorsal fin. Until recently the right Whales have been supposed to consist of only two species, one the B. mysticetus, confined to the Northern hemisphere, the other the B. australis, restricted to the Southern. Johnston, in his Physical Atlas,† and Lieut. Maury,‡ give maps in which they show the range of both of these. The Northern right Whale, according to these maps, occupies the Polar seas, the Atlantic north of a line drawn from Newfoundland to Madeira, and terminating at Cape St. Vincent, and all the Pacific north of an irregular line whose most southerly points are 30° and 33° and the most northerly 45° or 50°. But the researches of Eschricht and Reinhardt §

* Flower, in "Proceed. Zool. Soc.," 1864, p. 384.

† Johnston's "Physical Atlas."

‡ Maury "On the Physical Geography of the Sea," 9th ed. 1860.

§ Eschricht and Reinhardt, "Om Nordhvalen." 1861. A translation of the Danish monograph is intended to be published by the Ray Society.

seem to have proved that the habitat of the Balæna mysticetus is, and has always been, exclusively confined to the Polar Seas, and that it has therefore no claim to a place in the European fauna. It would appear, however, from Von Baer's account of the mammals inhabiting the seas of Nova Zembla, that the Whale is not found there. The right Whales of the North Atlantic, formerly chased by the Basque Whalers, belonged, according to Eschricht, to a species B. Biscayanus *Eschricht*, which has more affinity to the right Whale of the Southern hemisphere. At all events, it has the characters which Mr. Flower uses as generic to distinguish the Southern right Whale from the mysticetus. Whether a similar double series of species exists in the Southern hemisphere, is not known, but there is some indication that it may, for Dr. Gray has described a second Southern species, B. antipodarum, from New Zealand. Which of these Southerners, B. australis or B. antipodarum, is the more Antarctic, or whether there is one more Polar than the other, is not known.

The occurrence in the opposite Polar regions of species so closely allied, and whose constitutions are similarly adapted for life in the coldest regions of the earth, and apparently incompatible with a residence in warmer latitudes, is a suggestive fact, which may throw some light upon a much-disputed point, regarding the glacial epoch; viz. whether the cold of that period was a local refrigeration confined to the north, and due to the peculiar distribution of land and water, or to some cosmical cause, affecting only the northern hemisphere; or whether it was a general diminution of heat affecting the whole earth, and to be ascribed to some more universal cause. There is plenty of proof that the glacial ice did not extend over the whole earth. Dr. Falconer says, we have distinct proof that the glacial refrigeration which characterised the Alpine valleys, and plains of Europe north of the Alps, was greatly modified in intensity on the southern side of the chain. The enormous glacier of the Valley of the Adige, after emerging from the 'Lago di Garda,' melted away, leaving on the margin of the Valley of the Po a vast mass of moraine. On the southern side of the Apennines, glacial phenomena have nowhere as yet been traced down upon the plains on their flanks.*

The glacial phenomena in North America come to an equally abrupt termination before they reach the Gulf of Mexico, and from the general uniformity of the line of termination, and other circumstances, there is reason to think that at the time when the glaciers, which have so left their mark, were in existence, they ran into the sea as the ice now does on the coasts of Greenland, which may be a reason why no marks of glacial action are now found south of what may have been the old line of coast. These facts, I believe, to be due to the greatest part of these southern plains in Europe, and the whole of them in America, having been under water during the most part of the glacial epoch; but I do not the less arrive at the same conclusion as Dr. Falconer that the Arctic Circle did not come much farther south than the seas which covered Italy in Europe, and Georgia in North America; and that the cold was, as it should have been, less intense in the tropics than nearer the poles.

We can hardly expect that evidences of glacial action similar to those left in the northern hemisphere should be found in the southern, because all the land nearer the Pole than the latitudes where in the north the action ceased, viz. (Italy in Europe, and Georgia in America, in other words, 35° and 45° North lat.) was there under water, except New Zealand and Tierra del Fuego, and it is precisely in these lands that glacial cold has been ascertained to exist—marks of its action having

* Falconer, in "Nat. Hist. Rev.," Jan. 1863, p. 111.

MAP LIII

WHALE BONE WHALES.

Balaena Mysticetus — *Green*
" *Biscayanus* — *Blue*
" *Australis* — *Orange*
" *Antipodum* — *Yellow*

ARCTIC OCEAN
NOVA ZEMBLA
BAFFIN BAY
GREENLAND
ISOTHERMAL 32°
Arctic Circle
ESQUIMAUX INDIANS
RUSSIAN AMERICA
CUMBERLAND
Davis Strait
ICELAND
LAPLAND
NORWAY
SWEDEN
FINLAND
SIBERIA
HUDSON BAY
BRITISH AMERICA
LABRADOR
SCOTLAND
IRELAND
ENGLAND
BALTIC
RUSSIA
EUROPE
ASIA
IRKUTSK
ALEUTIAN Is
VANCOUVER
OREGON
NORTH CANADA
AUSTRIA
FRANCE
PRUSSIA
INDEPENDENT TARTARY
Altai M.
MONGOLIA
KAMTSHATKA
AMERICA
AZORES
PORTUGAL
SPAIN
ITALY
TURKEY
BLACK SEA
CASPIAN SEA
JAPAN SEA
NORTH PACIFIC OCEAN
NUEVA CALIFORNIA
UNITED STATES
MEDITERRANEAN
ASIA MINOR
PERSIA
AFGHANISTAN
PUNJAB
THIBET
CHINESE EMPIRE
CHINA
JAPAN
NORTH ATLANTIC OCEAN
Tropic of Cancer
TEXAS
G. of MEXICO
MEXICO
WEST INDIES
SAHARA DESERT
EGYPT
RED SEA
ARABIA
HINDOOSTAN
BIRMAH
ARABIAN SEA
BENGAL SEA
CHINA SEA
SANDWICH Is
CARIBBEAN SEA
VENEZUELA
GUAYANA
NUEVA GRANADA
ECUADOR
Equator
AFRICA
CEYLON
PHILIPPINE Is
BORNEO
CELEBES
SUMATRA
JAVA
N. GUINEA
MARQUESAS Is
LOW ARCHIPELAGO
SOCIETY Is
COOK Is
SOUTH PACIFIC OCEAN
PERU
BRAZIL
SOUTH AMERICA
Tropic of Capricorn
INDIAN OCEAN
MADAGASCAR
CAPE COLONY
CAFFARIA
NORTH AUSTRALIA
AUSTRALIA
NEW HEBRIDES
NEW SOUTH WALES
SOUTH AUSTRALIA
SOUTH ATLANTIC OCEAN
LA PLATA
CHILI
PATAGONIA
FALKLAND Is
TIERRA DEL FUEGO
VANDIEMEN
NEW ZEALAND
SOUTHERN OCEAN

Day & Son (Limited) Lith.

been found there, and great glaciers still existing in both. It is expected by some that similar proofs of cold will also be found in the mountains in the south-east of Australia—an anticipation which I do not share, because it is nearer the tropics than the limit of glacial cold in the northern hemisphere (except on very high mountains). Any evidences of glacial action in the southern hemisphere are no doubt susceptible of the explanation that they may only be of recent phenomena, or that they may have occurred at a different time from, or been alternate with, the glacial cold in the northern hemisphere, but we shall see that such explanations are not reconcilable with cosmical facts or with the phenomena of the distribution of Whales.

In the first place, all that we know of the past temperature of the globe, confirmed as that is by the evidences of organic life in the North Polar regions, is opposed to the idea of cold ever having invaded it previous to the glacial epoch; and as it appeared in the north then, and is present *in the same degree*, both there and in the south now, the presumption is that it first appeared in both at the same time.

Previous to the glacial epoch the Dolphin section of Whales had obviously lived in enormous numbers,—at least in the northern hemisphere,—witness the cetolites of the red crag of Suffolk and of the Antwerp beds; but there is no evidence to show that any of the present Whales then existed. There was one right Whale (B. Lamanoni) whose bones have been found in the tertiary beds of Paris, but it was not a polar one, for the heat was greater then than now; and as the range of large marine animals is even now very extended, it probably was still greater in the miocene epoch, when the temperature was more uniform.

Now the present cold-living Arctic and Antarctic species must either have been developed out of the miocene species separately in the Arctic and in the Antarctic regions, or they must not. If they were, then, of course, the cold must have been present in both hemispheres. If they were not,—and they only first appeared in the polar regions of one hemisphere,—then the species so produced, or their descendants, must have found their way to the polar regions in the other hemisphere across the Equator. But in the present state of things this would be impossible, for, to use Lieutenant Maury's words, "The torrid zone is to the 'Right Whale' as a sea of fire, through which he cannot pass." It must, therefore, have been cold enough to allow it to do so, which equally implies that the glacial cold must have extended over both hemispheres. There is, indeed, another alternative, namely, that out of the Northern Right Whale may have been produced one or more new species fitted for equatoreal life, and that from these again may have been developed in the southern hemisphere fresh species fitted for polar seas. But this is at best but a clumsy hypothesis; and it is open to the objection, first, that a reversion to a polar type in a similar form is opposed to the usual working of nature, which never repeats herself; and next, that, in the event supposed, we should still have had the intermediate equatoreal species, of which, on the contrary, we have no trace. The inference is to my mind strongly in favour of a general extension of cold having affected both hemispheres; and I prefer the idea of its having been so great as to have allowed the genus to have passed to and fro from each hemisphere.

Finners. (Map 54.)—The Balænoptera, Rorquals, or Finners, are the largest of known animals, whether fossil or living. These were separated by Cuvier into three species, the Rorqual of the Cape; the Rorqual of the Mediterranean; and the Rorqual of the North. Each of these has now been made the type of a genus. Megaptera, the hunchbacked Whales; Physalus, the razor-backed Whales; and Sibbaldius, which latter has again been further subdivided.

The first, MEGAPTERA, is best known by one species, M. LONGIMANA, which stands in natural history books as a citizen of the world. The result of the recent inquiries of which I have spoken, however, seems to show that each species has only a limited range, and probably makes a greater or smaller migration within its district; and it is possible that even this species, whose wide range is better authenticated than that of any other, may turn out to have acquired this reputation by mistake. Certainly one specimen from the Cape is preserved at Paris, which was considered by Eschricht, and also by Van Beneden, to be undistinguishable from the Greenland species. The cervical vertebræ of another specimen from the Cape, however, are in the British Museum, and Dr. Gray has pointed out and figured some differences between them and the same parts of the M. LONGIMANA from the Northern seas which he considers most striking specific distinctions. *

The same difficulty occurs with another of those gigantic finners, SIBBALDIUS LATICEPS. Its usual habitat is the North Sea, but a specimen of a Whale of this genus and sub-section has lately been received from Java by the Leyden Museum, and this has been examined and described by Mr. Flower,† and his conclusion is, after having compared it bone by bone with the northern SIBBALDIUS LATICEPS, that they agree in every particular, and must be considered zoologically identical. This opinion is the more reliable, that it is obviously wrung from him most reluctantly, as is apparent when he says that on account chiefly of its peculiar habitat he has some difficulty in placing it with LATICEPS, and as he is sure that its identity will be disputed by many cetologists on account of the habitat he names it provisionally S. SCHLEGELII. It would rather appear therefore that one or more of the BALÆNOPTERA range over the whole world.

The majority of species known, however, belong to the Northern hemisphere, a preponderance doubtless in part due to its having been better examined, and in part to the greater extent of soundings and coast on which their food breeds.

DELPHINIDÆ.—SPERM-WHALE. (Map 52.) That the Sperm Whale, PHYSETER, or CATODON MACROCEPHALUS, is a Dolphin, is apparent from its teeth at a glance. It was formerly thought that several species existed, Lacepede having made as many as eight out of this single one.

Its range is very wide. It has been seen and captured in almost every part of the ocean between latitude 60° South and 60° North. Several ancient authors have stated that it has often been seen at Greenland. Sir Thomas Brown,‡ (1686), after stating that "many conceive the Sperm Whale to have been the fish which swallowed Jonah," adds, that "Greenland inquirers seldom meet with a Whale of this kind." *Seldom,* is perhaps here used only as a saving clause against *never.* Cuvier refers to reports that it had been seen there, but these are now believed to be erroneous; at any rate, no modern instance is recorded of a Sperm Whale being found so far north as Greenland. They have been recorded as found off the north of Scotland, but no farther. Beale§ gives a list of their favourite places of resort twenty years ago. He says that they are seldom or never seen on 'soundings,' that is, where the bottom of the sea can be touched by the deepest sea line, or on the 'banks,' as they are termed by whalers, that exist in various parts of the ocean, as 'Brazil banks,' which are only discolorations of the water caused by the myriads of animalculæ, which perhaps form the substance of the common black Whale's food, along with cuttle-fish, medusæ, and other small animals. But the Sperm Whale has been sometimes taken near the borders of the submarine pastures, particularly near those of Brazil.

* DR. GRAY on British Cetacea in "Proceed. Zool. Soc. 1864," p. 195.

† FLOWER in "Proc. Zool. Soc., 1864," p. 401.

‡ SIR THOMAS BROWN, "Religio Medici," 1686.

§ BEALE, THOMAS, "Natural History of the Sperm Whale," London, 1836, p. 189.

MAP LIV.

FINNER.

MEGAPTERA LONGIMANA.

Supposed range.....
Places where actually taken or stranded

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

BAFFIN BAY

GREENLAND

ESQUIMAUX INDIANS

RUSSIAN AMERICA

HUDSON BAY

BRITISH AMERICA

NORTH AMERICA

UNITED STATES

MEXICO

WEST INDIA IS

SOUTH AMERICA

EUROPE

ASIA

SIBERIA

LAPLAND

FINLAND

SWEDEN

NORWAY

RUSSIA

PRUSSIA

AUSTRIA

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

INDEPENDENT TARTARY

MONGOLIA

CHINESE EMPIRE

CHINA

THIBET

PERSIA

AFGHANISTAN

PUNJAB

AFRICA

SAHARA DESERT

EGYPT

NUBIA

ARABIA

RED SEA

ARABIAN SEA

BENGAL SEA

CHINA SEA

CEYLON

BORNEO

CELEBES

N. GUINEA

JAPAN SEA

AUSTRALIA

N. AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW ZEALAND

NEW HEBRIDES

Day & Son (Limited) Lith

The particular places which Mr. Beale mentions as its favourite resorts are the following: viz. on the north coast of New Guinea from 140° to 146° east longitude; New Ireland from Cape St. George to Cape St. Mary; from Squally Island to the northwards; from St. George's Channel to the southward; on the east coast of New Britain; about the islands of Bougainville and Bouka Bay, particularly off the northern shore of Bougainville as far as the Green or Bentley's Islands; Solomon's Archipelago, as far to the northward as Howe's group; Malanta, along the north-east and south-west parts; and in the Straits as far to the north as Gower's Island; and off the west points of New Hanover; off any part of King's Mill group, but more particularly off the south-west parts of Roach's Island distant from the land thirty or forty miles; and off the south-west portion of Byron's Island on the equinoctial line from the longitude of 168° to 175° east longitude. About three or four miles off the south side both of Ellis' group and Mitchell's group; about fifteen to thirty miles off the south-east side of Rotumah; off the eastern coast of New Holland from 25° to 34° south latitude, and along the north-west coast; from the East Cape to North Cape of New Zealand, the land dipping; and off the shore to the north-eastward as far as Curtis's Island; off Middleburgh Island and adjacent Isles of Tongataboo; off the south-west side of Tootooillah, at the Navigator Islands; and from Fenning's to Christmas Island; off the north point of Moratay, one of the Moluccas; and off the east and west sides of Gilolo and the adjacent Isles; off the east side of Bonton and in the Straits of Timor; off the south side of Omby, Panton, and the adjacent islands as far as Sandalwood Island to Java Head; and off the shore in latitude 12° to 16° south, and longitude from 112° to 120°; off the eastern side of Mahee Island; off Johanna Island, in the Mozambique Channel; off the Island of Aldabra; off the Cape of St. Mary's, Madagascar; in the Persian Gulf and Red Sea, on the line from 55° to 60° west longitude; in the China Sea; all round the Bonin Islands within forty miles of them; along the coast of Japan, Volcano Bay, Loo Choo Islands; off shore ground of Japan from 28° to 40° north latitude; off Cape St. Lucas, and off the Tres Marias Island, on the Californian coast; off the shore of Peru, from longitude west 90° to 130°, in latitude 5° south, to the line. The coast of Peru from the line to 16° south off Paita Head used to be very famous, but from Mr. Beale saying "used to be," it is to be implied that it is or was then no longer so. At the Galapagos Islands, off the south head of Albemarle Island, Weather and Lee bays, or Elizabeth's and Banks' bays; on the middleground between the Continent and the Galapagos Islands; off the Island of Chiloe to the northward along the coast of Chili, and as far south as 37°, the land dipping.

They are also occasionally seen about the equinoctial line in the Atlantic Ocean, but these would rather seem to be either straggling "schools" which have rounded Cape Horn (they have never been known to double the Cape of Good Hope),* or unprospering colonies, for they are becoming scarcer and scarcer in more than their due proportion. It is from these that the specimens which have occasionally been met with in the North Atlantic, or in the English seas, have wandered. They have been now and then cast ashore, and then they are usually in an emaciated condition. They seem to be unprepared for, or not to be adapted for, shallow seas. Accustomed (perhaps not individually, but by hereditary practice or instinct) to swim along the Coral islands of the Pacific within a stone's throw from the shore, they cannot understand, their instinct is not prepared to meet, shallow coasts and projecting headlands. If they were habitual residents in our seas, they must either be speedily extirpated, learn more caution, or be developed into a new species.

* Maury's "Physical Geography of the Sea."

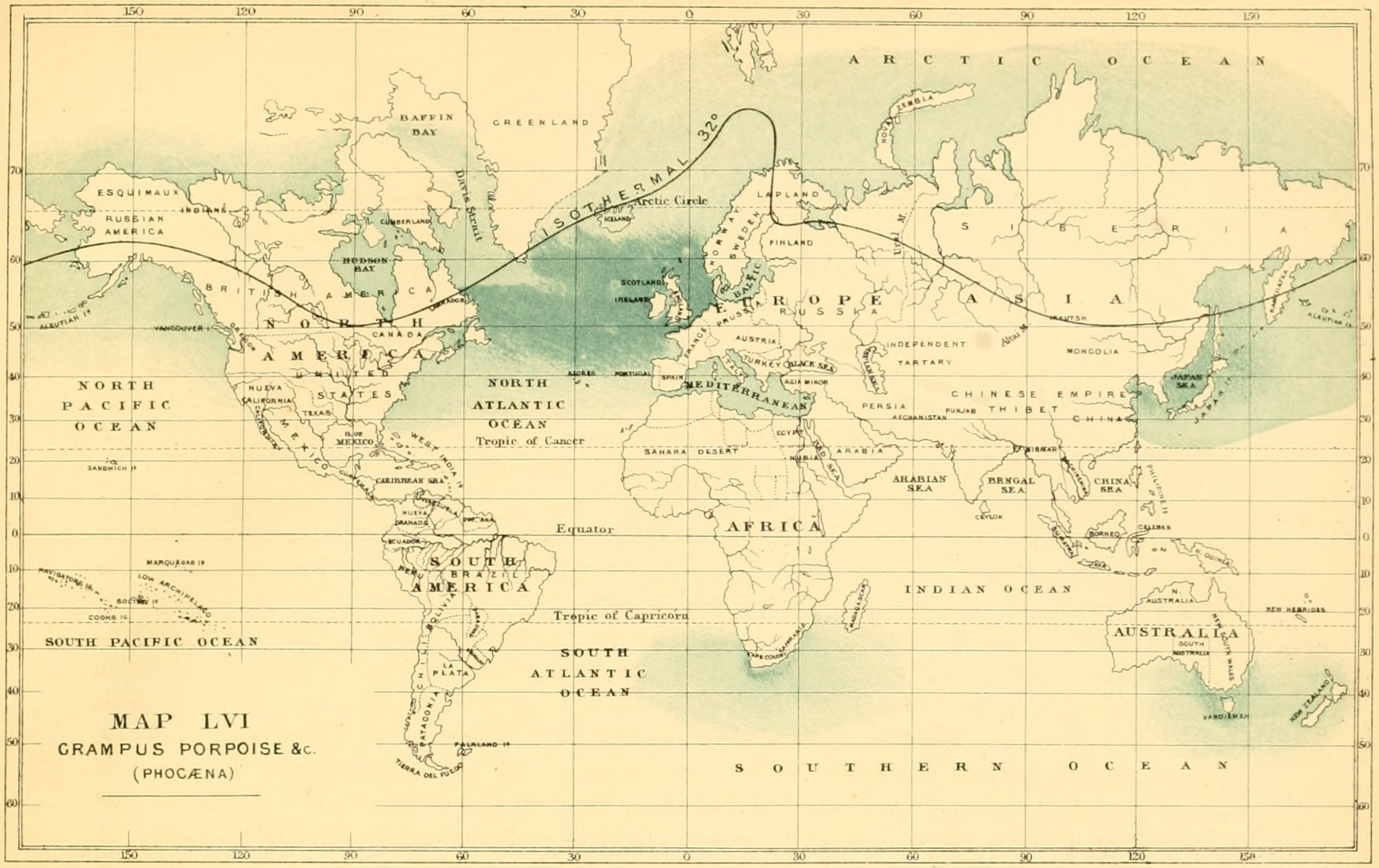
They have been stranded or captured on our coasts, amongst other places,* at Teignmouth, Whitstable Bay, mouth of the Thames, coast of Essex, coast of Kent, Holderness, Hull, Limekilns in the Frith of Forth, Thurso, and not unfrequently at the Orkneys.

Dr. Gray quotes the following letter from Walderwick, on the coast of Suffolk, March 7, 1788: "After a hard gale of wind northerly, no less than twelve male Whales, which undoubtedly came out of the Northern Ocean, were towed and driven on shore all dead, and in a high state of putrefaction, excepting one. Six were found upon the coast of Kent; two on the coast of Holland; one at the Hope Point in the River Thames was the only one seen alive, he ran aground, and smothered himself in the mud, and was afterwards made a show of in the Greenland Docks."†

On running over the above localities I observe that almost every place that has been above mentioned as a favourite resort of the Sperm Whales, although out of soundings, has claims to be considered the site of submerged land. The islands in the Polynesia, which are its special feeding-ground, are the beacons left by the submerged Pacific continent. In pure deep seas animal life is usually scarce, and the absence of breeding-ground is probably the chief cause of it; but this only applies to a certain kind of animals, those which require a bottom on which to deposit their spawn; but there are many which do not require this. The spawn of some floats about unattached; for others a frond of weed is sufficient attachment; and it has occurred to me that the distribution of the Sperm Whale may in some way be connected with the geological antecedents of the ocean it inhabits. I think it not improbable that the site of a submerged land may swarm with life which originally proceeded, or was dependent on it, long after it has been in the deep bosom of the ocean buried. The Sargasso Seas, which swarm with Eolidæ and Crustacea, are examples of this life; it is not invariably either present or absent in deep water, and it is its presence or its absence which is instructive. Those animals which required a bottom to spawn upon may have died out or been developed into others which do not; and those which do not require such a support may have multiplied correspondingly. In one of the maps in Lieutenant Maury's book, already cited, there is a space of sea opposite the western coast of South America, and lying between Patagonia and New Zealand, marked "Desolate region, distinguished by the absence of animal or vegetable life;"—no Sperm Whales here,—nothing for them to feed upon,—and no symptoms, either by banks of Sargasso or coral islets, of any land ever having existed there. There is no apparent reason why this place, except from some special cause peculiar to itself, should be more desolate than any other in the same latitude,—than the deep sea on the east side of Patagonia, for example. I can imagine that, if the bottom of the sea should subside gradually, where animal life had once abounded; animal life—not that animal life, but animal life due in some way to it—might continue to linger over it long after it had passed beyond the depth at which it could practically have any effect upon the animal life above it; but if a part of the circumference of the globe has always been under water, before and ever since the creation of life, no life is likely to be found on that spot, because it has never had a starting-point of life from which to begin; and, as already said, a slender barrier stops the spread of species, and species would certainly not spread to a spot where there was nothing for them to feed upon. Again, animal life could not begin to feed upon animal life until vegetable life had previously prepared the way, by providing food for the animals which were to furnish food for others; and vegetable life

* Gray in "Proceed. Zool. Soc. 1864," p. 231.

† Letter in Sir Joseph Banks' copy of the "Phil. Trans." in the British Museum.

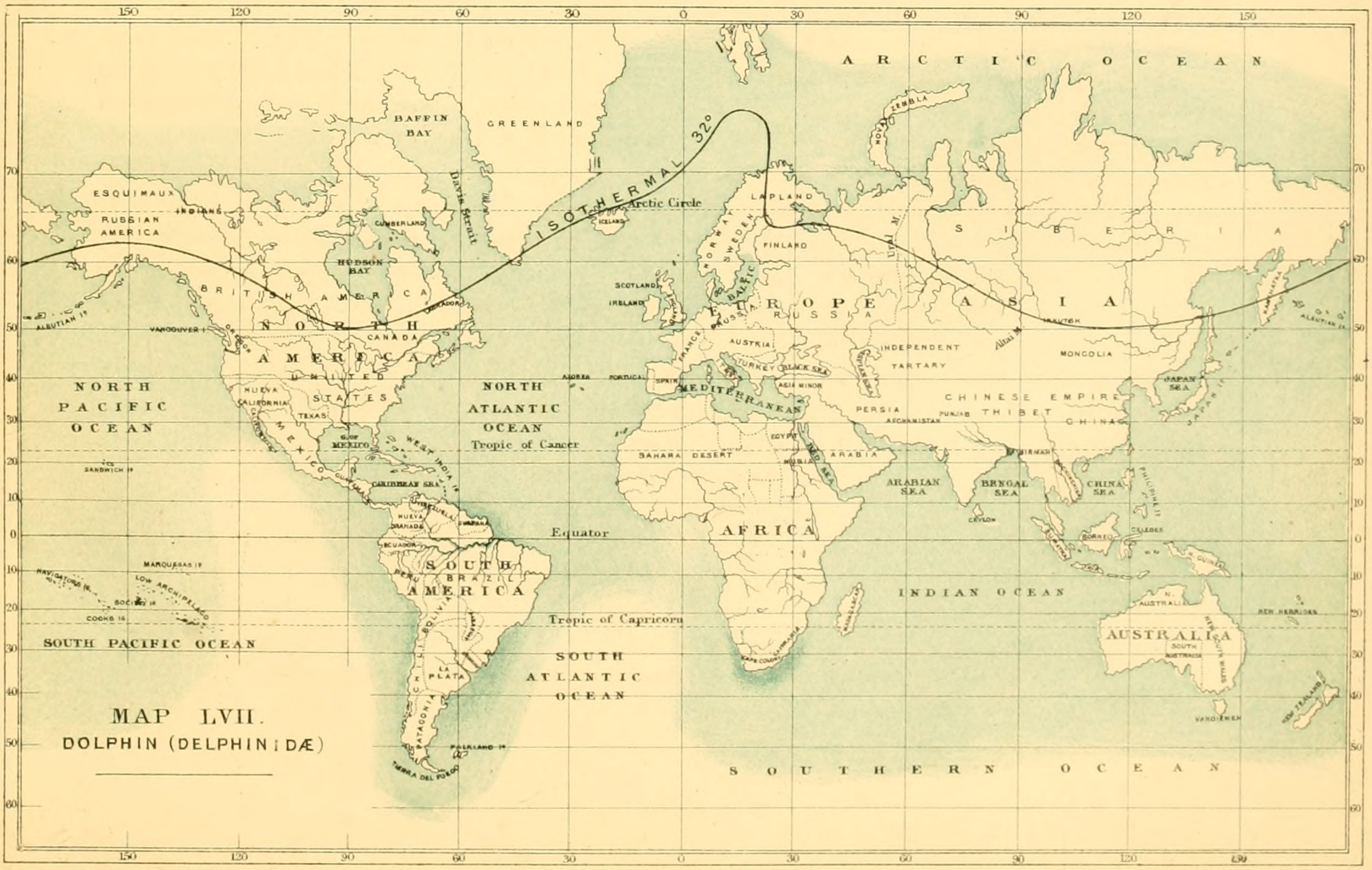


MAP LVI

GRAMPUS PORPOISE &c.

(PHOCÆNA)

Day & Son (Limited) Lith.



MAP LVII.

DOLPHIN (DELPHINIDÆ)

Day & Son (Limited) Lith.

could not begin to grow without a foundation of land, accessible either above or below water. The total and constant absence of all life at any particular spot appears to me, therefore, to furnish a presumption that there has never been dry land or shallow water there. Whether the continuance of deep water in one spot for some interminably long time might not have the same effect is another question, which, whatever way it may be answered, would not affect my explanation of the cause of the absence of the Sperm Whale from such spots.

Remains of an extinct species of PHYSETER (P. ANTIQUUS) have been found in pliocene beds in the south of France.

DOLPHINS. (Maps 56 and 57.) — The common Grampus tumbles through the heavy waves all the way from Britain to Japan, *viâ* the North-west passage. It is common both in the North Atlantic and the North Pacific. The other species allied to it are chiefly northern, one from the Cape, and one from Japan being all that are known to come from any other district than the North Atlantic.

The Bottle-nosed Whales and Dolphins are more equally distributed, or better known, more than a dozen being known in the North seas, and from fifteen to twenty from other parts of the world. The common Dolphin is found in all the seas of the Northern hemisphere, and fossil in sandy downs on the coast of France and at Montpelier. New Holland and the Indian Archipelago furnish each four; the Cape, two; Madagascar, one; the southern coasts of South America from La Plata to Chili, three; and the Red Sea, one.

The BELUGA, or White Whale, is found in the north of the Atlantic, from the mouth of the St. Lawrence to Spitzbergen, also at Bhering's Straits, and probably all round the Polar circle. It is possible that a careful examination by competent authorities may discover that more than one species exists in these regions. Mr. Newton mentions that those he had seen in the Gulf of St. Lawrence had a tallowy appearance, while those of Spitzbergen had the clear, semi-transparent hue of spermaceti; and I have been informed by those who have seen them at Bhering's Straits that there they have the colour of a leaden spoon.

MONODON MONOCEROS.—The Narwhal is peculiar to the Polar Seas, although three specimens are recorded as having wandered to, and been captured on, the shores of Britain. The Greenland seas, and the seas around Spitzbergen and Nova Zembla, as far east as New Siberia, are well known as haunts of this animal. It is also found in the seas about Bhering's Straits.

PLATANISTA, &c. There are some instances of a notable deviation from their normal character in this marine family,—viz. three river, that is, fresh-water species: one, INIA AMAZONICA, about seven feet long, which inhabits the river Amazon and its larger tributaries, up to the Andes. In the Old World there are two Indian species, one peculiar to the Ganges,—PLATANISTA GANGETICA, and another allied species, P. INDI, from the Indus. These animals are also about seven feet long, and have a long, sword-shaped snout, compressed laterally. Their eyes are so small that on a superficial view they might be supposed to be entirely blind. The blow-hole has a form quite unusual among Cetaceans. But it is not only on account of their personal peculiarities that these animals are interesting; both the Old and the New-world species have special independent points for interesting inquiry.

As to the two Indian species, the question is, How each should occur in a river which has now no communication with the other, and which empties itself into the sea on the opposite sides of the Peninsula. This is the only case of the kind which we have yet met with, nor do I remember any similar fact recorded of any other mammals. There is, indeed, a certain similarity in the

distribution of fresh-water fish. The minnow is a fresh-water fish; it cannot live in sea water; neither can its spawn, and yet it is found in almost every streamlet in Britain, although belonging to opposite watersheds and different systems. So is it with the loche, the stickleback, and most of our other fresh-water fishes—we are so familiar with the phenomenon, that it seldom occurs to us to inquire how this wonderful fact has been brought about. We shall have to make up our minds upon this when we come to the Fishes, but in the meantime the present case is still more extraordinary. The Dolphins are not only in different systems of rivers, but belong to a marine genus. We have to account, not only for a marine animal being developed into a fresh-water species, but also into two allied species in two unconnected rivers.

They are so closely allied, that they must have taken their origin from a common and not very distant ancestor; and it does not seem at all a satisfactory explanation to suppose, that this common ancestor frequented the shores of India, and first gave off one new species in the delta of the Indus, and then repeated the process on the other side of the peninsula at the mouth of the Ganges. Moreover, it implies a step taken by the common ancestor, which is, according to my reading, against the first principles regulating the origination of species. The animal never voluntarily seeks the change which produces the development of a new species. It is most comfortable in the country in which it was born, and for which it is adapted—*Inertia* is strong to keep it where it is. It is like Sydney Smith, when he said that where etiquette prevented him doing things disagreeable to himself, he was a perfect martinet. Where personal comfort retained the Dolphin within the bounds of its original habitat, it would not readily seek to wander beyond them; therefore, I cannot conceive it possible that a Dolphin, or rather a school of Dolphins, (for the reader will remember that my theory of the origin of species only acts upon a large body) should desert the congenial open sea, for the uncongenial muddy flats of a delta, and by remaining there voluntarily for a sufficient number of ages, give rise to new fresh-water river Dolphins. In general, the change originating a species comes to the animal—not the animal to the change. Hunger and the struggle for life may make exceptions to the rule, but on looking back at the past history of the globe, it seems very evident that cases resulting from such causes are very exceptional indeed. So I argue that here the change from salt to fresh water must have been forced upon the Dolphins.

The hypothesis which seems to me best to account for the facts is this:—

1. The five rivers, the Indus, the Jhelum, the Chenab, the Ravi, and the Ghora, flow through a desert which also extends over a great space on the west of the Indus in its lower course. This immense sandy waste was undoubtedly at no very distant date in geological time the bottom of a sea continuous with the Arabian Sea; it still bears the aspect of the bottom of the sea; and I assume (no very great assumption) that when India was last raised above the waters, that great sandy desert was left as a great gulf or bay, extending up almost to the Himmalayahs; and that in it numerous marine dolphins played and sported as they do now in the Arabian Sea or the Bay of Bengal.

2. As the land continued to rise, this gulf was shut off from the sea by the elevation of the coast between Bombay and Kurrachee, then of course became a salt lake, without exit, in which also of course were shut up our marine Dolphins.

3. Into this lake flowed the waters which now supply the five rivers above mentioned, as well as the sources of the Ganges, and of its upper tributaries, from the snows of the Himmalayah.

4. Under the operation of such an immense influx of fresh water, the lake gradually became fresh water.

5. The change from salt to fresh water was not so rapid as to destroy the Dolphins, but sufficiently so to induce a change in the species. It must have been more rapid than in Lake Baikal, and under its influence the Dolphin became changed into a fresh-water PLATANISTA.

6. The dividing water-shed which now separates the sources of the Ganges from the sources of the Indus, had not yet been sufficiently elevated to divide the two, and as soon as the lake was full to overflowing it overflowed, and the waters escaped into the line of the Ganges. There would then only be one great river in the north of India, and that the Ganges. By the time this happened, the transformation of the Dolphin into the Platanista had been completed,—it may have been either PLATANISTA INDI or P. GANGETICA that was produced, or it may have been a common ancestor of both. When this happened, the Platanista, whatever its species, would inhabit both the lake and the Ganges, but they could not go back to the sea, *viâ* the Ganges, for by this time they had been changed into fresh-water species.

7. But the land continued to rise, and the Himmalayahs, in their rise, also raised that portion of land lying between the sources of the Ganges and this great lake. Of course, this cut off the exit by the lake into the Ganges. Those individuals of Platanista, which were out in the waters of the river, would find themselves cut off from their natural home or reserve, and restricted to a river-life in the Ganges; a new condition, perhaps, of sufficient importance to induce a second change into PLATANISTA GANGETICA.

8. The lake, cut off from its exit by the Ganges, continues to rise until it again overflows elsewhere, and this time finds an exit where the mouth of the Indus now is, and the Indus flows through the midst of it; old channels show that the Indus once so flowed, and not, as now, to the west of it. The surviving shoals of Platanista, in their turn, would find their lake-life turned into a river one, and PLATANISTA INDI is the result.

I have no doubt that INIA AMAZONICA, the Amazonian species, was produced by a similar concurrence of circumstances, with the exception that there it was not a double event, but only a single-barrelled phenomenon, at least so far as species is concerned. A species has indeed been described under the name of I. BOLIVIENSIS, but it is understood to be only a synonyme of the I. AMAZONICA. We know that the Amazon flows in the course of an ancient arm of the sea, that Brazil and Guiana, &c., were once islands, and the ancestors of INIA must have been caught in a sea gulf turned by a rise of land, into an inland lake without an outlet, and in this lake been converted into fresh species in the same way that Platanista first was. The fact that it is found at a great distance from the sea, and above cataracts which must have proved an absolute barrier to its ever having ascended from it by the present channel of the river, sufficiently proves this. In some natural history books, it is said in general terms to inhabit the great rivers of South America,* conveying the impression that it occurs in more than in the Amazon and its tributaries, and I have a recollection of seeing somewhere the Orinoko given as one of its habitats, but I cannot find the reference. If it really does inhabit the Orinoko as well as the Amazon, it would infer something like a repetition of the history of the Platanistas of the Ganges and Indus, with the exception that only one species has been developed.

* DALLAS, W. S. "Natural History of the Animal Kingdom," 1856, p. 683.

ZEUGLODONTIDÆ.—ZEUGLODON CETOIDES of Owen is a great fossil Whale with peculiarly formed teeth; according to Giebel, it is intermediate between the Whales and the Seals. The teeth give some countenance to this idea, appearing when looked at transversely to be formed somewhat on the plan of those of the Seal; at any rate, more so than on the plan of the teeth of the Dolphins; but its character is at once settled by its possessing a single nostril with an upward aspect above and near the orbits, being the usual structure of the spout-hole in Whales, and by its immense bulk, seventy feet in length, either of which goes far to prove it a cetacean. The entire skeleton has been obtained from the miocene deposits of Alabama, so that we know nearly as much as we can ever expect to do of this creature. Its head was long and narrow. The teeth indicate a carnivorous diet, and Prof. Owen points out that their mode of succession conforms more to the general mammalian type than to that of the living Cetaceans; certain teeth displacing and succeeding each other vertically.

The first teeth were found at Malta, and are preserved in the Woodwardian Museum at Cambridge. Remains have since been found at various places in America. These were described by Dr. Harlan under the name of BASILOSAURUS, the king of the Saurians, he having taken it for a reptile. Arkansas, South Carolina, and Alabama, are the American districts in which its remains have been met with. Respecting this creature Sir Charles Lyell says, that its colossal bones are so plentiful in the interior of Clarke county, as to be characteristic of the formation, an eocene white rotten limestone. The vertebral column of one skeleton found by Dr. Buckley, at a spot visited by him, extended to the length of nearly seventy feet, and not far off part of another back-bone, nearly fifty feet long was dug up. He obtained evidence during a short excursion, of so many localities of this fossil animal, within a distance of ten miles, as to lead him to conclude that they must have belonged to at least forty distinct individuals.*

To this family probably belongs a new genus, PONTOGENEUS PRISCUS, described by Leidy from a cervical vertebra, and of which remains have been found in Louisiana and Carolina.

* LYELL, "Elements of Geology," 6th edition, 1865, p. 308.

CHAPTER XXXI.

EDENTATA — EXTINCT SPECIES — DATE AND RANGE OF MEGATHEROID SPECIES IN NORTH AMERICA — EXISTING SPECIES.

Edentata. (Maps 58 and 59.) — Although the fauna of most countries is distinguished by some element which it possesses in a greater degree than any other, and which gives it its peculiar character, none of them enjoy absolute and sole possession of the special forms which give the fauna their character. Thus Africa is the land of the Antelopes and heavy pachyderms, Australia that of the Marsupials, and South America of the Edentata; but Africa has to share the Pachyderms and Antelopes with India; Australia, the Marsupials with South America; and the Edentata of America are represented (although but feebly) in Africa and India.

There is considerable resemblance between South America and Australia in the past history and in the present conditions under which their special fauna exists. In both it has flourished in greater vigour than it now does; in both the Carnivora are feebly represented — both have some typical forms in common; and in both the place of the feeble and small animals which now inhabit them was filled by gigantic animals allied in structure but strange in form, which puzzle us as to their appearance and the means by which they gained their living. Nature has framed strange fellows in her time, but none of them stranger than some of the Edentata.

The Edentate fauna of South America is one of the instances which is most frequently brought forward in illustration and support of the view, that each country has a special fauna, due to some general law, which has been in operation through past ages as well as now, in some mysterious way suiting the animals to their abiding place, and preventing them wandering into other bounds. I have already shown how I think the law of change originating new species explains this. That species do not pass the limits of their special range, except when driven, is, in the first place, due to their being most comfortable where they are, and consequently indisposed to leave their present quarters, and in the next place, when driven beyond their bounds, either by geological changes or insufficient food for their numbers, the change of condition alters them into new species, so that, although they are virtually the old creatures in new lands, they are not recognisable.

The further back we go in the history of the globe these influences must have had less and less effect. The conditions of life were then everywhere more uniform, and the passage from one part of it to another entailed little alteration in the circumstances of the animal. Hence the rarity of change of form and of new species. In those long gone-by times, too, provinces may have retained their specialty from another cause, neither more nor less than the law which keeps the prisoner in his dungeon, and the bird in its cage. "I can't get out," may have been with them the sole cause of their then staying where they were.

The facts relating to special faunas in the eocene and early miocene times seem to show that when the peculiar facies was impressed on the fauna and flora of any country it was at that time isolated from all other countries; that when it was united to other lands, the typical form spread into them under the same, or nearly the same form.

We see this in North and South America, which have at different times been separated and again united. When isolated, the Edentate and Marsupial fauna, considered characteristic of South America, increased and flourished there. When united it overflowed and spread into North America. This is proved by the fossil remains of Edentate animals found in that country, and by the persistence there to the present day of small species belonging to that and the marsupial type.

But if the affinity of the North and South American Edentata proves former continuity, so must that of the Old-world and the New-world species. This affinity is something very different in degree from that of which we have been speaking. The Old-world species are of a peculiar type. There is the same general structure, and the same idea shows itself in various ways: but it has taken a different direction. In the New-world Armadillos, the animal is enveloped, more or less, in impervious horny plates, under which it can obtain protection. The Old-world Pangolins are clothed, on the other hand, with scales. One species, the Cape Orycteropus, is not; it is merely clothed with hair; but both Pangolin (Manis) and Orycteropus are Ant-eaters, and truly represent the Ant-eaters of South America, which have coarse hair too; but the Pangolins have borrowed the idea of their horny cloak from the toga of the Armadillo, the cousin of the American Ant-eater.

Whence have these creatures come? some common ancestor has doubtless worn a coat made of such stuff. The general structure of the Monotremata comes nearer to that of the Edentata than to that of any other animal. They have often been classed together, or next each other. Cuvier formerly so classed them. Giebel and others, in our own times, do so now; and although the Monotremes are more generally placed after the Marsupials, and next the Birds, in right of their duck-bill and lower organisation, even those who place them there admit that the Edentata possess a similarly low organisation.* The Echidna bears a coat so far similar to that of the Pangolin, that it is horny; only, instead of horny scales, it has solid horny quills. We have not quite the same barrier here raised up which met us in our attempts to trace the Placental animals directly from the Marsupial, viz. the impossibility of believing that nature has several times repeated the same change. In the Monotremata we find the change half operated to our hand. The marsupial pouch has disappeared,—the marsupial bones remain.

We may thus suppose the Edentata to be not very distantly related to the Monotremes. Their common ancestors may have lived in the Pacific Continent which we have supposed at one time to have existed in the South Seas, or between Australia and Africa. Whether there was a communication between America and this supposed land, or whether the species had to arrive by Africa, and thence across the Atlantic, by land then in existence, is one of those problems for the solution of which we have no sufficient data. I shall only notice as possibly having a bearing on

* "The unusual number of three-and-twenty pairs of ribs, forming a very long dorsal, with a short lumbar, region of the spine, in the two-toed Sloth, recalls a lacertine structure. The same tendency to an inferior type is shown by the abdominal testes, the single cloacal duct, the low cerebral development, the absence of medullary canals in the long bones in the Sloth; and by the greater tenacity of life, and long enduring irritability of the muscular fibre in both the Sloths and Ant-eaters.—Owen, in "Proc. Linn. Soc." ii. 23, 1857.

it, that two out of three species of the Orycteropus occur on the west coast of South Africa opposite where the Ant-eaters occur in South America. No doubt another species occurs in South Nubia, and no doubt, also, the Manis is found in Senegal and West Africa too, and it has scarcely less affinity to the Ant-eaters than the Orycteropus, therefore the circumstance is not worth much.

One most interesting fact bearing upon this point is that the remains of an extinct Edentate animal (named Macrotherium giganteum) have been found in the Old World (from Miocene beds at Sansans, in the south of France, and at Linz), and although they are very imperfect, sufficient has been made out, first, to lead Cuvier to class them with the Pangolin; and now, when additional, though still most meagre materials have been obtained, to cause Gervais to suppose them most akin to Orycteropus; lastly, to enable Professor Owen to say with confidence that they belonged to a gigantic genus intermediate between the Manis and Orycteropus.* It is right to add, however, that this determination is not that of all Palæontologists. Dr. Giebel finds no resemblance in the remains to those of Orycteropus. He thinks them much closer to the smaller Armadillos. The determination of this point has much interest. If the animal was a Pangolin, it shows that the only Edentate fossils in the Old World belong to the same type as still continues to inhabit it; while, on the other hand, if more nearly allied to the Armadillo, it furnishes another instance in addition to that of eocene opossums, from the Paris gypsum, of a form supposed to be peculiar to South America, having at that time also lived in Europe. Professor Owen regards its Old-world relations (between Manis and Orycteropus) as deeply interesting, on account of the geographical position of both these Edentate genera, viz. on tracts of land, which are now most contiguous to the continent containing the remains of the extinct osculant genus; but although most contiguous now, we must remember that at the time when the Macrotherium lived, Africa was wholly disarticulated from Europe, and India probably from Asia; the communication between the country to the north and that to the south of the line of the Himmalayan range and its extensions, being apparently difficult or wholly interrupted. In fact, there appears then to have been freer communication between the New World and the Old, than between the Africano-Indian region and Europe.

In the classifications of the Edentata, all systematists agree that there are at least two sections which, for distinction, might, after the plan of division of vertebrata and invertebrata, be called the Ant-eaters and the non-Ant-eaters. This was Cuvier's division. It is now Van der Hoeven's. Owen, on the other hand, increases the subdivisions to three,—the Bradypodidæ or Sloths, the Dasypodidæ or Armadillos, and the Edentata or Ant-eaters. Giebel again divides them into four families,—the Ant-eaters or Vermilinguia, the Armadillos or Fodientia, the extinct Megatheroid animals or Gravigrada, and the Sloths or Tardigrada. In forming an opinion as to the relative merits of these views, there is one general principle, which will prove a safe guide. Where two structures characteristic of different sections are found in the same animal, the value of each should be estimated by its relative importance. Is the kind of food an animal feeds upon, or the mode in which it procures it, of most importance? The fact of Mammals being universally divided into the great sections of carnivorous, herbivorous, and insectivorous, almost answers this question. If the modifications of structure dependent on the kind of food consumed are found to furnish the best characters for the *great* groups, while what I call accidental structure is used only for small ones, it sufficiently shows the general estimate of their relative importance. Now, in the Edentata

* Owen's "Palaeontology," p. 348.

we have animals feeding upon three kinds of food,—the Ant-eaters feeding upon ants and other insects, as their name declares; the Armadillos, omnivorous, feeding on almost anything,—fruit, leaves, roots, insects, flesh, and having no prejudices against offal; and the Megatheroids and Sloths, whose sustenance was and is wholly vegetable. For each of these kinds of diet the animal has a special organization, and the mode of procuring it is quite a minor consideration. If it does so by burrowing or by climbing trees or by walking on the ground, its limbs will be modified to suit that mode of getting at its food; but the main organs will remain untouched. They are essential: the others accidental. For this reason I prefer Owen's division, in which he places the Megatheroid animals and the Sloths in the same section. It may be right to divide that section into the large extinct burrowing species and the small existing arboreal animals; the accident of their getting the same food in different ways, as well as their difference in size, (for, as already said, size *is* an element in the affinities of nature,) justify this; but it is a division of different value and less importance than that between the other groups of the family.

For the same reason I think that Giebel has made a mistake in carrying the Orycteropus from the Ant-eaters to the Armadillos. He has doubtless placed it among the Fodientia or Burrowers, because it burrows; but its true affinities are with the Vermilinguia. The form of the tongue in the Monotremata, the Myrmecobius, and Myrmecophaga, is a long, round thing, like an earthworm, and that of the Orycteropus is of the same type, long, thin, but flat, like a piece of tape; their purpose is the same, although their mode of application is slightly different. The general structure of the animals is, moreover, essentially the same, and their geographical distribution may be interpreted in accordance with their affinity.

In compliment to our latest acquaintances, the Whales and the Pachyderms, I shall commence with the largest,—the Sloths and Megatheroid animals.

I. Bradypodidæ. (1). Gravigrada. The Megatheroid animals are now all extinct. In South America their remains have been found in Brazil, in Paraguay, in Uruguay, near Buenos Ayres, in North Patagonia, and on the other side of the Andes at Lima. Agassiz proposed to divide this group into two sections, of which the Megatherium and Megalonyx were the types; but, as his distinction was mainly founded on the idea that the one (the Megathere) had a long trunk, and the other, the Megalonyx, a short snout, an assumption which, as regards the Megathere, turns out to be untenable, I do not adopt it.*

A species of Megatherium, not the South American M. Cuvieri, but an allied one, M. mirabile, formerly inhabited Georgia and South Carolina, but traces of it have not been found further to the north. Remains of a species of Mylodon different from that of South America, occur through a great part of North America, from Natchez on the Mississippi to Big-bone Lick, in Kentucky, in the east, and to the Williamette River, in Oregon (one of the tributaries of the Columbia), on the west. One species of Megalonyx lived in North America† whose remains have been found in caves in Tennessee, and in deposits at Natchez, and in Virginia. Bones of the Ereptodon priscus have been found in the deposits through which the Mississippi runs.

* Agassiz in "Boston Soc. Nat. Hist." Sept. 1862, p. 102.

† Dr. Falconer, in his paper on "Fossil Elephants," already so often quoted, says, "Knowing as we do, what an important feature the large extinct Edentata constitute in the newer pliocene fauna of the littoral regions, both of North and South America, and of the interior of the United States, it is not a little remarkable that neither in the lower miocene of the Nebraska, nor in the pliocene fauna of Niobrara, both of which have been so ably investigated by Leidy, has a single edentate form been discovered."—*Nat. Hist. Rev.* iii. p. 62.

MAP LVIII
EDENTATA
FOSSIL.

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

Day & Son (Limited) Lith.

MAP LIX
EDENTATA.
EXISTING.

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

Day & Son (Limited) Lith.

To what cause should their extinction be referred? It may have been simply that their time was up,—that the life of the genus had run its course; or if we look for a more direct cause, it would not be difficult to find one in the glacial cold, were it not for the statement which has been made on the best authority that, like the Mammoth and Mastodon (animals which seem to have owed their origin to the change at the glacial epoch), these Edentates survived that time.

Dr. Falconer, in his paper on "Fossil Elephants," says: "Of two asserted facts, which it was of the utmost importance to determine with accuracy, one appears to have been clearly established: namely, that the extinct Edentate and Proboscidean fauna of the United States existed long after the deposition of the northern drift. This was put beyond doubt by Lyell many years ago;"* and then he goes on to cite instances where the Mastodon Ohioticus (which was within the special scope of his paper) was certainly so found: but he gives no instance, nor does he refer to any authority, in support of his statement regarding the Edentata; and as to them, Lyell says in 1865, "Whether the 'loes' and other fresh-water and marine strata of the Southern States in which skeletons of the same Mastodon are mingled with the bones of the Megatherium, Mylodon, and Megalonyx, were contemporaneous with the drift, or were of subsequent date, is a chronological question still open to discussion."† Supposing it to have been contemporaneous with its early stage there is nothing inconsistent with their having died under the cold, or they may have passed their time in exile in the tropics during its continuance, and on its retreat have returned to their old place, but, unable to stand the modified climate, soon dropped off.

I have endeavoured to arrive at some conclusion on the subject, and although it becomes me to speak with the greatest diffidence in a matter on which professed geologists have come to a different opinion, I may be allowed to express a doubt that the North American Megatheroids did survive the period of the drift, that is, the glacial epoch. I believe that the general understanding that they did so, has arisen from their bones having been in one or two instances found in company with those of the Mastodon and other animals which did survive that epoch, but that these exceptional cases are capable of explanation. Professor Owen's memoir on the "Megatherium," and Leidy's on the "Extinct Sloths of North America," supply us with notes of every locality where their remains have been found, and an examination of the age of the deposits at each of these places gives the following result:‡—

Species.	Locality.	Formation in which Remains found.	Before or after Glacial epoch.
Megatherium—Cuvieri *Desm.* (Americanum *Owen*)	Banks of the River Luxan near Buenos Ayres (1789)	Pliocene	Before glacial epoch.§
,,	Lima (1795) (no particulars)	Unknown	Unknown.
,,	Paraguay (1795) (no particulars)	,,	,,
,,	Uraguay, in the bed of the Queguay (1823)	Pliocene	Before glacial epoch.

* Falconer, op. cit. p. 62.

† Lyell's "Elements of Geology," London, 1865.

‡ This list has had the advantage of being submitted to Dr. Leidy previous to publication.

§ For shortness I call the pliocene beds "before the glacial epoch," although, strictly speaking, I believe its cold began to show itself in the pliocene times. In using that phrase here, I merely mean before the glacial epoch had put on its full rigour.

Species.	Locality.	Formation in which Remains found.	Before or after Glacial epoch.
Megatherium — Cuvieri (*continued*).	Bed of Salado, near Buenos Ayres (1831)	Pliocene	Before glacial epoch.
,,	Lower bed of cliff called Puenta Alta at Bahia Blanca,—cliff composed of cemented quartzoze shingle (Darwin, 1834)	Pliocene (out of 23 shells from same bed, 12 to 16 recent)	,,
,,	River Luxan near Buenos Ayres (1837)	Pliocene	,,
,,	Las Averias, an estate north of the Rio Salado (1838)	,,	,,
Megatherium mirabile *Leidy*	Skiddaway Island, Georgia (1834)	"Pleistocene Marl"*	(*de quo quæritur*)
,,	White Bluff, Savannah in Georgia	Disputed	Disputed.
,,	Ashley River, in South Carolina	,,	,,
Megalonyx Jeffersoni *Cuv.*	White Cave, Tennessee	Pleistocene	(*de quo quæritur*)
,,	Blue Ridge, Western Virginia	Pliocene	Before glacial epoch.
,,	Big Bone Cave, White County, Tennessee	Pleistocene	(*de quo quæritur*)
,,	Memphis, Tennessee	Pliocene	Before glacial epoch.
,,	Natchez	,,	,,
,,	Alabama	Unknown	Unknown.
,,	Kentucky, Virginia	,,	,,
Megalonyx dissimilis *Leidy*	Natchez	Pliocene	Before glacial epoch.
Megalonyx gracilis, *Lund*	Caves of Brasil, and superficial deposits, to the Straits of Magellan	,,	,,
Mylodon Darwinii, *Owen*	Southern parts of South America	,,	,,
Mylodon robustus, *Owen*	La Plata	,,	,,
Mylodon Harlanii, *Owen*	Mammoth Ravine, Mississippi	,,	,,
,,	Ashley River, South Carolina	,,	,,
,,	Williamette or Mullonah River, a tributary of the Columbia, Oregon	,,	,,
,,	Benton Co., Missouri	Miocene or Pliocene	,,
,,	Bigbone Lick, Kentucky†	Pleistocene	(*de quo quæritur*)
,,	Natchez	Pliocene	Before glacial epoch.
Ereptodon priscus *Leidy*	Mississippi	,,	,,
Gnathopsis Oweni *Leidy*	South America	Unknown	Unknown.

* Lyell proposed this term "Pleistocene" for the Newer Pliocene, as opposed to Post-pliocene, that is, equivalent to before the drift as opposed to after it. The question as to the remains found in these Pleistocene deposits is twofold: first, the data of the deposit,— that is, whether it is Pleistocene or not,— a question which I imagine must be answered in the affirmative; and second, how the bones came into the deposit. They may belong to an older date, and have become mixed up with more recent remains in the newest bed.

† I do not know the original authority for this. Lyell does not put it very strongly. He says, "Besides which a few bones of a stag, horse, Megalonyx, and bison, *are stated* to have been obtained, &c."— Lyell's "Travels in North America," First Series, vol. ii. p. 65, 1845.

From this, it appears almost certain that the majority did not survive the glacial epoch. If any did it must have been the Megalonyx or Mylodon, and their age depends upon caves which might have served for two epochs, and have little to guide one but their contents. I believe, too, (although I do not speak with certainty,) that in the few instances in which remains have been found in post-glacial deposits, a single bone or tooth found on a single occasion is all that has been met with; which, I need not say, is the fashion in which bones washed out of an older deposit and preserved in a more recent one invariably occur. One may, therefore, speculate on the causes which led to their extinction, without being hampered by the feeling that the exceptions, which appear to have survived the glacial epoch, are absolutely incapable of explanation; and if that be so, no more likely cause for their extinction can well be given than the change of climate brought about by the glacial epoch. I have the less hesitation in doing so, in that the statement of my doubt may suggest inquiry to those who have the opportunity of making it, and lead to an authoritative settlement of the question.

We have already satisfied ourselves that the cold of that epoch affected the whole earth, tropics as well as poles (of course in different degrees). The larger Edentata seem to have been, not only, from their habitat, but also from their mode of life, peculiarly tropical animals, and it therefore follows, peculiarly unfitted to bear any great degree of cold. An amount of change which, in other animals, may only have been sufficient to stimulate the action of development into the creation of new species, may in them have been too great for the continuance of life, and have killed them off altogether.

The reasoning by which the habits of these large Edentate animals have been inferred from their structure, has always appeared to me a series of the happiest exercises of the inductive faculty.

Seventy years ago, Cuvier (then in the fulness of his fame) was the first to throw light upon their nature. A nearly complete skeleton had been found on the banks of the river Luxan, near Buenos Ayres, in 1789, and transmitted to Spain by a Spanish official, where it was preserved in the museum at Madrid; and a memoir containing a description and figure of the bones was published by Signors Garrigo and Bru,* in 1796, and submitted to Cuvier for his opinion. Their judgment went little further than that announced in their title-page that it was "un quadrupedo muy corpulento y raro,"—a very bulky and rare quadruped. But Cuvier at once assigned it its true position as one of the Edentata, and he thus summed up his conclusions as to its habits and food: "Its teeth proved that it lived on vegetables, and its robust fore-feet armed with sharp claws make us believe that it was principally their roots that it attacked. Its magnitude and talons must have given it sufficient means of defence. It was not of swift course, nor was this requisite, the animal needing neither to pursue nor to fly."† And subsequently (1823) he pronounced that it had the head and the shoulder of a Sloth, whilst the legs and the feet offer a singular mixture of characters peculiar to the Ant-eaters and Armadillos.‡

About the same time (1821) two German naturalists, Drs. Pander and Dalton, who published a beautiful monograph of the skeleton, gave it as their opinion that it was a fossorial animal, and not merely an occasional digger of the soil, as Cuvier concluded, but altogether a creature of subterranean habits,—in fact, as Owen expressed it, a sort of Earth-whale or colossal Mole.

* "Descripcion del Esqueleto de un Quadrupedo muy corpulento y raro." Don Joseph Garrigo, Madrid, 1796.

† CUVIER's translation of the Memoir by Don Garrigo in the "Annales du Museum," 1796.

‡ CUVIER, "Recherches sur les Ossemens fossiles," V. part I. 1823.

The inquiry next became complicated with the question whether it was not provided with a carapace like an Armadillo, portions of the carapace of the GLYPTODON having accompanied some bones of the Megatherium which found their way to Britain. Dr. Buckland, in his "Bridgewater Treatise," warmly espoused this view. The discussion is instructive, but was brought to an end by the receipt of the bones and carapace of the GLYPTODON together in such connexion that all doubt on the subject was removed. While the question was still in doubt however, Professor Owen had ranged himself on the side of those who held that there was no ground for supposing the animal to be provided with any such armature. Dr. Lund next conceived, from the numerous points of resemblance to the Sloths, that its habits must have been the same as others; and in spite of the improbability of an animal eighteen feet in length, and nearly as bulky in its body as an Elephant, performing such a feat, he conceived that it passed its life clinging to the underside of branches of trees, as the small arboreal Sloths now do.*

A masterly analysis, by Professor Owen (from whose paper I have picked the above details), of the form and relations of every bone, both of the Mylodon† and Megatherium,‡ pointing out their affinities to those of other animals, and probable use to themselves, at last settled the matter, and his view is now universally adopted.

Guided by the general rule that animals having the same kind of dentition used the same kind of food, he concluded that the MEGATHERIUM must have subsisted like the Sloths on the foliage of trees: but the greater size and strength of the jaws and teeth led him to suppose that, as in the Elephant, small branches might also form a portion of its food.

The first part of the question which then naturally presented itself, viz. how it reached the leaves and branches, he answered by referring to the structure of its feet, which he showed, independent of the objection derived from the weight and bulk of the creature, were inconsistent with its being a climbing animal. Neither were they adapted wholly for fossorial purposes. Burrowing animals are not provided with clavicles, but the MEGATHERIUM has very largely developed clavicles; the fore paws have smaller claws than the hind paws, and are turned inwards, adapting them for grasping; the hind feet have enormous claws, and great, broad projecting heels, and the whole structure of the pelvis, tail, and hind-legs, show that they were the seat of enormous muscular power. Owen thence inferred that it obtained its food by uprooting and prostrating trees, and that it effected this, first by clearing away the earth about the roots chiefly by its hind-feet, and that then, clasping the tree with its fore-legs, it tugged and strove until it literally tore it up by the roots.

The next point was, how it plucked off the small branches and leaves for its food: having no incisors it could not nip them off, and its molar teeth being far back in the mouth, it could not use *them* for that purpose. Its hand was practically limited to one claw, so it could be of little more use than the iron hook, which is sometimes to be seen worn, fastened to their stump by soldiers or sailors who have lost a hand. The only other means which we know to be adopted by nature for such a purpose, are a nasal trunk, as in the Elephant and its allies, or a long muscular tongue, as in the Camelopard. Cuvier, and subsequently Agassiz, thought that the Megatherium had a proboscis like the elephant, and that it used it for plucking nutritive fibres and spongioles from the roots; but, as Owen remarks, it had no pre-nasal bones, and if it had, the snout of the Sow would have been better adapted for such a purpose; and a trunk would have answered equally well for

* "Blik paa Brasiliens Dyreverden för sidste Jordomvæltnin af Dr. Lund." 4to. Kjobenhaven, 1838.

† OWEN on the Mylodon. 4to, London, 1842.

‡ OWEN on the Megatherium. 4to. London, 1861.

plucking leaves. The real objection to this, however, lies in the fact that the sub-orbital foramina are too small to have supplied a trunk of the size of an Elephant's with vessels and nerves. If a trunk did exist it could not have exceeded in size that of the Tapir. There is evidence, however, in the strength and articulation of the hyoid bones (which by a rare chance have been recovered with one of the skeletons), and the unusual area of the foramina for the nerves of the muscles of the tongue, that it possessed a long tongue of great size and power, perhaps not without affinity to the round, slender tongue of the Ant-eater (although adapted for another purpose and of very different proportions). The fore-part of the under-jaw projects in front with a long rounded groove in the middle, apparently for the reception of this long cylindrical tongue; such a tongue would render a trunk, of any size, not only an unnecessary appendage, but positively an encumbrance. It is not improbable, however, that it had well-developed upper lips, for the number of small foramina in the anterior termination of the under-jaw show that it had a largely developed and very sensitive under-lip, and this would almost (although not absolutely necessarily) imply a correspondingly developed upper lip to meet it.

I have said that Professor Owen's conclusions are generally adopted. The only exception would appear to be the Professor himself, for both the skeletons of the Mylodon and Megatherium, set up under his direction in the Royal College of Surgeons and British Museum, are put up, in contravention of his views, in the position of a quadrumanous animal about to clamber up a tree. Agassiz objects to this position. He was of opinion that instead of being set up so, it should have been placed in a crouching attitude, with the hind-legs bent, sufficiently to allow the tail to touch the ground,—with the head bent down between the fore-legs, the broad chest resting upon the ground, supported by the fore-legs, extended in such a way that they should rest for nearly their whole length, and leave simply a free play for the extremities to reach out beyond the head.* His suggestions have not, however, been followed in his own adopted country. The cast of one in the Museum of Boston, in the United States, has been mounted in even a more arboreal attitude than our own. It appears to me that it can have only had two characteristic attitudes, the one that of a burrowing animal, something like that described by Agassiz, lying flat on the earth, with its back bent up and shovelling out the earth with its hind-feet, and the other, which I should have preferred, standing erect, resting on the tarsi of its hind-legs and on its tail, like a dog begging, and clasping the trunk of a tree to its breast.

Before reverting to our interrupted argument, from which this is scarcely a digression, the reader may be pleased to notice two things,—one, the fitness of the structure of the animal to the surface of the earth on which it lived,—a fine alluvial deposit, which its claws would shovel up with the greatest ease. Darwin speaks of the speed with which its relative the Armadillo makes its way through the soil: "In the course of a day's ride near Bahia Blanca several were generally met with. The instant one was perceived it was necessary, in order to catch it, almost to tumble off one's horse; for in soft soil the animal burrowed so quickly, that its hind-quarters would almost disappear before one could alight."†

The other thing to be noticed is that the forest region in North and South America must then have been greatly more extensive than it now is. The northern half of the Pampas must probably have been covered with trees, which must have extended as far north as Oregon and Nebraska, with scarcely an interruption, except from the Rocky Mountains, so far as then in existence.

* "Boston Soc. Nat. Hist." May, 1863, p. 192. † "Journal of a Naturalist," 2nd edition, p. 96. London, 1845.

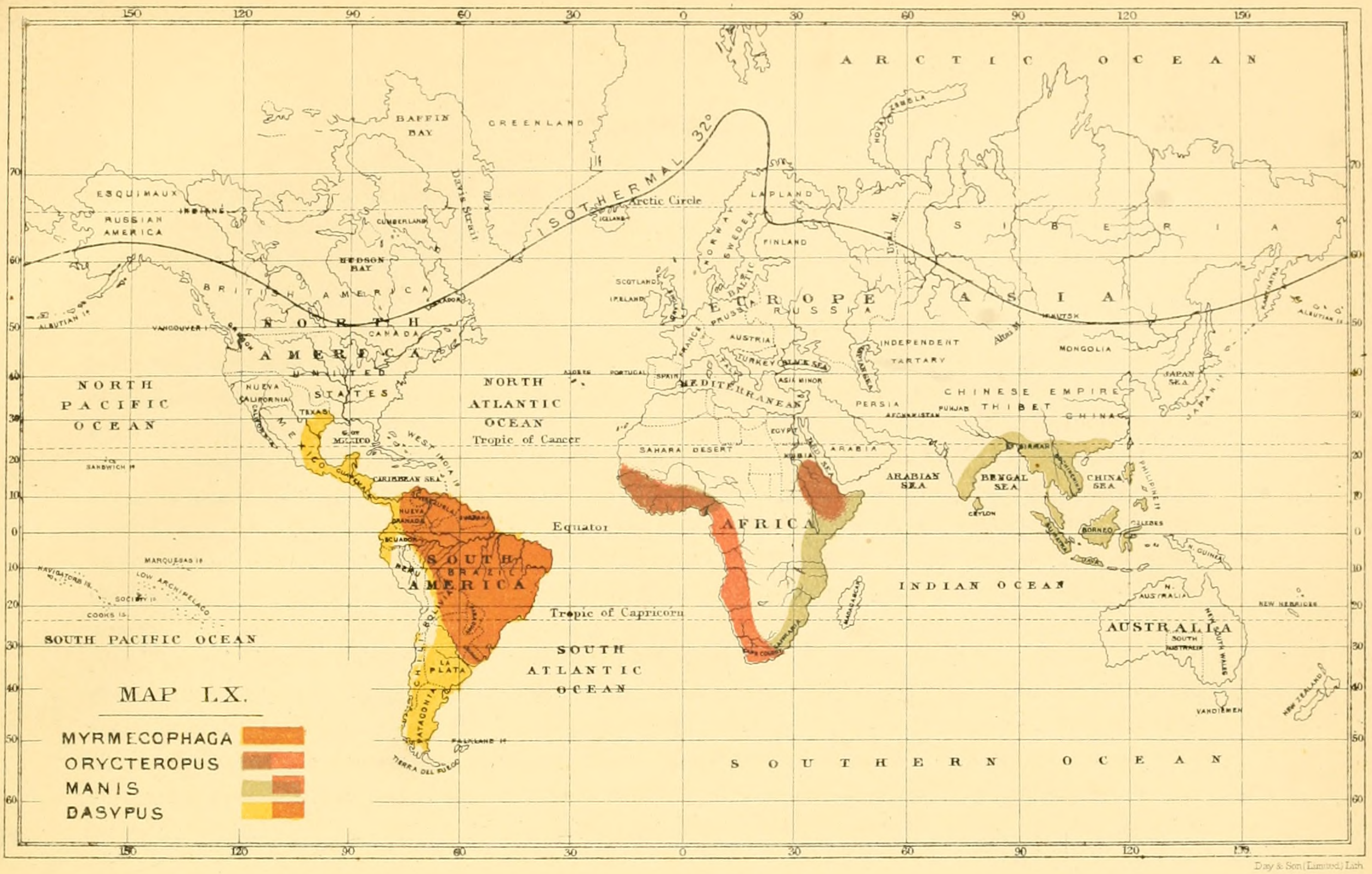
I have made these remarks by way of proving that these Megatheroid animals must, from their habits and mode of life, have been fitted for a very warm, damp climate, similar to, and, perhaps, even hotter than that of the Brazilian forests in the present day; the habits which have, I think, been successfully proved to be theirs being inconsistent with anything but a tropical climate. It is plain, that whole tribes of these great creatures, twelve and eighteen feet in length, could never have been supplied by leaves and twigs obtained by the wasteful process of uprooting trees, except in a country where the vegetation was most luxuriant and the growth exceptionally rapid.

It seems not improbable, therefore, that it is to the glacial cold that we owe the extinction of these larger Edentata; for, as Professor Owen remarks, the chemical conditions of life are such, that the larger an animal is, the less resistance can it make, and the more readily does it succumb to any unfavourable change; which is one of the reasons why we find small species surviving, while the larger species have, in many instances, disappeared, and are only now to be met with in a fossil state.

(2.) Sloths. (Map 61.) The Tardigrada inhabit the north-east of South America, reaching, in the north, almost to the Isthmus of Panama, on the west to the Andes, and on the south to the south of Brazil, but not into Paraguay. A new species of two-toed Sloth, Cholœpus Hoffmanni, has lately been found in Costa Rica, and described by Dr. Peters, who has discovered in it an abnormal number of cervical vertebræ—in the reverse direction from the three-toed Sloths. They have nine cervical vertebræ instead of seven. This animal has only six.

II. Armadillos. (Map 60.) Those little mailed creatures, whose restless activity is so attractive to the public in our Zoological Gardens, were represented in the pliocene and post-pliocene ages by animals which must have been considerably more staid in their demeanour and deliberate in their movements; for they were almost as large as the Megatherium, and enclosed entirely in an unyielding bony case, bearing some resemblance both in shape and pattern, on a great scale, to a portion of the shell of an Echinus or Sea Urchin. The existing Armadillos, as the reader knows, are invested in a succession of bands of jointed plates, which, like a suit of scale armour, conforms itself to the motion of the body, and allows the animal, when it chooses, to roll itself up into a ball, which is more or less protected, according to the number and breadth of the bands; and these, like the band of the plated armour of our defended ships, are always applied round the most vital parts of the body. But the extinct species, the Glyptodons, were wholly enclosed in theirs, except on the belly. Even the tail had a coat of mail, and the head was protected by a piece of armour, like the chamfron of a war-horse in the days of the Crusaders. The remains of these animals and of other extinct Armadilloes have chiefly been obtained from superficial deposits near Buenos Ayres, and from the bone-caves of Brazil.

The living species have pretty much the same range, but they extend further to the south; one, D. minutus, reaching as far south as 50° south latitude. The different species are local, and the range of each not extensive. The difference in the constitution of animals, as affecting the origin of species, cannot be better illustrated than by the Armadillos and Ant-eaters of South America. The Armadillos have apparently been susceptible to the most trifling change. They appear not to have been able to pass from one district into another,—from Brazil into Peru, or from Paraguay into La Plata,—without experiencing the change so keenly as to have set up the action of the modifying power, and produced a change of species. Dr. Burmeister has



MAP LX.

MYRMECOPHAGA
ORYCTEROPUS
MANIS
DASYPUS

Day & Son (Limited) Lith.

MAP LXI.

SLOTHS.

Day & Son (Limited) Lith.

studied on the spot the mammals both of Brazil and La Plata; and in his works on these districts he has enumerated the different species found in them, and out of twelve species of Armadillo found in these two regions, he did not find one both in Brazil and La Plata.* The DASYPUS PEBA, or nine-banded Armadillo, from Central America, has been stated to be an exception. It occurs in Brazil, and in Guiana, and is said to be common in Mexico, and not uncommon near the lower shores of the Rio Grande in Texas; but it turns out that the Brazilian and the Texan species are different.† I would preserve the name, D. NOVEMCINCTUS, for the Brazilian species, and PEBA for the Texan. On the other hand, the great Ant-eater (MYRMECOPHAGA JUBATA) is found throughout the whole of South America, east of the Andes and down to La Plata, wherever there is wood. No doubt it may be said that the physical condition of a wooded country is greatly more homogeneous than one not entirely wooded, and less change is felt in passing from one part of it to another. But the fact that there are only two species of Ant-eater as opposed to a dozen of Armadillos, over the same extent of country, shows, I think, that the one must be more susceptible to the changes which induce modification of form than the other.

The curious little mole-like CHLAMYDOPHORUS TRUNCATUS, the Pichyciego, or blind Armadillo of the natives, is found in the neighbourhood of Mendoza; but it does not extend across the Andes into Chili, although Chili is usually given as its habitat. Neither it nor any other Armadillo occurs on the western side of the Andes, until we reach Guyaquil. Burmeister has lately found a second species of this curious animal, also in that district, which he has named C. RETUSUS.‡

The Armadillos have been divided into various sub-genera. Two sections seem sufficiently distinguished; some having the fore-feet provided only with four toes, while others have the fore-feet five-toed. But these distinctions do not seem to have any geographical import. The Texan species (DASYPUS PEBA) belongs to the four-toed section; but that section goes as far south as the five-toed. Some of each being found in all parts of their range.

III. ANT-EATERS. (1.)—MANIS. (Map 60.) The Pangolins inhabit the Indian Archipelago and the land surrounding the Bay of Bengal, also the east coast of Africa from Šennaar to the Cape, and the west coast from Senegal to the Niger. I do not find any record of its occurrence on the south-west coast between the Cape and the Niger, its place there being seemingly occupied by the ORYCTEROPUS, for which the arid, sandy country is more adapted.

Focillon, in a review of the genus (MANIS)§ divides them into long-tailed and short-tailed species. These have not much geographical significance, however; the long-tailed, to be sure, is only found in Africa, but the short-tailed is found both in Africa and the East.

(2.) ORYCTEROPI. (Map 60.) Wholly African, and found on the west coast of Africa and South of Nubia, near the White Nile. Owen observes that of all Edentata the ORYCTEROPUS most nearly resembles the extinct genus SCELIDOTHERIUM (one of the Megatheroid South American forms) in the form of its cranium; and next to it in this comparison, the great Armadillo (DASYPUS GIGAS.)‖ Although burrowers, and on that account classed by some with the DASYPI, they are, as already mentioned, entomophagous, and most nearly allied to the Ant-eaters.

* BURMEISTER, H., "Systematic Uebersicht der thiere Brazils," 1864. BURMEISTER, H., "Erlauterung zur Fauna Brasiliens," 1856. BURMEISTER, H., "Reise durch die La Plata Staaten," 1861.

† BAIRD, on "U.S., Pac., R. R., Repub.," Vol. viii., 624, 1857.

‡ BURMEISTER in "Abh. d. Nat. Gesellsch. zu Halle," vii.

§ FOCILLON, Ad. in "Rev. et Mag. de Zool." Sept. 1850, p. 465.

‖ OWEN, in "Zoology of the Beagle."

(3.) Myrmecophaga. (Map 60.) The Ant-eaters occupy the whole of South America east of the Andes, and north of La Plata, wherever there is wood. Burmeister did not find them in La Plata, although they are said to be found in the wooded northern parts of that country.

The females of these animals appear to be more frequently met with than the males. Schomburck mentions that he several times procured females of the Ant-bear and never males, and says: "If it could be substantiated that the number of males is considerably smaller than that of the females, in that circumstance would rest an additional ground for supposing that the extinction of its species like those of the Edentata in general is determined upon."* It is to be hoped not; for in our own race the number of males is smaller than that of the females, and we should be sorry to imagine that on that account an edict for our extinction had gone forth.

* "Ann. of Nat. Hist." iv. 206. 1840.

CHAPTER XXXII.

INSECTIVORA—MOLES, SHREWS, TUPAIAS, HEDGEHOGS.

In winding up our skein of Mammals, as we experience some difficulty in disentangling a knot in which the Edentates, Monotremes, and Marsupials, are mixed up together, I shall leave that end of the thread, and, seeking out another free end, begin of new, and try to reach the Monotremes on their other side. I shall take the Insectivora.

The most intimate relations of the Insectivores are with the Rodents, and I have already remarked on the repetition of the same typical forms in this order as are met with both in the Rodents and in the Marsupials. The Mice being represented by the Shrews; the Jerboas by the Macroscelides; the Squirrels by the Tupaias; and the Porcupines by the Hedgehogs.

The most noteworthy point in their distribution is, that they are not found at all in South America nor in Australia. One genus, of difficult location, Solenodon, is found in Cuba and St. Domingo; and the North American Shrews descend into Mexico; but no animal belonging to this order has yet been found in either of the Marsupial countries. It has been suggested that perhaps the presence of the one (the Marsupials) doing insectivorous duty may have something to do with the absence of the other by whom that work is usually performed elsewhere, but I do not look upon this as more than a coincidence. The real cause is to be sought for in their derivation, and it seems not an unreasonable inference, that their original starting-point or specific centre must be looked for in other lands than these, and probably at a distance from them; and neither their insectivorous function, nor the analogy of some of their forms to Marsupial types, ought to militate against this; for it is to be observed that there is no point of resemblance which can be traced between them and some of the Insectivorous Marsupials, such as between the Shrews and the Antechini. the Macroscelides and the Phascogales or Perameles, which does not also occur in the Rodents in a more marked degree. Thus, if there is a similarity between a Shrew and an Antechinus, the resemblance is still greater between the Mouse and the Antechinus (see Frontispiece); and the same with any others showing indications of resemblance. The Rodent steps in between the Marsupial and the Insectivore, in every instance of similarity, and can show greater resemblance to both than either can to the other. To the Rodents then we must look for the derivation of the Insectivora, in preference, at least, to the Marsupials.

Small as the Insectivora are, their remains form a very important chapter, if not in Palæontology, at least in Palæontological literature. We have already seen that the first traces of Mammals found by geologists belonged to the insectivorous Marsupials; but remains which have been referred by some to the true Insectivora have also been found at a very early date,—as, for example, the Stereognathus, from the Stonesfield beds, which is claimed by some for this order,

although by others it is referred to the Ruminants. It was the lower jaw of a small so-called insectivorous animal, SPALACOTHERIUM TRICUSPIDENS, found in the Purbeck beds, which has proved the existence of Mammalia about midway between the older oolitic and the older tertiary periods. Professor Owen* says that the particular modification of the pointed cusps, as to number, proportion, and relative position, resembles in some degree the Cape Mole—CHRYSOCHLORA AUREA; but both in these respects and in the number of Molars, accords more closely with that of the previously existing AMPHITHERIUM, which had been referred to the insectivorous Marsupials. The insectivorous nature of these species receives a certain amount of confirmation from the fact, that in the beds where they have been found, especially in the Purbeck beds, plentiful indications of insect life are also met with. In the tertiary beds numerous remains of Insectivora occur, which have received the generic names of DIMYLUS, GEOTRYPUS, HYPORYSIUS, PALÆOSPALAX, &c.

Dr. Wagner† includes the GALEOPITHECUS amongst the Insectivora, an arrangement which seems unsound for reasons already mentioned. In other respects, his arrangement of them is very natural, viz., into CLADOBATES, or Squirrel-like species; Shrews; Moles; and Hedgehogs. Another arrangement, including both fossil and living species, had been previously proposed by M. Pomel, in an article on the distribution of the order.‡ And more recently, Professor Peters, of Berlin, has proposed another, adopting some of Wagner's suggestions, more especially the reception of GALEOPITHECUS into the order.§

The zoologist may like to compare these different systems of classification. I have therefore contrasted them in a table in the Appendix. The arrangement which seems to me best is, 1. Moles; 2. Shrews, including Macroscelides; 3. Tupaias; 4. Hedgehogs.

MOLES.—(Map 63.) The Moles are distributed over the whole Northern hemisphere. A genus of them is also found in South Africa, but none have been met with in the intertropical parts of the World, nor in South America nor Australia.

There are three types of form which are peculiar, respectively, one (TALPA) to Europe and Asia; another (SCALOPS) to North America; and the third (CHRYSOCHLORIS) to South Africa,—all very limited in number of species.

The European Mole extends eastwards in the temperate latitudes from Ireland (where it has erroneously been said not to exist) through Europe and Asia, until it passes the Altai Mountains. It is there replaced by another species (T. WOGARA) first described by Temminck, from Japanese specimens, but since found by Radde to extend as far westwards as Irkutsk. A new genus (UROTRICHUS) has been found in Japan, and no doubt will also be met with on the mainland. The most interesting fact regarding it is, that another species of the same genus has lately been found in California. Mr. Lord says he can perceive no difference between the Japanese and Californian species;‖ but Dr. Baird, who describes the latter, seems to have entertained no doubt that they were distinct, and, moreover, mentions that the eye and ear cannot be perceived, whereas in the Japanese species they are only said to be very minute.¶

* OWEN, "Palæontology," p. 317.

† WAGNER, in SCHREBER'S "Saugethiere," Supplement, Vol. v.

‡ "Bulletin de la Société Géol. de France," Second Series, VI., Nov., 1848–56.

§ PETERS, iieber die Saugethiere-gattung Solenodon in "Abhand. Ak. Wissen," 1863.

‖ LORD, in "Proc. Zool. Soc," 1864, p. 161,

¶ BAIRD, op. cit. viii., 76.

MAP LXII

INSECTIVORA.

MAP LXIII

MOLES.

European Mole
Talpa Wogara
„ Insularis
Species of Scalops
„ Urotrichus
„ Chrysochloras

Day & Son (Limited) Lith.

It was for long thought that the Mole was found in North America as well as in Europe. This was a mistake, owing to the extreme similarity of the American Scalops to our Mole. In fact, until the naturalist takes them in hand and points out the differences, they would be passed by any moderately observant person as identical. They are found in nearly every portion of North America as far south as Mexico. One rather remarkable form constituting the genus Condylura, the Star-nosed Mole, which is characterised by the point of the nose being star-shaped, inhabits the northern parts of the United States from the Atlantic to the Pacific. One species of Scalops, perhaps two, is restricted to the Pacific coast, one to the Atlantic. One is found sparingly in New York, Massachusetts, and Ohio, and another on the prairies of Michigan, Illinois, and the west. The genus Urotrichus has hitherto been found only on the west side of the Cascade Mountains, Washington Territory, California.*

The Cape or Gilded Mole, Chrysochloris, so called from the greenish golden gloss of its fur, is wholly South African. It differs somewhat in its structure from the true Moles, having, for example, only three fingers developed in the fore-paws instead of five. The number of teeth is smaller; but its general appearance and habits are the same as those of the Mole, their galleries, perhaps, being only somewhat deeper. Three species are known to belong to it; one from the Cape, another from Natal, and a third from Mozambique.

I know of no fossil remains of the Mole.

Shrews.—(Map 64.) The Soricinæ first make their appearance in small number of species during the miocene period, and continue through the glacial epoch to the present time, without material change of form or size.

Although they have been divided into many sections it will be sufficient, for the purpose of showing their distribution, to separate them into three. The long-tailed Shrews (Sorex, Amphisorex, and Crossopus), which are found in the northern part of both hemispheres, extending all across Europe, Asia, and North America; the short-tailed Shrews (Blarina), which are confined to North America; and the section Crocidura, whose habitat is in the tropical part of the Old World, with a few species which extend a little beyond the tropic of Cancer into Europe and Asia. The last are chiefly distinguished from the other Shrews by their dentition. In outward appearance they do not materially differ from them. The Desman (Myogale) is a Shrew with a naked, more or less compressed tail, of which one species is found in the south-east of Russia, and another on the banks of the streams at the foot of the Pyrenees. Its bare and laterally compressed tail, like that of the Musk Rat in North America, shows another point of affinity in this order to the Rodents. Remains of an extinct species of Desman have been found in the miocene beds at Sansans, in the south of France.

Solenodon. Until lately, this singular genus was only known from a description, by Professor Brandt, of St. Petersburg, of a species found in St. Domingo, five-and-twenty years ago,† of which there were only two specimens known, one in the St. Petersburg Museum, and another (imperfect) formerly in the collection of the Zoological Society, now in the British Museum. It is about the size of a Rat, with a tail nearly as long as itself; has a snout like a Shrew, but a number of affinities

* Baird, in "United States Pacific Railroad Exploration," 1857, vol. viii.

† Brandt, De Solenodonte, Novo Mammalium Genere, "Mem. Acad. St. Petersburg," ii. p. 459, 1836; and "Mammal. Exoticor, Descriptiones et Icones," pp. 1-20. Tab. 1, 2, 1835.

with different members of the Insectivora, and has been a stumbling-block to naturalists on account of the difficulty of finding its proper place. No other specimen was found until 1863, when Señor Poey, of Havannah, obtained a second species in the mountains of Bayamo, in Cuba.* This example came into the hands of Professor Peters, of Berlin, and he has carefully examined and described it,† and has come to the conclusion that although it presents various points of affinity with the North American Moles (Scalops) and the Shrews and the Desman of Russia, and in some respects with the Hedgehog, it must be placed in the same group as the Madagascar genera, Centetes, Ericulus and Echinogale (a group which usually, although not by Dr. Peters, is placed in the same family as the Hedgehogs.) Dr. Peters parallels this most remarkable geographical location by some other instances. He remarks that Madagascar is the only island where, if we except the Brachylophus fasciatus of New Guinea and the East Indies, iguanoid lizards with the Pleurodont character, occur out of America, and the same island alone in the Old World furnishes examples of the American Colubrine forms Xiphosoma and Heterodon. It is true that one or two remarkable instances of resemblance between species from Madagascar and America do stand recorded in our books; but they all require careful sifting, not only as regards their affinities, but also the authority for the locality. It is part of my business for the purposes of this work to do so, as we successively encounter them; and as regards the present instance, the Solenodon, I have to say that the grounds for referring it to the Madagascar type appear to me to be insufficient. That it has more outward resemblance to the Shrews than to the Centetidæ cannot be disputed; that it has many points in its anatomy corresponding with that of the Shrews is admitted; and that the judging between their value and number is a nice and difficult operation is also not denied. Therefore, even although the Madagascar element did seem to prevail in its physiological relations, I confess that I should still prefer to question Dr. Peters' decision, and to trust to the superficial resemblance, and the other admitted affinities nearer home, rather than to the balance of physiological relations struck by him. A fair estimate of these, however, by no means leaves the same impression on me as they have on Dr. Peters. Where modifications of an abstract type occur in exactly the same number and degree, in important organs and in less important ones, it may be that he awards the greater value as indicative of affinity to what he considers accordance in the more important ones. On that footing these in the Solenodon may possibly bring it nearest the Madagascar type. But this principle of valuation is, I think, erroneous. On the principle laid down by Agassiz, I hold that deviations on the more important structures ought rather to refer to the larger divisions of the order than to the minor sections. At first sight it may appear otherwise; for it seems a natural inference that the more important the organs in which correspondence occurs the more nearly allied should be the animals in which such correspondence appears. But these are the organs which go farthest back in time, and indicate the general source from which the whole family sprung. Modifications on *them* speak of remote affinity, whereas resemblances in the less important and less vital characters, such as outward appearance, colouring, hair, and anything not relating to what I may call the foundation or great beams of the house, indicate more recent affinity. I, therefore, place Solenodon next its nearest neighbours in geographical position, and those likest it in external appearance,— the Shrews.

* See for an account of its habits "Memorias sobra la Historia Natural de la Isla de Cuba:" Par Felix Poey, Habana, 1861.

† Peters, "Ueber die sauge-thier-gattung Solenodon. Abh. Ak. Wiss. Berlin. 1863.

Macroscelides.—(Map 65.) These are the representatives in the Insectivora of the Jerboas in the Rodents and of Perameles among the Marsupials, with the latter of which they have, in addition to a general resemblance, an agreement in the imperfect ossification of the palate, it being perforated by many holes. The group is very limited in number (six species being all that are known). If we contrast their distribution with that of their Rodent analogues, the Jerboas, it will be found that their districts are not the same, but lie next each other, the one, rather belonging to the northern hemisphere, the other to the African region.

To them probably belongs the genus Rhynchocyon, from Mozambique, although it has also affinity with Gymnura, in next Section.

Tupaia. (Map 65.) The Insectivora possess no analogues to the Flying Squirrels, or to the Marsupial Petauri; but the Cladobates, including the old genus Tupaia, represent the ordinary form of Squirrels, although more slender and with a more elongated muzzle, which gives them what may be called, without a pun, a more shrewish cast of countenance. They have also the same habits and food, and are called by the natives by the same name—Tupaja. They are confined to the Malay and Burmese districts, reaching from the Khasia Hills on the north and west, to Java and Borneo on the south and east. Only six species are known, all arboreal. The Hylomys Suillus, found in Java, Sumatra, and Borneo, at a height of from 1200 to 2000 feet above the sea, likewise belongs to the same group. It also is arboreal. Ptilocercus Lowii, also a Bornean rat-like animal with a pinnated tail, is another form of Tupaia. The genus Gymnura, from Malacca and Sumatra, although bandied about from place to place, seems properly to belong to this group, apparently differing most in not being arboreal. The tail is scaly, and Van der Höven thinks it resembles in external appearance the American Opossum. It has something the look of a Hedgehog, and has long bristles scattered among the hairs of its back.

The Madagascar genus Eupleres used to be placed here, but it is now properly removed by Dr. Gray to the Genetts, with which its outward appearance and dentition best correspond.

Centetina.—Madagascar Hedgehogs. (Map 66.) This family is composed of three animals from Madagascar and Mauritius, bearing the spines and prickles of Hedgehogs, and resembling them a good deal in appearance, but without the power of rolling themselves up in a ball. Three genera—Centetes, Ericulus, and Echinogale,—have been made for the reception of the three species. As above mentioned, Professor Peters wishes to add the Solenodon from Cuba as a fourth.

Hedgehogs.—(Map 66.) From the fossil remains which have been found of this genus, it appears to have been pretty widely spread in middle Europe, both in the miocene and post-glacial epoch. Bones of the existing European Hedgehog (Erinaceus Europæus) have been found in deposits of the latter date. It now extends all over Europe and across the northern half of Asia. In the southern half it is replaced by another species with longer ears (E. auritus). Various other species are found in Asia — two or three occur in India, and about the same number in Africa. These, with the exception of one at the Cape of Good Hope, are found in the north of Africa, and one of them which inhabits the Desert of Sahara, like many other animals, is clothed by nature with a dress scarcely distinguishable from the prevailing hue of the soil on which it lives. None have yet been found in West or Central Africa; but, doubtless, links will be found connecting the solitary Cape species with some of the other African forms.

CHAPTER XXXIII.

CHEIROPTERA—BATS—FRUGIVOROUS BATS—INSECTIVOROUS BATS—(LEAF-BEARING, AND NOT LEAF-BEARING.)

"THE CHEIROPTERA," says Professor Owen, "with the exception of the modification of their digits, for supporting the large webs that serve as wings, repeat the chief characters of the Insectivora;"* and so they do with some few exceptions, such as the pectoral mammal. That modification in itself is of little importance. It is to be regarded merely as an "accidental" element in their structure, consequent on the mode in which they are to procure their food; and, therefore, not calling for their removal from an order to which they otherwise belong, any more than their flippers require the removal of the Seals from the Carnivorous Mammals; or their deprivation of limbs, the separation of the Sirenia from their Pachydermatous allies. But whilst they are clearly Insectivora, an inquiry into the past history of the order suggests doubts of their being modifications of the terrestrial species. It is rather the latter that are to be looked on as modified CHEIROPTERA; for, according to all appearance, the Bats can trace the most distant parentage of the two. Looking back into the past geological formations, it is impossible to avoid being struck by the extraordinary resemblance which they bear to the Pterodactyles, or flying Lizards, of the oolitic period.

The first impression which would undoubtedly strike any one unacquainted with anatomy would be that they belonged to the same class of animals. The form of the head; the relative proportion of the limbs; the processless vertebræ; the general idea of the wing; the disproportion in the length of the digits; the dermal wing-membrane, of which fine traces are still preserved in the Solenhofen specimens of Pterodactyles, are all repeated in the Bat. Fig. 1, representing the wing of the Pterodactyle; Fig. 2, that of the Bat; Fig. 3,† that of a Bird, show the comparative affinity of the Bat to the Pterodactyle more strongly than any words can do; and although the anatomist comes and disillusionizes us by pointing out that the vertebræ of the Pterodactyle are articulated after the Reptilian plan; that the dentition is Reptilian; that the cranium, pelvis, and other parts of the skeleton, are so likewise; and that even the microscopical structure of the bones is Reptilian, we find it impossible to believe that the two creatures have not something to do with each other.

How strongly, for example, did the discovery of marks of feathers on the ARCHAEOPTERYX add to the conviction of its affinity to a bird? and shall we deal a different measure when we find impressions of a leathern wing, like that of the Bat, left among the wing-bones of the Pterodactyle? It is incredible that two animals so identical in plan could have been repeated by chance. And we

* OWEN, in "Proc. Linn. Soc." ii. p. 23, 1857.

† These figures are copied from Professor Owen's drawings in his paper on ARCHAEOPTERYX LITHOGRAPHICUM, published in the Royal Society's "Philosophical Transactions," vol. CLIII., part 1, 1863, p. 33.

MAP LXVI.

HEDGEHOGS.....

EUROPEAN HEDGEHOG

CENTETES.....

MAP LXVII

FRUGIVOROUS BATS

(PTEROPI)

Note Preponderance of Species shewn by intensity of colours

Day & Son (Limited) Lith.

refer the Bat back to the Pterodactyle as its progenitor, whether it has been derived directly from the Reptilian type, or its elements have been filtered through the Birds. In either view it seems more likely that the terrestrial Insectivores may be derived from, or be a modification of the Bats, than the Bats a modification of them.

Bats are found all over the world. Some groups are confined to the Old and some to the New World, whilst others are cosmopolitan; but although the same genera are sometimes found both in the Old and the New World, there is no instance of the same species being so found. They are very numerous; nearly 400 species having been described; and they are all so similar to each other that the greatest difficulty has been found in discovering generic characters, by which to enable the

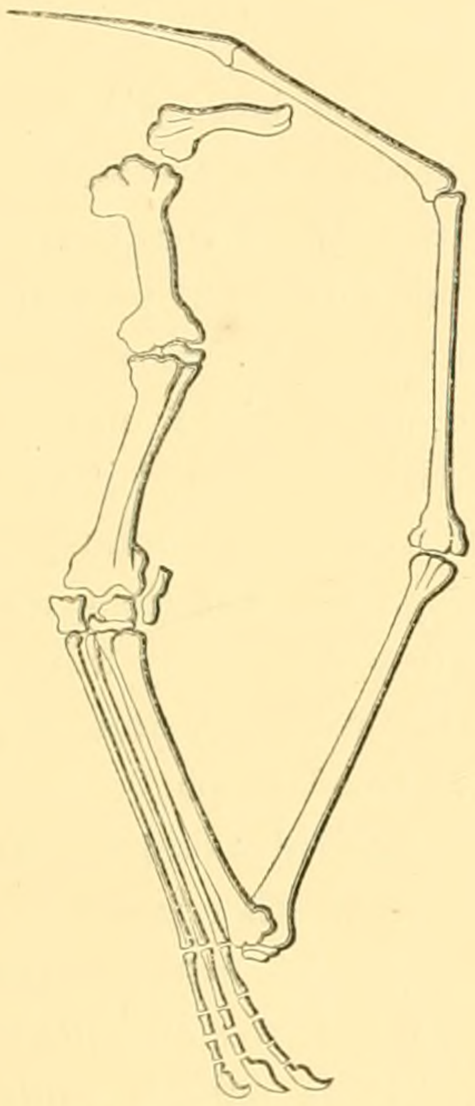


Fig. 1. Pterodactyle.

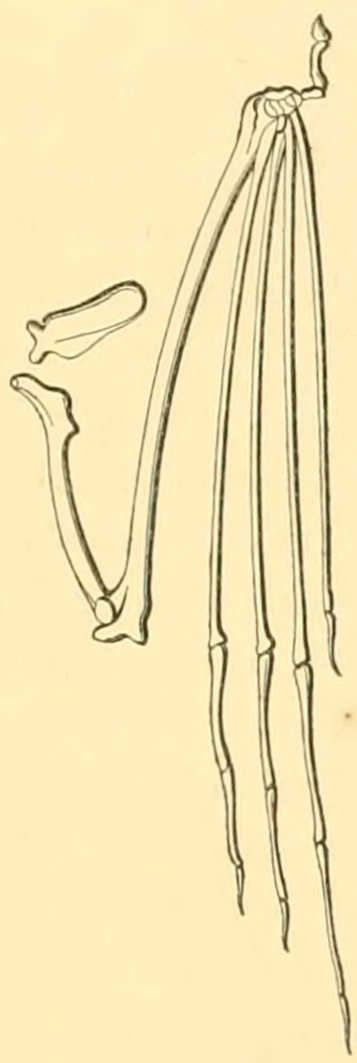


Fig. 2. Bat.

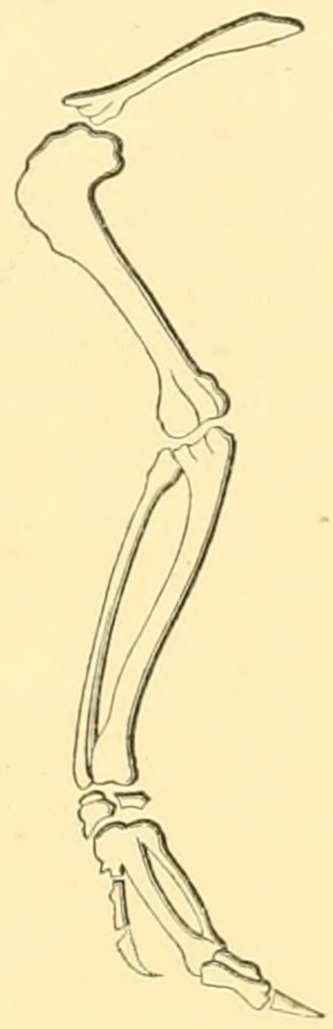


Fig. 3. Bird.

naturalist to classify them. This has been done by the combination of characters which, in other orders, would not be considered of more than specific value; and in many of the genera the specific characters have been reduced to the size of the animal, and the quality and colour of the fur.

Frugivorous Bats. (Pteropi.) (Map 67.) The frugivorous Bats have been named Flying Foxes, from many of the species in India being of the colour of the fox, with a head somewhat like a fox, and, when their wings are expanded, looking nearly as large.

About forty species of Pteropine Bats are known, but one genus is sufficient to contain the whole, with the exception of about a dozen peculiar species, for which special genera have been established. One species is found in New Holland and Van Dieman's Land. One or two on the different islands scattered about in the Pacific and Indian Ocean. In some instances species occur peculiar to the individual group of islands on which they are found,—as at the Andaman, the Nicobar, and the Marianne Islands; but generally both in this group and in the insectivorous Bats the species have an extensive range; one, for instance, which has been taken at the Samoa Islands, is

also found at Timor, Amboyna; another, PTEROPUS EDWARDSI, ranges from the Indian and Australian districts, to Madagascar and the Commoro Islands, although it has not been recorded as reaching Africa. The great focus of this family is India, the Malayan region, and the Indian Archipelago, Sumatra possessing more species than any other island.

They are not found either in Europe or America.

Some imperfect remains found in the Solenhofen lithographic stone (oolitic) had been referred by M. Kruger to an extinct species of PTEROPUS. There is little doubt, however, that they belonged to some one or other of the species of Pterodactyle which are found in that formation. No extinct Pteropine Bat has hitherto been discovered, but it is very probable that they may yet be detected in the countries which they still inhabit, as in the bone-caves of Borneo (deposits full of promise, which have not yet been examined).

INSECTIVOROUS BATS. If no extinct Pteropine Bats have yet been discovered, it is not so with the Insectivorous Bats. Although their remains are no doubt often overlooked, a sufficiency has been discovered to settle definitively that they existed during the upper eocene epoch, and have continued through all the subsequent periods in very much the same form as at present. They have been found in the Paris gypsum, in the London clay, and in bone-caves and post-glacial deposits in all parts of Europe. Cuvier obtained a tolerably complete skeleton of a species from the gypsum of Montmartre, which he named VESPERTILIO PARISIENSIS. De Blainville considered it very close to, if not identical with, the living species, V. SEROTINA. The other remains showed similarly close resemblances, and he thence inferred that the physical condition of Europe was not then materially different from what it now is; a conclusion which, although probably true, is scarcely warranted by that fact, for at the present day many species range through the most dissimilar climates, as the RHINOLOPHUS FERRUM-EQUINUM, which ranges from England to the Cape of Good Hope.

The Insectivorous Bats are divided into two easily distinguished sections. The one (the VESPERTILIONIDÆ), with their nose and lips not differing from those of other quadrupeds,—whence one of their sectional names, GYMNORHINÆ; the other having the upper lip or nose expanded into diversiform prolongations, usually membranous, and bearing resemblance to leaves and other objects,—whence their names, PHYLLOSTOMA, RHINOLOPHUS, ISTIOPHORA, &c. It is only the former of these (the VESPERTILIONIDÆ) that have left fossil remains in Europe; but of the latter, which are largely represented in the Tropics both of the Old and the New World, remains of six fossil species have been discovered by Lund in the bone-caves of Brazil. One, if not more of these, has been referred to a species still living in Brazil. Whether justly or not may be a question.

NASAL-LEAF–BEARING BATS. (ISTIOPHORA.) (Map 68.)—This section contains some of the most *bizarre* and curious-looking head-pieces that exist on the face of the earth. What the use of the extraordinary processes by which the face of these bats is furnished—(we ought not to say disfigured, but still less can we say adorned) is not known with certainty; but it is supposed rather to be connected with increased delicacy in the sense of touch than that of smell (which is the supposition which most naturally occurs to one), for the leaf-processes are mere re-duplications of the skin, not supplied by any branches of the olfactory nerve. As I have just said, they are largely represented in the Tropics, both in the Old and New Worlds, and more feebly the farther we remove from them. And we have a repetition here of what takes place in the Monkeys. They are divided into two great groups,—the RHINOLOPHI and the PHYLLOSTOMATA; the former peculiar to the Old World, and the latter to the New.

MAP LXVIII

LEAF NOSED BATS

ISTIOPHORA (PHYLLOSTOMATA &C.)

Note: Preponderance of species indicated by intensity of colours

MAP LXIX

BATS.

GYMNORHINÆ (VESPERTILIO)

Day & Son (Limited) Lith.

Rhinolophi. The most northerly species of this group are the Rhinolophus ferrum-equinum, and Rh. hipposideros, which are found in the south of England (the latter also in Ireland) and extend across the whole of Middle and South Europe. The former ranges also over the whole of Africa. There are many species in India and the Malayan Peninsula and Indian Archipelago. The Indian district is the chief focus of this section. We do not know so many from Africa, although from the number found by Professor Peters in Mozambique it is probable that other parts of it, if as well searched, would be equally productive. One or two are now known on the eastern coast of New Holland. We have no record of species found in Arabia and Persia; but there is no doubt that many of the species found on their borders will also be found within their territory. The same remark applies to China.

Phyllostomata. These are the Vampires, or Blood-sucking Bats, so well known in story. They are not, however, all blood-suckers. Some, which might be supposed more especially sanguinary from the admirable organisation of their lips for sucking, are wholly innocent of offence; they suck nothing worse than ripe, fleshy fruits.* The family is confined to South America, the West Indian Islands, and Central America. A single species (Megaderma Californica) is found in California; but it is obviously a mere advanced sentinel of the main body from the south, and is, moreover, closely allied to a West Indian species. None are found in the south-eastern states of North America, notwithstanding that this is usually laid down in Physical Atlas Maps. Besides this, another species of Bat has been found in California (Antrozous pallidus) belonging to the section without nasal appendages, but with a dentition closely approaching to that of the Vampire Bats, in their most constant character (four incisors in the lower jaw) as well as with enormously developed ears, which is another of their characteristics,—being in both respects the only North American species so endowed, and apparently indicating a transition between the leaf-bearing Bats and the Gymnorhinæ;† a transition which has a bearing on the view entertained by some naturalists that the leaf-nose is not a character of essential importance; for some species which bear it, differ from others in their general appearance and in their flight, which is a good, although not easily definable character, while in these respects they correspond with species which have no nasal leaf. The fact, however, of those bearing them being confined to a special province, seems to me in itself sufficient to show that the character is not of the indifferent systematic nature implied in this idea. The Vampire, *par excellence*, is the species named Ph. spectrum; but it is no better entitled to a pre-eminence in blood-thirstiness than many other species which have similar habitudes. It and they extend over the whole of tropical South America, as far south as La Plata. They are not, however, found in that district. Not a single specimen of Phyllostomatous Bat was found by Dr. Burmeister during his three years' sojourn there. Indeed, the whole family is most poorly represented in that naked land; there being only four species known in it, while thirty-one are described from the neighbouring territory of South-east Brazil. The absence of anything on which to hang or rest themselves after the Bat fashion, is in itself sufficient reason why few should be found there.

Bats without Nasal-Leaf Appendages. (Gymnorhinæ.) (Map 69.)—The greatest part of this group consists of the Vespertilionidæ, which may all be treated, geographically, as one large genus. There are a very few—the Noctilionidæ—which, like Antrozous, are transi-

* Bates, in "Proc. Zool. Soc." 1860, p. 99.

† Allen, Dr. H., "Monograph of the Bats of North America," Smithsonian Institute Collection, 1864. p. 68.

tional between the Leaf-bearers and the true Vespertilios. One of these Noctilios (N. LEPORINUS) fills the anomalous position of a fishing Bat. Mr. Fraser, who observed its peculiar habit in its native country (Ecuador), describes it as skimming along the bank of the river, every now and then making a dash at, and, actually striking the water, catching the minute shrimps as they pass up stream, and adds that it had a very fishy smell.* Dr. Shortt has subsequently recorded similar fishing propensities of the *Pteropus* of India—the prey there being small fishes.†

The statement occurs quoted by Mr. Tomes, in an account which he gives of the mammals collected by Mr. Fraser at Ecuador, and it suggests the following reflection to him: "From the great resemblance which exists between the fur of the New Zealand MYSTACINA, and that of the Water Shrews, and, indeed, that of other mammalia with similar aquatic habits, I had long ago been led to suspect that that Bat might be aquatic in its mode of life, but I could never gather direct evidence on the subject. Certainly I never suspected that this Noctilio took its food in the manner noticed by Mr. Fraser." The identity of the structure of the hair of the V. MYSTACINA with that of the Shrews is to my mind evidence not of a similar teleological purpose, but of a common descent. The same peculiar structure of hair occurs *inter alia* in the Moles, the House and other Mice, the Shrews, and some Bats; and as the structure is very peculiar and not found in other families, the circumstance certainly seems suggestive of a common origin. I am one of those who think there is no evidence equal to circumstantial evidence. And if I were a hanging man, to borrow the phraseology of the betting ring, (which I am not—not from any soft-hearted, humanitarian weakness, but solely on principles of economy—thinking as I do that I could put the hangee to a better use); but if I *were* a hanging man, I would hang a man without remorse on circumstantial evidence, where I would not touch a hair of his head on direct testimony. An identity of structure between the hair of a Bat and that of these other animals is circumstantial evidence of a strong kind; for it is in trifling matters of an unlooked-for kind, that circumstantial evidence is most pregnant in its bearing. The reader will remember that the hair of the different orders of animals differs materially in its microscopic appearance and structure.‡

To this group belong the great majority of our English and European Bats. It is divided into two large sections, the SCOTOPHILI and the VESPERTILIONES,—both tolerably well marked. The distinction between these is chiefly in the wing-membranes, and the thickness of the ear; and, although difficult to describe, is easily recognised when once pointed out. The difference extends to their facial expression. As Mr. Allen describes it,§ the difference may be compared to that between a mastiff and a terrier dog. The former (the SCOTOPHILI) massive, with broad head, pendular lips, and wide ears; the latter more slender, with a narrower face, and delicate, upright ears. A very large number of species, however, stand in scientific works under the genus VESPERTILIO, which cannot be satisfactorily allotted to the one or the other, for want of sufficient information. In the list which I have given in the Appendix, such species are included under Vespertilio as the more general head.

The Pipistrelle and the V. NOCTULA, perhaps our best known European Bats, occur all over Europe north of North Italy, and over North Asia, north of the Caspian, from Sweden to Spain and Greece, and from Russia to Japan. It is recorded as found fossil in a bone-cave at Antibes, near Nice. The Barbastelle has only been found beyond Europe in the Himmalayah. The PLECOTUS

* TOMES, "Proceedings Zoological Society," 1860.

† SHORTT, in "Proc. Zool. Soc.," 1863, p. 438.

‡ See INMAN, Dr. T., On the Natural History and Microscopic character of Hair, in "Proc. Liter. and Philos. Soc. of Liverpool," No. vii. 1854, p. 83.

§ ALLEN, D. H. op. cit. p. 27.

AURITUS, or Long-eared Bat, has the same, but a slightly more extended range, reaching into North Africa, and is also found in the Caucasus, Georgia, &c.

In the Leaf-bearing Bats, the same genera are never found in both the Old and New Worlds. In this section the same genera sometimes occur in both, but the same species never. The countries most numerously supplied with species are India and the Malayan districts in the Old World, and Brazil in the New. The range is indeed very much the same as that of the leaf-nosed Bats, except that they have a wider and more northerly range; and that, unlike them, they occur in North America. A good many are found in Australia. These are chiefly of the form of the European Pipistrelle. Mr. Tomes remarks, *apropos* to NYCTOPHILUS UNICOLOR, that all the species of Bats which he had seen from Van Dieman's Land, "differ remarkably from those of the mainland, in having all the fur everywhere short and cottony, and perfectly devoid of lustre and uni-coloured." He says elsewhere, however, that "he has often been surprised that Australia does not furnish a single form among the Bats that is not common to nearly all the world besides; indeed many of the species are found in the Indian islands, and, curiously enough, in China." This, however, chiefly applies to typical form; it indeed also applies to a few of the actual species, but the majority of those found in Australia are limited to that country. One or two peculiar species occur in New Zealand. None in either this or last section are recorded from Madagascar; but this may be owing to deficient information. There are several oceanic species, and the Nicobar Islands, which possess peculiar species both of the frugivorous and leaf-nosed Bats, have an endemic species of this group also. Of Bats in general, the Novara Expedition* has produced no fewer than four new endemic species from these islands alone. Considerable variety exists in the size and colour of some of the Indian species of Bats, as happens in the Squirrels and some other mammals, those which inhabit South India and Ceylon being smaller and darker in colour than those living more to the northward, and species intermediate in size and colour being found at intermediate localities. This does not hold with all, however, and I am not aware that it extends beyond the territory of the Indian region.

* "Die Ausbeute der Oesterreichischen Naturforscher an Saugethieren und Reptilien wahrend der Weltumsegelung Sr. Majestät Fregatte Novara," von D. L. J. Fitzinger, 1861.

CHAPTER XXXIV.

RODENTS—TOXODON.

The Rodents should follow the Pachyderms and precede the Marsupials. If I had so arranged them, we should have been left without a place for the Whales, Bats, and Insectivora; and I have introduced these orders between the Pachyderms and Rodents rather as a necessary digression than as a natural connexion. I beg the reader now to revert to the Pachyderms, and suppose that we have only just finished them off, and that we are now to adjust the Rodents in continuation of them as satisfactorily as we can.

Mr. Waterhouse has studied the Rodents with much care and success, and his works have greatly lightened the labour and cleared the path for any one who wishes to acquire a knowledge of the order.

In his first essay* on the subject he divided the order into three great families,—the Mice, the Porcupines, and the Hares. In his subsequent works on the subject,† he added a family for the Squirrels, and first proposed a sub-family, or separate group, for the reception of the Rats with external cheek-pouches. That group has been adopted by others, and raised by Baird to the rank of an independent family. It appears to me that Waterhouse is right throughout; and Baird and those who adopt his view wrong in this step. I shall explain why I think so when we come to the Pouched Rats. In the same way I think that Brandt and Giebel err in establishing the families Spalacini and Dipodini for other sections of Rats. I look upon them merely as subsections of the other Rats and Mice. So far as relates to these members of the Rodent family, therefore, I adopt Mr. Waterhouse's main arrangement, pure and simple, subject to some modifications in the details of the different families. But I add to the order two genera, or families, which Mr. Waterhouse excluded, the Hyrax and Toxodon. These have usually been included among the Pachyderms. They seem to me, however, to be too essentially rodent in their characters to be so treated, and their admission here necessitates some modification of Mr. Waterhouse's arrangement, to allow them to fit in properly. The last of the Pachyderms were the aquatic section, Sirenia. I begin the Rodents with the Toxodon, an extinct water Rodent, or gigantic Capybara. Its affinity to the Capybara requires that animal to follow it, and that brings with it the whole of the Hystricidæ, or Cavies, and Porcupines. Next to them I place the genus Hyrax, which, on the one hand, is also connected with the Capybaras, and, on the other, with the Hares and Pikas. I then get back again into Mr. Waterhouse's groove, which I follow without any great deviation, except transposing the Mice and

* Waterhouse, "On the Arrangement of the Rodentia," in Charlesworth's Magazine of Nat. Hist., 1839, p. 90.

† Waterhouse, "Natural History of the Mammalia," vol. iv. 1858; and "Table of Rodents," in Keith Johnston's "Physical Atlas."

Squirrels. My classification will thus stand: 1. The Toxodontidæ. 2. The Hystricidæ, Cavies, the Porcupines, &c. 3. The Hyracidæ. 4. The Leporidæ, Hares. 5. The Sciuridæ, Squirrels, &c. 6. The Muridæ, Mice. Mr. Waterhouse's arrangement is supposed to be in an ascending order, the Hares being lowest, and the Squirrels most advanced in organisation. I pay no attention to this: it is not advancement—but affinity which is my guide. Therefore I content myself with placing those next the Marsupials, which appear most nearly allied to the members of that order.

The Rodents are found in every quarter of the world, but their metropolis is South America. Next to it in preponderance of species comes North America. The two together counting nearly as many species as are to be found in the whole of the rest of the globe. No species is found both in South and North America; no species both in South America and Africa. None aboriginal in Australia are found anywhere else. No species are found both in the Old World and the New. Some authors make a few exceptions to this, but we shall presently see that even these are doubtful. Africa, Asia, and Europe, have species which are found in all three. In what I have above said I of course do not take account of introduced species, house Rats and Mice, and such small deer.

The exceptions above alluded to are five or six boreal species, regarding which it is doubtful whether those found in the north of Europe and Asia are or are not the same as those inhabiting the north of America. These doubtful species are the Polar Hare, the Beaver, the Musk Rat, the Lemming, and Spermophilus Parryi. With these exceptions, which may be determined either way, according to the ideas which each individual may entertain of what constitutes a species, there are no two species common both to the Old World and the New.

Toxodontidæ. — When speaking of the Nesodontidæ, I mentioned the circumstances under which the bones of it and of this genus were found by Mr. Darwin. They were discovered in South America, near Bahia Blanca. Unfortunately all that were procured were imperfect portions of skulls, which, however, were so remarkable as greatly to add to the disappointment that more complete specimens had not been found. D'Orbigny since then has added the description of the fore-arm of a second species of Toxodon. But that is, I believe, all that is yet known of the genus.

It may well be supposed that with such scanty materials even the order to which these genera belong is a matter of doubt, and it is only provisionally that they are placed here. That they were animals of great size is apparent from the dimensions of the skull, that of Toxodon Platensis being two feet four inches in length, and one foot four inches in breadth; but whether they are Rodents, Pachyderms, Ruminants or Sirenians, to all which they have been referred, or whether they were aquatic or terrestrial, whether they had legs or fins, was all unknown when Professor Owen described them, and is not much better known yet.

The Toxodon Platensis had incisors like the hare; a very small one behind a very large one in each maxillary bone; it had no canines, but a large vacant space between the incisors and molars, as in Rodents; the molars, seven on each side, diminishing in size as they advance to the anterior part of each jaw, as in the Pachyderms, and also as in the Capybara, which, in this respect, as well as in other peculiarities, shows affinity to the Pachyderms.

In Professor Owen's words, the dentition closely resembled the rodent type, but manifested it on a gigantic scale, and tended to complete the chain of affinities which link the Pachydermatous with the Rodent and Cetaceous orders. The masticating and temporal muscles must have been

both large, and Professor Owen presumed that the great incisors were used like the canines of the Hippopotamus, to divide or tear up the roots of aquatic plants. The osseous parts pertaining to the senses of sight and hearing resembled those of the aquatic Rodentia and Pachydermata. The aspect of the nostrils is placed upwards, as in the Sirenia, but they differ in having narrow canals of intercommunication between the nasal passages and the frontal sinus. The articulating condyles of the cranium were thought by Owen to indicate that when the body of the Toxodon was submerged (for Owen appears soon to have come to the conclusion that it must have been a "submerged" animal) the head could be raised so as to form an angle with the neck, and bring the snout to the surface of the water, without the necessity of any corresponding inflexion of the spine. When Owen wrote his description there was no evidence to determine the character of the extremities, whether they were ungulate, unguiculate, or pinnate, while the structure of the nostrils suggested that the habits of the animal were not so strictly aquatic as to warrant the supposition that the under extremities were altogether wanting. D'Orbigny's discovery of the forearm of another species of this genus (T. PARANENSIS), has proved that it is not a pinnate animal, but has limbs not unlike the Tapir or Capybara. It is to the latter that it seems to me to have most affinity; it moreover inhabited the continent which is *par excellence* the country of Rodents; and I have accordingly preferred to place it here among the Rodents, instead of to follow Professor Owen, and place it among the Pachydermata. The Capybara, however, reaches a size of no more than three or four feet, whereas, judging by the proportions of the head, the TOXODON must have been at least twelve or sixteen feet in length.

MAP LXXII

HYSTRICIDÆ.

WHOLE FAMILY.

Note. Intensity of colour indicates preponderance of Species.

Day & Son (Limited) Lith.

MAP LXXIII

CAVIES.

Dolichotis Patagonicus

Hydrochoerus Capybara

CHAPTER XXXV.

RODENTS *continued*—HYSTRICIDÆ—CAPYBARA—CAVIES—CHINCHILLAS—OCTODONS—ECHIMYINA—AGOUTIS—PORCUPINES.

The Hystricidæ (Map 72) take their name from the Porcupines; but by much the larger portion of them is composed of other ingredients. Besides the Porcupines, the family contains the Cavies or Guinea-Pigs, the Chinchillas, the Chilian Squirrels or Octodons, the Spiny Rats or Echimyina, and the Pacas and Agoutis, or Dasyproctidæ. All these are South-American forms; and, with the exception of the Porcupines, so entirely so, that only two species belonging to them are found anywhere else than in the New World, and only five or six out of South America. The Porcupines are different. They are found in all the four quarters of the world, but are divided into two well-marked groups; one peculiar to the New World, and the other to the Old.

Cavies. (Cavini.) (Map 73.) I take the Cavies first, and first of the family I take the puzzling Capybara as having most affinity to the Toxodon. This animal may be called a Pachydermatous Rodent. Even its outward appearance indicates this double relationship. When viewed at a distance, from its manner of walking as well as from its colour, it resembles a pig; when seated on its haunches, and attentively watching any object with one eye, it reassumes the appearance of its congeners, Cavies and Rabbits.* It has more of the Pachyderm in its constitution, however, than merely a resemblance to a pig. It has the body of its molar teeth completely traversed by nine or ten plates of enamel, reminding us of the plates of which the Elephant's tooth is composed, and which also are united by cement somewhat in a similar manner. Other analogies with the Pachyderms, even in their habits, can be traced, indicating a certain amount of connexion between the two orders. For example, when the animal is swimming in the water, and has young ones, they are said to sit on its back, as the young of the Hippopotamus do on its back.

Apropos to this species, Mr. Waterhouse says, "As in the class Mammalia, the largest known species are aquatic, so in the minor divisions of the class we find, *as a general rule*, the largest species have aquatic habits. Few species of the order Rodentia attain a size approaching to that of the Beaver or Coypu, whilst in the Capybara we have presented to us by far the largest species of the group,—a gigantic Water Cavy."‡ If Waterhouse had thought of the Toxodon as a Rodent he would have had a still stronger case in point.

But although the speculation is ingenious, and receives support from some cases, on a view of the whole class it applies in too few instances to allow us to regard it as a normal law

* Darwin, "Journal of a Naturalist," p. 50.

† Waterhouse, op. cit.

of nature. The Gorilla is the largest of the Quadrumana; it has not aquatic habits. The Lion is the largest of the Felidæ; it has not aquatic habits. The Wolf is the largest of the Dogs; it has not aquatic habits. The Mammoth was the largest of the Pachyderms; it had not aquatic habits. And so on with all except some half-dozen. If he intended to say, that when any species had aquatic habits it was one of the largest of its order or group, it would be more just. The Polar Bear probably attains a greater size than any other Bear, it is aquatic; there are few Polecats larger than the Otter, it is aquatic; the Hippopotamus is a good-sized Pachyderm, if it be a Pachyderm, and larger than a Sow, if we reckon it and the Swine as sole members of the omnivorous family; in the Rodents the rule seems to hold well; the Toxodon beats every thing else; even abstracting it the Capybara is the largest of the Guinea-pigs; and the Beaver of the Squirrels, if it is a Squirrel, or of the Voles, if it is a Vole.

The Capybara extends over the whole of South America east of the Andes, and north of the Rio de la Plata, wherever there is water. Mr. Darwin says that it occasionally frequents the islands in the mouth of the Plata, where the water is quite salt, but is more abundant on the borders of the fresh-water lakes and rivers. He never heard of its being found south of the Plata; but as he sees in a map that there is a Laguna del *Carpincho* (the local name for the Capybara) high up on the Rio Salado, he supposes such must have occurred. And why not? Such a stream as the Plata might be an effectual barrier against the passage of a land Cavy, as the Uruguay has been against the migration of the Viscacha; but against a water Cavy it would be an invitation instead of a deterrent. Still the fact appears to be that they now keep on the north side of it.

Fossil remains, apparently belonging to the existing Capybara, and some bones which he refers to a second species, have been found by Dr. Lund in the bone-caves of Brazil. Four other fossil Cavies are also enumerated by him as having left their bones in the same caves. Waterhouse speaks of them as evidently nearly allied to existing species, although more than one of them are probably distinct.

The Cavies have to mourn or rejoice in (as they take it) the absence of a tail. Doubtless they rejoice in it, because if they required it, or could have used it to advantage, it would have been given them. But to us, who do not see behind the scenes, it gives them an unfinished sort of look, as if by some accident a portion of the rump had been cut off, and Nature had healed it up as it was, without taking the trouble to replace the amputated portion. Some of them have a certain resemblance to the Hares, both in outward appearance and some parts of their structure. The Patagonian Cavy (Dolichotis Patagonica) is like a long-legged Hare. It has comparatively long ears for a Cavy, or rather, I should say, it *has* ears; most of the Cavies seeming to have lost them at the same time as their tails. It has an apology for a tail, curled up like that of a Rabbit. The colour is that of a Hare; and in size it is merely a little larger; its palate is perforated like the Hare's, and its teeth short like its; but, for all that, it is a Cavy still. It inhabits the desolate parts of Patagonia, which is about equivalent to saying it inhabits the whole of it, north of 48° 30′ S. L. Mr. Darwin says, "The Patagonian Cavy is found only where the country has a desert character. It is a common feature in the landscape of Patagonia to see in the distance two or three of these Cavies hopping one after the other in a straight line over the gravelly plains, thinly clothed by a few thorny bushes and a withered herbage. Near the coast of the Atlantic the northern limit of the species is formed by the Sierra Tapalguen, in S. L. 37° 30′, where the plains rather suddenly become greener and more humid. The limit certainly depends upon this change, since near Mendoza (33° 30′), four degrees further

MAP LXXIV

CHINCHILLAS.

Viscacha

Alpine Chinchillas

MAP LXXV.

SPINY RATS

ECHIMYINA

Note Intensity of colour indicates preponderances of Species

ISOTHERMAL 32°

Arctic Circle

Equator

Tropic of Cancer

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

GREENLAND

BAFFIN BAY

ESQUIMAUX

RUSSIAN AMERICA

INDIANS

HUDSON BAY

CUMBERLAND

DAVIS STRAIT

ICELAND

BRITISH AMERICA

CANADA

UNITED STATES

NUEVA CALIFORNIA

TEXAS

G. OF MEXICO

MEXICO

WEST INDIA IS.

CARIBBEAN SEA

NUEVA GRANADA

GUYANA

ECUADOR

PERU

BRAZIL

BOLIVIA

CHILI

PATAGONIA

LA PLATA

FALKLAND IS.

TIERRA DEL FUEGO

ALEUTIAN IS.

VANCOUVER I.

OREGON

SANDWICH IS.

MARQUESAS IS.

NAVIGATORS IS.

SOCIETY IS.

COOKS IS.

LOW ARCHIPELAGO

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

BALTIC

SCOTLAND

IRELAND

FRANCE

PRUSSIA

RUSSIA

AUSTRIA

TURKEY

BLACK SEA

CASPIAN SEA

ASIA MINOR

AZORES

PORTUGAL

SPAIN

MEDITERRANEAN

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

PERSIA

AFGHANISTAN

PUNJAB

INDEPENDENT TARTARY

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

JAPAN IS.

KAMTSCHATKA

O. OF ALEUTIAN IS.

URAL M.

ALTAI M.

ARABIAN SEA

BENGAL SEA

CHINA SEA

PHILIPPINE IS.

CEYLON

BORNEO

CELEBES

JAVA

SUMATRA

N. GUINEA

MADAGASCAR

CAPE COLONY

N. AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VANDIEMEN

NEW HEBRIDES

NEW ZEALAND

150 120 90 60 30 0 30 60 90 120 150

70 60 50 40 30 20 10 0 10 20 30 40 50 60

Day & Son (Limited) Lith.

northward, where the country is very sterile, the animal again occurs. Its southern limit is between Ports Desire and St. Julian, about 48° 30′." *

The rest of the Cavies are chiefly found in Brazil, from whence probably comes the common Guinea-Pig, whether it be descended from the C. APEREA, or be a distant species. Eight species are met with in Brazil; three in Bolivia, east of the Andes; one in Guiana; two in Paraguay; and two, including the Dolichotis, in Patagonia. None are found in Chili. One, C. CUTLERI of Von Tschudi, is said to occur in Peru, west of the Andes; with one other questionable exception, no species of the HYSTRICIDÆ is found there.

Dr. Giebel and other authors include the Paca and Dasyproctas among the Cavies. I am not sure but that they may be right; but on the whole, where I have no decided opinion of my own, I prefer to follow Mr. Waterhouse's arrangement, because he has made it a special and successful subject of study.

CHINCHILLAS. (CHINCHILLINÆ.) (Map 74.) I have already expressed my dissent from the idea of series of animals existing parallel in rank, except in so far as that implies degrees of affinity. Two brothers may produce families which are parallel in rank, being alike in degree of affinity, and to such an extent I admit the parallelism; but something more seems to be intended by Owen and Waterhouse, and some others, who have adopted the idea, when they speak of parallel or equivalent groups. They speak of them as if Nature had planned out parallel series, in which representative analogies were to be found applicable to the various essential characters of each. Mr. Waterhouse dwells upon this in his preliminary remarks on the Marsupial order. And in this family, in pointing out the affinities of the Chinchillas to their different allies, he repeats the same idea. He says, "As, however, the Chinchillas and Hares are essentially of two very distinct types of the Rodent structure, and the characters just alluded to (imperfect palate, &c.) are for the most part characters indicative of a low grade of organization, it would seem that the amount of resemblance which exists between these two groups, the Cavies and the Hares, rather arises from these lowest members of the Hystricidæ being nearly parallel in rank, in the animal scale, with the Leporidæ, and does not indicate an affinity of a very near degree."† It rather appears to me that, as in the resemblances between cousins, such parallelisms are an indication of no distant affinity, at all events certainly involve no general or special law other than that which produces similarity of form and structure by descent. The existence of such parallelism is only the evidence of a common origin.

With the exception of the VISCACHA, which inhabits the plains of the Pampas, all the Chinchillas (in whole amounting to only three or four species) inhabit the lofty regions of the Andes of Chili, Bolivia, and Peru. The Viscacha is so stout and heavy, and resembles the light and active Chinchillas so little in outward appearance, that it has been mistaken for a Marmot. But, as Mr. Waterhouse has pointed out, it is in fact a burrowing Chinchilla, in the same way that the Marmot is a burrowing Squirrel. In all essential points of structure it is formed on the same model. Mr. Darwin says that it is found as far south as the Rio Negro, in lat. 41° S. L. but not beyond. It cannot, like the DOLICHOTIS PATAGONICA, subsist on the gravelly and desert plains of Patagonia, but prefers a clayey or sandy soil, which produces a different and more abundant vegetation. Near Mendoza, at the foot of the Cordillera, it occurs in close neighbourhood with the allied

* DARWIN, "Zoology of H.M.S. Beagle," and "Journal of a Naturalist," p. 70.

† WATERHOUSE, op. cit. ii. 209.

Alpine species. There is a curious circumstance in its geographical distribution, mentioned by Mr. Darwin, viz. "That it has never been seen, fortunately for the inhabitants in Banda Oriental, to the eastward of the river Uruguay; yet in that province there are plains which appear admirably adapted to its habits. That river has formed an insuperable obstacle to its migration, although the broader barrier of the Parana has been passed, and the Viscacha is common in Entre Rios, (the province between the two rivers), directly on the opposite shore of the Uruguay. Near Buenos Ayres these animals are exceedingly common."*

Octodontina. These animals are not distantly allied to the Chinchillas, and their habitat is on the whole similar; their range being chiefly on the Andes, or along their base. Unlike most of the Rodents which we have hitherto encountered, however, a goodly proportion of them are inhabitants of Chili, on the west side of the Andes. That great chain has proved a barrier to the passage of a large portion of the South-American Mammals; and where species of the same family occur on both sides of it, Alpine species also usually occur upon it too. This is the case with the Octodontina; but it is not so with the Chinchilla, the only species in that group which is found beyond the limits of the mountains being the Viscacha, and it is found only to the east of the Andes.

The distribution in this respect must throw some light upon the original habitat of such species, but it still leaves it a very complicated question; for, in the first place, the species may have first taken its place on the mountains, as in the case of species pushed towards the Equator by the glacial epoch, and afterwards have sent species to the right or to the left, or to both; or the original ancestors may have first appeared on the low ground on one side of the mountains, and sent off species up them, which may either have gone no further, or may have been developed into fresh species on the other side, and afterwards either the original or the mountain off-shoot, or both, may have been extinguished. In such uncertain ground it may help us in our conjectures if we can lay down any general principles to guide us in the application of the facts. When different species of the same family occur, both in lofty cold regions and in neighbouring warm lowlands, which habitat is most likely to have been the original? whether would the species most probably spread, from the cold to the hot or from the hot to the cold? In the first place, I do not believe that animals ever spread far or change their abodes unless on compulsion; and, least of all, from a warm to a colder one; all inhabitants of cold climates have, I suspect, had the change forced upon them either by a general change of climate, or by a gradual upheaval of the ground on which they rested. The fact that until a comparatively recent stage in the geological history of South America the lowlands were under water, and that their appearance is due to the upheaval of the Andes, which therefore must have been dry first, is an item of proof tending in the same direction.

But supposing my idea in this respect to be erroneous, is there any probability more in one direction than the other? or is it a matter of equal chance to either? Other things being equal, I should think it more likely that the change would proceed from the animal in the cold country than from that in the warm. More provision of apparatus in the way of fat, fur, &c., is needed to fit for life in a cold country than a warm one, and more energy and *vis* appears to be required to make the change. Less decided action has to be taken, as it were, to enable life to be suited to the warm country. It may seem that this must depend upon the constitution of the animal;

* Darwin, "Journal of a Naturalist," p. 124.

that a Polar Bear would require as much resolution to go into a warmer climate, as a Sun Bear into a cold one. I doubt if it be so. Of course, each must prefer its own climate; but the preparation for encountering cold is different from that for encountering heat. The former requiring action, resolution to face it; the latter, a mere passive "*laissez faire.*" I should expect, therefore, that unless there were disturbing influences in operation, the progress of development must have been rather from the Alpine species down to the lowland than the reverse.

One or two fossil teeth and bones of OCTODONTINA have been met with in South America. Of these, one extinct species, described by Professor Owen, was found by Mr. Darwin at Mount Hermoso, near Bahia Blanca. Mr. Darwin considered it contemporaneous with the Megatherium, Mylodon, and other extinct Mammals, found near the same spot, where it was discovered. D'Orbigny has also figured and described another fossil fragment belonging to the family.

The members of this family are united by Giebel with those of the next, the ECHIMYINA, or Spiny Rats, in the section of MURIFORMES, but Waterhouse appears to me to have more correctly appreciated their affinities.

SPINY RATS. (ECHIMYINA.) (Map 75.) These are loathsome-looking Rats with spines mixed with their hair, to a greater or less degree. It is not a very natural family, and, as always happens in such cases, considerable difference of opinion exists as to the members or genera of which it should be composed. The most remarkable feature in its distribution is, that while its type is South American, one genus (PETROMYS TYPICUS) is found near the Cape of Good Hope, and another (AULACODUS SWINDERIANUS) both in West Africa and South Africa,—each represented by a single species only, as if they were stragglers or distant outposts. Although there may be some doubt as to this being the proper section in which to place these animals, there can be no doubt that at least the latter AULACODUS truly belongs to this South American family. The place of the PETROMYS is more difficult of determination, but it is to be observed that, when species of South American types are found in the Old World, it is almost invariably from West Africa (and the shores of the Bight of Benin or Biafra seem peculiarly favoured) that they are obtained. The Andes have acted as a barrier against the passage of these Rats from the east to the west of South America, no species appearing on their west side until far to the south; and then only one species (the Coypu) doing so. That species extends almost to the Straits of Magellan, so it has probably got to the west of the higher mountains by turning their flank. One or two species are found in the West Indian Islands, Cuba and St. Domingo. The great metropolis of the family, however, is Brazil. One genus (CARTERODON) is of some interest, as having first been determined by means of fossil remains obtained in the bone-caves of Brazil. Dr. Lund found numerous remains of it there, especially of its teeth and under-jaw; and although he had not met with it living, he considered, from the appearance of the bones, that it was or might be still in existence, and arranged it among the living species. Waterhouse followed, and on the characters of the bones established this genus, still leaving it undetermined whether or not the animal was fossil. At last Reinwardt obtained two living specimens of the animal, from which the C. SULCIDENS was at length fully described. One or two other species have been made out from the bones in the caves of Brazil, which there is no reason to believe to be still existing.

AGOUTIS. (DASYPROCTINA.) Almost entirely confined to Brazil, and the regions bordering upon it; the only exception being one or two species found in the West Indian Islands, Grenada

and St. Lucia. None are found to the west of the Andes. A very complete account of the anatomy of one of this family (Dasyprocta cristata), will be found in a valuable paper by Dr. Murie, lately read before the Zoological Society.*

Porcupines (Hystricina). (Map 76.)—The Porcupines are rather a versatile race; some are terrestrial and some arboreal,—some burrowing and others climbing,—some lucifugous and some luciphilous,—some of them are Old-world and some of them New-world species. The Old-world kinds are terrestrial, burrowing animals; the New-world arboreal, climbing, prehensile-tailed creatures; and they are characterized, moreover, by two different types of structure, one having five toes, the other only four, on their fore-feet; one having special adaptations of the foot for burrowing, and another of the foot and tail for climbing; the molar teeth being rooted in the one, semi-rooted in the other; and there being differences in their dentition and other points.

Tree Porcupines (Cercolabes). The chief district inhabited by the Tree Porcupines is the north of Brazil. They also live in Guiana and Surinam, and some of the West Indian Islands; but I can find no notice of their being found in the south of Brazil. They reach the Andes, for a specimen of one was taken by Tschudi in Peru, on the eastern side of the Cordilleras; but it must be rare there, for his Indians did not know it. Specimens have also been procured from Bolivia, east of the Andes. A species is likewise found on the east coast of Mexico. The family is represented in North America by the genus Erethizon, which is clearly a branch of the South-American form, although its tail is thicker and stouter, and not prehensile. It extends from Mexico to the Arctic Circle, and from the Atlantic to the Pacific. Two species belong to it, one of which inhabits the east side of the continent, and the other (nearly allied, but still distinct) the west, the Missouri region being the dividing line. The white-haired Porcupine (E. dorsatus) is found on the east, and the yellow-haired Porcupine, E. epixanthus, on the west.

Fossil species of the Tree Porcupine have been found by Dr. Lund in the bone-caves of Brazil, and in caves at Minas Geraes.

Ground Porcupines. (Hystrix.) The Ground or Burrowing Porcupine is confined to the Old World. The commonest species (H. cristata) is found in the south of Europe and north of Africa, extending southwards to the Gambia, along the west coast of Africa, where it meets, and is replaced by another species (Hystrix Africana). Another African species has been found by Dr. Peters in South Africa. Three or four species are found in India and the Malayan Peninsula; in Java, Sumatra, and Borneo, and probably other islands of the Indian Archipelago. The commonest species, next to the European, is the Asiatic, H. hirsutirostris, which meets the former in Asia Minor and Syria, and ranges eastward through Persia and Affghanistan to Continental India.

Falconer and Cautley found remains of species of the Porcupine in the Miocene Sevalik formations; and Cuvier refers a tooth which was found in the Val d'Arno to this genus.

* Murie in "Proc. Zool. Soc." March 1866.

MAP LXXVI
PORCUPINES

Burrowing Species	*Hystrix Cristata*	
	„ *Africana*	
	„ *Africae Australis*	
	„ *other Species*	
Arboreal Species	*Cercolabes, species of*	
	Erethizon dorsatus	
	„ *epixanthus*	

Day & Son (Limited) Lith.

MAP LXXVII
BEAVERS.

Beaver (extinct)	
European Beaver (living)	
American do	

ARCTIC OCEAN
BAFFIN BAY
GREENLAND
ISOTHERMAL 32°
Arctic Circle
ESQUIMAUX
RUSSIAN AMERICA
INDIANS
CUMBERLAND
HUDSON BAY
BRITISH AMERICA
NORTH CANADA
UNITED STATES
NORTH AMERICA
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
Tropic of Cancer
Equator
Tropic of Capricorn
SOUTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH AMERICA
EUROPE
ASIA
RUSSIA
LAPLAND
FINLAND
SCOTLAND
IRELAND
AUSTRIA
TURKEY
INDEPENDENT TARTARY
MONGOLIA
CHINESE EMPIRE
THIBET
CHINA
JAPAN SEA
PERSIA
AFGHANISTAN
PUNJAB
ARABIA
SAHARA DESERT
MEDITERRANEAN
BLACK SEA
ASIA MINOR
AFRICA
ARABIAN SEA
BENGAL SEA
CHINA SEA
CEYLON
BORNEO
CELEBES
N. GUINEA
INDIAN OCEAN
AUSTRALIA
N. AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VANDIEMEN
NEW ZEALAND
NEW HEBRIDES
SOUTHERN OCEAN
MEXICO
CARIBBEAN SEA
WEST INDIA IS
BRAZIL
PERU
CHILI
BOLIVIA
LA PLATA
PATAGONIA
TIERRA DEL FUEGO
FALKLAND IS
MARQUESAS IS
SOCIETY IS
COOKS IS
NAVIGATORS IS
LOW ARCHIPELAGO
SANDWICH IS
ALEUTIAN IS
VANCOUVER I
Davis Strait
Behring Str.
Ural M.
Altai M.
Davis Strait
Baffin Bay

Day & Son (Limited) Lith.

CHAPTER XXXVI.

RODENTS *continued*—HYRACIDÆ, OR LAMNUNGIA.

HYRAX, or DAMAN. (Map 45.*) The species composing this genus or family are a few small animals, no larger than Rabbits, and not unlike them, although more compact and clumsy. They are said to be good to eat. The Syrian species is pretty generally believed to be the Saphan, or Coney of the Old Testament.

The genus is one of the most difficult to place of any of the mammals. It is either a Rodent or a Pachyderm, but seems to have as many claims to be considered the one as the other. Besides the form of the Rodents, it has their habits, their dung, their skin, hair, nostrils, eyes, ears, tail, incisors, most of the muscles, and some parts of the internal organs. On the other hand, it has the molars of the Rhinoceros — at least they simulate them very closely; but it is well to remember that the folds and replications of enamel in some of the Rodents might, if a little exaggerated, produce a very good resemblance to a pachydermatous molar; moreover, De Blainville does not interpret them as Cuvier did. The skull, especially behind, resembles that of the Rhinoceros; the humerus, the dorsal vertebræ, and, generally speaking, the whole skeleton comes nearer to that of the Rhinoceros than to that of any known Rodent. It was classed by Linnæus and the old authors with the Rodents, but Cuvier removed it from them and placed it among the Pachyderms, where it has ever since remained: not through inadvertence or simple deference to the great man's opinion, for its position has again and again been keenly scrutinized by our first anatomists; but from a conviction that a preponderance of the pachydermatous element does really exist in it. The discovery of the fossil remains of extinct palæotheroid animals holding an intermediate position between it and the Pachyderms, and participating in the characters of both, no doubt must have had much weight in turning the scale in the minds of modern naturalists, and in maintaining its place among the species of that order.

De Blainville seems only to have been half a convert, and if Professor Owen adopts without reservation the view that it is a pachyderm, it may be partly due to his liking for recondite discoveries. He says, that "in the course of his experience he has often found that the prominent appearances which first catch the eye and indicate a conformable conclusion are deceptive, and that the less obtrusive phenomena which require searching out, more frequently, when their full significance is reasoned up to, guide to the right comprehension of the whole. It is as if truth were whispered rather than outspoken by Nature." †

* The reader must go back to the maps of the Pachyderms for this map. It was lithographed among them before I had mustered courage to propose the removal of the genus from its prescriptive place.

† OWEN, "Palæontology," p. 323. 1860.

Is this really so? It is a question, perhaps, rather of apprehension or idiosyncracy than of fact; and mine leads me, so far from believing, to dissent from the proposition that truth is told by Nature in whispers. I think she speaks clearest when she speaks loudest: the truest solution is usually the most obvious, the most common-place, and the least far-fetched. It is a trite saying, that all great discoveries are characterised by their simplicity: as with Columbus and his egg, we stand amazed that we never thought of them before; they were so obvious; they lay at our feet, whilst we were peering through telescopes; and it is to be remembered that, as if purposely to prevent us from being misled, the trivial external characters of animals, such as distribution of colour, are often more persistent than more important internal structures.

The tide seems turning, however. Professors Brandt and Huxley have both shown indications of reverting to the original view, and reinstating the Hyrax in its position as a Rodent. I shall so treat it. If we went entirely by internal structure, we should find that we had to dispose of other relations of affinity besides that of the Pachyderms. It and the MYRMECOPHAGA alone of Mammals have a pair of cœcal appendages to the intestines similar to those of birds, both in form, position, and direction. Seeing, therefore, that it is in so many respects abnormal, I think it may be admitted to the companionship which it itself, by its outward appearance, would seem to have selected.

Five or six species of HYRAX have been described; some of which are, probably, only varieties. Giebel admits only two;* one, the Syrian Saphan, or Coney of the Bible, HYRAX SYRIACUS, which ranges from the coast of the Red Sea northwards through Syria, by Lebanon, and southwards into Arabia and Ethiopia; the other, the Cape species, HYRAX CAPENSIS, peculiar to the Cape and east coast of Africa, extends from Abyssinia down the east coast southwards.

It is to this species that Giebel refers the HYRAX ARBOREUS, described by Smith as living in woods. Peters found the same form in Mozambique, and it may be a mere variation in colour of the Cape species. Dr. Kirk found another species in Zambesia. Two other arboreal species, H. DORSALIS (*Fraser*) and H. SYLVESTRIS (*Temm.*), have been described from West Africa, but they are, in all probability, merely two names for the same thing.

No fossil species of this genus have been discovered; and no remains of the allied palæotheroid animals which I have above referred to have been found elsewhere than in Europe.

* GIEBEL "die Saugethiere," i. 210.

MAP LXX

LAGOMYS.
(PIKAS)

Existing
Fossil

MAP LXXI

HARES.

Variable Hare
Polar "
Common "
Various American Hares
Various old World "
Marsh Hares aquaticus palustris
Brasiliensis

Day & Son (Limited) Lith.

CHAPTER XXXVII.

RODENTS *continued*—LEPORIDÆ—PIKAS—HARES.

LAGOMYS. (PIKAS.) (Map 70.) I bring in the Pikas here before the Hares on account of their having a somewhat greater resemblance to the HYRAX than the Hares have. Fossil remains of extinct species have been found in bone breccia in Corsica and Sardinia of the same age as the breccias at Gibraltar and Cette. Similar relics have been obtained from Kent's Hole; and specimens, referred without doubt by Cuvier and Waterhouse to this genus, have been discovered in the pliocene lacustrine formation at Œningen.

The living species are few in number, but their distribution is interesting. A glance at the Map will show that they are, with the exception of a single patch on the Rocky Mountains, between latitudes 42° and 62° N., confined to Asia and the south of Russia, stretching from the Black Sea on the west to Kamtschatka on the east, and from the Altai Mountains on the north to the Himmalayahs, not crossing to the Indian side, on the south. In this space there are five or six species known; two belonging to the northern and eastern parts of its range, one to the south-western, one to the Himmalayahs, Affghanistan, and Cashmere, and another to the high Steppes of Central Asia. There appear to be two species in North America, one (the best known) that called the "Little Chief Hare," is found on the Rocky Mountains, and another has been reported by Mr. Lord from the summit of the Cascade Mountains. The position of both these species trending towards Kamtschatka, suggests that the line of connexion by which, at some former time the Old-world and New-world species were united, must have been by the Pacific rather than by the more distant route of Europe. At the same time we must remember that the fossil remains show that species of the genus formerly existed in Europe, and others may yet be found in North America.

An allied animal, which has been erected into a genus under the name of TITANOMYS by Von Meyer, in the belief, no doubt, that it was a gigantic Mouse instead of a pigmy Hare, has left remains in the middle Tertiary deposits at Weisenau in Germany.

HARES.—(Map 71.) There are about thirty species of Hare known, perhaps one or two more or one or two fewer, according to opinion of value of character. Of these, sixteen are peculiar to the Old World and thirteen to the New. If South America, on the one hand, and Africa on the other, be omitted, the numbers will be equal,—twelve in North America, and twelve in Europe and Asia. The number found in South America is one, in Africa four.

The common Hare (LEPUS TIMIDUS) is found in England and the Lowlands of Scotland, and all over Europe to the Ural Mountains, with the exception of the Peninsula of Scandinavia. It is now introduced into Ireland, but formerly was only represented there by the Varying Hare (LEPUS VARIABILIS), which turns white in winter.

The latter extends over the whole north of Europe and Asia to the Arctic Sea. It is sometimes found in the south of Scotland, and even in Cumberland, and is common in the Highlands. It is this species which inhabits Norway, Sweden, and the north of Russia. Nilsson has proposed to divide it into other species, L. CANESCENS and L. BOREALIS, both found in the south of Sweden; but the more general opinion is that these are only varieties. It stretches away thence north of 55° on to Kamtschatka. Schrenck says that it is very common in Amourland and Saghalien.*

It is also found in the Alps in Switzerland, and in the Pyrenees, the higher parts of Bavaria, and the Caucasus; but is not found in any of the low grounds or plains between these mountainous regions. This is one of the very few instances amongst Mammals of a phenomenon of distribution exceedingly common among plants,—viz., of Arctic species being found on the tops of high isolated mountains or ranges of mountains, far distant from their normal boreal habitat,—a circumstance undoubtedly due in the case of plants to the glacial epoch. As at its recess the heat gradually returned, and gained upon the cold, it drove the general army of temperate and boreal species of plants and animals which had been developed under the influence of the cold, slowly northwards, and they, as they passed on their way, left detachments like garrisons to hold the different lofty fastnesses through which the host retreated. These have done their duty faithfully,—they have set an example to all garrisons. Well provisioned with a constantly self-renewing store, they have held each their castle through countless ages, apparently hopelessly cut off from the main army, girdled in on every side by an impenetrable blockade across which no straggler or emissary can hope to pass, which none could enter and live.

I believe that their enemy (heat) is slowly and gradually drawing his circumvallation closer and closer round their holds, imperceptibly straitening their communications, and if no change come, will end in scaling the heights and exterminating the garrison, destroying all, both old and young, ruthlessly and without distinction. Ere then the war between cold and heat may undergo a change. The allies of heat may desert its cause, and allow the Arctic species to recover their lost ground, and liberate their long-besieged brigades.

If this should ever happen, would the species, if endowed with consciousness, recognise one another again when they met? Or if they have changed, which will have changed most—whether will the Polar form, which has gone on with the main body, or those left behind on mountain-tops, be nearest the typical form which the common ancestor of both bore at the time they parted? Probably those left behind, cooped into narrower limits, and more exposed to changes, must have been most transformed. As yet the Varying or Variable Hare, in this respect ill-named, has nothing varied. The species from the North Cape, and that from Switzerland, may be laid side by side, and no difference be perceptible.

The European form in winter becomes, practically,† wholly white except the tips of the ears. It is the same with the Polar Hare of America; but the black tip of the ears in winter is as absolute a specific character as the black tail of the Ermine, or the black shaft of the feathers of the White Willow Grouse.‡

* SCHRENCK, VON LEOPOLD, "Reisen und Forschungen in Amurland." 1858.

† There is a slight freckling of black and yellow on the bands of the ears, and the nose is yellowish.

‡ It is not known what is the cause of this singular exception to the effect of cold upon the colour of the fur and feathers in animals exposed to cold. Waterhouse ascribes the blanching of the fur to the extreme cold. "I am strongly inclined to believe," says he, "that the extreme cold in such cases as the present, by checking the plasmatic circulation, not only bleaches but ultimately destroys the vitality of the hairs, and that this is the

The Arctic Hares of the New and Old World (L. GLACIALIS and L. VARIABILIS) are so much alike that there is the greatest difficulty in distinguishing them. But most naturalists consider them distinct; and I may be allowed to add my holloa to the general voice; for it is a species which, through the kindness of my Hudson's Bay correspondents, I have had good opportunities of studying. The chief differences lie in the relative proportions of the parts and tinge of the fur. The American species appears never to lose its white livery, at least in the Arctic regions. It is mentioned in the Appendix to Sir John Ross's Second Voyage, that a specimen they had cast its winter coat early in May, and was not replaced by the darker hairs of the ordinary summer fur, but retained the pure white colour. And Otho Fabricius says that in Greenland it is white except the tips of the ears, both in summer and winter. Of these, of course, Sir John Ross's specimen belonged to the American species, and the individuals found in Greenland are of the American type too. Dr. Baird gives the dimensions of a Greenland specimen which he had examined, and which correspond with the proportions of the American species. It may thus be assumed to be correctly recorded as that species; so that we have here another instance (besides the Reindeer) of the American type of a Polar species being that which occurs in Greenland, in opposition to what has been clearly established* to be the case in plants. Further inquiry, however, made "with intention," into the specific characters of Greenland specimens of those Polar animals which occur in both hemispheres, such as the Reindeer, the Hare, and the Glutton, is very desirable. The American species ranges as far north as the Georgian Islands, in lat. 75°. It occurs on both sides of Baffin's Bay and on the east side of America extends into Labrador and Newfoundland. Dr. Bachman thinks it even reaches as far south as Nova Scotia. In the interior its southern limit is about 62° N. lat.,† and about the line of the M'Kenzie River and Slave Lake it does not come further south than 64° N. lat.‡ in consequence of the wooded character of the country, as it is never found in woods.

The other North American species are allotted out to different portions of the territory fitted for them. For example, the Prairie Hare (L. CAMPESTRIS) for the prairies; the Sage Hare (L. ARTEMISIA), for the Rocky Mountains, where it feeds upon the Sage or Artemisia, which there covers great tracts of otherwise barren land; the Swamp Hare (L. AQUATICUS), for the swamps which border the Mississippi; and the Marsh Hare (L. PALUSTRIS), for the less swampy but still wet spots in Carolina, Florida, and Alabama. These two last take readily to the water, swim with ease, and even dive for a short distance; they feed on the roots of aquatic plants, especially on a species of Iris growing in the water. Their legs are more scantily clothed with hair, thus adapting them better for their dripping mode of life.

South America has only one species (L. BRASILIENSIS), which is found scattered over Brazil, and in parts of Peru and Bolivia. In character it comes nearest to the Marsh and Swamp Hare of North America.

reason why they are, after a time, cast off, to be replaced by new and coloured hairs." WATERHOUSE's *Natural History of the Mammalia*, vol. ii. p. 52. 1842. If so, why is the hair on the tip of the Hare's ears, or Ermine's tail, not white too? They are more exposed to the cold than any other part of the body. As to its being a cause of the hair being cast, that is a phenomenon of a more general nature occurring in animals that have not their fur bleached in winter as well as those that have, and consequently an explanation applicable only to one, and that the smallest number of cases, is not sufficient.

* HOOKER, Dr. Jos., "Outlines of the Distribution of Arctic Plants," in the Linn. Soc. Trans. xxiii. 251. 1861.

† WATERHOUSE, op. cit. ii. 102.

‡ RICHARDSON's "Fauna Bor. Amer." 221. 1829.

More than one species has been described as inhabiting the south of Europe, but their distinctness has been questioned. One species (L. MEDITERRANEUS) is admitted to be good. It extends into Africa, and is found all through the Sahara to the sea-coast, but becomes of a paler and more tawny hue when found inland; that is, a colour more nearly corresponding to that of the desert. Two or three are found in Siberia and Central Asia. Several have been described as inhabiting different parts of the Himalayahs, but probably they are all referable to four species—one with a coarse fur which extends into China, and another reaching into Affghanistan and Cashmere, and two which inhabit the plains of India. In the same way, it is probable that half-a-dozen species have been made of one which inhabits Syria, Arabia, Egypt, Nubia, and Abyssinia.

Three well-marked species, not unlike our common Hare, exist in South Africa; but a great blank lies between them and the nearest species in Abyssinia. It is a point of interest to ascertain whether any occur in the interval. As a rule Hares are inhabitants of cold and temperate climes and are absent from the tropics; the two species which occur in the plains of India are the only Old-world tropical species with which we are acquainted. One of these (L. NIGRICOLLIS) occurs in Java and the Mauritius, but Mr. Blyth says that they were introduced into both,* which is very probable, but he does not mention the grounds on which he makes the statement.

The range of the common Rabbit is very much the same as that of the common Hare (L. TIMIDUS), but extends beyond it into North Africa.

Fossil remains of various species of Hare have been found in different parts of the Continent; in post-glacial deposits, and in bone-caves or bone breccia at Auvergne, Gibraltar, Cette, Parma, Kent's Hole (in England), Liège, Montpelier, Lunel-Viel, and in Aude. In Brazil remains have been met with which cannot well be separated from the only species which now lives in that country, L. BRASILIENSIS.

* BLYTH's "Catalogue," p. 132.

MAP XCII.

BRISTLY SQUIRRELS.

(XERUS.)

Day & Son (Limited) Lith.

MAP XCIII.

SQUIRRELS.

(SCIURUS)

Day & Son (Limited) Lith.

CHAPTER XXXVIII.

RODENTS *continued* — DORMICE — SQUIRRELS — MARMOTS.

Dormouse (Myoxinus).—(Map 87.) This family is confined to the Old World, where it has been in existence since the Miocene epoch. Remains of three extinct species have been found in France, two of them in the gypsum of Montmartre, and one in the middle tertiary beds of Sansans, in the south of France. The living species are few in number, and are confined to the Old World. The commonest, our small English species, (Muscardinus avellanarius), is found throughout temperate and northern Europe, and a nearly allied species, still smaller and prettier, is found in Japan. The Glis vulgaris (Seven-sleeper of the Germans) has a more southerly range, living in the south of Europe, as far east as the Wolga, and extending into Georgia. It is it that the ancients so highly prized as a dainty, and fed for the table in separate hutches, as we do turkeys now. It comes nearer to the squirrels than any other member of this family. Of the remaining genera, Eliomys extends from the south of Europe into Africa and Arabia, and Graphiurus inhabits the Cape of Good Hope. A singular form (Platacanthomys lasiurus,) said by its describer, Mr. Blyth, to be allied to the African Graphiuri, occurs on the Malabar coast of India. It has sharp flat spines on its back, and it is possible ought more properly to be referred to the Xeri, or spiny Squirrels. Another remarkable aberrant form half-way between the Squirrel and Dormouse (Anomalurus) from West Africa, may also be taken in here with the Dormice.

Sciuridæ.

Anatomically and physiologically considered, the best classification of the Squirrels is into true Squirrels and Marmots; a division which, with the exception of a single genus (Tamias), corresponds very nearly to terrestrial and arboreal Squirrels. The terrestrial Squirrels consist of the Marmot (Arctomys), the Prairie Dog (Cynomys), and the Spermophile (Spermophilus). The genus Tamias is also terrestrial, but in structure and affinity belongs to the arboreal section, which, besides it, contains the true Squirrels (Sciurus), the Spiny Squirrels (Xerus), and the Flying Squirrels (Pteromys). Like the Hamsters, and some other Rodents, a considerable proportion of the Squirrels possess cheek-pouches. All the species of Spermophilus and Tamias have largely developed internal cheek-pouches, and Arctomys has traces of them.

he only fossil remains of Squirrels are of recent date. An Arctomys has been found in the alluvium of Auvergne, and remains of another animal allied to the Marmot (Plesiarctomys Gervaisii) have been met with in the recent fresh-water calcareous deposits of Apt near the mouth of the Rhone. Remains of the living species of Squirrels have also been found in bone-caves, but nothing indicating its presence in Europe, or indeed anywhere else at a more ancient date.

In a family containing such an army of species as the Squirrels, one is glad to be able to break

it up into brigades. After separating from them the Marmots, Ground Squirrels, and Flying Squirrels, we have a very homogeneous section, the Squirrels proper, which peculiarly require further subdivision, but for which it is scarcely possible to find good sectional characters. One small section may, indeed, without inconvenience be subtracted from it, viz.:—

Bristly Squirrels. (Xeri.) (Map. 92.) These are Squirrels with bristles or spines in their fur; they are confined to Africa, south of the Sahara. The Map shows their range, but only those places where the genus has been actually taken, and these, it will be seen, extend along the coast almost all round the continent,—Senegal, Fernando Po, Congo, South Africa, Somali-land, Abyssinia, and Senaar. We may, therefore, expect that it will be found all over it, but until it has been ascertained to be so, I have refrained from assuming it.

Sciurus. (Map 93.) The remaining Squirrels, even thus restricted, are still a numerous genus. There are about one hundred and eighty species, standing described in systematic works, of which, however, at least the half are synonymes; and I have little doubt that if the remainder were subjected to the same stringent scrutiny that Audubon and Bachman's North American species* have undergone at the hands of Dr. Baird, and with the same advantages of materials collected by Government explorations, they would be correspondingly reduced.

The great accumulation of synonymes and doubtful species is due to the variability of most of the species both in size and colour. Speaking of the Indian species, Sc. maximus, Mr. Blyth, who perhaps has had more experience of Indian species than any other naturalist, says, "It exhibits permanent varieties of colouring, each peculiar to a certain range of distribution; and in some instances the size is more or less reduced, *e.g.*, Sc. hypoleucos and Sc. albipes. It is difficult to conceive of the whole series as other than permanent varieties of one species; and the same remark applies to the races of Pteromys, and to at least some of those of Sciuropterus, as also to various named Sciuri."† And not to speak of varieties and local races, from time to time indicated by Mr. Blyth, he says of the whole of the group of medium-sized Squirrels with grizzled fur, proper to south-east Asia and its Archipelago: "Extraordinarily developed in the Indo-Chinese countries, and Malayan Peninsula, where the species or permanent races would seem to be almost endless, differing more or less in size and colouring."‡ Dr. Baird makes similar remarks upon the North American species: "The determination of the species of Squirrels of North America has always been a matter of great difficulty. Owing to many different reasons, the species themselves exhibit an unusual tendency to run into varieties of colours, among which red, grey and black, are the predominating ones with all possible intermediate shades; these varieties are sometimes more or less constant in particular localities, sometimes changing with every litter. I am not aware that there is any material difference of colour at different seasons or ages in the same animal."§ Mr. Blyth found the Indian varieties also constant to their localities: "The next four races," says he, "with probably others, are also very closely akin, but inhabit different localities, from which they are respectively true to the details of their colouring."‖ Another source of perplexity, noticed by Dr. Baird, is the alteration in the average size with the latitude. "Many of our animals," he says, "become smaller as we proceed southwards, until on the sea-coast of Georgia, Florida, and the Gulf,

* Sir Charles Lyell tells us of the remonstrance of a subscriber to Audubon and Bachman's Quadrupeds of North America on this subject: "If you describe so many squirrels I cannot go on taking in your book." —Lyell's "Second Visit to the United States," vol. i. p. 302. 1850.

† Blyth, Cat., p. 98.

‡ Ibid. p. 101.

§ Baird, op. cit.

‖ Ibid. p. 101.

MAP XCIV.

Rodent Flying Squirrels
Pteromys
Sciuropterus
Both kinds together
Marsupial Flying Squirrels
Petaurus

ISOTHERMAL 32°

Arctic Circle

Equator

Tropic of Cancer

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

NORTH AMERICA

SOUTH AMERICA

EUROPE

ASIA

AFRICA

AUSTRALIA

BAFFIN BAY

GREENLAND

DAVIS STRAIT

ESQUIMAUX

RUSSIAN AMERICA

INDIANS

CUMBERLAND

HUDSON BAY

BRITISH AMERICA

LABRADOR

NORTH CANADA

VANCOUVER I.

OREGON

NUEVA CALIFORNIA

UNITED STATES

TEXAS

MEXICO

G. of MEXICO

WEST INDIA I.

CARIBBEAN SEA

NUEVA GRANADA

VENEZUELA

GUAYANA

ECUADOR

PERU

BRAZIL

CHILI

PATAGONIA

LA PLATA

FALKLAND I.

TIERRA DEL FUEGO

ALEUTIAN I.

SANDWICH I.

MARQUESAS I.

LOW ARCHIPELAGO

SOCIETY I.

COOK I.

NAVIGATORS I.

ICELAND

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

SCOTLAND

IRELAND

ENGLAND

BALTIC

PRUSSIA

RUSSIA

FRANCE

AUSTRIA

PORTUGAL

SPAIN

ITALY

TURKEY

BLACK SEA

ASIA MINOR

MEDITERRANEAN

AZORES

CASPIAN SEA

PERSIA

AFGHANISTAN

PUNJAB

INDEPENDENT TARTARY

Altai M.

IRKUTSK

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

JAPAN SEA

JAPAN I.

KAMTSCHATKA

SAHARA DESERT

EGYPT

RED SEA

ARABIA

NUBIA

ABYSSINIA

CAFFRARIA

CAPE COLONY

MADAGASCAR

HINDOOSTAN

BURMAH

ARABIAN SEA

BENGAL SEA

COCHIN CHINA

CHINA SEA

PHILIPINE I.

CEYLON

BORNEO

CELEBES

N. GUINEA

NEW HEBRIDES

NEW ZEALAND

YANDIEMEN

SOUTH AUSTRALIA

NEW SOUTH WALES

Day & Son (Limited) Lith.

they reach their minimum. This is very strikingly seen in the Common Deer, which on the Sea Islands of Georgia is so small as to be readily lifted and thrown across a horse with perfect ease by a man of ordinary strength. It is in the Sciuridæ, next to the Deer, we find this law to prevail most decidedly. Nearly all the species of extensive North and South range will be found, on careful examination, to substantiate this position."

It appears also that, as with the Foxes, the smaller species of Squirrel assume the black fur to the greatest extent in the more northern portions of the United States. Dr. Baird also made this observation, that as a general rule where a Squirrel exhibits any annulation of the fur on the throat or belly, it is a variety of some species, typical examples of which have the under parts either uniformly white or reddish to the roots, and the annulation is usually accompanied by a duskier colour of the fur. The tendency to annulation below is strongest in the Squirrels of the Mississippi Valley, and applies both to grey and fox-coloured species. But Dr. Baird had met with no instances of annulation among the Squirrels west of the Rocky Mountains.

There is another curious peculiarity in some of the North American Squirrels, which may give a hint for testing varieties or species in other instances. It illustrates the proverb "that what is bred in the bone will come out in the flesh;" here it should be "the fur." The bones of the Fox Squirrels, which have rusty-coloured bellies, are red; those of the white-bellied varieties are white. This is not an isolated case of colour penetrating to the bones. A variety or species of domestic fowl has always black bones.

Flying Squirrels. These are divided into two sections, readily distinguishable, the one by having the fur of its tail divided distichously, and smoothed off to each side (Sciuropterus); the other (Pteromys) by the tail being bushy all round. Both have their representatives in the Marsupial Petauri and Acrobata, in Australia the former corresponding to Pteromys, the latter to Sciuropterus.

Sciuropterus. (Map 94.) This section has much the same distribution as the true Squirrels,—that is, the preponderance of species inhabits the Indian Archipelago,—then about a third of the whole are North American, and a single species (Sc. volans) is found in north-east Europe and north-west Siberia, not extending eastwards beyond the Lena. There are fifteen species in all. According to Audubon, the Sciuropterus volucella is far more numerous in North America than it is supposed to be. He frequently caught it in traps set for the smaller Rodentia in localities where he had never seen it.* It is met with in all the Atlantic States, and Audubon obtained specimens in Upper Canada, within a mile of the Falls of Niagara. But there is reason to believe

* I can readily imagine this. With permission of the authorities I once turned loose a living specimen of this American species into the large palm-house in the Royal Botanic Gardens, Edinburgh. The moment it was released from its little cage, it flew up the nearest tree like a shot. We saw it for a short time, high up, clasped to the trunk, until it made another dart, when it vanished from our sight; and the eager searching of many keen eyes was ever after unavailing to obtain a glimpse of it. Sir Charles Lyell bears similar testimony. He tells us that at Charleston he expressed his regret to Dr. Bachman that he had not yet seen the Flying Squirrel in motion, "and was surprised to hear that Dr. Bachman had observed about a hundred of them every evening for several weeks near Philadelphia, on two tall oaks, in the autumn when acorns and chestnuts were abundant, and when they had spare time to play. They were amusing themselves by passing from one tree to another, throwing themselves off from the top of one of the oaks and descending at a considerable angle to near the base of the other; then inclining the head upwards just before reaching the ground, so as to turn and alight on the trunk, which they immediately climbed up to repeat the same manœuvre. In this way there was an almost continuous flight of them crossing each other in the air between the two trees."—Lyell's "Second Visit to the United States," vol. i. 303. 1850.

that it does not exist much to the north of the great lakes. He also found specimens in Florida and Texas. Lichtenstein found it in Mexico, and it is in M. Salvin's list of species found in Guatemala. Besides it three other species are found in North America. A larger species (P. SABRINUS) replacing it in Lower Canada. Neither it nor any other species, however, is found in South America. None are found in Africa or Southern Europe.

PTEROMYS. (Map 80.) This section is confined to India, chiefly the Nepaul, Sikkim, and other Himmalayan districts, and to Java and the rest of the Indian Archipelago. It numbers only six or seven species.

The numerical proportion of the species of Squirrels and Flying Squirrels in the different quarters of the world, may perhaps furnish some data for determining the site of their original birth-place, or specific centre, and the course of their subsequent dispersion. These have a more uncertain basis than they would otherwise have had, owing to the variable character of many of the species, and our consequent ignorance of their true numbers; still we can make out something from them even here. Generally speaking, I do not attach great weight to numerical statistics of this nature: in the first place, because I know that they must be wrong; the estimate of what a species is being constantly inconstant, and invariably varying according to the bias of the author who describes it. In this instance, North America, on the one hand, has had her lists purged of half her species by Baird, and India on the other has had *hers* doubled by Hodgson and Blyth. Had both been dealt with by the same men the proportion would have been preserved, but here the balance is quite upset. In the next place I regard them less, because we can never tell to what cause the preponderance of species is due. The presence of species is something; it is a positive fact; their absence is nothing, or at best only half something. The species may have been present, where it is now absent, and in greater numbers than any others elsewhere; but a flood, or a sinking of the land for four-and-twenty hours, or a famine, or a pestilence,—a rinderpest, may have swept them all away. It is therefore only when they are very marked that numerical statistics can be at all trusted to, and even then they must be used with great caution. Notwithstanding what I have above said they are still well marked in the Squirrels, and the following facts stand out sufficiently clear and positive to allow us to reason from them. We have the positive fact that they are found in every region of the world, except Australia and Madagascar. It may be assumed as proved, too, that a greater number of species is found in India and the Malayan Archipelago than anywhere else; and the reader will remember that *that* is the region nearest to the land of their equivalents the Marsupial PETAURI. Probably the half of them are found there; a third may inhabit North America; Africa and South America may each have about a ninth or a tenth; and Europe and Northern Asia are limited to the single species found in Britain.

The Indian Archipelago seems, therefore, to have most right to be considered the starting-point, or specific centre of the family; and if so, it is plain that a swarm must have been thrown off from thence, which, somehow or other, has reached North America. How can they have got there? Can the transition have been made by SCIUROPTERUS VOLANS, the European and Asiatic species, drawing its origin from India, extending to America, by the Bhering Straits route, or some neighbouring passage, and then becoming changed into SC. VOLUCELLA? It is against this idea that SC. VOLANS is not found east of the Lena nor west of the Gulf of Finland. It rather looks as if *it* were an offshoot from some of the Himmalayan species going northwards, and spreading a little to the right hand and to the left. In speculating on this we

MAP XC.

MARMOT

(ARCTOMYS.)

MAP XCI.

TAMIAS.

(STRIPED SQUIRREL.)

Day & Son (Limited) Lith

must remember that our date is confined to the period subsequent to the glacial epoch, for the cold of that epoch cleared off almost everything both from Europe and North America, and consequently no use can be made of any old bridge which may have subsisted between Europe and America prior to the glacial epoch.

The above inference as to the course of the distribution of species extends to the true Squirrels as well as to the Flying Squirrels. What has taken place in PTEROMYS and SCIUROPTERUS is obviously repeated in SCIURUS in every point, although the contrasts are less marked, there being a much larger number of species. Africa seems to have little connexion with the Indian Squirrels, from which I look for the distribution of the rest. Can the communication have been by South America? No doubt there are several indications of a very ancient connexion between New Zealand and Peru, especially in plants and insects. It may have included the submerged continent now buoyed off by the Pacific Islands, and by that route the Squirrels may have reached North America. On the other hand, we have seen that there are no Flying Squirrels in South America at all. And as the true Squirrels were what is called "in the same boat" as the flying ones, the specialties of their distribution being merely an exaggerated repetition of the facts relating to the latter, we can hardly avail ourselves of the presence of two or three true Squirrels in South America, to explain their passage to the north.

It must therefore have been by North America that the family established itself in the New World. We may assume it as certain that there was such a connection between Asia and North America by Bhering's Straits, or a little to the south of it. But the Indian Squirrel was a tropical creature, and there is an absence of Squirrels in the north-east of Asia. These considerations seem to point to another more southerly connection between Asia and North America, by Japan and California, or stretching from China to California, in the line of the Sandwich Isles. From the comparative rarity of the Squirrels in South America, and their abundance in Mexico and North America, we may perhaps infer that the gap which at one time existed between North and South America was present when the Squirrels established themselves in North America. That gap seems to have been open and closed up more than once.

STRIPED GROUND-SQUIRREL. (TAMIAS.) (Map 91.) The Striped Ground-Squirrels stand between the true Squirrels and the Spermophiles. Like the latter they possess internal cheek-pouches, and the form of the skull is similar in a certain portion of them. They have all a black stripe down the middle of the back, and usually two others on each side; a disposition of colouring which also appears in some of the Mice, as MUS PUMILIO. Two species occur in Europe and Asia; the remainder, consisting of four or five species, are American, one ranging from Canada to Columbia; another from the Missouri to Oregon; one is peculiar to California, and another to New Mexico.

For long, one species known by the name of TAMIAS STRIATUS was thought to be common to both Siberia and North America. More recently naturalists have come to the conclusion that there are two different species, one peculiar to each continent, and Dr. Baird has named the Siberian species T. PALLASII. The American animal is the larger of the two, and has the shortest tail, which is more bushy and cylindrical. The colour also differs somewhat, the light tints being pale yellow ochre in the Siberian, and rusty brownish red, mingled with grey, in the American; and the black stripes on the back are arranged at different distances. This is Wagner's account;*

* WAGNER, "Supp. Schreber Saugethiere," iii. 233.

but we can hardly trust to it, for Baird, on the other hand, says that the Old-World species is the largest; "in fact, fully twice the size." In truth, there seems to be little on which to found a species beyond size, colour, and length of tail—in other words, in those very characters in which ordinary variation chiefly occurs. But here the important point is, that the distinctive peculiarities on these points seem to be constant on each side of the Pacific. Similar constant differences, however, occur between the individuals in different districts elsewhere. Baird noticed them in all the specimens of TAMIAS QUADRIVITTATUS from a particular district in North America. He says, "In all the specimens from the Upper Missouri and Yellowstone Rivers there is a constant difference from the preceding description, in the much greater lightness of colour. The dark stripes have much less black in them, &c. *These are smaller, and the tail longer.* The tail is also much lighter-coloured," &c. &c.*

The difference in the proportions of these Yellowstone River specimens too is of the same character as in those of the Siberian specimens of SPERMOPHILUS PARRYI, as well as of TAMIAS PALLASII. Increase of size is accompanied with shortening of the tail, and diminution of size with an increase in its length. It is as if the tail remained the same, and seemed only relatively longer or shorter according to the increase or diminution of size in the other parts of the body. It would be interesting, by a series of measurements both of Old-world and New-world individuals, to ascertain whether this is the case; and if so, where the increase really takes place. Those given by Dr. Baird in his work sufficiently supply this for the American species; all that is wanted is similar and equally careful data for the European and Asiatic species.

SPERMOPHILUS. (Map 88.). These Ground-Squirrels closely resemble ordinary Squirrels in appearance, the easiest point of distinction being their possession of cheek-pouches. There are twenty five species known, of which one is extinct and has left traces in the bone breccias of France and Germany. Of the other two dozen, nine are Old-World (European and Siberian), and fifteen North-American species. None are found to the south of the temperate latitudes of the northern hemisphere. Those found in the Old World are chiefly Siberian: only two occur in Europe, S. CITILLUS in Austria, Hungary, Poland, Silesia, and Bohemia, and probably also in Russia and Siberia; and S. GUTTATUS in Volhynia, Bessarabia, and Russia between the Don and the Wolga. The Ural, Altaic, Caucasian, and Kamtschatkan Mountains, the Irtisch and Kirghis Steppes, and eastern Siberia, are the habitats of the Asiatic species.

In America a considerable number of species belong to a sub-genus proposed by Brandt (OTOSPERMOPHILUS), with long ears, in contrast to the other species, which have very short ears. These are not found in the Old World. None of the Spermophiles of either section are met with, or perhaps I should say, are now met with, on the eastern board of North America. Three are found in the central districts, three in the Rocky Mountains, three in California, and five in Texas, Sonora, and New Mexico, and on the borders of Mexico.

The most interesting of the Spermophiles are those known as S. EVERSMANNI, and S. PARRYI, the former of which inhabits the eastern half of northern Siberia, from the Altaic Mountains to Bhering's Straits, where it meets the North American form, S. PARRYI, which has as wide a range eastward of the Straits, see Map 89. Brandt and the Russian zoologists generally consider these species as identical. At the same time they can always be readily distinguished from each other, S. PARRYI being the larger of the two, and having a shorter and more bushy tail.

* BAIRD, op. cit. p. 298.

MAP LXXXVIII.

SPERMOPHILUS.

(GROUND SQUIRREL.)

Note. Preponderance of Species indicated by intensity of colour

Day & Son (Limited) Lith.

MAP LXXXIX.

Spermophilus Parryi

" Eversmanni

Supposed by some to be the same.

Day & Son (Limited) Lith.

Two questions of interest arise out of the close resemblance of this and other species similarly circumstanced, such as TAMIAS STRIATUS and T. PALLASII. The one is, whether they are identical or not; and the other, to what cause their extreme resemblance or identity is due. As to the first question, that is a matter of opinion, which every one will answer according to his own views of what constitutes a species; they hover on the borders between a species and a variety. As to the second question, the explanation of their supposed identity is generally assumed to be, that individuals have crossed over from the one continent to the other by Bhering's Straits, when the sea there was frozen over in winter.

Dr. Baird says, and I suspect the majority of naturalists would concur in the remark, that "there is nothing to prevent the mammalia of the north-western portions of the American continent from passing over to Asia, as the strait intervening is frozen solid every winter."*

Now I think we may sometimes stretch this idea too far. It is perfectly true as regards some animals, but I am not so sure that it is equally applicable to all. The quotations which I have already given from Captain M'Clintock's Diary show that apparently the whole of Polar animal life is migratory, and swarms across the ice as freely as over the land. But I have some difficulty in believing that non-Polar animals would equally avail themselves of the same means of transit. Certainly the fact seems to have been that these Spermophiles do not avail themselves of this yearly bridge, for neither of them extend their range beyond their respective continents, but come up close to the Straits, S. PARRYI being found in the island of Aricamtchitchi at the Straits, and the other on the Kamtschatkan shore. If it were not so—if the time when they crossed from one continent to the other was not distant, why are they not absolutely identical? If S. PARRYI could take a run across to see its cousin S. EVERSMANNI every winter, or S. EVERSMANNI in like manner come over to America, why should *all* the American specimens be bigger? and why should they all, and always, have shorter and bushier tails? Some distinctive difference occurs in every species with which I am acquainted, which is represented both in North America and the Old World. There is constantly a perceptible distinction, although it be slight. On this ground it seems to me plain that the journey across Bhering's Straits is not a thing which "there is nothing to prevent." In one sense (the physical one) there is nothing to prevent it. So there was nothing to prevent any one before Columbus sailing from Europe to America; and if a Squirrel had the intelligence, ambition, and perseverance of Columbus, it no doubt would soon cross the Straits. But not having them, what is there to induce it to leave the land where its food is, and to start on a journey of sixty miles across a frozen sea?† nay, not across, but, to all its perception, on an illimitable horizon of ice, without bourne, and without object or inducement, but opposed to everything of the kind. And let the reader think for a moment what sixty miles is. He is, perhaps, a good walker, and when in fair training will walk his thirty miles a day. It would take him two days to cross the Straits, sleeping one night on the ice; but if he only made out ten miles, which would probably be enough for the energy of a Spermophile, then he must sleep another night and walk another day; and again, and again, and again, and yet again, before he reached the opposite shore. It is not as if they were in a boat, which, once set adrift, might be blown hundreds of miles without effort on the part of those in it. They must set out

* BAIRD, op. cit. p. 324.

† Sir Charles Lyell says that Bhering's Straits do not exceed in width the Straits of Dover. I have been unable to find a reliable statement of their width, but the measurement by scale on our maps gives sixty miles.

with an intention, and an intention to do a disagreeable thing, against their present interests and inclinations for a future, distant, and problematical advantage; a thing which, I imagine, no beast ever yet did, and few men. Of course I except Polar and migratory animals which are moved by their instinct to travel in a particular direction. I therefore do not adopt the idea of Bhering's Straits when frozen being a serviceable bridge for non-Polar animals to cross by.

I need scarcely repeat that I account for the occurrence of so many plants, insects, and other animals in North America, which, although recognisable as American varieties of species also found in Europe or Asia, cannot be separated from them as distinct species, by the hypothesis that, at some not very distant geological period, the New and the Old World were united at their northern extremity, and that a bridge existed not only across the Atlantic but across the Pacific.

Prairie Dog. (Cynomys.) As the Spermophiles are the inhabitants of mountainous and rocky places, so the Prairie Dogs are inhabitants of plains; they are intermediate between the Marmots and Spermophiles, and have, by different authors, been placed in each. Two species have been described, but there are probably one or two more. They are North American, and their range is extensive. The common Prairie Dog is found over the entire extent of the region between the Missouri River and the Rocky Mountains. It has not hitherto been recorded as occurring north of the United States lines. Southwards it extends to the Rio Grande, as far as the Presidio del Norte, in 30° N. Lat. It is not probable, however, that it goes so far south as Matamoras, as it is not noticed by Dr. Berlandier in his notes on the zoology of that region.

Marmot. (Arctomys.) (Map. 90.) These are the largest of the Squirrel family, some of them being not very far behind the Beaver in size. The number of species does not exceed seven, three of them inhabiting the Old World, the rest the New. The Arctomys bobac of Europe and Asia, and A. monax of North America, are the best known; the range of the former stretches from Switzerland to Kamtschatka, and that of the latter across North America, from the Atlantic to the Pacific, or rather almost to the Pacific. Such a space as lies between Switzerland and the Atlantic in Europe also separates A. monax from the Pacific in America, its place there being taken by A. flaviventer. Another species, A. pruinosus, which occurs on a small tract of country lying on the borders of the Rocky Mountains, between the Columbia and Fraser's River, may perhaps also be found in Asia. Middendorff* says that a large species in Kamtschatka exactly corresponds with it, and Baird seems inclined to adopt his view.†

Fossil remains of an extinct species have been found in the volcanic alluvium of Auvergne.

The Spermophiles and Marmots would, according to my hypothesis, be still more recent descendants from the Squirrels. They are entirely northern species, and as they are more largely represented in America than in the Old World, the chances are in favour of their having come into existence in North America, and spread from thence into the Old World by Asia.

* Middendorff, "Siberische Reise."
† Baird, loc. cit. p. 347.

CHAPTER XXXIX.

RODENTS *continued*—MURIDÆ—BEAVERS—VOLES—RATS—MICE.

MURIDÆ. THE various groups of this family, which seem entitled to rank as sub-families, are—1. The CASTORINI, or Beavers; 2. The ARVICOLINÆ, or Voles; 3. The DIPODINI, or Jerboas; 4. The SPALACINI, or Mole Rats; 5. The SACCOMYINI, or Gophers; and 6. The MURINI, or true Rats and Mice.

CASTORINI.

APLODONTIA. Dr. Baird includes the Sewellel (APLODONTIA LEPORINA of Richardson) among the Beavers.* Giebel places it amongst the SPALACINI.† It is probably intermediate between the Marmot and the Beaver, or the Marmot and the Gopher. Being that I sway in doubt, I follow the line suggested by Baird.

Its habits are scarcely at all known. It is said to be about the size of, and very like, the Musk-Rat in appearance. Its feet are not webbed; so we may assume that it is not aquatic. It varies in colour from brown to black. It is confined to a narrow region in Washington territory, on the north-west coast of North America, extending from the coast to the Rocky Mountains. It is doubtful whether it will be found either on the coast range in the Williamette Valley or on the Cascade Mountains.

BEAVERS.—(Map 77.) Naturalists have been much puzzled where to place the Beaver in their systematic arrangements, and it occupies very different places in different systems. Dr. Baird maintains that it is an aquatic Squirrel, as the Marmots are burrowing Squirrels. It certainly has a good deal in common with the Squirrel, but it seems to me to have still more to do with the ARVICOLINÆ; I consider it a gigantic Vole. The skull, perhaps, is more akin to that of the Squirrel, but there are other characters which show greater affinity with the MURIDÆ. It has the aquatic habits of many of the Voles, and the scaly tail of the Rat has become a flattened oar in the Beaver as well as the Musk-Rat; in the former with the blade placed horizontally, and working as in the whale, in the latter placed vertically and working as in fishes.

It was for long a question whether the Old-world and the New-world Beavers were distinct species or not. This has now been settled in the affirmative, chiefly on the strength of anatomical differences.‡ In outward appearance there is scarcely any appreciable difference; but amongst others the same test,—the difference in the relative proportion of the nasal bones,—which distinguishes the skull of a lion from that of a tiger, is found also to distinguish these species of Beaver. Pro-

* BAIRD, op. cit. p. 353.
† GIEBEL, op. cit. p. 527.
‡ CUVIER, "Ossemens fossiles," viii. 112. OWEN, "British Fossil Mamm. and Birds:" 196. OWEN, "Catal. Osteol. Ser. Royal College Surgeons," ii. 1853. No. 2162.

fessor Brandt, of St. Petersburg, has carefully worked out the subject, and the reader will find full details in his work on Russian Mammals.*

Our Castor fiber, the Old-world Beaver, formerly inhabited the whole of Europe and Western Asia. It is now almost extinguished from the former, a few only still remaining in some parts of Germany, and perhaps on the Rhône, in France. The race, although so nearly extinct, has been preserved in Austria by the Austrian Emperor, in at least one of his extensive parks on the banks of the Danube. It is now probably extinguished in Sweden and Norway. Blyth records a specimen obtained from Norway in 1844, as being one of only two which had been killed in that country during the preceding twenty years. Some still survive in Poland and Russia. It is not found in the south of Europe, or on the Mediterranean or Black Sea, but still exists in considerable numbers in the streams of the Ural Mountains, and in those of the Caspian Sea, extending into Tartary. It is not found in Eastern Siberia, neither Herr Radde nor Schrenck having found any trace of it, or learning anything to lead to the belief that it had ever lived in that district, or Amourland; with the single exception that "it is said" that the Russo-American Fur Company obtained a skin in 1853–4, at their temporary station at the south end of Saghalien. Such an exception, unaccompanied as it is by any tangible fact, is very tantalising. The skin might have been an American one, or one brought by some far-travelled hunter from West Siberia. In ignorance of these points, nay, in uncertainty whether it was a Beaver's skin at all, the statement only serves to throw a haze of doubt on any conclusions drawn from the absence of the Beaver in that part of Asia.

Castor Canadensis. The American Beaver has a very wide distribution through North America. It formerly extended over the whole continent, from sea to sea, but it is now very rare east of the Missouri. A few are still found in the Adirondac region of New York; in the Alleghanies of Pennsylvania, Virginia, North Carolina, and even Alabama. They extend from the Arctic Circle to the Tropic of Cancer (68° to 26° N. lat.) They are found in the Gila and the Rio Grande, and reach the mouth of that river (in 26° N. lat.) In former times it was extremely abundant, but the great demand for, and high price of, its fur for hats, induced an extensive trade in it, which caused it rapidly to diminish. The substitution of silk in the manufacture of hats, and the introduction of the fur of the Nutria (American Otter) and Coypu (Myopotamus Coypus) of South America, has, however, reduced its price so much (they were offered to Dr. Newberry's party by the bale, at 25 cents each), that, according to Dr. Baird, beaver-fur now scarcely pays the expenses of the systematic and laborious pursuit on the part of the trapper which is required to obtain it; and, in consequence, the animal is again multiplying rapidly, and the western streams becoming well stocked.

Numerous fossil remains of both the living species have been found; those of the Old World in England and other parts of Europe; those of the New World in especial abundance in the bone-caves of Pennsylvania, showing that they must have lived there formerly in great numbers.

Two remarkable animals of the Beaver tribe, but considerably larger, formerly inhabited Europe and North America, respectively,—the Trogontherium and Castoroides. They are both now extinct, but seem to have been contemporary with the Beaver. Their remains have been discovered in peat-bogs and lacustrine deposits posterior to the drift. The American genus, Castoroides, was much

* Brandt, Prof. "Beiträge zur nähern Kentnniss der Säugethiere Russlands St. Petersburg." 1855. 4to. And in "Mémoires Mathém. Phys. et Natur. de l'Acad. Sc. St. Petersburg." vol. vii.

MAP LXXXVI

MUSK RAT

FIBER ZIBETHICUS

MAP LXXXVII.

DORMICE.

(MYOXINI)

Day & Son (Limited) Lith.

the larger of the two. It was more than twice the size of the Beaver (the length of its skull, for example, was nine inches, while that of the Beaver is only four). The TROGONTHERIUM, again, was only about a fifth larger than the Beaver.

ARVICOLINÆ. (Map 84.)

The lower-jaw bones of two or three species of fossil ARVICOLÆ have been found in the bone breccia of Goslar.

MUSK RAT. (FIBER ZIBETHICUS.) (Map 86.) Although unquestionably one of the ARVICOLINÆ, there is a good deal in the Musk Rat which reminds us of the Beaver. Its fur is similar, it passes the most of its time in the water; its tail also is naked and scaly, only narrow instead of broad, and placed vertically instead of horizontally. It inhabits the whole of North America, from the Atlantic to the Pacific and from the Rio Grande to the Barren Grounds of Arctic America. It is abundant in Washington territory, and to the north of that district on to Bhering's Straits, and in the north of the Rocky Mountains, but has not yet been met with in California. Dr. Newberry says: "In the Sacramento valley, in the Klamath Lake region, in the basin of the Des Chutes,—places apparently fitted by nature to be paradises of Musk-Rats; shallow, rush-grown lakes, and rush-bordered, canal-like streams, just where, in the Eastern states, Musk-rats would abound,—though I looked carefully I never saw the animal, his track, his habitations, nor even his characteristic heaps of emptied shells of *Unio* and *Anodonta*. I therefore concluded that in all this region the Musk-Rat does not exist."* Mr. Lord† describes a second species, FIBER OSOYOOSENSIS, as found in the Rocky Mountains and at Cascade Mountains, but the distinctions taken by him scarcely seem specific.

It was at one time supposed that the Musk-Rat was found on the Asiatic side of Bhering's Straits, but it appears now to be ascertained that the skins obtained from the Tschucktchis of Kamtschatka are procured from the tribes on the American side of the Straits.

VOLES.—(Map 84.) The Field-mice, or Voles, are numerous in species, which are spread over the northern hemisphere through America, Europe, and Asia, and in number of individuals they probably far exceed any other mammal. Inhabiting very nearly the same territories as the true Mice and Rats, they each have a tendency in an opposite direction. The true Mice rather affect the warmer parts of the temperate zone, the Field-mice prefer the colder; as in plants we see species occupying successive bands of latitude—the spruce-fir, for example, stretching in a broad band across the north of Europe, and the silver-fir doing the same in the middle of Europe, so these two families repeat something of the same sort in the animal kingdom, but so mixed together that it is not easy to prove it otherwise than by pointing to the fact that the extreme northern and cold districts have Field-mice, and no true Mice; and the southern and warmer districts have true Mice and no Field-mice. Thus we have no true Mice in Greenland and the circumpolar region, but we have the Lemmings, a genus of Field-mouse. So at the equator, and in the tropics, we have true Mice, but no Field-mice. On the cold and lofty steppes of Mongolia and Central Asia true Mice are absent, and their place is supplied by Field-mice. Two species occur at some elevation on the southern slope of the Himmalayahs, stragglers from Europe and Central Asia. In the deserts of Sahara Field-mice are unknown, but true Mice occur

* NEWBERRY, "Report in U.S. Pac. Railroad Expl.," vol. vi. p. 22.

† LORD in "Proc. Zool. Soc." 1863.

all through it. In the intermediate regions between the tropics and the Arctic circle both occur indiscriminately. Field-mice do not occur in South America, South Africa, or Australia.

The Field-mice are distributed very uniformly wherever they occur, different species being allotted to the different kinds of locality to which they are suited. Some species inhabiting the water, others the dry lands, while others, again, frequent rocky elevated regions, or Alpine mountain heights. The thick moss and swamps of sphagnum in the Arctic regions are said to swarm with species both of Field-mice and Lemming to an extraordinary degree, and to be the starting-point of the armies of Lemmings which from time to time have overrun the northern regions in inconceivable numbers.

The southern boundary of the Field-mice is not well defined; but that they extend at least as far south as Rome is too well authenticated by the mischief which the ARVICOLA TERRESTRIS (*Bonap.*) does to the gardens and vineyards there, by gnawing the young shoots, and by burrowing in and destroying the embankments in the neighbourhood of Leghorn. So great is the injury done by it, and by the foxes, in scratching up the ground in gardens to get at it, that the price paid for its destruction at Rome is one half more than for the Mole. At least three species are found in Italy,—A. TERRESTRIS, A. AMPHIBIUS, and A. ARVALIS.

It is interesting to find the migratory instincts showing themselves in the southern species as well as in the northern, when occasion calls it forth. Prince Bonaparte* mentions that it appears to change its habitat according to the rains, leaving the low country when it is inundated, and gradually advancing as the waters subside. In the year 1837, four-fifths of the entire harvest in the province of Piombina, in Italy, were devastated by the Field-mice, which had been driven to the high grounds by heavy floods in the meadows. In a single province in Germany, in 1822, 1,570,000 Mice were captured in fourteen days, as shown by official reports." In like manner, the injury done by them to young trees and shrubs in America has sometimes proved excessive.†

The long-tailed Field-mouse is scattered over almost the whole of the temperate regions of Europe, and does considerable mischief by its economical habits. It lays up an astonishing amount ("vast magazines," according to Pennant‡) of acorns, nuts, corn, and various seeds, or even roots, as a store for winter, as Virgil says:—

"Saepe exiguus mus
Sub terris posuitque domos atque horrea fecit."

The house and granary alluded to by Virgil is formed under ground, either in holes excavated by itself, or more frequently in small natural excavations under the trunks or roots of trees enlarged by themselves, or in the deserted runs of the mole.§

The Field-mice are divisible into two sections, ARVICOLA proper and HYPUDÆUS, the former distinguished by the molar teeth being without roots, the latter by their having two roots; and by the former having the ears more or less concealed, while in the latter they are distinct and well developed.

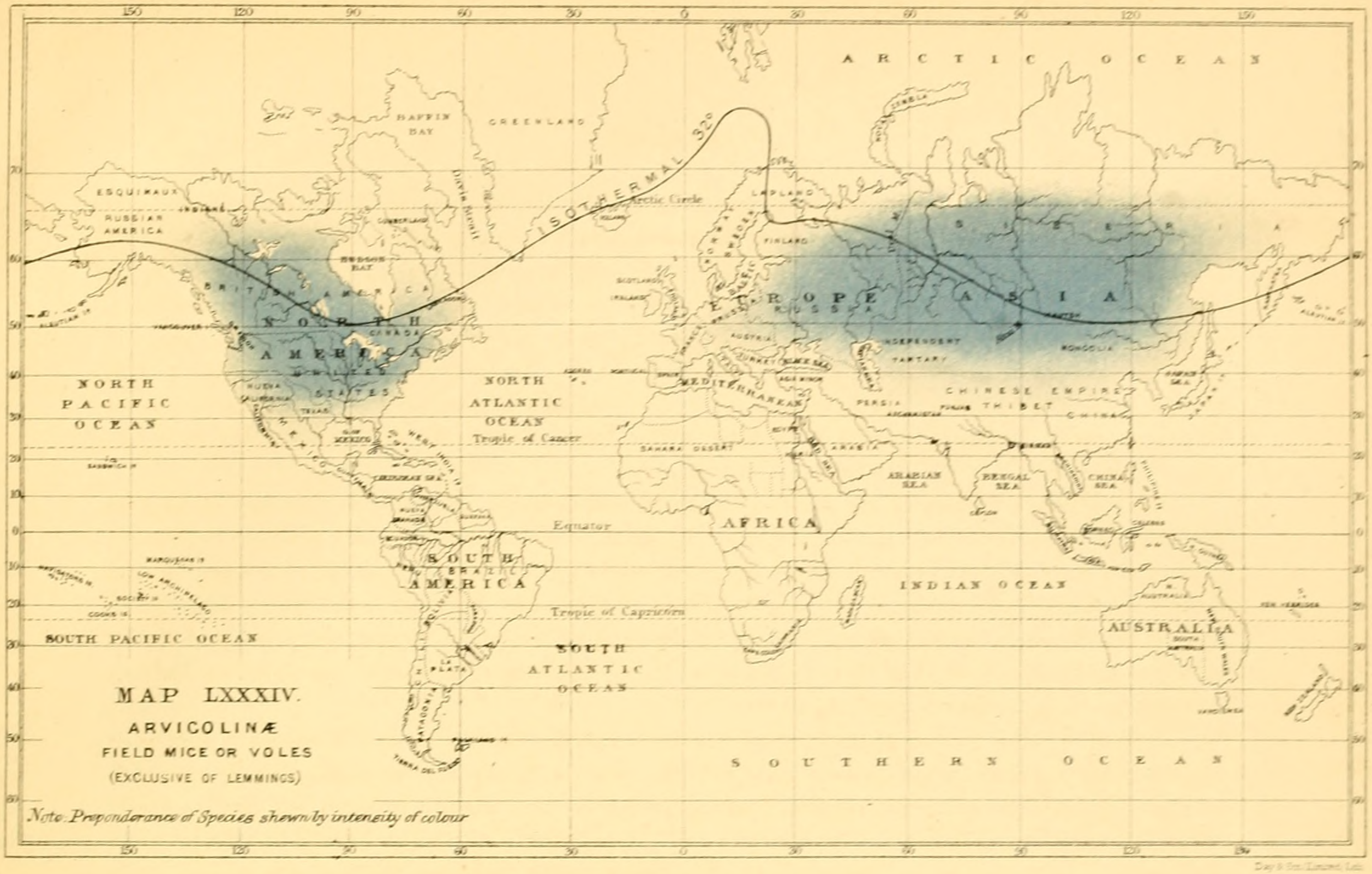
Dr. Baird, who has studied them carefully, says, in regard to the Old and New-World species: "As a whole, the skulls of American ARVICOLÆ differ from the European, as in only one species, (ARVICOLA AGRESTIS, from Sweden) have I found an accordance in every general respect with the

* BONAPARTE, "Iconographia della Fauna Italica."

† BAIRD, "General Report U. S. Pacif. Railroad Exploration," vol. viii. 510.

‡ PENNANT, THOMAS, "British Zoology," 1812, vol. i. p. 148.

§ BELL, THOMAS "History of British Quadrupeds," 1837, p. 306.



MAP LXXXIV.

ARVICOLINÆ

FIELD MICE OR VOLES

(EXCLUSIVE OF LEMMINGS)

Note. Preponderance of Species shewn by intensity of colour

MAP LXXXV.

LEMMINGS.

(MYODES)

American. An exception must, however, be made for the species of HYPUDÆUS, in which there is a close concordance."* Of these, there is only one species in America; it constitutes the connecting link between the Arvicoline HESPEROMYS and SIGMODON, and the ARVICOLÆ proper.

LEMMING (MYODES). (Map 85.) The Lemmings can easily be distinguished from the Field-mice by their feet having hairy soles, and by having their claws sickle-shaped and adapted for digging. They are confined to the Arctic portion of the northern hemisphere. The most northerly species is that best known by the name of MYODES GRŒNLANDICUS, which might have been more appropriately named, for although it is found in Greenland, that country is not its head-quarters. It was first described, and the specific name affixed, by Dr. Traill, from individuals procured by Capt. Scoresby on the east coast of Greenland, but it is not mentioned in Fabricius' "Fauna Grœnlandica," and its more especial habitat is the extreme northern shores of Asia and America. In Capt. Parry's second expedition a considerable number were caught in Repulse Bay. Mr. Goodwin (although he did not himself see them, not having landed) speaks of what must have been this Lemming, occurring in great numbers on the west side of Baffin's Bay, about lat. 70° near Agnes monument.† Middendorff‡ has shown that this species has been described under several names, and that the name entitled to adoption on the ground of priority is M. TORQUATUS of Pallas. One variety found on the shores of Hudson's Bay, distinguished by having the two middle fore-claws very large and much compressed, with the extremities blunt and divided by a terminal notch into two points, one above the other, seemed to have good claim to be considered distinct, and was described and known under the name M. HUDSONIUS; but it now turns out that exactly the same peculiarities are observed in Asiatic specimens, which were described by Baer as LEMMUS UNGULATUS.

In speaking above of the long-tailed Field-mouse, I reminded the reader of the nature of its habitation with some exactness, because it is the only guide we have to enable us to determine whether that species does or does not exist in Iceland, or whether, as I suppose, it is the Lemming which has been mistaken for it there—a fact which, as the reader knows, must have rather an important bearing on the past geological history of that part of the northern hemisphere.

Let us see how far the habits recorded of the Iceland species agree with those of MUS SYLVATICUS. I only know of three authorities who speak of its occurrence in Iceland with anything of a personal knowledge of the subject, and none of the three saw it themselves. The testimony of two of them, however, is so strong as to leave little doubt that something of the mouse kind does occur there. The three authorities are: 1. Olafsen and Povelsen, who, while they speak of it as only a variety of the domestic mouse, narrate an anecdote of its habits which is inconsistent with this supposition. 2. Sir William Hooker, who laughs at the anecdote, and states that the MUS SYLVATICUS is not, to his knowledge, found in Iceland; and 3. Ebenezer Henderson, who corroborates Olafsen and Povelsen's statement apparently on good grounds.

The account given by Olafsen and Povelsen is as follows:§—"There is but a small number of Mice in Iceland, and the white Mouse of the woods (MUS SYLVATICUS) appears to be only a variety of the domestic Mouse. The instinct of this little animal induces it to collect a quantity of grain for its winter provender; and its magazines may be frequently discovered in the woods and outskirts. We were assured that these Mice undertake long journeys, and even cross rivers, on which occasion they have the sagacity to pass the water in a diagonal line; they use pieces of dry cow-

* BAIRD, loc. cit. p. 511.

† GOODWIN, R. A., "Arctic Voyage," 1850, p. 114.

‡ MIDDENDORFF, "Siberische Reise," 11. Wirbelthiere, 1853, pp. 87–108.

§ OLAFSEN and POVELSEN, "Travels in Iceland," 1805, i. p. 117, English translation, 1806, p. 58.

dung for rafts, which they load with grain on their return. The number attached to one of these rafts is from four to ten, and each of them assists in launching it. It is also curious that they swim on each side, and their faces are opposite, while their tails serve for rudders. These voyages are not always successful, for sometimes their boats sink, when they save themselves by swimming with wonderful ingenuity. These curious circumstances were detailed to us by persons of credit, who had had ocular demonstration of the fact."

Pennant takes up this statement, and in his "Arctic Zoology," probably on its authority, says that "there is a species in Iceland, allied, as Dr. Pallas imagines, to the *economic Mouse;* for, like that, it lays in a great magazine of berries, by way of winter stores. This species is particularly plentiful in the wood of Husafels. In a country where berries are but thinly dispersed, these little animals are obliged to cross rivers to make their distant forages. In their return with the booty to the magazines they are obliged to repass the stream of which Mr. Olafsen gives the following account."—He then quotes Olafsen's statement, and adds, "When I consider the wonderful sagacity of beavers, and think of the management of the squirrels, which, in cases of similar necessity, make a piece of bark their boat, and their tail the sail, I no longer hesitate to credit the relation."*

Sir William Hooker (then Mr. Hooker), shortly after his return from Iceland, takes exception to Pennant's view of the matter. "I am sorry," says he, "such a ridiculous story should have been believed by a British zoologist. Iceland certainly possesses no species of *Mus* which our country does not possess, and the Mice that are found there are not likely to be furnished with any instinct or faculties superior to those of our own Mice. The circumstance above is laughed at by the more sensible Icelanders, and the species that performs these extraordinary feats which, according to Povelsen, is the Mus sylvaticus of Linnæus, is not, to my knowledge, found in that country."†

Mr. Henderson, however, being cognisant of Hooker's scepticism on the point, took advantage of the opportunities which a residence on the island for some time, gave him to get as much information about it as he could. He appears not to have seen it himself, but he says, "There is nothing about Husafell deserving of notice except its Mouse, the history of which has rendered it more famous than other parts of the island where the same zoological phenomenon has not presented itself. . . . Having been apprised of the doubts that were entertained on this subject, before setting out on my second excursion, I made a point of inquiring of different individuals as to the reality of the account, and I am happy in being able to say that it is now established as an important fact in natural history, by the testimony of two eye-witnesses of unquestionable veracity, the clergyman of Briamslaek, and Madame Benedictson of Stickesholm: both of whom assured me that they had seen the expedition performed repeatedly. Madame Benedictson in particular recollected having spent a whole afternoon, in her younger days, at the margin of a small lake on which these skilful navigators had embarked, and amused herself and her companions by driving them away from the sides of the lake as they approached them. I was also informed that they make use of dried mushrooms as sacks in which they convey their provisions to the river and thence to their homes. Nor is the structure of their nests less remarkable. *From the surface of the ground a long passage runs into the earth, similar to that of the Icelandic houses, and terminates in a large and deep hole, intended to receive any water that may find its way through the passage, and serving, at the same time, as a place for their dung. About two-thirds of the passage in, two diagonal roads lead to their sleeping apartment and the magazine, which they always contrive to keep free from wet.*‡

* Pennant, Thomas, "Arctic Zoology," Introduction, p. lxx.

† Hooker, W. J. "Tour in Iceland," 1813, i. p. 52.

‡ Henderson, Ebenezer, "Journal of a Residence in Iceland, in the years 1814, 1815, 1818," ii. 186.

Now I by no means participate in the unbelief of Sir W. Hooker; and I feel very sure that had his "Tour in Iceland" been written in 1863 instead of 1813, the sceptical passage would not have been found there.

That an economic rodent lives in Iceland is, I think, established; but the account given of its runs and granaries makes it not less clear that it is not MUS SYLVATICUS. There is no European Mouse that makes a nest in the manner described by Henderson.

But there is an animal very like a Mouse (the Lemming) which does make extensive burrows. It is provided with powerful sickle-shaped claws specially adapted for digging, and although I have not met with any account of the plan on which their burrows are constructed, there is abundant evidence that they do make them. Captain M'Clintock says in his diary of the expedition of the "Fox:"—"Hare-tracks are pretty common along the shore, and upon the sides of steep hills; they make burrows under the snow, but we have never found them in the earth like those of the Fox and Lemming." Von Baer says that in Nova Zembla gentle declivities are frequently burrowed through in every direction by them. In fact, the habit is notorious.

Another point in favour of the Iceland animal being a Lemming is, that Olafsen speaks of it as often white. Now although the MUS SYLVATICUS sometimes may be found white, when such a thing occurs it is only a case of albinism, and rare. But the Lemming in America is said regularly to become white in winter, although not so completely so as the Weasels. Both in Spitzbergen and Nova Zembla a little white animal has been observed. MM. Pachtissow and Ziwolka, during their winter stay in Nova Zembla, saw a little white animal in their hut which they, in their journal, call a Mouse. According to Mr. Ziwolka it was larger than a common domestic Mouse, and therefore could not have been a white individual of that species. It was doubtless a Lemming. According to Von Baer there are two species of Lemming found in Nova Zembla, one of which he considered identical with the MYODES HUDSONIUS.

As the Lemming is an Arctic animal, it must pass a longer night of winter than ordinary torpidity could survive. Some arrangement for a winter supply is therefore plainly necessary, and it is scarcely possible to conceive anything better adapted to the purpose than that described by Henderson.

I have, therefore, no doubt in my own mind that the economic Mouse of Iceland is a Lemming; and as Greenland is the nearest point where Lemmings have been found, I think it a fair conjecture, until rebutted by direct evidence, that the species found there is the American Lemming MYODES HUDSONIUS.

Five species of Lemming have been described as North American, and, with the exception of the Greenland species, they have been thought peculiar to the New World. Middendorff reduces them to two, both found in the Old World as well as in the New. If he is right in this, the Lemmings supply two of the very few mammals which are found on both sides of the Atlantic.

In addition to these there are three species found in Europe and Asia. One, M. LEMMUS, inhabiting the western part, Norway and Sweden; a second, M. LAGURUS, the middle part about the Ural River; and the third, M. SCHISTICOLOR, which has been found both in Norway and on the west coast of the Sea of Ochotsk.

SPALACINI.

MOLE RATS. (Map 83.) A small group of mole-like burrowing Rats, nearly, or wholly, blind. We are either very imperfectly acquainted with their range, or the group is

not a natural one. They are dotted down (see Map and List in Appendix) at the Cape of Good Hope, in Abyssinia, the Malayan Peninsula, South of Russia, and the Altai Mountains. There they seem to be found in at least two distinct geographical regions, and perhaps animals of two types are confounded under one head.

Saccomyinæ.

Pouched Rats. (Map 78.) There are two kinds of Rats possessing cheek-pouches; the Hamsters, or Rats with internal cheek-pouches: and the Gophers, or those with external cheek-pouches. There are no sufficient characters for separating the former from the rest of the Murini. The internal cheek-pouches are of so little importance that in one of the genera (Hesperomys) a species occurs possessing cheek-pouches (small, to be sure, but still distinct), while all the rest of the genus are without them. In all arrangements, therefore, the Rats possessing internal cheek-pouches have been left along with the others; but, as already mentioned, the Rats with external cheek-pouches have been raised by some authors to the rank of an independent family. The characters on which the family, thus constituted, is chiefly rested, are the external cheek-pouches and four molar teeth in each lower jaw; but as the number of molars in each lower jaw of the normal Murini is not constant, but two in some and three in others, there seems no reason why another group with four should not be admitted, if that were the only ground for separation; and as to the external cheek-pouches, I think I can, in a few words, show that that is not a character of any very great structural value. A short account of what we know of them will prove this.

The reader no doubt remembers the representation of a queer-looking animal, which he has seen figured in illustrated natural-history books, like a Mole or Rat, bearing a couple of large, vascular, oval, egg-shaped bodies, apparently pinned one to each jaw. Figs. 1*a* and 1*b* are copies of part of it. This figure was meant for a portrait of the Geomys bursarius, or "Sand-Rat of Canada," and the unnatural-looking, egg-shaped bodies, are the cheek-pouches, supposed to be filled with grain. It was first described and figured by Dr. Shaw;* and fuller accounts were afterwards supplied by Richardson of the anatomy and habits of another supposed species, G. Douglasii;† including the mode in which it filled and emptied its cheek-pouches (by pressing them with its fore-paws). Nay, if any one be sceptical, is there not the stuffed specimen from which Dr. Shaw described it, and from which his figure, which until lately has been copied by all subsequent authors, was taken? It was in Mr. Bullock's Museum, which afterwards passed into the hands of Temminck, and no doubt it is still to be seen in the Leyden Museum. There can surely be no mistake here. But yet, is it not rather curious that no one has ever seen another specimen like this,—that even Sir John Richardson never saw it,—that, inhabiting such a well-peopled country as Canada, no one has ever got a peep at it? Still, there is the specimen itself, challenging contradiction. But when modern science begins to put the subject to the question, we learn that no such *lusus naturæ* ever existed. It turns out to be an error, originating in the whim of an Indian.‡ It appears that, in 1798, one of this species was presented by a Canadian Indian to the lady of Governor Prescott. Its pouches had been inverted, filled, and greatly distended with earth: and from this trivial circumstance an error originated, which has been perpetuated even to the present day.

Even after the true nature of the animal and its cheek-pouches was ascertained, Sir John

* "Linnean Transactions," vol. v. p. 237.

† Richardson, "Faun. Bor. Amer." i. 203. 1829.

‡ Audubon and Bachman, "North American Quadrupeds," i. 332. 1849.

MAP LXXVIII
POUCHED RATS.

Cricetus (Hamster)
African genera
Gophers (Saccomyina)

MAP LXXIX
RATS & MICE EXCLUSIVE OF
HOUSE RATS & MICE MUS DECUMANUS, RATTUS, TECTORUM & MUSCULUS INTRODUCED EVERYWHERE.

Mus &c.
Hesperomys { *Vesper Rats* / *Mice*

Day & Son (Limited) Lith.

Richardson was slow to discard his original conception. In the zoology of Captain Beechey's Voyage he repeats his belief that "the figure in the Linnean Transactions is a correct representation of the form of the animal, and gives the true appearance of its cheek-pouches when distended with food."* He in some way had become convinced that the cheek-pouches of both GEOMYS BURSARIUS the original culprit, and of GEOMYS DOUGLASII, opened internally, and were pendulous; and he described the Californian Gopher as a new genus, under the name of DIPLOSTOMA BULBIVORUM, because he could not get the pouches to assume this form. He tried to evert them, without success. They would not become pendulous. "Its bottom alone can be turned out, by which it is emptied of its contents in the manner mentioned by Mr. Schoolcraft: but the lining of the exterior parietes of the pouch is firmly united to the external skin, and is incapable of being everted."† He forgot that the knife of the taxidermist passed between the two would separate the folded skin easily enough.

Fig. 2 shows the true form of the mouth of the species which gave rise to the mistake. From this

Fig. 1*a*.—Hypothetical Sand Rat (Geomys bursarius.)

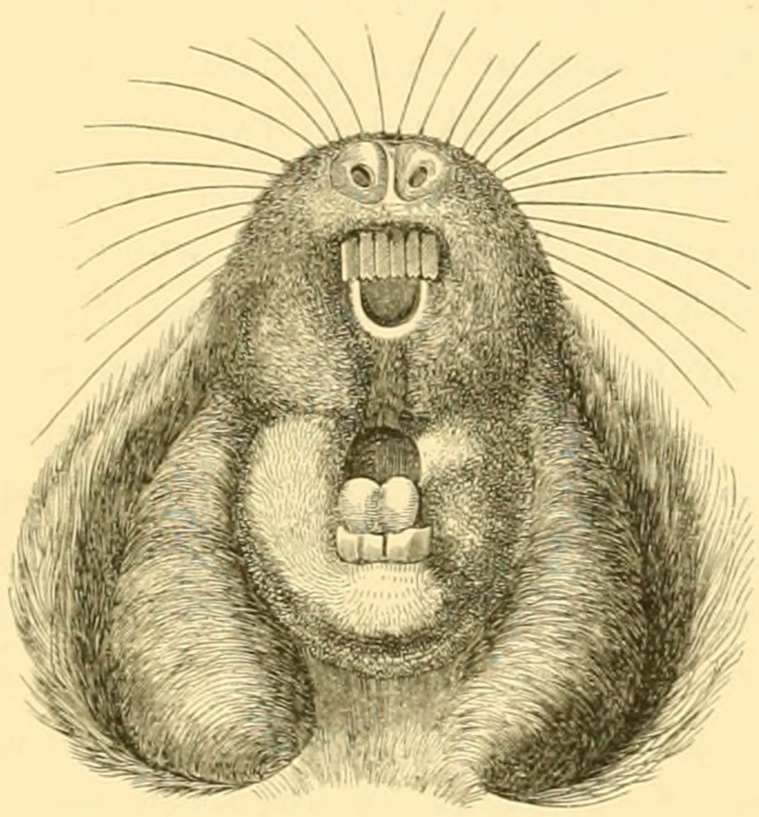


Fig. 2.—Real Sand Rat (Geomys bursarius.)

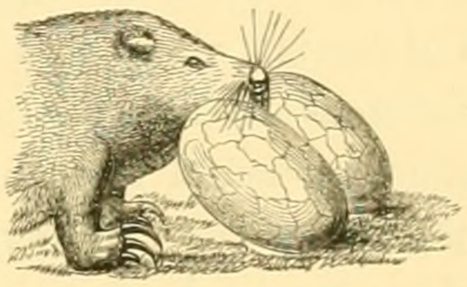


Fig. 1*b*.—Hypothetical Sand Rat (Geomys bursarius.)

we see that the mouth of these GEOMYNÆ is very peculiar. It is a sort of double mouth—an outer hall or porch, and an inner room: the outer hall is clothed with hair, like the rest of the body, the hair extending behind the incisors, both above and below; and it is in the side-walls of what are really its wide lips that the pouch occurs. What is called the mouth only commences at the molars, and the entrance to it is very small, as the entrance to the other is very wide. The incisors have a most peculiar look, thus standing isolated in the midst of the hairy face; but there is nothing unnatural in it. There is no physiological reason why hairs should not grow on the mucous membrane of the mouth, as well as on the skin of the face or body. The one is a mere continuation of the other, and we see it grow in the mouth in some animals. The whale grows its moustache inside its mouth instead of outside. The Rhytina grew it in its palate; whalebone, horn, and hair being all different forms of the same thing. It therefore appears that the term, external cheek-pouches, is a misnomer; although apparently external, they are, in reality, internal, and situated in quite the same homological position as those of the Hamster. The idea of

* BEECHEY'S "Voyage, Zoolog." p. 9.

† RICHARDSON, op. cit.

Lesson, who grouped all the Pouched Rats together, was, therefore, not so unreasonable a proposition as it looks like. Were it not for the other anatomical differences I should follow his example.

As to their geographical distribution, the whole of the externally-pouched species belong to the New World; the whole of the internally-pouched species to the Old World. The New-world species are all North American, at least none reach further south than Central America. They form two very distinct and strongly-marked groups; so much so, that one of the objections taken by Brandt in his revision of the order to Waterhouse's family of the Saccomyina, was the want of affinity of these two groups. The one group, consisting of the genera Geomys and Thomomys, being heavy, thickset, burrowing animals, in appearance something between a Mole and a miniature Beaver; the other, Dipodomys and Perognathus, light, elegant, graceful, jumping creatures, with the long hind-legs and short fore-legs of the Jerboa.

The latter form is confined to the west side of the continent, the limiting boundary being, not the Rocky Mountains, but the Missouri district, where formerly rolled the tertiary sea, stretching almost from the Gulf of Mexico to the Arctic Sea (see Map 81).

The former, our friend the "Sand-Rat of Canada," known throughout all the west of North America as the Gopher,* again naturally breaks into two sections; one the Geomys, with the superior incisors broad and grooved; the other, the Thomomys, with these incisors narrow and smooth. These are the pest and dread of the horticulturist wherever they occur. In some parts of California, where they abound, nothing under-ground escapes them—turnips, carrots, and every tuberous or bulbous plant is eaten up. Here, again, we have, even more markedly, the same phenomenon of distribution which occurs with Dipodomys. The species of Geomys are confined to the east of the continent, and those of Thomomys to the west. And what is the line of demarcation? the same as before, the tertiary beds dividing the continent from the north to the south. There are, however, two other specialties to be noted; one on the north and one to the south. On the north, Thomomys crosses the border line, and sends a species on to the shores of Hudson's Bay. How comes this western species to have passed the line which seems to have been an effectual barrier further to the south? Probably by migration subsequent to the elevation of the tertiary basin; we have seen that migration is more likely to occur with northern than southern species, and we know of no break in the tertiary beds to the north of Nebraska; still the whole of that portion has not been thoroughly surveyed, and breaks may exist which we do not yet know of, by which the animal may have passed.

The other point to be noted is, that to the south the eastern Geomys crosses the line of the limiting boundary in Texas, and goes south into Mexico and Central America. The western Dipodomys also goes south through Mexico into Central America, but that has no special significance on this point. It is merely a continuation further south of its natural range. But it is different with Geomys, which comes from the other side of the continent. If the reader will refer to Map 3 he will see, that there probably did exist a dry-land passage across the tertiary basin in the north of Texas, exactly in the line by which this species has extended its range.

There is another point on which the extent of the southern range of these species has a bearing; and that is, the limiting line between the faunas of North and of South America. These northern species are found as far south as Guatemala. There are other facts of the same nature, but there

* In the south-eastern states of North America that name is applied to the large Tortoise, and the Geomyna are there called Salamanders.

MAP LXXX

JUMPING MICE.

Meriones — *Hapalotis*

Day & Son (Limited) Lith.

MAP LXXXI.

GOPHERS.

Geomys

Thomomys

Note. Dipodomys & Perognatus same range as Thomomys besides Texas & East Mexico

Day & Son (Limited) Lith.

is scarcely an instance of a northern species having gone further south than the Isthmus of Panama. Southern species have passed to the north of it, but northern seem always to have stopped on the north side of it.

One other observation occurs to me, viz. that these coincidences in the limits of the geographical distribution of the DIPODOMYS and GEOMYS furnish an extraneous argument against Professor Brandt's objection to these being classed together, and in support of the view that they are allied to each other, notwithstanding the dissimilarity in their personal appearance.

MURINA.

RATS AND MICE. (Maps 78, 79, 80, 82.) This family contains a vast number of species, all bearing much resemblance to each other; and the discovery of some characters by which to break it up and render it more manageable is very desirable. Unfortunately, much cannot be expected in this respect: more may be done hereafter by a careful examination of species, and the consequent reduction in their number which will result. I shall commence with the group which comes most naturally after the external-pouched Rats, viz.—

THE HAMSTER. (CRICETUS.) (Map 78.) The Rats with internal cheek-pouches are not numerous. There are eight or nine species, the most widely spread of which is the Common Hamster. It ranges westward from the Rhine to the river Obi, and southwards from the Obi and Irtisch to Persia and Caucasus. Other Species extend the range somewhat further east. The C. FURUNCULUS and C. SONGARUS both inhabit the high steppes of Mongolia, and the former is found in the valley of the Onon, north of Mongolia. The genus does not appear, however, to reach the shores of the Pacific. It does not occur in Schrenck's list of the Mammals of Amourland, nor in Temminck's Fauna of Japan.

A large grey pouched Rat in West Africa, CRICETOMYS GAMBIANUS, probably extends over the greater part of Africa, south of the Sahara, as it has been found in Mozambique as well as Senegambia. Two species of another genus, named SACCOSTOMUS by Dr. Peters, have been obtained by him at Mozambique. Some remains referred to species of Hamster have been found in the tertiaries of Sansans and in the marls of Limagne.

If we now take the remainder of the old genus MUS, we find that it divides itself very naturally into two sections,—Old-world and New-world,—which are characterized by several characters; one of which, first pointed out by Waterhouse, is especially valuable. The Old-world Mice have large and broad molars, each with tubercules placed transversely; and those in the upper jaw have three tubercules in each transverse series. The New-world species have the molars narrower, and only two tubercules in each transverse (or slightly oblique) series. This is a very useful test, as it enables the naturalist to decide at once whether a given species caught on the one or the other continent really belongs to it, or has been introduced from the other. For example, the Black Rat (MUS RATTUS) has established itself so completely in North America, that, according to Dr. Giebel, some maintain that America is its native place, and that it has been introduced from thence into Europe. A glance at the upper molars settles this question, and shows that MUS RATTUS is an Old-world species, and that it must have been communicated from it to the New World, instead of being received from thence. In the same way several of the specimens which were obtained by Mr. Darwin from South America, &c., during his voyage in the "Beagle," and which might other-

wise have been described as new, turned out to be mere varieties of one or other of the Common European Rats; for instance, a Rat from Maldonada, near the mouth of the La Plata, which had sufficiently distinctive characters to lead to its being described and named (Mus maurus), examined with this light is only a dark variety of the Brown Rat. Mus Jacobiæ, from the Galapagos, is another variety; and an isolated species, Mus Islandicus, found nowhere but in Ascension Island, is only the Common Black Rat slightly modified.

A higher rank or degree of organisation has been inferred to belong to the Old-world Rats than to the New, from the former usually extirpating the latter, when they come in contact; but the facts will hardly bear out this inference, for not only is the superiority due simply to the greater size and more powerful teeth of the conquering species (chiefly the Brown Rat), but it is exercised by them as much upon their own countrymen, the Old-world species, as upon the New.

New-World Rats and Mice (Sigmodontes). The old name, Mus, has been reserved for the Old-world species. There are several appellatives for the New-world groups. Some of these (the genera Hesperomys and the North-American Reithrodons) are small and mouse-like; others (Holochilus and Neotoma) are rat-like; and Sigmodon is like the Arvicola, or Field-mouse.

Cotton Rats (Sigmodon). There are only two species of this genus. They are about the size of the Norway Rats, and look like Arvicolæ. They are confined to the southern portion of the United States, from Carolina westwards to Western Texas.

Bush and Wood Rats (Neotoma). These are there presentatives of the larger Muridæ in North America. Some have scaly tails, like our Rats; others have the tail bushy and furry, like the Dormouse, and the fur soft and full. Some of the species are very large, greatly exceeding the Brown Rat in size, and they are also much superior to it in beauty and docility. The genus is confined to North America, and occurs throughout the greater part of it. It is, however, not found in the New-England states. It is met with from the Missouri to the Pacific, and from Mexico northwards. The fossil remains of one extinct species have been found in the caves of Pennsylvania.

Vesper Mice (Hesperomys). The range of this genus is very erroneously laid down in most Physical Atlases—Johnston's and Berghaus' among the rest. It is found over the whole of the continents, both of North and South America; but the South American species all differ a little from the North American; and not only so, but none of the sub-sections into which they have been divided are found in both. Three out of several sub-genera, originally suggested by Waterhouse, have been adopted for the South American species; and Baird has made three more for the North American. The differences on which they are founded are, however, all slight in degree, and do not correspond with any geographical limits, the species being mingled with each other, except that the South American sub-genera, taken as a body, are slightly different in type from the North American, and are for the most part larger in size. Allowing for exceptions in both countries, they can be best characterized by saying that the South American species are all Rats, and the North American all Mice, there being only one North American species of any size, and it not exceeding the dimensions of a half-grown Norway Rat. Dr. Baird says, "A striking feature of the North-American Vesper Mice, to anglicize Wagner's name, is their diminutive size compared with the South American. Many species of the latter are fully equal to the Rats, or even larger, some of them, as Holochilus, with still larger teeth. Scarcely one of our" (North American) "species exceeds four inches to the root of the tail in the flesh, while most are the size of the Common House

Mouse, or less." * The North American species are upwards of a dozen in number. They are generally distributed over the whole country, from the Arctic Circle to Mexico, and it is difficult to say that one region has a greater proportion than another.

Mr. Salvin's list of Mammals from Guatemala contains three species of HESPEROMYS of the North American type, and one of them apparently a species actually found in North America. The South American sub-genus, CALOMYS, which comes nearest to the North American, is not apparently found further or in greater proportion to the North than any of the other South American sub-genera. Its metropolis seems to be South Brazil, which, indeed, has furnished a greater number of species of all the sub-genera than any other part of the country. Patagonia and Chili are represented by more than their due proportion, in consequence of having been the ground which was worked by Mr. Darwin. Previous to his visit, scarcely any were known to inhabit the south of South America. And notwithstanding that his researches were necessarily very cursory, and intermittent, he added between twenty and thirty species to our lists.

REITHRODON. The genus REITHRODON was founded by Mr. Waterhouse, on some Patagonian species of HESPEROMYS, of large size, the chief characters being that the incisors are longitudinally grooved while in Hesperomys they are not. They came from the extreme south of that district, and were the sole representatives then known of the genus. Since then, however, some small slender species of HESPEROMYS, having grooved incisors, have been found in North America, and referred by Leconte and Dr. Baird on the strength of that character, to REITHRODON. Dr. Baird informs us that he has seen neither skulls nor skins of REITHRODON from South America; but he says that judging from the figures giving by Waterhouse, there are considerable differences, not only in size but in other characteristics. It is, however, impossible to indicate these discrepancies without making a careful comparison of specimens from the two countries. The South American REITHRODONS have a body six inches in length, so stout and full, and the head so large and much arched, that one species has been called R. CUNICULOIDES (rabbit-like). The tail, also, does not exceed the half of the body. The North American species, on the contrary, are the smallest of the Mice, scarcely more than half the size of the House Mouse, which they otherwise closely resemble in shape and proportion. The tail is as long as the body alone, or else longer than the head and body together. The shape and character of the skull are quite different.†

Until the species of the South American Reithrodon be compared with the North American, it is premature, therefore, to treat them as identical. To do so may lead to misapprehension of their affinities and geographical distribution. I, therefore, in the meantime, speak of the two as the SOUTH AMERICAN REITHRODON and the NORTH AMERICAN REITHRODON. Three species of the South American genus are known, one inhabiting the open grassy Savannahs of Maldonado, another the coast of Patagonia, and the third the Straits of Magellan. The North American genus contains four or five species, which are confined, on the Atlantic border, to the Southern States. They are found about St. Louis, and westward to the Rocky Mountains. Species occur also in New Mexico, Sonora, and California.

We have already seen that there are grounds for believing that the break between North and South America, which at some former time must have existed, probably did not occur to the north of Guatemala, but between it and New Granada. The distribution of HESPEROMYS and of the REITHRODONS confirms this view. Besides the three HESPEROMYS of the northern facies above mentioned, Mr. Tomes'‡ list of the mammals collected by Mr. Salvin in Guatemala, contains two

* BAIRD, op. cit. p. 455.
† BAIRD, op. cit. p. 448.
‡ TOMES in "Proc. Zool. Soc." p. 278, 1861.

Reithrodons of the North American type, one of them a North American species; one Sigmodon, also North American; and a new species of the North American genus of Rats, Neotoma. Other similarly allied species of Squirrels, &c. were also met with.

Old-world Rats and Mice (Mus). An immense number of these have been described, and a careful revision of them is much needed. In the purged list which I have given in the Appendix, it will be seen that there are still ninety-three species reckoned good, while sixty-six have been disallowed as synonymes. Dr. Giebel, who is more trenchant, admits only thirty-three species as distinct, but after absorbing upwards of thirty names of described species as synonymes, he records forty-five other supposed species, the descriptions of which are so insufficient that he has been unable to decipher them, or to express any opinion upon them.

Out of this large number there are four species which are almost cosmopolitan. Originally, undoubtedly, from the Old World, they now inhabit every quarter of the globe; the Common Mouse, the Brown Rat, the Black Rat, and the Mus tectorum, or Egyptian Rat. Whence they have respectively sprung is involved in obscurity.

The Common Mouse may perhaps not be so completely cosmopolitan as is generally supposed. Mr. Blyth remarks that he has never seen an Indian specimen. It appears, like the Rats, to vary under altered conditions of life, the specimens in Guatemala, for example, being smaller than usual.

The Brown Rat, judging by its English names, last came from Norway or Hanover, it being generally known as the Norway or the Hanoverian Rat. The latter, however, was a political name, or name of prejudice, used by Old Jacobites, to signify that all ill things came in with the Hanoverian Succession. But both names are equally erroneous; and the commonly received opinion that the species originally came from the centre of Asia,—that *terra incognita* to which man, when puzzled, has had recourse for the original site of many species, must, according to my view, be not far from the right one; to the south of Northern Asia I look for almost the entire re-peopling of Europe after the glacial epoch. It was Pallas who first gave currency to the notion that the Brown Rat also came from that quarter. According to him it belonged originally to the warmer regions of Central Asia,—more especially Persia, which rather refractorily happens to be one of the very few places where the Rat in question is *not* to be found. Capt. Hutton, in 1846, states that "house rats are unknown in Kandahar;" and Mr. Blyth* mentions, that in India it is chiefly observed about the ports, a significant enough indication whence it came there—Schrenck† also informs us that it is not known in Siberia, though frequent in China, Japan, and Amourland, into which it appears to have penetrated from the coast. A good proof of the recent introduction of the Rat into Europe, were one needed, is furnished by the fact that neither the ancient Greeks nor Romans had a name for it. As with potatoes and other novelties, not knowing the thing they could not name it. The Mouse is the only species that they seem to have known, and even it seems not to have been very common, for when the Emperor Heliogabalus got up a mouse-show in Rome, all that he mustered was about ten thousand.‡ There would be little difficulty in collecting ten millions now-a-days. Pallas gives no very ancient date for the advent of the Brown Rat into Europe. He says it crossed the Volga from Central Asia in large troops in 1737, peopled Russia, and subsequently spread over the whole of Europe. According to Erxleben it reached England in 1730, France in 1750, which, looking to Pallas's date, seems all in harmony, rightly reasoned and in his own division,

* Blyth, "Catalogue," p. 113.

† Schrenck, "Mammals of Amourland."

‡ Lampridius, "Hist. Aug. Scriptores," ed. Casaubon, 1690, p. 110, as quoted in Marsh, G. P., "Man and Nature or Physical Geography as modified by Human Action," 1864, p. 80.

viz. the anticipatory order, reaching England before France, and indeed before it had set out at all. In 1775 it was taken to North America, some time subsequent to the Black Rat, which had already secured a footing there; it, however, soon encroached on it, and has now nearly exterminated it. Azara, who wrote in 1801–1802, mentions it as found in Brazil; and it certainly was common in Jamaica at the beginning of this century. Whenever it has once gained a footing, its progress has been wonderfully rapid. It is as common now in California as anywhere else, although it was unknown there prior to the gold fever. Audubon and Bachman, in 1851, spoke of it as not found on the Pacific Coast.

The Black Rat is a longer known animal, and, if that can be, its origin is involved in still greater obscurity. From time immemorial it has been the "house rat" of the civilized world. It is, however, now fading away before the Brown Rat, and is so nearly exterminated in Britain, that in most places it has become a matter of difficulty to procure a specimen. It still lingers in some of the out-of-the-way places in the thatched roofs of cottages, or at least did so a few years ago. It may not be so now, for it is difficult to predicate what change may have taken place in a very short time, where we have to do with such a very pushing fellow as the Brown Rat. According to Erxleben, the Black Rat was brought to the New World about 1544, that is, just about fifty years after its discovery by Columbus, and it increased so rapidly, and to such an extent, as to have given rise to the supposition already noticed, that it was introduced into the Old World from the New. It is said to have been introduced at an early period into New Zealand by European vessels, and it has now overrun the island, and nearly exterminated a former native species, the only terrestrial mammal yet ascertained to have existed in New Zealand. The Norway Rat had not made its appearance there in 1843, but it is no doubt by this time executing retributive justice upon the Mus rattus.

There are one or two facts connected with these Rats, which, although in the present state of our knowledge, we may be unable to draw any conclusions from them, should be kept in view. The reader knows that domestic animals more readily undergo variation than the real *feræ naturæ*. A moment's reminiscence of the numerous breeds of Cattle, Sheep, Dogs, Horses, &c., puts that beyond doubt. Is it the same with the semi-domesticated animals; that is, those which, without his sanction, have constituted themselves in some shape or other parasites or hangers-on about man? Mr. Waterhouse, speaking of variations in the Rat, thinks that it does apply to them. The instances which lead him to make the remark, arise out of the species of Rats brought home by Mr. Darwin, from the voyage of the "Beagle," and which were described by Mr. Waterhouse in the "Zoology" of that expedition. In the Galapagos were found two Rats; one of the Vesper type, which does not bear upon the point I have now in view. It doubtless dated its origin from the time when the Galapagos were united to the mainland. But there was another, and it was of the Old-world type. It was very like the Black Rat, but did in some respects differ,—its head was rather shorter in proportion,—its tail was longer, and the tarsi smaller. In other respects, and more especially in the character of the fur (which furnishes good means of distinguishing species) "it *very* closely resembles that species." Nevertheless, being so far distinct, Waterhouse, to preserve recognition of it, be it species or be it variety, gave it the specific name of Mus Jacobiæ, it being found in the island called James Island. If a new species, it is one which has been made within a few generations. We can almost specify the date since which it has been made. Being of the Black Rat kind it must have been established on the island previous to the supremacy of the Brown Rat, that is, before the latter had become the commoner kind in ships and houses. Darwin

mentions that the island was frequented about 150 years since by vessels belonging to the buccaneers: this therefore gives the date, and he adds, "If a peculiar climate, volcanic soil, and strange food, can together produce a race or strongly marked variety, there is every probability of such change having taken place in this case."*

The Egyptian Rat (Mus tectorum, or Mus Alexandrinus) is another species which may possibly have been an offshoot from, or descendant of, the Brown Rat (Mus decumanus). The former is now common in Italy, where it must have come apparently about the same time as the other; for, as already said, Rats were unknown to the ancient Romans. It comes nearer the Brown Rat than the Black Rat, although, like it, it has the tail as long as the head and body together, which the Brown Rat has not. Its habits differ somewhat from those of the latter, preferring dry places—a point on which the Brown Rat is indifferent.

There is another fact which may be used as an argument both for and against its being a scion of the Brown Rat, and that is, that the two are at all times in a state of determined hostility; but being stronger and more courageous than the Black Rat, the Egyptian species has been able to wage a more equal warfare with the former, and has hitherto escaped extermination. Their mutual antipathy may be an argument against their common parentage — although family quarrels are usually said to be the most bitter — and their strength and courage may be pointed to as qualities which it might be likely to possess if descended from the Brown Rat. If we could argue from our present knowledge of the Brown Rat's constitution, viz. that it bears all climates, and only varies when protected by isolation from the restoring influence of fresh blood of the common stock, that would dispose of the question without the necessity of going into these topics; but the fact is, that we know its history for such an infinitesimal portion of time — not a couple of hundred years — that we cannot tell whether it is less or more liable to change than any other animal. If the Mus tectorum is descended from the Brown Rat, it has passed the phase of variety, and become a full species.

Again, on the Island of Ascension, Mr. Darwin found two Rats,—varieties, as he and Mr. Waterhouse consider, of the Black Rat. These two animals differ in the colour of the fur, one being of a grizzled brownish colour, the other black, with more soft or glossy fur. That which has a black and glossy fur frequents the short, coarse grass near the summit of the island, where the common Mouse likewise occurs. It is often seen running about by day, and was found in numbers when the island was first colonized by the English.

The other, and browner-coloured variety, lives in the outhouses near the sea-beach, and feeds chiefly on the offal of the turtles slaughtered for the daily food of the inhabitants. "If the settlement were destroyed," says Mr. Darwin, "I feel no doubt that this latter variety would be compelled to migrate from the coast. Did it originally descend from the summit? and in the case first supposed, would it retreat there? and if so, would its black colour return? It must, however, be observed that the two localities are separated from each other by a space some miles in width, of bare lava and ashes. Does the summit of Ascension, an island so immensely remote from any continent, and the summit itself surrounded by a broad fringe of desert volcanic soil, possess a small quadruped peculiar to itself? or more probably, has this new species been brought by some ship from some unknown quarter of the World? Or I am again tempted to ask, as I did in the case of the Galapagos Rat, has the common English species been changed by its new habitation into a strongly marked variety?"† Mr. Waterhouse remarks upon this: "It appears as if the brown and

* Darwin in "Zoology of the Beagle," part ii. Mammalia, p. 35.

† Darwin, loc. cit.

black Rats, and likewise the common Mouse, all of which follow man in his peregrinations, and which to a certain degree are dependent upon man, and may, therefore, be termed semi-domestic animals, are subject to a greater degree of variation than those species which hold themselves aloof from him."*

The cases, however, do not seem parallel. If the change means anything in these instances, it is not the variation of a new breed, but the formation of a new species. We know that in the case of the very same species the individuals which have settled in Europe show no difference in any part of it; that those which have colonized North America and the greater part of South America have as yet remained constant; that the same is the case with the emigrants into Africa, India, China, Australia, and New Zealand. But we are, perhaps, dealing with an animal which has constitutionally great powers of enduring change of condition of life. Next, wherever man has been present to watch the process of variation, no variation has taken place, but in desert places like the Galapagos, or nearly uninhabited, like Ascension Island, there variation has shown itself; therefore isolation would seem to have something to do with it. It is as if in ordinary circumstances the inclination to change of form induced by change of condition of life was never allowed to operate, or each step towards change obliterated as soon as made by the prepotent influence of fresh blood from the normal type; but access to this being prevented in isolated situations, the progress to change is able to go on uninterrupted. The changes in other places may probably only be postponed, not refused. As just remarked, we must remember that we are dealing with an animal which has been exposed to change only for a very short period—the Brown Rat not for a hundred years, the Black Rat only for a slightly longer period; and sure enough it is in the species which has been longest exposed to it, viz., the Black Rat, that the most decided of these alterations have been observed.

One of the most interesting points connected with the distribution of Rats and Mice, is the occurrence of many species in Australia. It was for a long time thought that that continent possessed no placental mammals. But not only is this not the case, but the number of placental species is very considerable. They are, however, all rodents and bats, and the rodents all belong to this family. The Frontispiece sufficiently illustrates the similarity between one of the Australian placental Mice and the marsupial ANTECHINI. It is to be noticed, that the Australian species all belong to the Old-world type and not to that of the American species.

Almost the only part of the habitable globe where Rats and Mice are absent is the Arctic regions, and the elevated steppes of Central Asia. There they are replaced by Voles (Field-mice). Even in the burning Sahara the little Mouse makes its home, and the species there found are, like many others of her creatures in the same or similar circumstances, provided by Nature with a disguise which secures their safety by their modest garb, being dressed in a livery of the same colour as the soil on which they pass their lives.

In warm climates the species attain the greatest size, the Bandicoot Rat of India (not the Bandicoot of Australia, which is a totally different animal), M. GIGANTEUS, one of the largest being upwards of two feet in length.

Fossil remains of several species have been found in tertiary deposits in France and Germany.

Shakespeare says "there be land-rats and water-rats;" it is only in Australia, however, that this can be said with truth. Our Water-Rats are not Rats, but Voles (ARVICOLÆ); but two or three

* WATERHOUSE, op. cit.

species of a Water-Rat between the two are found in Australia, and a separate genus, Hydromys, has been established for their reception.

New Zealand is one of the few lands which are without, or almost without, aboriginal Mammals. One or two Bats, a small Rodent, and a questionable trace of an Otter, are all the non-marine mammals which have been found on, or supposed to belong to, it. The Otter rests upon footprints seen by Mr. Haast. The Bats are correct enough; and there is no doubt that a Mouse or Rat of some kind did, in former times, inhabit the country; but what it was is still very doubtful. They are said to have been extremely numerous in old times, and seem to have been regarded much in the same light as we regard game: for instance, the fact of their ancestors having caught Rats on any portion of land gave the Maoris a certain right in it—I presume, a sort of servitude, or right of shooting or hunting, which had to be bought up by the settler before he could obtain safe possession of the land—although the claimant may never have caught Rats on it himself; which, indeed, could now scarcely be done, because there are no Rats to catch, except "Pakeha Rats," that is, our Black Rat; (for it seems that the Brown Rat has not yet secured its footing there), and these do not count as game.*

Regarding this animal Dieffenbach says:—"There exists in New Zealand a frugivorous native Rat, called Kiore Maori (Indigenous Rat) by the natives, which they distinguish from the English Rat (not the Norway Rat), which is introduced, and called Kiore Pakea (Strange Rat). On the former they fed very largely in former times; but it has now become so scarce, owing to the extermination carried on against it by the European Rat, that I could never obtain one. A few, however, are still found in the interior, at Rotu Rua, where they have been seen by the Rev. Mr. Chapman, who described them as being much smaller than the Norway Rat. The natives never eat the latter. It is a favourite theme with them to speculate on their own extermination by the Europeans, in the same manner as the English Rat has exterminated their Indigenous Rat."†

In the "Proceedings of the Royal Tasmanian Society" I find a copy of a letter from the Rev. William Colenso, dated Hawkesbay, Sept. 1850, in which he says:—"I have procured two specimens of the ancient, and all but quite extinct, New Zealand Rat, which, until just now (and notwithstanding all my endeavours, backed too by large rewards), I never saw. It is, without doubt, a true *Mus*, smaller than our English Black Rat (*Mus Rattus*), and not unlike it. This little animal once inhabited the plains and *Fagus* forests of New Zealand in countless thousands, and was both the common food and great delicacy of the natives; and already it is all but quite classed among the things which were."‡

There is another more recent notice, which may relate to this animal, in a geological report by Mr. Julius Haast:—"Traces of a quadruped of smaller size, of nocturnal habits, the stride of which was between seven and eight inches, indicating that its mode of progression was by jumps or springs, were also discovered by me in the river-bed of the Hopkins, the stream which forms Lake Ohou; and as there is every reason to believe that this animal still exists in great numbers, hundreds of tracks having been formed in one night in the fresh-

* "The Old Settler in New Zealand," quoted from "Maori Sketches" in "Cornhill Magazine," Oct. 1865, p. 501.

† Dieffenbach, "Travels in New Zealand," 1843, p. 185.

‡ Rev. W. Colenso, in "Proceedings of the Royal Society of Van Dieman's Land," 1851, p. 301.

fallen snow, we may hope that some specimens of this entirely unknown quadruped will yet be obtained."*

I cannot help thinking that Mr. Haast's report gives us the truest glimpse of the animal: and that Mr. Colenso's bribes had defeated his own object, by inducing the natives to palm off upon him two young or small specimens of the Common Black Rat; or it may be specimens of the normal dimensions, supposing the animal to have become naturalized, and been somewhat reduced in size in course of the process of modification into a new species, like the Ascension Island and Galapago Island Rats of Mr. Darwin. It is in favour of this view that the Black Rat is the one which has been introduced there; because we read in the quotation from Dieffenbach that the English Rat which is introduced is not the Norway Rat, and there is no other which it can be but the Black Rat, because there is no other English Rat which attaches itself to man, sailing about in his ships, and accompanying his commerce. Further, if the Rat is a jumping rat, as Mr. Haast's report implies, this would bring it near the Australian Jumping Rats (Hapalotis); and as Australia is the nearest land to New Zealand (although distant upwards of 1000 miles), it is perhaps the existing country from which it is most probable that New Zealand should have drawn its inhabitants; and we know that, in point of fact, it is from Australia that the chief portion of its non-endemic flora has been drawn, as much as one-fourth of the whole (or 222 out of 935, when Hooker wrote his "Flora of New Zealand") being Australian. There is, however, another source from which it might be drawn, viz. America; that country is nearest to New Zealand on the other side, and has supplied about an eighth of its flora. A true specimen of this Rat would, therefore, be extremely interesting; and a glance at its teeth would at once reveal its past history.

Our information regarding it is, however, imperfect in more respects than as regards its personal appearance. I have not found it anywhere mentioned whether it is found both on Middle Island and North Island, or on only one of these. The first two of the above quotations refer to places in North Island, the last to Middle Island. If it is confined only to one, it would be still further interesting to find if that is the island which has most affinity with the country whose form the Rat bears; for it would appear from the flora of the islands that the relations of the two to Australia and America are in different proportions, indicating different dates for their separation from them.

Jumping Mice (Meriones.) (Map 80.) There are two sections of Mice with long hind-feet and short fore-legs, which leap like Kangaroos. One of them, consisting of the Jerboas, has characters of dentition and other peculiarities, on which it has by some been erected into a separate and independent family, of the same rank as the Mice; the other is not so distant from the latter and is composed of species of Mice, between the true Mice and the Sigmodontes, having the molars flat and the leaping structure of the Jerboas. The Meriones are not found in the New World. The genera are confined to Africa or the Continental parts of Asia. Some have been described from Labrador; but these were not true Meriones but Jaculi, part of the next group, the Dipodidæ.

Hapolotis. (Map 80.) This is an Australian genus, with jumping powers, like the Meriones and Jerboas, but differing from both. It is, however, more akin to the former than the latter. It is a desert animal; and at least the half of its species, if not more, is confined to the far interior of Australia. They are handsome little creatures, with a tufted brushy tail like the Jerboas.

* Haast (Julius), "Report of a Topographical and Geological Exploration of the Western Districts of the Nelson Province, New Zealand, undertaken for the Provincial Government." Nelson, 1861, from quotation in "Nat. Hist. Rev." Jan. 1864, p. 30.

I am not aware that fossil remains of any species of this family have been discovered.

Jerboas. (Dipodidæ.) (Map 82.) In Johnston's "Physical Atlas," the range of the Jerboa is laid down as limited to an irregular ellipse of no great size, occupying the space between the Caspian Sea and Egypt. Its range is vastly more extensive than this. In fact, it is spread almost over the whole world, with the exception of South America, the Indian region, and Australia; and over Australia, too, if we reckon Hapalotis as belonging to the group. It stretches, on the one hand, across Mongolia and Siberia to Amourland, and, on the other hand, across the Sahara to the Atlantic. Nor is this all: the genus Jaculus of North America belongs to the same family, and it extends over the whole of that continent, from the Atlantic to the Pacific. The family is composed of four genera, and fourteen or fifteen species. One of the genera, Pedetes, with a somewhat Kangaroo-like external appearance, is peculiar to the Cape of Good Hope.

MAP LXXXII.

JUMPING MICE.

Dipus & Alactaga
Jaculus
Pedetes
Hapalotis

MAP LXXXIII.

SPALACINI.

Day & Son (Limited) Lith.

CHAPTER XL.

MARSUPIALS.

Marsupials. (Map 95.) I have been obliged to anticipate most of what I had to say regarding the geological relations of the Marsupials. The reader knows that the oldest mammalian remains yet met with have been found in the secondary rocks of England; they are all insectivorous, and they have, almost without exception, been proved to be marsupial. The oldest (Microlestes) belongs to the trias, and it is marsupial. The next oldest is from the oolite (Phascolotherium), and it, too, is marsupial. Other marsupial remains have been found in the Purbeck beds; and it is more than doubtful if anything but marsupial animals have been discovered up to the close of the secondary epoch. The doubt is not from contrary evidence, but from a deficiency of complete evidence owing to the insufficiency of materials and the imperfect state of the bones discovered. At any rate, the remains have sufficed to establish this, that if they are not Marsupial, then they belong to the Insectivora.* The other orders do not begin to show themselves until the commencement of the eocene period. The marsupials were, therefore, so far as these records show, the reigning, if not the sole, mammals in existence at the oolitic epoch. The nearest living relation of any of them is the Myrmecobius of South-West Australia. The reader is also aware that such types of general structure of insectivorous Marsupialia exist nowhere now on the face of the earth except in Australia and South America, and that these remains have been found in the secondary epoch accompanied by myriads of marine shells of the genus Trigonia, a genus not now existing in any other than the Australian seas, where four species of it are not uncommon. The oolitic and eocene flora of Europe has still more marked relations to the present flora of Australia. We thence infer that at the close of the secondary epoch the fauna and flora of Europe extended to Australia, where its type has remained to a certain extent unaltered, although it has been replaced by another in Europe.

There are no secondary rocks in Australia. There are palæozoic and tertiary strata, but a gap where the secondary rocks should be. It is, therefore, a natural, and, if our data are sufficiently extended, a legitimate conclusion, that during the secondary period—viz. the period when Marsupials appear to have been the sole mammals on the face of the earth—Australia existed as dry land, and that it was inhabited by the Marsupials then in existence.

These conclusions have recently (1862) been challenged as unsound by Professor M'Coy of Victoria. He says, referring to the class of facts above noticed, "Such facts are very commonly

* "The doubt when it has existed," says Professor Owen, "lies between this and the insectivorous order, also low in the class according to cerebral characters."—*Palæontology*, p. 407.

received as indicating a continuance to the present day in Australia of the fauna which disappeared in all the rest of the world with the close of the mesozoic period; and this again carries with it the belief that Australia was the most ancient country in existence, having remained as dry land above the level of the sea for a period corresponding to that in which all the mesozoic and cainozoic formations of the rest of the world were being deposited. I am enabled to state that there is no sufficient foundation for this theory, from the great quantity of fossils which I have lately examined as Palæontologist to the Geological Survey of Victoria; and from evidence of this kind I can offer a sketch of the ancient successive changes of organic life in this country."*

He had found that the plants and animals in Australia have gone through exactly the same phases as those of Europe, both before and subsequent to the oolitic period. First, the palæozoic plants and shells of Australia are proved by organic remains to have been formed on the same type as those of Britain. Next, at the oolitic period the whole facies of the fauna of the sea and flora of the land had undergone just such changes as marked the geologically corresponding creations in India, Yorkshire, Germany, and America. Lastly, in Australia, as in Europe, the greater part of the country sank under the sea during the tertiary period; and every trace of the previous creations of plants and animals was destroyed and replaced by a new set both of plants and animals more nearly relating to those now occupying the land and sea of the country.† And these species were the antitypes of those now existing,—as the Diprotodon of the Wombat, the Macropus Atlas of the Kangaroos, and so on.

Do these facts, separated from his inferences, bear out the conclusions arrived at by Professor M'Coy? Not in themselves, I think. He tells us that Australia during the oolitic period had undergone changes similar to those which we know took place in Britain. I presume that no marsupial remains have been found, or we should have heard of them. Professor M'Coy tells us that no Trigonias have been found; but the inference from the similarity spoken of by him is, that they may be expected to have lived during that epoch: and if we may assume that, the position of the inquiry then is, that as in Britain marsupial mammals then existed, so in Australia, or some part of the southern hemisphere, they did so also. The whole of Australia was not afterwards submerged: some parts of it were. Some parts of it did remain above water, and on them the ancient marsupials may have lived, and their descendants developed new species of the same type down to the present time, each successive age gradually approximating them more to the existing species. There seems nothing in the Professor's facts inconsistent with this, nor opposed to the old and generally received belief.

Notwithstanding his protest, therefore, I still regard the inhabitants of Australia as the least changed descendants of the faunas of a tertiary or secondary age. I need not recapitulate the reasons for believing in the existence of a continent or continents, in the South Pacific, at least as old as Australia and Africa, and older than any other of our present continents. Nor need I argue that the oldest land is the place where the least changed forms of life are likely to be found, and that the oldest forms are likely to be the least highly organised; nor will it be necessary to do more in order to show that the Marsupials ought to be so considered, than to hint at the evidences of inferior organisation, shown by such reptilian characters as the permanent separation of the bones of the skull, the imperfection of the palatine portion of the skull—the longer continuance

* M'Coy, in "Annals of Natural History," 1862, p. 138.
† M'Coy, op. cit. p. 144.

of growth of the animals,*—the tipped or barbed tongue of the Opossum,—the resemblances to birds of the allied Monotremes,—and the structure of the sternum and shoulder, both in the Echidna and the Ornithorhynchus, which, although bearing a considerable resemblance to these parts in birds, have a still greater coincidence with those of the Lizards and Ichthyosauri. These facts are all evidences of the Marsupials holding the lowest place in organisation in mammals, and hence, presumably, the source, or one of the sources, from which the placental animals proceeded. Although named from their bearing a *marsupium*, or pouch, for the reception of their early born young, they do not all possess either the marsupium itself or the marsupial bones which usually accompany it. The Monotremes have it not, neither has the MYRMECOBIUS, which is allied in many respects to the ECHIDNÆ. Most of the PHASCOGALES and ANTECHINI are destitute of a pouch, and one large section of the Opossums is also without it. In others, as THYLACINUS, the pouch is present, but the marsupial bones are absent.

Professor Owen has suggested the following ingenious explanation of the teleological purposes of this structure:—"I have always connected with the long droughts in Australia—with the extensive tracts where there are no waters—with the difficulty of obtaining that necessary element of life, the singular peculiarity of organization which prevails among the Mammalian quadrupeds of Australia, viz. the possession of a soft, warm, well-lined, portable nursery pocket or perambulator. Take the case of one of our wild quadrupeds—suppose a fox or wild cat; they make their nest; they have their litter. Suppose it should happen that they must travel one or two hundred miles to get a drink of water, impelled by the peculiar thirsty condition of a nursing mother, but obliged to leave the little family at home, where would that family be when the parent returned from its hundred miles' journey—the poor little blind deserted litter? Why! starved to death. In order that quadrupeds should be fitted to exist in a great continent like Australia, where the meteoric conditions are such as to produce the dilemma I have instanced, those quadrupeds must possess an organization suited to such peculiar and climatal conditions. And so it is. That form of mammalian quadruped in this great continent native to it, and born so as to make their migrations to obtain that necessity of life, has the superadded pouch and genetic peculiarities, enabling them to carry their young ones wherever they go. And since we find that marsupial animals have lived in Australia from a very remote period, so may we infer that its peculiar climate has prevailed during as vast a lapse of time."

The fancy is ingenious, but will not bear much handling. The young litter would be still better protected by remaining unborn, as in the placental animals, until they are nearly ready to care for themselves, instead of being prematurely disclosed and placed in the perambulator. Besides this, purely desert animals are able to live without water. If such an apparatus were necessary for desert animals, those inhabiting the Sahara have more need of it than those in Australia. Moreover, although Australia is subject to periodical droughts, and in some parts is desert, that is by no means its general character. Lastly, if it is a true explanation, it should follow that the whole earth in the eocene and oolitic epoch was as dry and thirsty as Australia now is; a supposition inconsistent with the known luxuriance of the vegetation of these times.

In examining into the distribution of the Marsupials we must remember that Australia has, in

* Gould says, "I have observed this to occur with all Marsupials, but especially with Kangaroos. The great herds of the grey species, MACROPUS MAJOR, are frequently headed by an enormous male or boomer, as he is called. Like the rogue Elephants of Ceylon, these patriarchs are often solitary, and are generally very savage." GOULD'S "Mammals of Australia, Introduction."

all probability, formerly consisted of three large islands,—the north, the east, and the south-west. This is the inference from the geological data. There are these three isolated masses of land more or less surrounded by tertiary deposits which of course must have been under water when deposited. Let us see how the zoological data correspond with the geological.

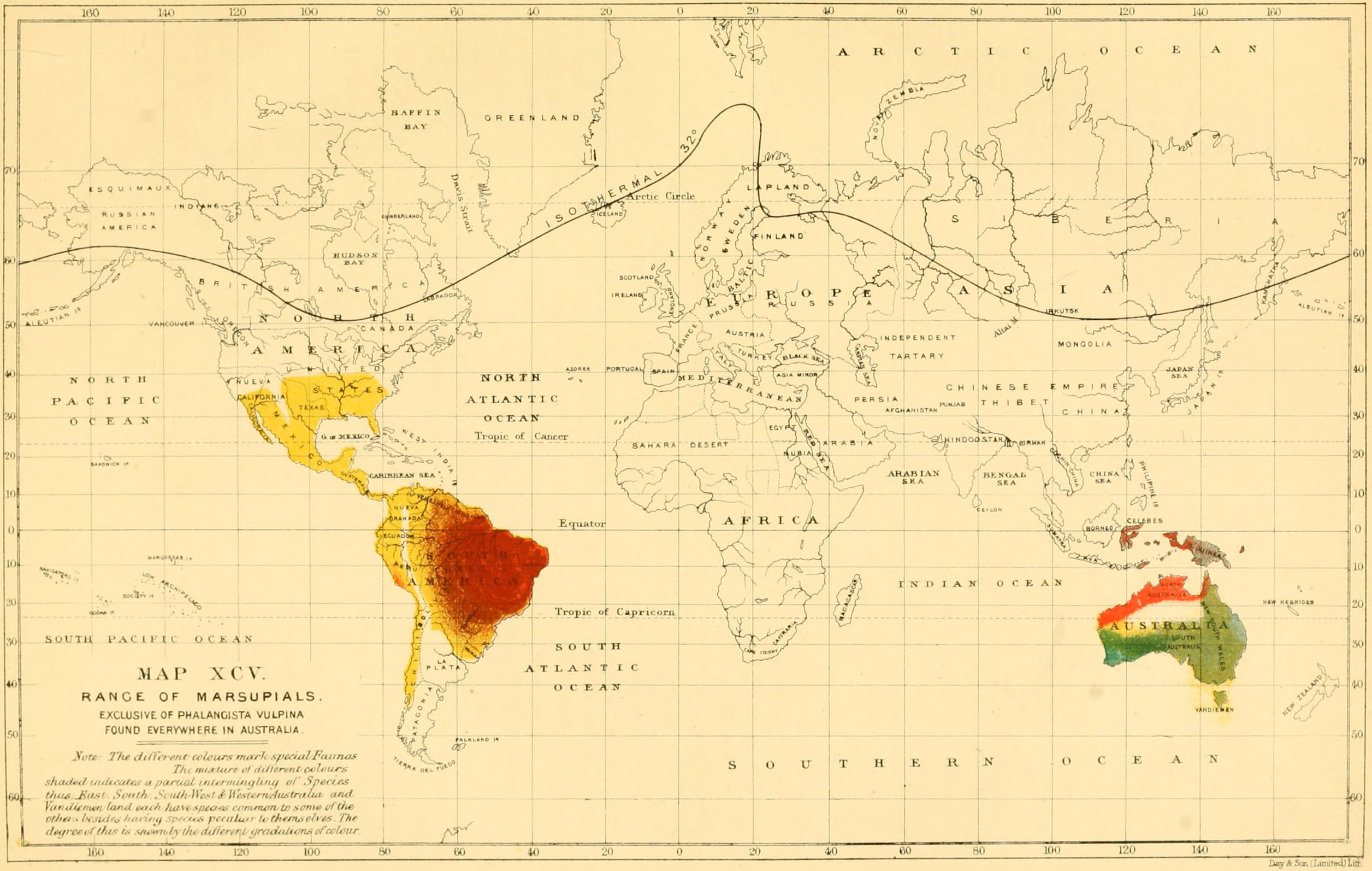
The chief groups or genera into which the Marsupials are divided, may be taken in the following order: 1. The Antechini; 2. The Phascogales; 3. The Dasyuri; 4. The Opossums; 5. The Phalangers; 6. The Petaurists or Flying Phalangers; 7. The Wombat; 8. The Kangaroos and Hypsiprymni; 9. The Peramelidæ; 10. Tarsipes; and 11. Myrmecobius, leading to the next order, the Monotremes.

Antechini. I have already drawn attention to the perfect outward resemblance which these insectivorous marsupials bear to the common Mice, Rats, and Jerboas. (*See Frontispiece.*) The majority are found in the eastern district (seven in New South Wales, and four in Van Dieman's Land), one is found in New Guinea in extension of this range. Five species occur in Western Australia; but not one of these species is found on the other side of the Continent. Three, however, which are found in South Australia, belong also either to the east or to the west.

Phascogale. These, although insectivorous and usually considered equivalents of some of the placental Insectivora, have fully more external resemblance to the Rats and Mice, although this is more markedly the case with the last genus, Antechinus, which Waterhouse considers only a part of it;—an opinion, however, which is not shared by Mr. Gould, who thinks that they have no connexion with each other. We only know three species of the restricted Phascogale. The genus especially affects the interior, and the species have been found respectively on the outskirts of New South Wales, South Australia, and West Australia.

Dasyurus and Thylacinus.—Tasmanian Devils, Tigers, &c. (Map 97.)—Van Dieman's Land is the stronghold of these carnivorous marsupials, four out of six being found there, and three being peculiar to it. Another is peculiar to the northern district of Australia. The other two extend into New South Wales, and one of them ranges both through it and South Australia and West Australia. Remains of an extinct Dasyurus and an extinct Thylacinus have been found in the bone-caves of Wellington Valley.

Opossums. (Map 96.) The Opossums seem to come most naturally next to the Phascogales. They are a very homogeneous group, alien to Australia. They all belong to the New World, and their range is very extensive, both in North and South America. In South America the genus occurs in much the greatest abundance in Brazil, two-thirds of the whole being found there, or twenty-two out of thirty-two. None are found in Patagonia, the La Plata river forming their southern boundary; one occurs in Chili, and seven in Peru (three of which are on the west side of the Andes), six in Paraguay, seven in Guiana, two in Mexico, one of which extends into California, and one in the Eastern United States of North America, but not further east than the Hudson. Not one of the species met with on the one side of the Andes occurs also on the other. Not that the height of the Cordillera in itself presents an absolute barrier to the passage of Opossums from the one side to the other, because Tschudi mentions one species (Didelphys Azaræ) which was killed at an elevation of 12,500 feet above the level of the sea, and although that species is not suited to the hot and wooded valleys, it might be the progenitor of species that were. Only two



MAP XCV.

RANGE OF MARSUPIALS.

EXCLUSIVE OF PHALANGISTA VULPINA
FOUND EVERYWHERE IN AUSTRALIA.

Note: The different colours mark special Faunas The mixture of different colours shaded indicates a partial intermingling of Species thus: East, South, South-West & Western Australia and Vandiemen land each have species common to some of the others besides having species peculiar to themselves. The degree of this is shewn by the different gradations of colour.

Day & Son (Limited) Lith.

aberrant genera are known, each having a single species, the one HYRACODON, from Ecuador, and the other a web-footed aquatic animal about the size of a large brown rat, CHIRONECTES (the Yapok) from Guiana, which, strange to say, is said to be possessed of large cheek-pouches; at least is so described by Mr. Ogilby, although Wagner, probably with justice, questions the accuracy of his observation.

That the origin of the Opossum belongs to the same period as that of the other Marsupials, appears a reasonable assumption; and its geographical position in a country nearest to the abode of the other Marsupials, suggests a derivation of the one from the other by a connection between these lands. At the same time, we are by no means shut up to this as the sole hypothesis which will meet the facts. As at the eocene epoch Marsupial, if not the only, seems at least to have been the principal form of Mammalian life over the whole globe, South America may have received and retained her Opossums from the general stock from the northern hemisphere, or some other quarter, without having had any communication with Australia.

The fossil remains do not oppose such an hypothesis. Numerous remains of species have been found in the bone-caves of Brazil, and are preserved in the British Museum. But Mr. Waterhouse remarks that he has not found any, the size and proportions of which would lead him to suspect that they belonged to species which are not known to exist at the present day in Brazil.* No trace of any species has been met with indicating anything closer or other than a general Marsupial affinity with Australian species.

The fossil remains which come nearest to the osteology of the Opossums is the well-known specimen discovered by Cuvier in the eocene beds of the Paris basin, and named DIDELPHYS CUVIERI by Fischer. But although it is clearly marsupial and insectivorous, apparently identical with the Opossums, it cannot be said to have been one beyond all doubt. Had it been found in a country of Opossums (the Brazilian caves for example), we should have accepted it as such without hesitation; but the absence or imperfect condition of the incisors and premolars leaves it an open question. Other remains of marsupial insectivora which constitute the genus THYLACOTHERIUM (SPALACOTHERIUM of Owen) have been found in Europe, and some of them in much older formations (the Stonesfield slate).

PHALANGERS.—PHALANGISTA. In the Placental species, a passage between the Mice and the Squirrels can be made through the Dormice. A similar passage occurs in the Marsupials, from the Phascogales on the one hand, to the Petauri and the Phalangers on the other, through a Dormouse-like group named DROMICIA. There are three species of them found in the east and south-west divisions of the continent: their habitats being, respectively, New South Wales, Van Dieman's Land, and West Australia. The Phalangers proper, which are regarded by Waterhouse and Owen as the equivalents of the small Quadrumana, are all to be met with in the eastern region. Two of them, indeed, have not been observed as occurring in New South Wales, but these are met with in Van Dieman's Land or Victoria, which are both, geologically, parts of the eastern region of Australia. Two of them are also found in Western or rather South-western Australia, and one, PHALANGISTA VULPINA, occurs everywhere throughout the continent, and of course also in Northern Australia, although, indeed, the identity of the specimens found in the northern region (Port Essington) with the PH. VULPINA of the rest of the continent is not absolutely certain. Waterhouse says he

* WATERHOUSE'S "Nat. Hist. of Mammals," vol. i. p. 529, 1846.

could perceive no points of difference of the least importance, although its fur was rather more dense and crisp; but Gould says that he observes that specimens from the northern coast are larger than those obtained elsewhere, and "a doubt exists in his mind as to their identity."* Closely allied to the Phalangers, and by many placed in the same genus, are a few species which are found in New Guinea and some of the adjoining islands. One, and only one, is also found in Australia, at its extreme northern point (Cape York). These form the genus or sub-genus CUSCUS. And along with them may be reckoned two allied forms DACTYLOPSILA and MYOICTIS, of Gray, both found in New Guinea. Of all, four are found in New Guinea, four in Amboyna, two in Celebes, two in other islands of the New Guinea group, one in New Ireland (an interesting proof of the extension of a former submerged continent in these seas), and one, as already mentioned, at Cape York.

The FLYING PHALANGERS or PETAURI. (Map 94.) The range of the PETAURI extends from the north coast of Australia along the east to Victoria in the south. There are six species, five of which correspond to the placental sub-genus PTEROMYS in having the tail bushy all round, and the feet not distichously disposed, and the other to the sub-genus SCIUROPTERUS, where the fur of the tail is distichously disposed. This is ACROBATA PYGMÆA, a lovely little thing, the tiniest pet in the world perhaps. It may truly be said of it that it could be bounded in a nut-shell. Gould kept one which made its nest in a pill-box in the corner of a drawer, and counted itself king of infinite space in his waistcoat-pocket. This is an additional instance, besides those already given, of an independent type of similar form to Placental species occurring among Marsupials. The PETAURI represent the PTEROMYDES; the ACROBATA, the SCIUROPTERI, which are found, not only in the Indian Archipelago, India, and the Himmalayahs, but also in North America, and in Europe and Asia, although only a single species occurs there. The Acrobat comes from New South Wales, and used to be exceedingly common about Port Jackson. Of the other flying Phalangers one is peculiar to the north coast, being found in the Cobourg Peninsula, —one to Victoria,—and three are found both in New South Wales and Victoria. None have been found on the west coast or the south-west, or the western part of the south coast.

WOMBAT.—PHASCOLOMYS. Although South Australia has rarely any independent features, it being generally a mere debateable ground between New South Wales and Western Australia, in which the species from both intermingle and overlap each other, it has in the Wombat an important and remarkable feature almost peculiar to itself. Out of four species now known, three of them are peculiar to South Australia; the fourth (the best known one) is also found there, although it more properly belongs to the south-eastern part of Australia, being found in New South Wales, Van Dieman's Land, and some of the islands in Bass's Strait. It is to be kept in mind, however, in estimating the weight of these localities as indicating any thing special in the Fauna of South Australia, that little more than single specimens of each of the rarer Wombats have yet been found.

The gigantic allied extinct animals, DIPROTODON and NOTOTHERIUM, lived at no great distance from the habitat of these Wombats, viz. Wellington Valley and Liverpool Plains.

The first glimpse of these most remarkable animals was obtained from the ossiferous caves of Wellington Valley district, by Sir Thomas Mitchell, in the course of his expeditions into the

* GOULD, J. "Mammals of Australia."

ARCTIC OCEAN

ISOTHERMAL 32°

Arctic Circle

BAFFIN BAY

GREENLAND

Davis Strait

ESQUIMAUX

INDIANS

RUSSIAN AMERICA

CUMBERLAND

HUDSON BAY

ICELAND

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

URAL M.

SIBERIA

BRITISH AMERICA

NORTH AMERICA

SCOTLAND

IRELAND

BALTIC

PRUSSIA

EUROPE

RUSSIA

ASIA

ALEUTIAN IS

VANCOUVER I

OREGON

CANADA

FRANCE

AUSTRIA

INDEPENDENT TARTARY

MONGOLIA

JAPAN SEA

UNITED STATES

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

Tropic of Cancer

AZORES

PORTUGAL

SPAIN

MEDITERRANEAN

TURKEY

BLACK SEA

ASIA MINOR

CASPIAN SEA

CHINESE EMPIRE

THIBET

CHINA

PERSIA

AFGHANISTAN

PUNJAB

NUEVA CALIFORNIA

TEXAS

GULF OF MEXICO

WEST INDIA IS

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

BURMAH

SANDWICH I

CARIBBEAN SEA

ARABIAN SEA

BENGAL SEA

CHINA SEA

PHILIPPINE IS

CEYLON

BORNEO

CELEBES

SUMATRA

JAVA

Equator

AFRICA

MARQUESAS IS

NAVIGATORS IS

LOW ARCHIPELAGO

SOCIETY IS

COOKS IS

INDIAN OCEAN

Tropic of Capricorn

SOUTH PACIFIC OCEAN

SOUTH AMERICA

SOUTH ATLANTIC OCEAN

N. AUSTRALIA

AUSTRALIA

NEW HEBRIDES

NEW ZEALAND

LA PLATA

PATAGONIA

FALKLAND IS

TIERRA DEL FUEGO

CAPE COLONY

MADAGASCAR

SOUTHERN OCEAN

MAP XCVI

OPOSSUMS & KANGAROOS.

Opossums (South American)

do (North American)

Kangaroos

Tree Kangaroos

Note Intensity of colour denotes preponderance of Species

Day & Son (Limited) Lith

ARCTIC OCEAN

ISOTHERMAL 32°

Arctic Circle

BAFFIN BAY

GREENLAND

Davis Strait

ESQUIMAUX

INDIANS

RUSSIAN AMERICA

CUMBERLAND

HUDSON BAY

ICELAND

NOVA ZEMBLA

LAPLAND

NORWAY

SWEDEN

FINLAND

URAL M.

SIBERIA

BRITISH AMERICA

NORTH AMERICA

SCOTLAND

IRELAND

BALTIC

PRUSSIA

EUROPE

RUSSIA

ASIA

ALEUTIAN IS

VANCOUVER I

OREGON

CANADA

FRANCE

AUSTRIA

INDEPENDENT TARTARY

MONGOLIA

JAPAN SEA

UNITED STATES

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

Tropic of Cancer

AZORES

PORTUGAL

SPAIN

MEDITERRANEAN

TURKEY

BLACK SEA

ASIA MINOR

CASPIAN SEA

CHINESE EMPIRE

THIBET

CHINA

PERSIA

AFGHANISTAN

PUNJAB

NUEVA CALIFORNIA

TEXAS

GULF OF MEXICO

WEST INDIA IS

SAHARA DESERT

EGYPT

NUBIA

RED SEA

ARABIA

BURMAH

SANDWICH I

CARIBBEAN SEA

ARABIAN SEA

BENGAL SEA

CHINA SEA

PHILIPPINE IS

CEYLON

BORNEO

CELEBES

SUMATRA

JAVA

Equator

AFRICA

MARQUESAS IS

NAVIGATORS IS

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INDIAN OCEAN

Tropic of Capricorn

SOUTH PACIFIC OCEAN

SOUTH AMERICA

SOUTH ATLANTIC OCEAN

N. AUSTRALIA

AUSTRALIA

NEW HEBRIDES

NEW ZEALAND

LA PLATA

PATAGONIA

FALKLAND IS

TIERRA DEL FUEGO

CAPE COLONY

MADAGASCAR

SOUTHERN OCEAN

MAP XCVII.

MARSUPIAL CARNIVORA.

Dasyurus hallucatus

" Geoffroyi

" " & viverrinus

" ursinus &

Thylacinus cynocephalus

Day & Son (Limited) Lith

interior of Australia.* At first they were supposed to have been extinct pachyderms; but subsequent acquisitions established their true marsupial character, and their near affinity to the Kangaroo, but with an osculant relationship with the herbivorous Wombat. They were of gigantic size; the head alone being larger than the whole body of the Wombat, and exceeding in dimensions that of the largest Rhinoceros. Professor Owen says, "Like the contemporary gigantic sloth in South America, the Diprotodon of Australia, while retaining the dental formula of its living homologue, shows great and remarkable modifications of its limbs. The hind pair were much shortened and strengthened, compared with those of the Kangaroo. The fore pair were lengthened as well as strengthened. Yet in the case of the Megatherium the ulna and radius were maintained free; and so articulated, as to give the fore-paw the rotatory actions. These in Diprotodon would be needed, as in the herbivorous Kangaroo, by the economy of the marsupial pouch."† Almost the entire skeleton is known from numerous remains which have been found in a lacustrine deposit, intersected by creeks in the plains of Darling Downs. Other specimens have been obtained from the alluvial deposits in the beds of the Condamine River, westward of Moreton Bay, and from the Melbourne district of Port Phillip.

The genus, NOTOTHERIUM, also found in the same formation, combined the characters of the Kangaroo and of the Kaola. It, too, was a herbivorous animal, of large size, although somewhat inferior to that of the Diprotodon. It is supposed to have been of the size of a Rhinoceros. There was also a Wombat as large as a Tapir belonging to the same period, and found in the same deposits.

KANGAROOS AND KANGAROO RATS:—MACROPUS, AND HYPSIPRYMNUS, &c. (Map 96.) The Kangaroo, as it is the first discovered and best known of Australian mammals, is also the most numerous in species and the most widely distributed. It is found in every part of the continent which has been yet explored. Some are peculiar to the east, some to the south, some to the west, and some to the north; some are adapted for living in the scrubs, others for the deserts, others again for rocky precipices and steep mountains, and others for living in trees, viz., the species peculiar to the tangled forest belts surrounding New Guinea, which, if they could not lead an arboreal life, could not live in the parts in which they are found at all. Their fore-legs are almost as long as the hind, and are fitted with long curved claws, suitable to the animal's mode of life. Mr. Gould‡ has divided the Kangaroos into ten sections, an amount of subdivision which seems more than is needed, and which at any rate is more than I have been able to profit by. His first section, MACROPUS proper, is not found in the north; but that district possesses more than an equal proportion of his second section, OSPHRANTER. HALMATURUS is found all round the coasts as well as in the interior; so is PETROGALE. Two species of the Tree Kangaroo, DENDROLAGUS (URSINUS and INUSTUS) are found in the mangrove shore-belts of New Guinea, and one on the north coast of Australia.§ These are remarkable adaptations of a type fitted for one condition of life, to another when compelled by circumstances to adopt it. The MACROPUS, which may be taken as the type, is fitted for plains; the PETROGALE for precipitous

* MITCHELL, SIR THOMAS, "Three Expeditions into Australia," vol. ii. p. 359. 1838.

† OWEN, R. "Palæontology," pp. 394, 395.

‡ GOULD, JOHN, "Mammals of Australia."

§ I have unfortunately mislaid the reference to my authority for saying that a species of DENDROLAGUS occurs on the northern Australian Coast, and I cannot recall to mind whether it was one of the known New Guinea species or a new DENDROLAGUS. I have, however, every confidence that the statement is correct. I noted it at the time I met with it, which I should not have done without comment, had I entertained any doubt of its authenticity. The occurrence on the north coast of Australia of a CUSCUS (a New Guinea form of Phalanger inhabiting the same district and existing under the same condition as the DENDROLAGUS) supplies a well-authenticated parallel instance.

and rocky mountains, and the Dendrolagus for a residence in trees. An adaptation for a life in trees could only be necessary where the soil on which they grow, like the half-drowned coast of New Guinea, afforded no rest to the sole of their foot. Another Kangaroo, not arboreal, Macropus Bruni (Dorcopsis Bruni of Gould) or the Filander, is found in the Island of Aru, near New Guinea. Some say that it is found in New Guinea itself. This species is noted in Johnston's "Physical Atlas," as found in Java, which, if true, would indicate that island as part of the Australian group or system. It is a mistake, however; no marsupial animal is found in Java or any of the islands west of the Straits of Macassar, and the error no doubt originated in the first example that was met with, and *that* the first Kangaroo ever seen by Europeans, having been observed by Le Brun at Batavia, and inferentially supposed to be an inhabitant of the land where he saw it. It appears from his narrative, however, that the animal which he saw was not wild but in captivity. He says, "Being at the country house of our general (at Batavia), I saw a certain animal called Filander, which was somewhat remarkable. There were many individuals *with full freedom*," (he would not have said that if they had been wild,) "running with some rabbits which had their holes under a little hillock encircled by a balustrade."* This species, although without the arboreal characters of the Dendrolagi, has yet some points of affinity with them, as in the character of its fur, &c.

Another of Gould's sub-genera (Onichogalea) has three species, one from the north-east, and the other two from the interior of the east and the west.

The Kangaroo Rats (sub-genera Lagorchestes, Bettongia, and Hypsiprymnus of Gould) number about sixteen, of which only two (Lagorchestes) are found on the north or north-west coast, the rest in East, South, and West Australia, in nearly equal proportions, the south sharing two of the species found in the west.

Peramelidæ. This is an insectivorous group, numerous in species, and universally dispersed over Australia and Van Dieman's Land, which passes less easily from Hypsiprymnus than it does by Tarsipes into Myrmecobius, and the Monotremes. It contains one species from New Guinea and the neighbouring isles, one from North Australia, three from West Australia, three from New South Wales, and one from Van Dieman's Land, and one of them is found in all the districts except the north.

Following these are three most remarkable genera, each consisting of only one species and perfectly unique in type,—the Chæropus castanotis, Tarsipes rostratus, and Myrmecobius fasciatus. These are all from the Swan River district of South-west Australia, apparently the most ancient and peculiar part of the Australian continent. The last has spread a little into South Australia, that is, one or two specimens have been found in that direction.

Tarsipes and Myrmecobius both have long extensile tongues. Myrmecobius uses its tongue for catching ants, as the ant-eater does. Tarsipes, not unlike a small harvest mouse, is said to use its tongue in the same way as the humming-bird for extracting honey from flowers, although it also eats insects; but it does not seem that because the same implement is applied to different purposes, our faith should be shaken in it as an evidence of the affinity of the animals that possess it. In the dentition and absence of the marsupial pouch of Myrmecobius, there is a marked approach to the Monotremes, and more especially Echidna, which again on the other side holds out a hand to the ant-eater section of the Edentata.

* Le Brun, "Voyage par la Moscovie en Perse et aux Indes Orientales," vol. ii. p. 347, fig. 213.

If we summarize the facts relating to the distribution of Marsupials which we have just recorded, we shall find that the following inferences may be drawn from them. First, that the north is thoroughly isolated, and distinct from the rest of the continent. With the solitary exception of PHALANGISTA VULPINA, which may have reached it by overland migration, not a single species inhabits it which is known elsewhere. At the same time, unlike the south-west, it has no unknown types of life. It has merely a collection of new species of genera already well known as inhabiting New South Wales, although most of them are so distinct as to indicate a long period of separation, only one (PETAURUS ARIEL), besides the Phalangista, being near any of the New South Wales species.

Next, it appears plain that the south-west corner, viz., that part of the continent stretching from Shark's Bay southwards, and round past Perth and Swan River, is a peculiar district. This, although possessing fewer endemic species than the north, has more of special organization. Here have been found those species of which no other similar creature has yet been found in any part of the world. As to actually distinct species, although not distinct forms, we find twenty-eight species out of thirty-nine (that is, about three-fourths) peculiar to itself. Four are common to it and the country to the north of it (North-west Australia), but are not found in South Australia, with which, however, it shares six. The difference between it and North Australia seems to be this, that although both equally isolated at some former period, the one (the south-west) has been so at a more ancient date, and for a longer period; and when the space between was raised out of the sea, and the intermediate regions turned into dry land, the character of the district surrounding North Australia has been of a more desolate, inhospitable character than that between South-west Australia and New South Wales, the communication between which, although difficult, has not been impracticable, as seems to have been the case with the north; from which it may perhaps be inferred in the absence of any special peculiarities in its condition, that the north has been last raised, and that the upheaved bottom of the sea to the south is more desolate from having had less time to become clothed with a productive soil.

New South Wales stands nearly in the same position as South-west Australia as an isolated region. It has forty species, of which twenty-nine are peculiar (or forty-one out of sixty, if Van Dieman's Land be taken along with it). Eleven of these are found in South Australia, and five in West Australia.

Van Dieman's Land, although belonging to the same division of the continent as New South Wales, has an unusually large number of endemic species. Out of twenty species, twelve, that is, rather more than the half, are peculiar to itself, and amongst them are more of the Marsupial Carnivora than are found in any other part of the continent, one of them being the THYLACINUS, which is a peculiar type found nowhere else. The general strain, however, of the species found in Van Dieman's Land is that of New South Wales. They are, with the exception of the THYLACINUS, all species of genera also existing in that region. Notwithstanding its large proportion of endemic species, therefore, it is not entitled to be regarded as a distinct and independent zoological province in the same sense, or at least in the same degree, that the north and south-west are; nor does this disproportion tell us anything about the length of time for which Van Dieman's Land has been separated from the mainland. I have already explained that I do not think that time has anything to do with the increase of species, except as giving greater opportunity for the occurrence of physical changes in the conditions of life, through which change in species may be induced.

Lastly, South Australia has twenty-eight species, of which only four or one-seventh (the smallest proportion of any) are peculiar. It has thirteen in common with New South Wales, and the same number common to Western Australia, and of these there are five common to all three. Only two are common to the south-west corner. It has obviously little claim to be considered a zoological province. It is the mere highway between the east and the west, as it was formerly the ditch or barrier separating them. The country between North and South-west Australia is chiefly indebted for its inhabitants to the countries bordering it to the south and east. The number of species as yet found in it is thirty-three. Of these ten, or about one-third or one-fourth, are endemic. The rest have found their way from the south-west or from New South Wales.

MAP XCVIII

Myrmecobius & Tarsipes

Ornithorhynchus & Echidna

Note The Echidna has also been met with in S. W. Australia but very rarely

Day & Son (Limited) Lith.

MAP XCIX.

Showing localities of the animals with ant-eating tongues whether Marsupial or not (Vermilinguia)

CHAPTER XLI.

MONOTREMES—ORNITHORHYNCHUS—ECHIDNA.

For such a very limited family—consisting of only three species, and these noways remarkable for the number of their individuals, but the reverse—and restricted to a small corner of a distant land, the Monotremes have made a great noise in the world. They have given rise to more speculation, and it is only fair to say, have thrown more light upon the past history of species, than any other animal of the same number of species or individuals.

The three species known, are—two species of Echidna, and the Ornithorhynchus anatinus or paradoxus, or Duck-billed Platypus (Platypus anatinus having been the first name given to it, although the generic name has since been disused, in consequence of its having been previously applied to a genus of insects.)

Echidna. (Map 98.) Putting out of view the tendency to Marsupial organization, the Echidna has affinity with the true Edentata. Like the Fodientia of that Order, it burrows rapidly. Messrs. Quoy and Gaimard having placed a specimen in a large case full of earth containing plants, it worked its way to the bottom in less than two minutes. Like the Ant-eaters, its food consists of ants, and these are captured in the same way that they procure their prey,—by the tongue, which in both instances is very protractile, very long, nearly cylindrical, slender and flexible, and is kept constantly lubricated with a viscous secretion to which the ants adhere. It, as well as the Ornithorhynchus, is wholly without teeth of the ordinary consistency, but the Duck-bill has two horny teeth in the jaw behind the bill, and the Echidna has horny papillæ on the palate. It bears spines or quills, more or less mixed with fur, on its back, like the hedgehog or porcupine.

The two species of Echidna are very close to each other, and are merely distinguished by the comparative length and quantities of their fur and spines, the one (E. hystrix) having long spines, and short hair, the other (E. setosus) short spines and long hair, the spines being almost concealed by the fur. The former is found on the Continent and in one of the islands in Bass's Straits, the latter only in Van Dieman's Land. It is in all other respects so identical with the spiny species, that it has been supposed by some to be merely a variety of it modified by climate. Mr. Gould says, "The more southern position and colder climate of that island may have had the effect of giving it a warmer coat, whiter spines, and of altering its general appearance."* An opinion in which I do not concur, if it implies that the animal, notwithstanding these changes, still continued

* Gould, "Mammals of Australia."

the same species as the other. The former is almost entirely confined to the east coast of New South Wales; but it (or at least a species) has also been taken at Swan River.*

The ant-eating structure seems so special an adaptation, that it is difficult to conceive that all the animals in which it occurs have not sprung from one and the same source. A supposition which receives support from the horny clothing which many of them possess,—whether it takes the form of quills, as in the Echidna,—scales, as in the Manis,—or harsh wiry bristles, as in the Ant-eater. To show how that corresponds with the distribution of the species possessing it, I have given a map pointing this out (Map 99). In endeavouring to trace the connexion of the species with this property, it may perhaps be more natural, seeing that the Monotremes and Myrmecobius are confined to the south of Australia, to look for their communication with the others rather by Africa than by New Guinea and the Indian Archipelago. But the light we have to go by from living species is not much, and we derive almost none from fossils.

Ornithorhynchus. The long extensile glutinous tongue of the Echidna is not shared by the Ornithorhynchus, or Duck-bill. It has a small flat tongue, but in other points its affinities with the Echidna are sufficiently numerous. It is found in New South Wales, Van Dieman's Land, Victoria, and South Australia, but not in Northern or Western Australia.

Like the Echidna, it is a great burrower, its burrows extending for a long distance into the banks where they make them. One that was opened by Mr. Bennett terminated at a distance of thirty-five feet from the entrance,† and some have been found to extend as far as fifty feet in length.

The geographical position of the Monotremes, not less than their tendency to Marsupial organization and their affinity with Myrmecobius, leave little doubt that their proper station is alongside the Marsupials. Those who, like Giebel, however, place them with the Edentata,‡ have no lack of arguments by which to support their opinion. In fact, it seems scarcely possible to dispute that they are allied to both. It is an interesting subject for speculation to endeavour to ascertain which preceded the other. Is the Monotreme the parent stock of both, or is it intermediate between the Marsupials and the Edentata,—the child of the former and the parent of the latter. Has the Marsupial been "born of the brooding of Echidna base"—or has it given birth to it, and it in its turn given birth to the Ant-eaters? On the one hand, we have the Monotreme so far departing from the Marsupial organization, and thus seeming to take a step towards the placental; on the other hand, the organization of the Monotremes is apparently of a lower type than that of the others, corresponding in more points with that of birds and reptiles, and so more likely to have first appeared. But unless we are prepared to accept the Monotremes as the connecting link between birds and mammals, which, seeing the wide gulph of separation between them, I imagine few would be prepared to do, we are not much further advanced.

We know nothing mammalian nearer the Birds than the Monotremes; but this is no proof whatever, scarcely an indication, that this was the route by which the mammalian element entered into existence, or even that the Mammals were derived from the Birds at all. They may have come from the Reptiles. As was remarked by Waterhouse, one of the most interesting features in the skull of the Marsupials, consists in the permanent separation of the bones: these do not anchylose in the adult and old animals, as do many of the bones (especially those of the cranial portion of the skull)

* Waterhouse, "Natural History of the Mammalia." Vol. I. Marsupiata. London, 1846, p. 42.

† Bennett, G., "Wanderings in New South Wales."

‡ Giebel, "Die Saugethiere," 1859, 389.

in the placental series: the temporal bone generally presents a permanent separation of the squamous, petrous and tympanic elements. And Professor Owen observed this condition of the bone in the mature skulls of an ursine Dasyure, a Virginian Opossum, a Perameles, in different species of Potoroo (or Kangaroo Rats), and Kangaroo, in the Wombat and the Kaola. These characters are fully more reptilian than ornithic, although some of them are shared by both, and other characters leading in a similar direction could easily be cited.

The sense of our feebleness and inability to follow up the indications which such affinities suggest oppresses us, and makes us, with greater and greater humility, the more we study them, acknowledge that "such knowledge is too wonderful for us; it is high, we cannot attain unto it."

CHAPTER XLII.

REGIONAL DISTRIBUTION OF MAMMALS.

Having completed our survey of the range of the different groups of Mammals, let us now briefly see what light the facts throw on their regional distribution.

Most of my views on this subject have been anticipated; a brief summary of the results therefore is all that will be acquired.

Before stating my own conclusions, however, as each branch of organic life reflects light upon the others, it will, no doubt, be satisfactory to the reader to be reminded of those which have been arrived at by others, not only regarding the mammals, but also in the other branches of zoology and in botany.

Various authors have endeavoured to embody the differences beween the Faunas and Floras of the different regions of the globe, into some kind of system; but, although I shall not occupy the time of the reader with a recapitulation of the opinions of any but the most eminent men in recent times who have paid attention to the subject, it will be seen that even they, with one or two exceptions, have worked upon no definite principle, and the result has been a mere catalogue of regions which possess peculiarities without distinguishing their relative importance, or their relation to each other.

The authors whose opinions I shall cite are, Schmarda for General Zoology, Sclater for Birds, Woodward for Molluscs, and Schow, Meyen, Decandolle, and Hooker, for Botany; limiting, however, my notice to the mere geographical extent of their proposed regions.

Schmarda divides the dry land into the following twenty-one zoological regions:—

1. The Polar land, or the region of fur-bearing animals and aquatic birds.
2. Mid-Europe region: the country of Insectivores, Carabidæ, and Staphylinidæ.
3. The Caspian Steppes: region of the Saiga Antelope, and of the Spalflax and Siphneus.
4. Central Upper Asia: region of Horses.
5. Mediterranean district: region of Heteromera.
6. China: region of Pheasants.
7. Japan: region of terrestrial Salamanders.
8. North America: region of Rodents and Conirostres.
9. The Sahara: region of the Melasomata and the African Ostrich.
10. West Africa: region of the Catarrhine Monkeys and the Termites.
11. Upper Africa: region of the Ruminants and Pachydermata.
12. Madagascar: region of the Lemuridæ.
13. India: region of the Carnivora and Pigeons.

14. Sunda district : region of the Serpents and Bats.
15. Australia : region of the Marsupials, the Monotremata, and Honey-sucking Birds.
16. Central America : region of the Land-crabs.
17. Brazil : region of the Edentata and the Platyrrhine Monkeys.
18. The Peruvian and Chilian district : country of Lamas and Condors.
19. Pampas. Region of the Lagostomidæ and Harpalidae.
20. Patagonia : region of the Guanaco and the Rhea.
21. Polynesia : region of the Nymphalidæ and Apteryx.*

His Marine regions are,—

1. The Arctic Sea : region of marine mammals and Amphipoda.
2. Antarctic Sea : region of marine mammals and the Impennes.
3. North-Atlantic Ocean : region of Cod and Herring.
4. South-European, Mediterranean : region of Labridæ.
5. Northern Pacific Ocean : region of Cataphractidæ.
6. Tropical part of Atlantic Ocean : region of the Manatee, the Plectognathidæ, and Pteropoda.
7. Indian Ocean : region of the Hydridæ and Buccinidæ.
8. Tropical Pacific Ocean : region of Corals and Holothuridæ.
9. Southern part of Atlantic Ocean.
10. Southern part of Pacific Ocean.*

Dr. Sclater's well-known plan of distribution of birds is as follows :—

1. Palæarctic region : including Africa north of the Atlas, Europe, Asia Minor, Persia, and Asia generally north of the Himmalayan range, upper part of the Himmalayan range, northern China, Japan, and the Aleutian Islands.

2. Æthiopian, or western Palæotropical region : including Africa south of the Atlas range, Madagascar, Bourbon, Mauritius, Socotra, and probably Arabia up to the Persian Gulf, south of 30° north latitude.

3. Indian, or middle Palæarctic region : including India and Asia generally south of the Himmalayahs, Ceylon, Burmah, Malacca, and southern China, Philippines, Borneo, Java, Sumatra, and adjacent islands.

4. Australian, or western Palæotropical region : including Papua and adjacent islands, Australia, Tasmania, and Pacific Islands.

5. Nearctic, or North American region : including Greenland and North America down to the centre of Mexico.

6. Neotropical, or South American region : including the West India Islands, Southern Mexico, Central America, and whole of South America, Galapagos Islands, and Falkland Islands.†

Mr. Wallace adopts Dr. Sclater's ideas generally regarding the distribution of birds;‡ and Dr. Gunther's views upon the distribution of reptiles are also merely a corroboration or adoption of the same.

* Schmarda, "Geographische Verbreitung der thiere," 1853.

† Sclater, in "Proceedings Linn. Soc.," vol. ii. p. 130. 1857.

‡ Wallace in "Ibis," October, 1859 ; in "Journal Proc. Linn. Soc.," Feb. 1860 ; in "Nat. Hist. Review," Jan. 1864.

The late Mr. Woodward's great knowledge of his subject has given us a valuable contribution towards the adjustment of the regions of the Mollusca, but it also is open to the same objection which, I think, applies to Schmarda's,—too much subdivision, and a want of some guiding principle in estimating the value of the different peculiarities which mark his regions. The great landmark is the *past* rather than the *present* geography of the world; and although Mr. Woodward must have been fully alive to this, I think he has scarcely made sufficient use of it in adjusting the limits of his regions. The following is his distribution of the Mollusca:—

I. Land regions.

1. Germanic region: (Europe and Siberia.)
2. Lusitanian region: (Mediterranean Islands, Madeira, Azores, Canaries, Cape de Verdes, Ascension, St. Helena, Tristan d'Acunha.) *
3. African region: (Tropical West Africa.)
4. Cape region.
5. Yemen: Madagascar, Comoro Islands, Seychelles, Mauritius, Bourbon, Rodriguez, Kerguelen land.
6. Indian region: Ceylon.
7. China and Japan.
8. Philippine Islands.
9. Java.
10. Borneo.
11. Papua and New Ireland.
12. Australian region.
13. South Australia and Tasmania.
14. New Zealand.
15. Polynesian region: Salomons, New Hebrides, New Caledonia, Feejees, Friendly, Navigators', Society Islands, Low Coral Islands, Sandwich Islands.
16. Canadian region and New England.
17. Atlantic States.
18. American region.
19. Oregon and California.
20. Mexican region.
21. Antilles.
22. Columbian region and Galapagos.
23. Brazilian region.
24. Peruvian region.
25. Argentine region.
26. Chilian region and Juan Fernandez.
27. Patagonian region, Tierra del Fuego, and Falkland Islands.

* The collocation of the three last with the Mediterranean district is very suggestive of extended speculation to the believers in an ancient Atlantic Continent.

II. Marine provinces.

1. Arctic province.
2. Boreal province : Norway, New England.
3. Celtic province : Britain, Denmark.
4. Lusitanian province : Portugal, Canaries, Madeira, Azores, Mediterranean, Black Sea.
5. Aralo-Caspian province.
6. West-African province.
7. South-African province.
8. Indo-Pacific province : Red Sea, Persian Gulf.
9. Australo-Islandic province : New South Wales, Tasmania, New Zealand.
10. Japonic province.
11. Aleutian province : Ochotsk, Sitka.
12. Californian province.
13. Panamic province : Galapagos.
14. Peruvian province.
15. Magellanic province : Falkland Islands.
16. Patagonian province.
17. Caribbean province.
18. Transatlantic province.*

In Botany, I need not refer to the older attempts at regional distribution of plants made by Willdenow and Treviranus.

The following are Schow's Phyto geographical regions :—

1. Alpine Arctic region : consisting of the Arctic and boreal regions of the Northern Hemisphere and the Alpine heights of more southern mountains.
2. Mid Europe, and Asia as far as the Caucasian and Altaic Mountains.
3. Mediterranean district, including Asia Minor, North Africa, and the Canaries and Azores.
4. Eastern North America.
5. Southern North America.
6. Japanese region.
7. East India and Ceylon (exclusive of the Alpine region south of the Himmalayah).
8. Emodic region, or mountains of India (consisting of the Alpine region south of the Himmalayah).
9. Asiatic Islands, or mountainous districts of the islands between South-eastern Peninsula and Australia, to the height of 5500 feet above the sea.
10. Upper Java, mountainous regions in Java, and neighbouring islands to the above height.
11. Polynesian region.
12. Persia and Arabia.
13. Desert region, the Sahara.
14. Tropical Africa.
15. Mexico, New Grenada, Guiana, and Peru.
16. Highlands of Mexico.

* Woodward, "Recent and Fossil Shells." 1851, part iii. p. xiii.

17. Cordilleras of the Andes, from 5500 to 9000 feet above the sea.
18. Andian region, above 9600 feet of elevation.
19. West Indian region.
20. Brazilian district.
21. La Plata, and Northern Patagonia.
22. Antarctic region, South Patagonia, Tierra del Fuego, Falkland Isles, &c.
23. South Africa.
24. Temperate Australia and Van Dieman's Land.
25. New Zealand.

Meyen, on the other hand, divides his regions by zones. He takes the three recognised zones,—the torrid, the temperate, and the frigid—and subdivides each hemisphere into eight smaller zones, viz.,—

1. Equatorial.
2. Tropical.
3. Subtropical.
4. Warmer temperate.
5. Colder temperate.
6. Sub-arctic.
7. Arctic.
8. Polar.

As this is based entirely upon a principle (temperature) which I only admit as an accessory in the distribution of species, I may dismiss Meyen's zones without going into any details as to their limits, and without considering his vertical zones, the details of which, although very interesting in themselves, have not much bearing upon the limits of the Regional distribution of Mammals.

Decandolle, in his admirable work on "Geographic Botany," does not actually give us his own views regarding botanical regions. He treats of the regions of species, of genera, and of families; but from his enumeration of the following "grandes regions," in relation to families, we may infer that he looks upon them as special; they are,—

1. Temperate North America.
2. Temperate regions of the Old-world.
3. Intertropical America.
4. Intertropical Africa.
5. Intertropical Asia.
6. New Holland.
7. The Cape, or extra-tropical South Africa.
8. Chili, Buenos Ayres, South Brazil.

Elsewhere he adds from other regions to these. viz. 1, the Arctic Regions; 2, Intertropical Polynesia, New Zealand, Norfolk, Brougham, Auckland, and Campbell; 3, Kerguelen Isles, Amsterdam, St. Paul, Prince Edward, Tristran d'Acunha; 4, Patagonia and Falkland Islands.*

* Decandolle, "Géographie Botanique raisonnée," 1855, p. 1255.

His minor Regions, as drawn from the areas occupied by species, are as follows,—

1. Arctic region: comprised between the Polar and Arctic circles in Europe, Asia, and America.
2. The temperate regions of Europe (being Europe *minus* Lapland, Spain and Portugal, Languedoc province, Italy, the shore of the Adriatic, Greece, Roumelia, and the Crimea).
3. Region of the Mediterranean Sea (being the circumference of that sea without Egypt, and comprising Portugal).
4. Canary Islands, Madeira, Azores.
5. Senegambia, Cape de Verd Islands, Sahara.
6. Guinea, north of the Equator, and Soudan.
7. Central Guinea (Congo, Benguela, towards the centre of the Continent).
8. Islands of St. Helena and Ascension.
9. Cape of Good Hope (extra-tropical South Africa).
10. Tristan d'Acunha.
11. Prince Edward's Islands, Kerguelen, and St. Paul's.
12. Madagascar, Mauritius, Bourbon, Seychelles, and Comoro Islands.
13. Mozambique and Zanzibar, almost to the centre of the Continent.
14. Region of the Red Sea (Abyssinia, Cordofan, Nubia, Egypt, Arabia Occidental).
15. Persia: region of the Euphrates and Oriental Arabia.
16. Caucasus, Crimea, Armenia.
17. Tartary (the lower region to the east of the Caspian Sea).
18. Siberia, from the Ural Mountains to Kamtschatka, and from the Polar Circle to the Altai Mountains.
19. Central Asia, between the Altais and the Himmalayahs.
20. Cashmere, Cabool, Affghanistan, to the mouths of the Indus.
21. Himmalayahs (on the south side), being Nepaul, Bhotan.
22. China and Japan.
23. Philippine Islands.
24. Cochin-China (Annam, Cochin-China, Tonquin, Bankok).
25. Birman Empire and Assam.
26. Bengal and the Ganges.
27. Indian Peninsula and Ceylon.
28. Indian Archipelago, States of Malacca (Sunda Isles, the Moluccas, Borneo, Timor, New Guinea, New Ireland).
29. New Holland, Van Dieman's Land, New Zealand, New Caledonia, Norfolk.
30. Feejee Islands, Friendly, Society, Marquesas, and Easter Islands.
31. Marion, Caroline, Mulgrave Islands.
32. Sandwich Islands.
33. The Aleutian Isles, and the North-west of America, Oregon, Rocky Mountains, and New California.
34. United States (*minus* Texas and Oregon), Canada, Labrador, Newfoundland, Bermudas.
35. Mexico, Texas, California proper, Guatemala, Yucatan.
36. Antilles (Cuba and Bahamas, as far as Trinity).

37. Venezuela.
38. New Granada.
39. Peru.
40. Galapagos Islands.
41. Bolivia.
42. Guiana.
43. Course of the Amazons and Rios Negro, and Madeira.
44. North-east of Brazil (Maranham, Goyaz, Piauhy, Bahia, and Ceara).
45. Western Brazil and Paraguay (Mato-grosso, Cuyaba, Paraguay, Chaco).
46. South-east of Brazil (Minas, Rio, Saint Paul, Saint Catharine, Saint Pierre).
47. Uruguay and Plata (Banda Oriental, Buenos Ayres as far as Chili).
48. Chili and Juan Fernandez.
49. Patagonia, Tierra del Fuego, and the Falkland Isles.
50. The Antarctic Archipelago of the Shetland Isles, Georgia, the Southern Sandwich Isles, &c.*

If we are to regard the eight regions first above mentioned as truly representing Decandolle's idea of the regional distribution of plants (of which, however, I am by no means sure), then I would with the greatest deference venture to demur to his conclusions. The idea embraced in them is not very different from the system proposed by Meyer and adopted in Johnston's "Physical Atlas," where the earth is separated into provinces, according to latitude and longitude.

Although Dr. Joseph Hooker has perhaps done more than any other living Botanist for the science of Geographical Botany, especially in the way of supplying original material, I am not aware that he has anywhere expressed a definite opinion upon the great Botanical Regions, or their limits. The nearest approach to this which I am acquainted with in his writings is an incidental comparison in his Indian Flora of the plants of that country with the typical floras of other regions.† In this he notices the following types as characteristic of the regions in which they occur; viz.

1. The Australian type.
2. The Malayan Archipelago type.
3. The China and Japan type.
4. The Siberian type.
5. The European type.
6. The Egyptian type.
7. The Tropical African type.
8. The American type.

It does not appear whether these are all the regions into which he would divide the world; nor whether he regards them as all of equal value, but I think we may assume it to represent pretty nearly the main ideas which he entertains on the subject. So regarding it, it appears to me that of all the above authors, or any others that I have met with, Dr. Sclater and he take the most comprehensive and philosophical view of the subject; and although I differ to a certain

* Decandolle, op. cit, p. 478.
† Hooker's "Indian Flora." i. p. 103.

extent from both, it is not so much in principle as in the estimate of the value of the different divisions, and in the boundaries and extent to be allotted to each. Their distribution no doubt refers to different branches of organic life in my present subject, Mammals, but I believe the extent of difference to be attributed to that score is very trifling.

From Dr. Hooker I differ in company with Dr. Slater, as to the value to be given to the Siberian, Egyptian, European, and Chinese types. If North and South America are to go together as one, then surely these Old-world provinces should in like manner only form part of the great Europæo-Asiatic region.

From Dr. Sclater again I differ, whether in company with Dr. Hooker or not, I am not sure, in reckoning North and South America as one great region.

I differ from both in thinking that in estimating the *great* regions of the earth, we ought to include the Indo-Malayan region along with Africa, south of the Sahara.

In some other minor points I have also come to different conclusions from them. I shall, however, best indicate the points of divergence by stating separately my own views on the subject.

CHAPTER XLIII.

GREAT AND MINOR MAMMALIAN REGIONS.

It appears to me that the whole mammalian fauna now on the globe naturally divides itself into four great primary provinces of nearly equal value, each of which is subdivisible into two or more sections. These are: —

1. The Europæo-Asiatic, embracing 1. The Scandinavian district; 2. The Mediterranean district; 3. The Mongolian district.

2. The Africano-Indian, including 1. Africa, south of the Sahara; 2. The Indo-Malayan district.

3. The Australian, including 1. Australia; 2. New Guinea; 3. Polynesia.

4. The American, including 1. North America; 2. South America.

I. The Europæo-Asiatic Region.—This consists of Europe, North Africa, as far south as the southern limits of the Sahara, the northern half of Arabia, Syria, Asia Minor, Persia, and all Asia (including Japan, &c.) north of the southern slope of the Himmalayan range.

This corresponds with Dr. Sclater's Palæarctic region, with some exceptions. It carries the Mediterranean district considerably further south into Africa than he does. He stops at Mount Atlas, only including that portion of Africa which is north of that range. I look upon the barrier between Æthiopia and North Africa to be the Sahara, and not Mount Atlas. And not only so, but that the boundary line lies not on the north of the Sahara nor yet in the middle, but along its southern margin. Its inhabitants, although many of them are peculiar to itself, are decidedly of northern forms. Species of Hedgehog, Jerboa, the northern type of Shrews, Weasel, &c., all indicate a northern affinity. It would appear, that on the Sahara being raised from the bottom of the sea into its present position, it had been colonised from the north rather than from the south, and this is quite in accordance with the physical geography of the country. No one, now-a-days, will imagine that the bed of the Sahara was all raised simultaneously—at one shot, as it were. It must have been by degrees; and as the seat of elevation is shown by the inclination of the strata along the southern flanks of Mount Atlas, to have been in that range, it follows that the first part of the desert raised would be that nearest to it, the north, and the last the south: hence the Saharan Lake or Sea would be always diminished from the north, and the last remnants of it would be that most to the south; so, too, the colonisation would always be from the north, until the whole elevation was completed. Then it would, no doubt, be open to the animals from

MAP C.

GREAT MAMMALIAN REGIONS

ISOTHERMAL 32°

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

ARCTIC OCEAN

NORTH PACIFIC OCEAN

NORTH ATLANTIC OCEAN

SOUTH PACIFIC OCEAN

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

SOUTHERN OCEAN

BAFFIN BAY

GREENLAND

HUDSON BAY

BRITISH AMERICA

RUSSIAN AMERICA

UNITED STATES

CALIFORNIA

TEXAS

G. of MEXICO

CARIBBEAN SEA

SOUTH AMERICA

EUROPE

RUSSIA

SWEDEN

FINLAND

SCOTLAND

IRELAND

AUSTRIA

TURKEY

BLACK SEA

ASIA MINOR

SPAIN

PORTUGAL

AZORES

AFRICA

SAHARA DESERT

ARABIA

PERSIA

INDEPENDENT TARTARY

SIBERIA

MONGOLIA

CHINESE EMPIRE

THIBET

CHINA

OKHOTSK SEA

KAMTSCHATKA SEA

JAPAN SEA

YELLOW SEA

ARABIAN SEA

BENGAL SEA

CHINA SEA

AUSTRALIA

NEW ZEALAND

Dreg & Son Lamped Lith.

the south to enter it, too; but they would find the ground occupied by other animals fitted for the conditions of life of the desert, and in the struggle for life would be defeated.

The attempt to refer Arabia to its proper place is attended with peculiar difficulty, partly on account of its relations both to the Mediterranean district and Africa, and still more from the insufficiency of our information regarding its geological structure, its mammalian inhabitants, and the limits of their range; in fact, there are few countries of which we have scantier details, or as to which we more require information, than Arabia and Beloochistan.

From the imperfect notices which we possess, we know that a double element is present in Arabia. To the north, the animals are of the Mediterranean type. To the south, the African element prevails.

The conclusion to which I have arrived is, that in Arabia there has been a repetition or extension of the same phenomenon which occurs in Africa, viz., that until the recent epoch, the south has been separated from the north by a great sea, similarly situated to the Sahara, and that while this subsisted the southern part was united to Africa.

The features of the country harmonize with this view. Palgrave describes the whole of it as consisting of a central district, surrounded on every side by deserts, of which that lying to the south (Rhoba el Khali) is much the largest. It is this which I think formed the original boundary between the northern regions and the Africano-Indian continent now submerged. It sweeps round the south of Central or Inner Arabia in an immense semi-circle, reaching almost to the sea-shore, except on the south-east and south-west corners, that is, Oman and Yemen. This great desert is obviously a prolongation of the old Saharan sea, interrupted by the raised land of Nubia, Abyssinia, and Yemen, and the part lying to the south of it (Hadramaut) must have had its lot thrown in with the Africano-Indian continent; for it, or at least that portion of it which has been examined, must have been above water since the early tertiary epoch, for its geological formation is nummulitic and eocene. How far this formation extends into Oman and northwards from Aden through Yemen, is not, I believe, yet known.

That there is a considerable amount of African element of life in Arabia is shown by the following facts. The whole of the district of Hadramaut is inhabited by a race which is distinct from the northern Arabs, and more nearly allied to the Negro than they are. "The Kahtanee race," says Mr. Palgrave, "furnishes the link between the Arab and the Abyssinian." . . . "They are, so to speak, nearer related to the Negro than the Ismaelitic tribes, and hence more readily admit Africans to fellowship, intermarriage, and civil rights, nay even to government—a fact which has not escaped the discerning eye of Niebuhr."* He adds that "Kahtan, or in the Hebrew orthography Jektan, is acknowledged by all Arabs for the first founder and author of their race and nationality, while his residence is no less unanimously fixed in Yemen."†

To this I attach no weight, further than as an indication that this, perhaps, may have been the first district peopled; but the idiosyncratical facts mentioned by him are of more importance. "The influence, the black slave population imported from Africa exerts on this part of Arabia, (Oman at the mouth of the Persian Gulf) is hardly to be understood by unamalgamating Anglo-Saxons; but deeply felt and indeed extended among the more impressible Kahtanee population. I say Kahtanee, not Arab, in contradistinction to the northern and central races, both of which,

* Palgrave, "Journey in Central and Eastern Arabia," 1865, p. 453.

† Palgrave, op. cit. p. 455.

but especially the former, have a large admixture of that iron fibre which renders the European, and above all the Saxon machine (to borrow Hamlet's phrase), so remarkably independent of impressions from without. Hence among the Arabs of Shomer, and even of Nejid, Negroes, whatever their number, hardly weigh for more in the scale of national habits and feelings than they would in Norfolk or Yorkshire. But in Oman the case is very different."*

Then, monkeys are numerous in some of the southern portions of Arabia, and the species so far as known are the same as those found in Abyssinia and Nubia, such as CYNOCEPHALUS HAMADRYAS. What the exact extent of their range may be we do not know, but they are found abundantly in the south-west corner. Niebuhr tells us that in the woods of Yemen they occur in great numbers, although he somewhat laughingly treats as exaggerated the statement of a former English traveller that he had seen them in tens of thousands.

Next, great numbers of gazelles and antelopes are found in Arabia. Niebuhr speaks of their numbers in Yemen, and Palgrave bears testimony to their abundance in Central Arabia as an article of food; any species which have been recorded from Arabia are also found in Nubia and Abyssinia.

Ostriches range over almost the whole of the plains of Arabia, at least as far north as almost 30° N.L. This, however, is less significant, for they formerly ranged through countries still further to the north. It is mentioned by old travellers as common on the Isthmus of Suez down to the middle of the seventeenth century, and appears to have frequented Syria and Asia Minor, &c., at earlier periods.

Palgrave mentions a locust in Central Arabia from a gastronomical point of view, which so far as can be judged from the description of a non-entomological writer,† is of an African type, while the kinds he speaks of as found more to the north, are clearly of the northern type.

In the face of such instances it is impossible to dispute that an African element does exist in Arabia, and everything—geographical position, geological structure, and dispersion of the animals—goes to show that it has proceeded from the south. The question then comes to be, how far it extends north? Schmarda, in his map, includes almost the whole country south of the Peninsula of Sinai, along with Nubia, Abyssinia, and South Africa, as one region. This, I think, takes the line too far to the north. If it were taken as at the time when the present Rhoba el Khali desert ceased to be sea; then, I apprehend, the true limit of the African region would be a line along the southern margin of that desert, that is, along the north of Hadramaut, leaving only a narrow strip of land next the Arabian Sea; and if the elevation of the desert had taken place in consequence of the rise of land in the north, then it would still have been the proper limit; for a rise from the north would produce a repetition of what we find in the Sahara, viz. that the desert had been peopled on the side which first emerged, in its case the north. But it is not so clear that it was so in the present instance. The Kahtanee Arabs are no doubt confined to the Hadramaut, but the monkeys extend at least considerably to the north in Yemen, and the antelopes and locusts go as far north as Central Arabia and the ostriches beyond it. I am inclined to think that this implies that the invasion of the new territory disclosed on the raising of the beds of the deserts, took place from the direction of Africa (that is, the south-east) viz. by

* PALGRAVE'S "Journey through Central and Eastern Arabia," p. 272.

† I trust I do Mr. PALGRAVE no wrong in assuming that he is innocent of entomology. My opinion is formed from his reporting, and apparently believing, that like bees, these locusts have queens.

the elevation of the highlands of Abyssinia. This, no doubt, is mere conjecture, founded on the distribution of the animals. Subsequent geological observations may show that the fact was not so, but in the meantime, as we have no better guide to go by, I have followed the distribution of the majority of species so far as we know it, leaving a little margin to the north for wandering species, such as the ostriches, to spread over, and placed the limit of the African portion of Arabia to the north of the southern desert instead of to the south of it, as in the case of the Sahara.

From the north of the Europeo-Asiatic region I exclude Greenland and Spitzbergen, on the strength of the American character of the Reindeer, the Polar Hare, and the Hudson's Bay Lemming, which are almost the only Greenland circumpolar mammals in which attempts have been successfully made to distinguish the American from the Old-world type. I also provisionally exclude Iceland, because I believe that the only aboriginal animal, the economic MUS SYLVESTRIS, of Olafsen and Henderson, will prove to be the American Lemming.

I am silent as regards the Aleutian Islands, for the only mammals which I know of as having been found there are the Rhytina, the Walrus, various Seals, and other marine animals, which range along both sides of the Northern Pacific.

This enormous region, covering, as stated by Dr. Sclater, a space of not less than fourteen millions of square miles, has a very homogeneous, although by no means numerous mammalian fauna, but is, notwithstanding, separable into three minor provinces, nearly equivalent to Dr. Hooker's European, Siberian, and Egyptian types.

The first is the Scandinavian, which includes north and mid Europe, and Asia north of the Caspian and west of the Lena. The mammals of Great Britain furnish a fair illustration of the mammalia found this region.

The next province is what is now called the Mediterranean region, and consists of the lands which surround that sea; viz. Spain, Italy, Greece, and generally what is known as the South of Europe; Asia Minor; Syria; North Arabia; Egypt; North Africa; and the Sahara. The most difficult points in relation to this district are Nubia and Abyssinia, and the south of Arabia. To this province belong the Azores and Canary Islands. It has a more African facies than the Scandinavian; the Jackal, the Zorilla, the Genet, the Leopard, Lion, and other felines, making their appearance in it.

The last remaining province consists of the high steppes of Central Asia, extending from Cashmir through Mongolia to Japan, and apparently including the non-arctic northern regions lying to the east of the Lena. Irkutsk seems to be about the point where the eastern and the western species overlap each other.

This province is characterised not so much by different genera as different species of the animals which inhabit the Scandinavian district.

A list of the genera common to these different districts and of those absent from them is given in the Appendix.

I have the more confidence in the view entertained by Dr. Sclater and myself of the unity of Europe and Asia, north of the Himmalayahs, as a great province of life, in that it is consistent with the course of events which I believe to have occurred in these continents during and subseqent to the glacial epoch, and which I have explained at length in discussing the theory of a Miocene Atlantis. The comparative paucity of species in this region is, I think, evidence of its having received its population more recently than other regions where the inhabitants are more numerous.

II. The Africano-Indian Region. This includes Africa, south of the Saharan desert, the South of Arabia, and the Indo-Malayan and Indo-Chinese regions.

I have already explained the geological grounds on which I consider India to have been united to Africa during the miocene epoch. These are supported by the affinities of the two faunas.

If we put aside a few instances where species have wandered a little beyond their natural bounds, Africa and India have a large number of points in common, and that not only in what they possess but also in what they do not. Among many others they possess the following mammalian forms in common, and alone possess them. To them are confined the whole tribe of Old-world Monkeys (Catarrhini). In them are found species of Anthropoid Apes, and this remarkable type occurs nowhere else. Each of them has Baboons, no other region has. The Lemurs are found in both, and nowhere else. Both are the countries of the Jackals. The Buffaloes are denizens of both. Africa is the great centre of the Antelopes, but a few are also found in the Indian region, and they are almost absent from every other. Camelopards, although now confined to Africa, in former times also lived in India. The true Shrews are found in neither country, although plentifully in Europe and Northern Asia; but the tropical Shrews (Crocidura) occur in both, and nowhere else. More instances might be cited, but enough has been done for my purpose. In like manner, the most of the species found in Europe and North Asia are absent from India and Africa. The Elephant and Rhinoceros are usually cited as indications of the former union of Africa and India. They undoubtedly are so, but their presence solely in these two countries now cannot be cited as instances of a special fauna inhabiting both. Their occurrence in Europe, Asia, and America, during the miocene period, shows that they were not peculiar to the Africano-Indian region. So the Hippopotamus was formerly European. If Africa is, *par excellence*, the land of the heavy Pachyderms now, it was not so always. The specialty of these faunas rests on other grounds. In the Appendix will be found a list of the genera present in, and absent from, both of these lands.

If, in defiance of these concurrences, we separate India from Africa, we must alter the standard of our regions; we must separate North America from South America, New Guinea from New Holland, and Polynesia from both, and perhaps establish other provinces, such as the Mediterranean, the Scandinavian, and the Mongolian.

But although India and Africa form one great region, equivalent in size and homogeneousness to the Europæo-Asiatic, their subdivision into two very important and well-marked regions is equally clear — the African and the Indo-Malayan. The Indian portion of this region consists of India south of the southern ridge of the Himmalayah, Ceylon, the Indo-Chinese region, viz. Burmah, Cochin China, Siam, part of China, the Malayan Peninsula, Sumatra, Java, Borneo, and the neighbouring islands west of the Straits of Macassar.

The Philippine Islands also belong to this district and Formosa, and the other islands adjoining the coast of Southern China. Formosa, in addition to the Chinese types of Mammals, possesses also a trace of the Himmalayan element. It is, in fact, the termination of that range. These mountains after crossing China here sink into the sea. Mr. Swinhoe mentions that the species which are identical with those of China are darker and of more lively tints, and those that differ more nearly resemble Himmalayan forms than those of the plains of China. Dr. Sclater reckons Mauritius as an appurtenance of Africa, which its proximity would seem to confirm, but its Coleoptera are certainly Indian (Protætia maculata would condemn it for Indian in any court in Europe). The only mammals that I can find recorded as inhabiting Mauritius, besides the domestic animals (including

MAP CI.

MINOR SUBDIVISIONS OF

GREAT MAMMALIAN REGIONS.

Day & Son (Limited) Lith.

the Rat), are a Malayan Monkey and an Indian Hare, viz. MACACUS CYNOMOLGUS, the organ-boys' favourite, and LEPUS NIGRICOLLIS; both, however, are said by Mr. Blyth to have been introduced.

The African province is divisible into several distinct districts. There is, first, one in West Africa, composed of Senegambia and Guinea, or the whole West-African country south of the Sahara and north of the Niger. This is, *par excellence*, the district of Monkeys, especially of the CERCOPITHECI. Next, there is the country between the Niger and the Congo. Great rivers, we have already seen, form effective barriers to restrain the spread of species, but they must be long enough not to be easily turned. We have a good illustration of this in the province in question. On the north it has the Niger, which is too long to be turned, and it consequently forms a tolerably effective barrier. Next come the Old and New Calabar rivers, and the Gabon, which are broad rivers, but not of great length. They can be turned; and we see a general provincial resemblance between the faunas of these different rivers, although each has a lesser local fauna of its own also. To the south is another barrier river, the Congo, which can be turned, but not so easily as the others. It seems sufficiently large and long to act as a barrier, although not so effective a one as the Niger.

Beyond the Congo we come to the Angola district, in which the Cape element begins to predominate; and when we cross the Orange River we are in a new province, which extends southwards to the Cape, thence northwards to Natal and Mozambique, and with little change on to Abyssinia. Whereas the west coast has four tolerably distinct provinces south of the Sahara, the east coast seems to have only one. A change occurs about Mozambique which becomes more decided when we reach Zambesia, and probably reaches its height in Somali Land. When we reach Abyssinia we pass into a new country, a sort of debateable land,— in fact, we seem to enter on the old barrier between Africa south of the Sahara, and the northern regions. Its affinities, when they are not with the the north, which they chiefly are, are more with the west than with the south.

The gradual passage from the south to the north, and the break at Abyssinia, are well illustrated by a comparative table, given by Dr. Sclater, of the species of Antelope found by Captain Speke in East Africa, contrasted with those found by Rüppell in Abyssinia and by Peters in Mozambique:—

"ABYSSINIA (*Rüppell*).	E. AFRICA (*Speke*).	MOZAMBIQUE (*Peters*).
	Antilope melampus	Antilope melampus
	Calotragus melanotis	Calotragus melanotis
Scopophorus montanus	Scopophorus montanus	
	Nesotragus moschatus	Nesotragus moschatus
Heleotragus bohor?	Heleotragus reduncus	
	Kobus ellipsiprymnus	Kobus ellipsiprymnus
	,, sing-sing	
	,, leucotis	
	Ægoceros leucophæus	
	,, niger	Ægoceros niger
	Catoblepas gorgon	Catoblepas gorgon
	Boselaphus sp.	Boselaphus Lichtensteinii
	Tragelaphus Spekei	
	,, sylvaticus	Tragelaphus sylvaticus
	Oreas Livingstonii	Oreas canna?
	Strepsiceros kudu	Strepsiceros kudu"*

In what I have here said, however, I should observe that I have drawn my conclusions not

* SCLATER, in "Proc. Zool. Soc." 1864, 99.

entirely from the mammals, but from a general view of all the classes of its inhabitants with which I am acquainted.

Madagascar, with an African type, is thoroughly peculiar, and there is reason to expect that its complete examination will present some very interesting results. This we know already, that while some parts of it teem with the most extraordinary and beautiful creations, others are in no respects particularly remarkable, and contain many of the species already known from the opposite coast of Africa. I have already noticed the chief points in the geographical distribution of its Mammals in speaking of the Lemurs, which are its most remarkable mammalian inhabitants.

The Indian region has not the same marked provinces which exist in West Africa. It is in this respect, like the east of Africa, pretty homogeneous throughout. The continent of India might be divided into the Himmalayan or mountain district, and the plain. Ceylon may form another district, and the Indian Archipelago another. Perhaps the most noteworthy points are those which I have already discussed regarding the mammalian fauna of Borneo, and the cause of its peculiar constitution. I have already said that I do not believe that the concurrent presence of species in Sumatra and Ceylon, rested on by Sir Emerson Tennent as proof of the former continuity of the latter with the former, instead of with India, is anything more than a proof of the common origin of the Malayan and Indian faunas.

The characters of the Mammalian fauna of Africa have given rise to a class of speculation which I notice only to avoid the appearance of having neglected or ignored it; for I do not think that they have much useful bearing upon, or relation to, geographical distribution. M. Pucheran, for example, draws attention to the following particulars as characteristic of the mammals of Africa, viz., the predominance of terrestrial over aquatic species; the prevalence of fawn-coloured fur; a tendency to modification in the proportion of the limbs of the animals (of which the Hyæna, the Giraffe and the Buffalo are examples), by which the anterior limbs are increased in size apparently at the expense of the posterior; and the Macroscelides, Helomys, and Dendromys, of the reverse; a tendency to unusual development of the ears (a character already noticed by Geoffroy St. Hilaire as common in desert animals, and by De Blainville in southern animals); and the existence of a genus of rodents peculiar to itself in each of four zones into which he divides the continent.

I do not say that each of these peculiarities may not furnish interesting subjects of inquiry, but as they are the result of affinity, and the conditions of the country, they have only a secondary and reflected relation to geographical distribution.

III. The Australian Region contains Australia, Van Dieman's Land, Papua and adjacent islands east of the Straits of Macassar and Lombok, Polynesia, and New Zealand.

Similar reasons to those which induce me to unite Africa to India on the great scale, justify the union of New Guinea with Australia. Like them, their past geological history indicates that the straits and seas which now separate them did not always exist. Like them, too, their faunas have a certain affinity together, and also many joint points of dissimilarity from others. Dr. Sclater says of them, "New Guinea is in some respects so peculiar in its ornithology, as far as we are acquainted with it, that it would at first sight appear as if it ought to form a zoological region of itself; but there are certainly many genera common to it and Australia, and for the present I am inclined to retain it as part of the Australian region. Both New Zealand and the Pacific Islands

have also some claims to stand alone as separate regions, their forms of ornithic life being in many cases peculiar and local. If they can be attached anywhere, however, it is to Australia."*

So far as the Pacific Islands are concerned a few Bats are the only mammals found on them, and, therefore, much on either side cannot be inferred from their presence, especially as they belong to types which extend to India and China as well as to Australia. Still, the inferences from their belonging to forms also found in Australia do not, so far as they go, contradict any indications in this direction which can be drawn from other classes of organised beings. These, however, are but few and indistinct.

The distribution of Mammals in New Guinea and Australia teaches us something regarding the disjunction of the lands, and also something regarding the origin of species, confirmatory, as I read it, of change of condition playing an important part in the process of development. The point of resemblance between them in Mammals is the occurrence of marsupial animals in New Guinea as well as in Australia. But the New-Guinea forms are mostly, as already mentioned, of peculiar types, usually so distinct as not to fit into any of the old genera, so that new genera have to be made for their reception. There are Kangaroos; but with one exception (the Filander) they are Tree Kangaroos (Dendrolagus). There are Phalangers, but they are of the genus Cuscus. For long, these forms were supposed to be confined to New Guinea. The number of species known has gradually increased, but they always came from New Guinea or its dependencies. But, latterly, it has been ascertained that they are not absolutely confined to that district, and that species are also found in the nearest points of Australia. A Tree Kangaroo has been found in North Australia, and a Cuscus on Cape York, the north-east point of Australia. The occurrence of these species there seems to prove that the disjunction of the two countries must have been pretty long a-doing, and that the country between the two passed through the same half-drowned condition as that of the present coast of New Guinea, where the Dendrolagus is now found. If New Guinea had been summarily divorced from Australia, and new species had sprung up in it, the new forms would have been confined to it. They could only be found in Australia by the animal floating or swimming across, which I may be permitted to say is at least not a likely mode of progression for a Kangaroo. But if we suppose the disjunction to have proceeded at a slow pace, and the peculiar conditions of the land (whatever they may have been) to have existed long enough to have allowed the production of new species before the final separation was actually consummated, we should then have a simple explanation of the presence of those New-Guinea forms in Australia. That they are rare probably shows that the disjunction must have been nearly completed by the time they had begun to appear, and that they are still confined to the points of Australian land nearest to New Guinea seems to warrant one of two inferences; either that species are slow to leave their country, or that when they do so and get into lands with new conditions of life they are transformed into other species, or die off.

Having been so recently engaged in discussing the different provinces into which Australia is divided, I shall merely refer the reader back to the two last chapters for information on that point. The occurrence of one or more Papuan Marsupials in the New Hebrides shows that that group belongs to the New-Guinea district, and not to the Polynesian.

IV. The American Region.—The whole of the American Continent, both North and South,

* Sclater, op. cit. p. 141.

seems to me to belong to one zoological region, in the same way as the other large regions of which we have been speaking. No doubt the boreal extremity of North America is tinged with a Europeo-Asiatic admixture; but this is an extraneous element grafted upon the genuine stock, and easily eliminated from it. Regarded from the same extended point of view from which we have regarded the others, I can see no ground for separating the South from the North. In Mammals, the chief character warranting separation is the occurrence of extinct and existing Edentata, and yet it is not so long ago (speaking geologically) since they existed in North as well as in South America. We have seen that it is a moot point whether the Megatherium did not survive the glacial epoch on North-American soil; and one or two small members of the edentate family do still survive in its southern parts to this day.

Wherever there is a typical difference between the families of the Old and New World, it extends equally to those of North as of South Amercia, as in the case of the Vesper Mice and Cotton Rats. The largest carnivora are common to both; and the Opossum wanders as far north as the Dasypus. On the other hand, the great tribe of Platyrrhine Monkeys, although it extends into Mexico, does not enter North America proper, but no inference unfavourable to the unity of the whole American Continent can be drawn from this fact, because in no country are the Monkeys found much beyond the line of the tropics. That is their limit, and they do penetrate into North America as far as the tropic of Cancer. They go as far as the temperature they require will allow them. The Phyllostomatous Bats also do not advance into North America beyond that tropic. But there are other forms of mammalian life which are limited to South America, as the Tapir, the only living representative of the American Pachydermata, the Llamas, the Cavies, Chinchillas, and other Rodents. Still, there is generally a New-world facies, which distinguishes the life of both North and South America from that of the Old World; in the same way as there is an Old-world facies applicable alike to European and Asiatic species. The same principles which we have applied to the partition of the Old World seem, therefore, when applied to the New, to call for the recognition of North and South America as one single distinct, great zoological region.

It is, however, divisible, like the preceding regions, into two very distinct halves—North and South America. As to the former, the chief points calling for notice here are its northern and southern limits. Are we to consider Greenland a part of it, or not? We have seen that, judged by its earlier life (plants and insects), it should go along with Europe; estimated by its later life (birds and mammals), it belongs to America. We must, therefore, regard it as American or European, according to the date when it is spoken of. It is like a young lady who has been married. If we are asked whether she is Miss Europe or Mrs. America, we reply that she is both; but as by custom she bears the name due to her later condition, I think we must reckon Greenland as now American, although formerly European; the exact date of the dissolution of her connexion with Europe we cannot tell, but it was subsequent to the deposit of the peat-bogs in Shetland and Orkney. The same remarks apply to Iceland and Spitzbergen. The facts which lead to these conclusions seem equally to show that North America must have received the Europeo-Asiatic element, which prevails over the whole of its northern half, not from Europe but from Asia, by a former union of the two Continents at Bhering's Straits, or some equivalent line of transit.

The North-American continent is divisible into several provinces. The most northerly, or Arctic region, viz. the country lying north of the latitude of Slave Lake, has been divided into two, that east of Mackenzie's River and that west of it; and the former of these, if not also the latter,

has been divided into two smaller, north and south, districts — that bearing wood, and that (the more northern, called the Barren-Ground region) too desolate and cold for wood to grow upon. South of these northern districts the fauna indicates a tripartite longitudinal division; and each of these stripes is capable of further local subdivision, according to its latitude and climate. We should expect the Rocky Mountain range to form the chief longitudinal line of separation, but, as already said, it only separates species in a minor degree. The actual mountain barrier appears to be the Cascade range on the west side of the Rocky Mountains, separating Oregon and California from the rest of North America; and the dividing limit between the two other regions seems to be the Nebraska country, in which lie the Mauvaises Terres, and Nebraska and Niobrara beds, on this side of the Rocky Mountains, — the line of separation, in fact, being marked by the site of the ancient tertiary sea in which these beds had been deposited.

These longitudinal sections reach as far south as Texas and New Mexico, when a new province commences, which continues through Mexico and Central America to the Isthmus of Panama.

As to the southern boundary of the whole North American region I have already, when speaking of the Vesper Mice, given my reasons for preferring Panama to a more northerly point. Although South American species extend to the north of this limit, few, if any, North American species pass to the south of it; and this distribution concurs with the physical features of the country in pointing out the narrowest and lowest neck of land as that most likely to have been the place where a barrier between the two continents existed at some former period, which allowed the shells of the Pacific to penetrate into the Gulf of Mexico.

Dr. Sclater has carried the ornithic limit between the two regions up into the heart of Mexico, but not without hesitation. Even more than in the Mammals, Central America is a sort of debateable ground, in which the species of birds both from the south and the north meet and overlap each other.

The same difficulty occurs with regard to the West Indian Islands. Do they belong to the north or south? They have something of both in their character, besides a good deal that is peculiar to themselves. But, in the first place, a preponderance of essentially South-American forms occurs in them, more especially the Phyllostomatous Bats; and in the next place, if we look at Map 2, which shows the effect of a depression of land to the extent of 600 feet, (an amount which must have been greatly exceeded before a marine channel separating North from South America could have been formed,) we see that although they now lie so near North America a great part of the southern extremity of that continent, viz. Florida, Georgia, Alabama, South Carolina, &c., must then have been beneath the waves. This would place a much greater distance between North America and these islands than there is now, while their present relations, so far as regards size and distance from South America, would remain comparatively unchanged. The same is the case with Central America. It would still have stood then as now; and the configuration of the land and water in that region, under such a depression, gives a great temptation to suppose the connexion of the West Indian Islands to have been with Central America on the one hand, and Venezuela on the other: but the distribution of the mammals does not seem to sanction this, and I rather incline to think, that when North and South America were disjoined it was by a strait at Panama, which turned up along the eastern coast of Guatemala, and passed to the north of Cuba and Haiti, leaving them and the other West Indian Islands connected with Venezuela on the east and south.

The South-American half of the New World consists of the whole of South America, the West Indian Islands, Tierra del Fuego, the Falkland Islands, and Galapagos.

Whilst these are the regions, I think, which the distribution of Mammals (aided by some slight collateral help, drawn by anticipation from that of other classes) shows to exist, there are some facts in distribution which indicate a more extended connexion of the different lands. A former northerly land communication between the western coast of North America and Northern Asia, by which such animals as the Spermophiles, Moose, Reindeer, and Glacial Hares, may have passed, seems clear beyond doubt; but a more southerly one (probably at an earlier date) may also have existed. The occurrence of the Japanese Mole Urotrichus, both in Japan and on the opposite shore of California, is additional testimony in favour of this view. It cannot be expected that in such doubtful cases any great number of instances should be found among Mammals. They are comparatively so few in number, that a single instance should have more weight than many examples drawn from classes of animals which are more numerous in species. But we shall by-and-bye find that other similar instances are to be met with amongst these too.

In like manner, there are affinities indicating former continuity between South America and the Indian Archipelago, subsisting, perhaps or ever the Andes had begun to rise above the level of the surrounding land. It is difficult to explain the occurrence of the Tapir in both in any other way, or the use of the blow-pipe by the natives of New Guinea and the tribes of the Amazons on any other footing. The facies of the Fauna of the Galapago Islands speaks of the former extension of the continent at least as far as these Islands. To the same period and same access may be referable the origin of the Monkeys in South America. Besides the argument from opportunity of passage, the New-world Monkeys have rather more resemblance to the Indian than the African species.

There are also some affinities between the species of Western Africa and the coast of Brazil which point to some such continuity between these countries. There is the remarkable instance of what may almost be called a South-American Old-world Porcupine (Aulacodus Swinderianus) in West Africa; of the Petromys typicus, another Rodent, belonging to the South-American type, in South Africa; and of the Ant-eater and Orycteropus, the Manis and Dasypus, found respectively in these countries. I have elsewhere given some striking instances of new species of Coleoptera from Old Calabar, very closely allied to Brazilian species.* Mr. Fry has detected other instances of a like nature in species from Lagos; and Mr. Bates informs me that he is satisfied that similar affinities exist in some of the Lepidoptera of the two opposite countries. It is difficult to imagine how these coincidences can be accounted for in any other way than by continuity of land, or contiguity so near as to be equivalent to continuity at some former time.

There are other topics which, if they had not been already discussed in the progress of this volume, ought to have been treated of here, but to do so would merely be to occupy the reader's time with a twice-told tale. With my views on the submerged Pacific Continent; on the separation of the Indian region from the Australian; the divisions of Australia; the submerged Africano-Indian Continent; the former junction of Madagascar to Africa; the possible existence of land between South-west Australia and the Cape of Good Hope, the Miocene Atlantis and kindred topics, the reader who has followed me thus far is familiar.

* "Trans. Linn. Soc." xxiv. p. 449. 1862.

APPENDIX.

No. I.—Classification of Mammals proposed by different Authors of eminence.

CUVIER'S CLASSIFICATION (First System). 1800.

Order.

1. MAN
2. QUADRUMANA
   Monkeys, (including Lemurs, but not Galeopitheci)
3. CARNIVORA
   1. Bats (including Galeopitheci)
   2. Insectivora
      Hedgehogs, Shrews, Moles
   3. Carnivora proper
      1. Bears, Badgers, &c.
      2. Polecats, Otters, Dogs, Hyenas, Cats
      3. Seals
4. MARSUPIALS
   1. Opossums, Thylacinus (Australian Tiger), Dasyurus (Devil), and Perameles
   2. Phalangers—Flying Petaurus
   3. Hypsiprymni
   4. Kangaroos
   5. Koala
   6. Wombats
5. RODENTS
   Squirrels, Aye-Aye, Rats, Marmots, Beavers, Porcupines, Hares, Cavies, Agoutis, Damans
6. EDENTATA
   1. Sloths
   2. Armadillos, Ant-eaters, &c.
   3. Monotremata
7. PACHYDERMATA
   1. Proboscidea—Elephants
   2. Pachydermata proper—Hippopotamus, Hog, Peccari, Rhinoceros, Hyrax, Tapir
   3. Solipedes—Horse
8. RUMINANTS
   Camels, Musk-deer, Camelopard, Antelopes, Goats, Sheep, Oxen

CUVIER'S CLASSIFICATION, *continued*:—

Order.

9. CETACEA
   1. Herbivorous Cetacea — Manatees, &c.
   2. Cetacea proper
      1. Dolphins
      2. Whales

MILNE EDWARDS' CLASSIFICATION. 1855.

1. Bimana
2. Quadrumana
3. Cheiroptera
4. Insectivora
5. Rodentia
6. Edentata
7. Carnivora
8. Amphibia
9. Pachydermata
10. Ruminantia
11. Cetacea
12. Marsupialia
13. Monotremata

VAN DER HOEVEN'S CLASSIFICATION. 1858. (reversed)

Order.

1. BIMANA
   Man
2. QUADRUMANA
   1. Monkeys
   2. Lemurs
3. PTENOPLEURA
   Galeopitheci

VAN DER HOEVEN'S CLASSIFICATION, *continued*:—

Order.

4. CHEIROPTERA
   1. Frugivorous Bats—Pterotocyna
   2. Insectivorous Bats—Nycterina
5. FERÆ
   1. Erinaceina—Hedgehogs
   2. Soricina—Shrews
   3. Talpina—Moles
   4. Ursina—Bears
   5. Mustelina—Pole Cats
   6. Canina—Dogs
   7. Viverrina—Civet Cats
   8. Felina—Cats
   9. Pinnipedia—Seals
6. GLIRES (RODENTS)
   1. Sciurina—Squirrels
   2. Dipoda—Jerboas
   3. Eriomyina—Chinchillas
   4. Muriformia—Petromys
   5. Cunicularia—Georhychi
   6. Murina—Rats and Mice
   7. Palmipedia—Beavers
   8. Aculeata—Porcupines
   9. Subungulata—Cavies
   10. Duplicidentata—Hares
7. EDENTATA
   1. Tardigrada—Sloths
   2. Effodientia—Armadillos, Manis, Ant-eaters
8. RUMINANTS
   1. Cavicornia — Ox, Sheep, Goat, Antelope
   2. Elaphii—Deer
   3. Tylopoda—Llama, Camel
9. PACHYDERMATA
   1. Artiodactyla
      1. Hippopotamina—Hippopotamus
      2. Suina—Sow

VAN DER HOEVEN'S CLASSIFICATION, *continued* :—

Order.

9. 2. Perissodactyla
   1. Solidungula—Horse
   2. Tapirina—Tapir
   3 Lamnungia—Hyrax
   4. Nasicornia—Rhinoceros
   3. Proboscidea
   1. Elephantina—Elephants

10. CETACEA
   1. Sirenia—Manatee, Dugong
   2. Cetacea—Whales, Dolphins

11. MARSUPIALS
   1. Pedimana—Opossum
   2. Dasyurina—Devil and Tiger
   3. Peramelina—Perameles, Tarsipes
   4. Phalangistæ—Flying Petaurus
   5. Macropoda—Kangaroos
   6. Glirina—Wombat

12. MONOTREMATA
   Echidna—Ornithorhynchus

OWEN'S CLASSIFICATION. 1857.

Sub-Class.

1. ARCHENCEPHALA (ruling-brained)
   1. Bimana
   Man

2. GYRENCEPHALA (folded-brained)
   1. Unguiculata
      1. Quadrumana
         1. Catarrhina — old world Monkeys
         2. Platyrhina — new-world Monkeys
         3. Strepsirhina—Lemurs
      2. Carnivora
         1. Digitigrada—Cats and Dogs
         2. Plantigrada—Bears
         3. Pinnigrada—Seals
   2. Ungulata
      1. Artiodactyla (even-toed)
         1. Hog, Peccari, Hippopotamus
         2. Cattle, Sheep, Goats, Antelopes, Deer, Camels
      2. Perissodactyla (odd-toed)
         1. Horse
         2. Rhinoceros, Tapir, Hyrax
      3. Proboscidea
         1. Elephant
         2. Dinotherium
      4. Toxodontia (fossil)
         1. Toxodon
         2. Nesodon
   3. Mutilata
      1. Sirenia
         1. Manatee
         2. Dugong
      2. Cetacea
         1. Dolphins
         2. Whales

3. LISSENCEPHALA (smooth-brained)
   1. Bruta
      1. Sloths
      2. Armadillos
      3. Ant-eaters

OWEN'S CLASSIFICATION, *continued* :—

Sub-class

2. Cheiroptera—Bats
   1. Frugivorous Bats
   2. Insectivorous Bats
3. Insectivora
   1. Moles
   2. Hedgehogs
   3. Shrews
4. Rodentia
   1. Non-claviculata (Cavies, Damans, &c.)
   2. Claviculata (Squirrels, Rats, Marmots, Beavers, Porcupines)

4. LYENCEPHALA (disconnected-brained)
   1. Marsupialia
      1. Rhizophaga (root-eating)—Wombat
      2. Poëphaga (grass-eating)—Kangaroos
      3. Carpophaga (seed-eating)—Flying Opossums, Petaurus
      4. Entomophaga (insect-eating) Perameles
   2. Monotremata
      1. Echidna
      2. Ornithorhynchus

GIEBEL'S ARRANGEMENT. 1859. (reversed.)

UNGUICULATA

I. QUADRUMANA

Similæ

1. *Fam. Simiæ Catarrhinæ*
   Pithecus
   Hylobates
   Semnopithecus
   Cercopithecus
   Innuus
   Cynocephalus

2. *Fam. Simiæ Platyrrhinæ*
   Mycetes
   Ateles
   Lagothrix
   Cebus
   Pithecia
   Brachyurus
   Nyctipithecus
   Callithrix
   Chrysothrix
   Hapale

Prosimiæ

3. *Fam. Lemures*
   Lichanotus
   Propithecus
   Lemur
   Lepidilemur
   Chirogaleus
   Stenops
   Pterodicticus
   Microcebus
   Otolicnus
   Tarsius

GIEBEL'S ARRANGEMENT, *continued* :—

II. CHEIROPTERA

4. *Fam. Dermoptera*
   Galeopithecus

5. *Fam. Frugivora*
   Pteropus
   Macroglossus
   Harpyia
   Hypoderma

6. *Fam. Istiophora*
   Diphylla
   Desmodus
   Phyllorhina
   Rhinolophus
   Megaderma
   Nyctophilus
   Nycteris
   Phyllostoma
   Glossophaga
   Rhinopoma
   Brachyphylla
   Stenoderma

7. *Fam. Gymnorhina*
   Mormops
   Chilonycteris
   Taphozous
   Noctilio
   Emballonura
   Diclidurus
   Dysopes
   Thyroptera
   Vespertilio
   Nycticejus
   Furia

III. FERÆ

Insectivora

6. *Fam. Aculeatæ*
   Erinaceus
   Echinogale
   Ericulus
   Centetes

9. *Fam. Soricinæ*
   Eupleres
   Gymnura
   Hylomys
   Ptilocercus
   Cladobates
   Rhynchocyon
   Macroscelides
   Myogale
   Solenodon
   Sorex

10. *Fam. Talpinæ*
   Urotrichus
   Spalacotherium
   Scalops
   Palæospalax
   Hyporyssus
   Geotrypus
   Dimylus
   Talpa
   Condylura
   Chrysochloris

Carnivoræ

11. *Fam. Felinæ*
   Felis
   Cynælurus
   Machairodus
   Pseudælurus

GIEBEL'S ARRANGEMENT, *continued :—*

12. *Fam. Hyeninæ*
Proteles
Hyæna

13. *Fam. Caninæ*
Hyænodon
Speothos
Protocyon
Canis
Cynodon
Otocyon

14. *Fam. Viverrinæ*
Galidia
Crossarchus
Rhyzæna
Herpestes
Galidictis

15. *Fam. Mustelinæ*
Enhydris
Pterura
Lutra
Gulo
Icticyon
Mustela
Rhabdogale
Galictis
Ratelus
Helictis
Mephitis
Mydaus
Meles

OMNIVORÆ

16. *Fam. Arctocyoninæ*
Amphicyon
Palæocyon
Agriotherium

17. *Fam. Ursinæ*
Ailurus
Arctitis
Cercoleptes
Nasua
Procyon
Ursus

IV. MARSUPIALIA

18. *Creatophaga*
Thylacinus
Dasyurus
Phascologale
Phascolotherium
Thylacotherium
Myrmecobius

19. *Fam. Entomophaga*
Chæropus
Perameles
Didelphis
Cheironectes
Tarsipes

20. *Fam. Carpophaga*
Petaurus
Phalangista
Phascolarctos

21. *Fam. Poephaga*
Nototherium
Diprotodon
Hypsiprymnus
Dendrolagus
Macropus

22. *Fem. Rhizophaga*
Phascolomys

GIEBEL'S ARRANGEMENT, *continued :—*

V. GLIRES

23. *Fam. Chiromyini*
Chiromys

24. *Fam. Sciurini*
Sciurus
Pteromys
Tamias
Spermophilus
Plesiarctomys
Arctomys

25. *Fam. Myoxini*
Graphiurus
Eliomys
Muscardinus
Glis

26. *Fam. Castorini*
Castor

27. *Fam. Arvicolini*
Fiber
Arvicola
Myodes

28. *Fam. Dipodidæ*
Pedetes
Dipodomys
Macrocolus
Jaculus
Alactaga
Dipus

29. *Fam. Merionides*
Otomys
Mystromys
Meriones

30. *Fam. Murini*
Hapalotis
Phlæomys
Hydromys
Cricetus
Cricetomys
Saccostomus
Perognathus
Saccomys
Drymomys
Anodon
Dendromys
Pseudomys
Steatomys
Mus
Hesperomys
Neotoma
Sigmodon
Reithrodon
Sminthus
Acomys

31. *Fam. Sciurospalacini*
Geomys

32. *Fam. Spalacini*
Ellobius
Haplodon
Heliophobius
Georychus
Bathyerges
Siphneus
Spalax
Heterocephalus
Rhizomys

GIEBEL'S ARRANGEMENT, *continued :—*

33. *Fam. Chinchillidæ*
Archæomys
Chinchilla
Lagidium
Lagostomus

34. *Fam. Muriformes*
Spalacopus
Schizodon
Ctenodactylus
Octodon
Petromys
Ctenomys
Loncheres
Aulacodus
Carterodon
Cercomys
Dactylomys
Habrocoma
Mesomys
Echinomys
Plagiodontia
Capromys
Myopotamus

35. *Fam. Hystrices*
Anomalurus
Theridomys
Artherura
Hystrix
Erethizon
Cercolabes
Chætomys

36. *Fam. Cavini*
Dasyprocta
Cœlogenys
Hydrochærus
Dolichotis
Kerodon
Cavia

37. *Fam. Leporina*
Titanomys
Lagomys
Lepus

VI. EDENTATA

38. *Fam. Tardigrada*
Choloepus
Bradypus

39. *Fam. Gravigrada*
Scelidotherium
Mylodon
Megalonyx
Megatherium

40. *Fam. Fodientia*
Chlamydotherium
Glyptodon
Heterodon
Euryodon
Dasypus
Glossotherium
Orycteropus

41. *Fam. Vermilingua*
Myrmecophaga
Manis

42. *Fam. Monotremata*
Echidna
Ornithorhynchus

GIEBEL'S ARRANGEMENT, *continued*:—

UNGULATA

I. SOLIDUNGULA

1. *Fam. Equina*
Equus
Hippotherium
Hipparion

II. BISULCA

2. *Fam. Tylopoda*
Camelus
Auchenia

3. *Fam. Camelopardalidæ*
Sivatherium
Camelopardalis

4. *Fam. Cervina*
Dorcatherium
Cervus
Moschus

5. *Fam. Cavicornia*
Antilope
Capra
Ovis
Bos

III. MULTUNGULA

6. *Fam. Anoplotheridæ*
Dichobune
Xiphodon
Anoplotherium
Dichodon
Chalicotherium
Hoplotherium

7. *Fam. Toxodontidæ*
Nesodon
Toxodon

GIEBEL'S ARRANGEMENT, *continued*:—

8. *Fam. Suina*
Adapis
Hyotherium
Hyracotherium
Hippohyus
Hyopotamus
Chæropotamus
Entelodon
Palæochærus
Phacochærus
Dicotyles
Porcus
Sus

9. *Fam. Genuina*
Merycopotamus
Hippopotamus
Hyrax
Elasmotherium
Rhinocerus
Anthracotherium
Lophiodon
Anchitherium
Palæotherium
Tapirus

10. *Fam. Proboscidea*
Mastodon
Elephas

PINNIPEDIA

1. *Fam. Zeuglodontidæ*
Squalodon
Zeuglodon

2. *Fam. Phocina*
Otaria

GIEBEL'S ARRANGEMENT, *continued*:—

Cystophora
Leptonyx
Phoca
Halichærus

3. *Fam. Trichechidæ*
Trichechus

IV. PINNATA

SIRENIA

4. *Fam. Sirenia*
Dinotherium
Halitherium
Manatus
Halicore
Rhytina

CETE

5. *Fam. Monodonta*
Monodon

6. *Fam. Delphinodea*
Delphinopterus
Ziphius
Berardius
Hyperoodon
Platinista
Inia
Delphinus
Phocæna
Physeter

7. *Fam. Balænodea*
Balænoptera
Balæna

II. Different Classifications of the Insectivora.

POMEL'S ARRANGEMENT. 1848.

1. SPALACOGALIDÆ

1. Talpinæ

Talpa. Europe, Asia.
Wogara. Japan.
Geotrypus (Fossil).
Astromycter. N. Amer.
Galeospalax (Fossil).
Hyporyssus (Fossil).
Scalops. Mex., N. Amer.
Scapanus. N. Amer.

2. Mygalinæ

Chrysochloris. S. Africa.
Solenodon. West India.
Mygale. Europe.
Plesiosorex (Fossil).
Mysarachne (Fossil.)
Urotrichus. Japan, California.

3. Soricinæ

Talpasorex. N. Amer.
Sorex. Ind., Eur., Afr., N. Amer.
Corsira. N. Amer.
Blarina. N. Amer.
Otisorex. N. Amer.
Hydrogale. N. Amer.

Galemys
Brachysorex. N. Amer.
Crossopus. Eur., Ind.
Pachyura. Old World.

Musaraneus
Cryptotis. N. Amer.
Myosorex. Afr.
Crocidura. Old World.

2. GALECHINIDÆ

1. Glisoricinæ

A. Hylogale
Sorexglis. Old World.
Oxygomphius. Old World.

B. Dipogales
Macroscelides. Afr.

2. Echinogalinæ

A. Anachantes
Echinogale. Mad.
Hylomys. Java.
Galerix. Java.
Gymnura. E. Ind.

B. Erinacinæ
Erinaceus. Eur. and Asia.

3. Centetinæ

Echinops. Mad.
Ericulus. Mad.
Centetes. Mad.
Echinodes. Mad.

WAGNER'S ARRANGEMENT. 1855.

1. Dermoptera.

Galeopithecus. Ind. Arch.

2. Scandentia.

Cladobates. Ind.
Ptilocereus. Borneo.
Hylomys. Java.

3. Soricidæ.

Rhyncocyon. Mosamb.
Gymnura. E. Ind.
Macrosceloides. Afr.
Sorex. Old World and N. Amer.
Crossopus. Eur. and Asia.
Brachysorex. N. Amer.
Anotus. N. Amer.
Crocidura. Afr. and Ind.
Mysorex. Afr.
Solenodon. St. Dom. and Cuba.
Myogale. E. and W. Eur.

4. Talpidæ.

Urotrichus. Jap., and Calif.
Scalops. N. Amer.
Rhinaster. N. Amer.
Talpa. Eur. and Amer.
Chrysochloris. S. Afr.

5. Aculeata.

Centetes. Madag.
Ericulus. Mad.
Echinogale. Mad.
Erinaceus. Eur. and Asia.

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1. *With a cæcum.*

1. Galeopitheci

Galeopithecus. Ind. Arch.

2. Tupayæ

Cladobates. India.
Phlocercus. Borneo.
Hylomys. Java.

3. Macroscelides.

Rhynchocyon. Mosamb.
Macroscelides. Afr.

2. *Without a cæcum.*

4. Centetina

Solenodon. W. Ind.
Centetes. Madag.
Ericulus. Madag.
Echinogale. Madag.

5. Erinacei

Erinaceus. Eur. and Asia,
Gymnura. E. Ind.

6. Talpina

Myogale. Eur.
Urotrichus. Jap. and Calif.
Condylura. N. Amer.
Scalops. N. Amer.
Talpa. Eur. and Asia.
Chrysochlora. S. Afr.

7. Sorices

Sorex. Old World and N. Amer.

III. Synonymic List of Species of Mammals and their Localities.*

Note.—The extinct species are printed in Italics.

QUADRUMANA.

Anthropini.

Homo sapiens *Linn.* var. albus. Eur., Asia, Java, Sum., Born., North Africa, N. and S. America.
var. niger. Afr., S. of Sahara, Hills in India, Aust., New Guinea, Polynesia.

Catarrhini.

Simia Abelii ? *Fisch.* Mias Rambi. Sumatran Orang. Sum. Born.
bicolor ? *Geoff.* Sumatra.
morio ? *Owen.* Mias Kassar. Borneo.
Satyrus *Linn*—(Agrias *Schreber*). Orang Outang. Borneo, Sumatra.
Wurmbii ? *Kuhl.* Mias Pappan. Borneo.

Troglodytes Gorilla *Sav. and Wym.* Gaboon.
niger *Geoff.*—(Calvus, and Koolu Kamba, *De Chaillu.* Tschego *Duvernoy.*)† Chimpanzee. W. Afr., Gaboon, &c., from 10° N. long., to 10° S. Lat.
vellerosus ? *Gray.* Cameroon Mountains, W. Afr.

Hylobates (Siamanga) syndactyla *Raffles.* Java and Sumatra.
Lar *Linn.*—(longimana *Schr.* albimanus *Vigors.* Entelloides *Geoff.*) Malacca.
leuciscus *Schreb.*—(Moloch *Aud.* Mulleri and funereus *Geoff.* Hulock and concolor *Harlan.* choromandus and leucogenys *Ogilby.*) Java, Malacca, Borneo, Solo, China, East Indies, Malabar, Bengal, Arracan, Assam.
variegatus *Kuhl.*—(agilis and Lar *F. Cuv.* Rafflesii *Geoff.*) East Indies, Malacca, Sumatra.

Protopithecus antiquus Lartet.—(*Pithecus antiquus* De Blainv. *Pliopethecus antiquus* Gerv.) Miocene.—Sansans, S. France.

Mesopithecus Pentelicus Wagn. From the Pentelikon. Greece.

Dryopithecus sp. St. Gaudens, S. France.

Semnopithecus (Presbytes) auratus *Desm.*—(chrysomelas and Sumatranus *Mull.* femoralis *Horsf.*) Sumatra, Borneo, Molucca.

Semnopithecus comatus *Desm.*—(mitrata *Esch.* Siamensis. *Schleg.* nigrimanus *Geoff.*) Sumatra, Java, Siam.
cucullatus *Geoff.*—(Johnii, jubatus *Schr.*) Neilgherries and Ghats, Madras.

Entellus *Dufresne.*—(albipes *Geoff.* Anchises and Priamus ? *Blyth.* Nepalensis, petrophilus, and schistaceus *Hodg.* Thersites ? *Blyth.*) Bombay, Madr., Nep., Ceylon.
fascicularis ? *Raffles.* Sumatra.
frontatus *Mull.* Borneo.
hypoleucus *Blyth.*—(Dussumieri *Geoff.* Johni *Martin.*) Malabar, Travancore.
leucoprymnus *Desm.*—(cephalopterus *Zimm.* Nestor *Benn.* latibarbatus *Geoff.*) Ceylon.
maurus *Schreb.*— (cristatus *Raffles.* pruinosus *Desm.*) Sumatra, Borneo.
melalophus *Cuv.*—(flavimanus *Geoff.* rubicundus *Mull.* nobilis *Gray.*) Java, Sumatra, Borneo.
Monspessulanus Gerv. Tertiary Slates at Montpelier.
nasicus *Schreb.*—(nasalis *Shaw.* rostrata *Blum.* Kahau *Wurmb.* larvatus *Geoff.* recurvus *Vigors.*) Borneo.
Nemæus *Linn.*— (Douc *Buff.* pygarthrix *Geoff.*) Cochin China.
obscurus *Reid.*—(leucomystax *Mull.* halonifer *Cantor.* Barbei, Phairei, and albocinereus *Blyth.*) Singapore, Malayan Islands.
pileatus *Blyth.* Chittagong.
Pyrrhus ? *Horsf.* China.
subhimalayanus De Blainv. Subhimalayan District.
sp. Miocene beds, Sivalik Hills.
sp. ,, ,, ,,
ursinus ? *Blyth.* Ceylon.

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* To give a complete list of all the authorities by whose works I have profited in compiling this list, would be almost to repeat the name of every recent writer on the subject; but I cannot refrain from specially mentioning those of Dr. Giebel, Dr. Baird, Dr. Gray, and Mr. Blyth, as those to whom I am most indebted. Next to these, I would acknowledge my obligations to Blasius, Bonaparte, Burmeister, Gay, Gervais, Keyserling, Leidy, Middendorf, Müller, Nilsson, Pictet, Radde, Schreber, Schinz, Sclater, A. Smith, Schrenck, Tschudi, Wagner, and Waterhouse.

† Dr. Gray has, I think, satisfactorily shown ("Proc. Zool. Soc." Dec. 1861, p. 273) that the species described by De Chaillu ("Proc. Boston Soc. Nat. Hist." vii. 296 et seq.), under the names of T. Calvus and T. Kooloo Kamba, are not distinct from the Chimpanzee, T. niger. The same conclusion should probably be come to with the supposed species, T. Tschego, described by Duvernoy ("Archiv. Mus. d'Hist. Nat." viii. 1). The figures there given of its skeleton correspond with the skeleton of the Chimpanzee, and the very name which he has preserved for its specific designation is almost identical with the native name of the Chimpanzee; for Mr. Bowdich, in his account of his mission to Ashantee in 1817, p. 440, informs us that its name is Inchego. He speaks of two distinct kinds, the *Inchego* (Chimpanzee) and *Ingena* (Gorilla), and tells some curious tales, a mixture of truth and fable, of the habits, strength, and ferocity of the latter.

Cercopithecus albigena *Gray.*—(Presbytes albigena *Gray.*) Gab.
albigularis *Sykes.*—(monoides *Geoff.*) Zanguebar.
Campbelli? *Waterh.* West Africa.
capillatus *Geoff.* West Africa?
Cephus *Erxl.*—(erythrotis *Waterh.*) W. Africa, Fern. Po.
cynosurus *Geoff.*—(Faunus *Linn.* Sabæa *Wolf.* tephrops *Bennett.*) West Africa.
Diana *Linn.*—(palatinus *Wagn.* Roloway *Geoff.*) West Africa.
erythrarchus *Peters.* Mozambique.
Erxlebenii *Dalb.*—(nigripes *Du Chaillu.*) West Africa, Gaboon.
flavidus *Peters.* Mosamb.
griseo-viridis *Desm.*—(engythithia *Herm.* cano-viridis *Rupp.* sub-viridis *F. Cuv.* cinereo-viridis *Temm.*) Abyss., Nile Districts.
labiatus *Geoff.*—(Samango *Sund.*) Caffraria, Mozambique, Angola.
Lalandii *Geoff.*—(pygerythrus? *F. Cuv.* pusillus *Desm.*) South Afr., Cape G. Hope.
leucampyx *Mart.*—(diadematus *Geoff.* Diana *F. Cuv.*) West Africa.
mona *Erxl.*—(monacha *Schr.*) Gambia, Senegal.
nictitans *Erxl.*—(Martini *Waterh.*) West Africa, Fern. Po.
ochraceus *Peters.* Mozambique.
Petaurista *Erxl.*—(Ascanius *Schr.* melanogenys and ludio *Gray.*) Guinea, Angola, Congo.
Pluto? *Gray.* Angola.
pogonias *Bennett.*—(Burnettii *Gray.*) Fer. Po.
ruber *F. Cuv.*—(patas) and rufa *Schreb.* pyrrhonotus *Ehrenb.*) Nile District, Senaar, Nubia, Kordofan.
rufo-viridis? *Geoff. Erxl.* W. Africa.
Sabæus *Linn.*—(callitrichus *Geoff.* griseus *F. Cuv.* chrysurus *Blyth.* Tantalus *Ogilb.* viridis *Herm.*) West Africa, Cape de Verde Islands.
talapoin *Erxl.*—(pileatus and capillatus *Geoff.* melarhinus *Schinz.*) West Africa.
Werneri *Geoff.*? W. Africa.

Cercocebus Æthiops *Cuv.*—(collaris *Gray.*) Senegambia?
fuliginosus *Cuv.*—(Æthiops *Linn.* Atys *Aud.*) W. Afr.

Colobus Angolensis *Sclater.* Angola.
ferrugineus *Wagn.*—(fuliginosus *Ogilb.* Temminckii *Kuhl.* Pennantii *Waterh.* rufoniger *Martin* verus? *Van Bened.* olivaceus *Schr.*) Gambia, Fern. Po.
Guereza *Ruppell.* West Africa, S. W. Abyss.
polycomus *Geoff.*—(leucomeros *Ogilby.* vellerosus *Geoff.* bicolor *Wesm.*) W. Africa, Gambia.
Satanas *Waterh.* Fern. Po.
ursinus *Ogilb.* Sierra Leone.

Innuus (Macacus) arctoides. *Geoff.* Cochin China.
Cyclopis *Swinh.* Formosa.
cynomolgus *Desm.*—(Aygula and cynocephalus *Linn.* mulatta *Shaw.* carbonarius and irus *F. Cuv.* aureus, Philippensis and palpebrosus *Geoff.* fascicularis *Raffles.*) East Indies, Borneo, Java, Sumatra, Malacca, Celebes, Banka, Timor, and other Malayan Islands.

Innuus ecaudatus *Geoff.*—(sylvanus *Linn.* pithecus *Geoff.*) Gibraltar, North Africa.
eocenus Owen. Suffolk.
fusco-ater *Schinz.* Celebes.
Nemestrinus *Desm.*—(platypygus *Schr.* leoninus *Blyth.* libidinosus *Geoff.* carpolegos *Raffles.*) E. Indies, Borneo, Sumatra.
pileatus *Geoff.*—(Sinicus *F. Cuv.*) Ceylon.
plioceanus Owen. Upper Tertiary in Essex.
Rhesus *Desm.*—(erythræus *Schreber.* Nepalensis, oinops, and Pelops *Hodg.* Assamensis *McClelland.*) Bengal, Nepal.
Silenus *Linn.*—(veter *Linn.* senex *Temm.* vetulus *Erxl.*) Ceylon.
Sinicus *Desm.*—(radiatus *Geoff.*) East Indies, Coast of Malabar.
speciosus *F. Cuv.*—(melanotus *Ogilby.*) Japan, Kiusu, Nippon, Sikok, not further north than 35° N. Lat.

Cynopithecus niger *Bennett.* Celebes, Moluccas.
nigrescens? *Temm.* Philippines.

Cynocephalus Babouin *Desm.*—(Anubis *F. Cuv.* antiquorum *Schreb.*) Nile District, Abyss. Angola.
Doguera *Puch.* and *Schimp.* Abyssinia.
Gelada *Wagn.*—(Theropithecus niger *Geoff.*) Mountains in Abyss., 7000 to 8000 feet high, Palestine.
Hamadryas *Desm.*—(Ægyptiaca *Hassel.* Wagleri *Agass.* Thoth *Ogilby.*) Abyssinia, Senegal, Arabia.
leucophæus *Desm.*—(Drill *F. Cuv.* brachyurus *Temm.*) W. Africa.
Mormon *Illig.*—(mandrill *Buff.* mantegar *Tyson.*) West Africa.
olivaceus? *Geoff.* Guinea.
porcarius *Desm.*—(comata *Schr.* Sphingiola *Herm.* ursinus *Wagn.*) South Africa.
Sphinx *Illig.*—(papio *Desm.*, choras *Ogilb.*) Guinea.

Platyrrhini.

Ateles ater *F. Cuv.* Venez., Guiana.
Belzebuth *Briss.*—(Brissonii *Fisch.* Marimonda and Aru *Humb.*) Brazil, Equador, Venez., Guiana.
Geoffroyi *Kuhl*—(fuliginosus *Kuhl.* frontatus *Gray.* variegatus *Natterer.* melanochir *Desm.*) Boliv., S. Brazil, Cuba, Mexico.
hybridus *Geoff.* North Brazil, Peru.
marginatus *Geoff.*—(frontalis *Bennett.* albifrons *Schinz.* Chuva *Humb.*) S. Brazil, Peru.
paniscus *Linn.* Guiana, Brazil, North of the Amazon, and east of Rio Negro; not to the South.
pentadactylus *Geoff.*—(Chameck *Humb.* subpentadactylus *Desm.*) Peru.

Brachyteles arachnoides *Geoff.*—(hypoxanthus *Desm.* macrotarsus *Spix.* tuberifer *Geoff.* hemidactylus *Geoff.*) S. Brazil.

Lagothrix Humboldtii *Geoff.*—(cana *Humb.* lagothrica *Humb.* infumatus and olivaceus *Spix.* Capparo *Less.* Castelnaui *Geoff.* Pöppigii *Schinz.* Tschudii and Geoffroyi *Puch.*) Boliv., Peru, Equad., Venez.

Mycetes Beelzebul *Linn.*—(rufimanus *Kuhl.* discolor *Spix.*villosus *Gray.*) Brazil, South of the lower Amazon —not on the North.
niger *Geoff.*—(straminea *Geoff.* Caraya *Humb.* barbata *Spix.*) Bolivia, Paraguay, N. Pampas, Brazil, Peru.
palliatus *Gray.*—(Beelzebul *Schott.*) New Grenada, Nicaragua.
seniculus *Linn.*—(chrysura *Geoff.* laniger *Gray.* auratus *Gray.*) N. Brazil, Equad., New Gren., Venez., Guiana.
ursinus *Geoff.*—(fuscus *Illig.* flavicaudata and Guariba *Humb.* bicolor? *Gray.*) N. Brazil, New Gren., Equador, Peru.

Cebus capucinus *Linn.*—(flavus, albus, and barbatus *Geoff.* libidinosus and gracilis *Spix.* fulvus *Desm.* olivaceus *Schomb.* nigrovittatus *Wagn.* versicolor *Puch.* cucullatus *Spix.* chrysopus *F. Cuv.* albifrons *Humb.*?) Throughout Tropical South America, Costa Rica, Columbia, N. Gren., Guiana, Venez., Peru.
cirrifer *Wied.*—(niger *Geoff.* cristatus *F. Cuv.*) Bahia, Pernambuco.
fatuellus *Linn.*—(Apella *Linn.* lunatus and frontatus *Kuhl.* niger, elegans, and vellerosus *Geoff.* Azarae *Regn.*) Brazil, New Gren., Venez. Guiana, N. Pampas.
hypoleucus *Geoff.* Central America.
macrocephalus *Spix.*—(unicolor *Spix.* castaneus *Geoff.*) Guiana, and to the N.E. of the Peruv. Cordil.
macrognathus Lund. Bone Caves in Brasil.
monachus *Cuv.*—(macrocephalus *F. Cuv.* xanthosternus *Wied.* xanthocephalus *Spix.*) S. Brazil, from Rio Janeiro to St. Paul.
robustus *Wied.*—(variegata and cirrifera *Humb.* cirrifer *Geoff.*) Brazil, Peru.

Pithecia albicans *Gray.* Upper Amazon.
leucocephala *Geoff.*—(nocturna and adusta *Illig.* irrorata *Olfers.* rufibarbata *Kuhl.* capillamentosa *Spix.* pogonias *Gray.* albinasa, chrysocephala, and rufiventer *Geoff.*) Guiana, Venez., N. Brazil.
Miriquoina *Geoff.* Parag.
monachus *Geoff.*—(inusta and hirsuta *Spix.* irrorata *Gray.*) Brazil, S. of the Amazon, and E. Peru.
nigra—*F. Cuv.* Equatorial America.

Brachyurus calvus *Geoff.* Brazil, N. of the Upper Amazons, W. of Japura; not to the South.
melanocephalus *Humb.*—(ouakary *Spix.* ouakaria *Gray.*) Guiana, New Gren., N.W. Brazil.
rubicundus *Geoff.* Brazil, North of the Upper Amazon, West of Japura; not to the South. St. Paul's.
Satanas *Hoffm.*, *Humb.*—(chiropotes *Humb.* Israelita *Spix.* sugulata *Mill.* Couxio *Less.*) Brazil, North of the Amazon, and East of Rio Negro, Guiana, Banks of Orinoco.

Nyctipithecus felinus *Spix.*—(Commersonii *Vigors.* trivirgatus *Cuv.* Azarae *Humb.* Humboldtii *Schinz.* Oseryi *Geoff.*) New Gren., Guiana, Brazil, Boliv., Peru.
vociferans *Spix.*—(lemurinus *Geoff.*) New Gren., and on the Brazilian and Peruv. border.

Callithrix caligata *Wagn.*—(brunnea *Wagn.*) North-West Brazil.
chlorocnemis Lund. Bone Caves of Brazil.
cuprea *Spix.* North-West Brazil.
donacophila *D'Orb.* Boliv.? Peru.
Moloch *Geoff.*—(sakir *Spix.* infulata *Kuhl.* discolor *Geoff.*) North-East Brazil.
nigrifrons *Spix.*—(cinerascens and gigot *Spix.* melanochir *Wied.*) South Brazil.
personata *Geoff.* East and South Brazil, Peru.
primaeva Lund. Bone Caves of Brazil.
torquata *Geoff.*—(lugens and amictus *Geoff.*) New Gren., West Brazil.

Chrysothrix sciurea *Linn.*—(leucopis *Herm.* Boliviensis, entomophagus and ustus *Geoff.* nigrivittatus *Wagn.*) Costa Rica, Columbia, N. Gren., Guiana, Venez., Brazil.

Hapale aurita *Geoff.* New Brazil.
bicolor *Spix.* Brazil, North of the Amazon.
chrysoleucus *Wagn.* North-West Brazil.
chrysomelas *Pr. Max.* Brazil, Peru.
chrysopyga *Wagn.* South Brazil.
Devillei *Geoff.*—(rufoniger *Geoff.*) Peru.
flavifrons *Geoff.* Peru.
Geoffroy *Pucheran.* Panama.
humeralifer *Geoff.* Brazil.
Iacchus *Linn.*—(vulgaris *Geoff.*) Guiana, Venez., E. Brazil.
labiata *Geoff.*—(nigricollis *Spix.* fuscicollis *Spix.* and mystax *Spix.*) N. Gren., Equad., N.W. and W. Brazil, Peru.
leonina *Wagn.* East. slope of Cord., Putumayo, Caqueta.
leucocephala *Geoff.* All Brazil.
melanura *Geoff.* North-West Brazil.
Midas *Linn.*—(rufimanus *Geoff.*) Guiana, Venez., N. and N.W. Brazil, Peru.
nigrifrons *Geoff.*—(Illigeri *Puch.*) Columbia?
nitida. Peru.
Œdipus *Geoff.*—(Titi *Less.*) Darien, New Gren., Equad., Guiana, Venez.
penicillata *Geoff.* S. Brazil.
pileata *Geoff.* S. America.
pygmæa *Wagn.* Brazil and Peru.
rosalia *Linn.*—(marikina *Less.*) S. Brazil.
rufiventer. Mexico.
tamarin *Link.*—(ursula *Geoff.*) Brazil, S. of the Lower Amazon.
ursula *Wagn.* Guiana, Paraguay.
Weddelii *Deville.* Bolivia.

Lemuridæ.

Indris albus *Vinson.* Madag.
brevicaudatus *Geoff.*—(Indri *Sonn.*) Madag.
Propithecus diadema *Bennet.* Madag.
Varecia leucomystax *Bartlett.* Madag.
nigra *Geoff.* Madag.
rubra *Geoff.* Madag.
varia *Geoff.*—(macaco *Linn.*) Madag.
Lemur Catta *Linn.* Madag.

Prosimia albifrons *Geoff.* Madag.
albimana *Audeb.* Madag.
Anjuanensis *Geoff.* Madag., Commoro Islands, Anjoana Isle.
collaris *Geoff.*—(fulvus *Geoff.* brunneus *Van der Hoeven.*) Madag.
coronata *Gray.* Madag.
melanocephala *Gray.* Madag.
mongoz *Linn.* Madag.
nigrifrons *Gray.* Madag.
rubriventer *Geoff.*—(flaviventer *Geoff.*) Madag.
rufifrons *Bennet.*—(chrysampyx *Geoff.*) Madag.
xanthomystax *Gray.* Madag.
Otolemur Agisambanus *Coq.* Zanzibar.
Otogale crassicaudata *Peters.* East and West Africa, Natal, Mozambique.
Garnettii *Ogilby.* Port Natal.
pallida *Gray.* Fernando Po.
Microrhynchus laniger *Gmel.*—(lanatus *Schreb*, longicaudatus *Geoff.* Awahis *Jourd.*) Madag.
Hapalemur griseus *Geoff.* Madag.
olivaceus *Geoff.* Madag.
Cheirogaleus Milii *Geoff.*—(typus *Cuv.*) Madag.
Smithii *Gray.* Madag.
typicus *A. Smith.* Madag.
Lepilemur (Microcebus) furcifer *Blainv.* Madag.
murinus *Miller.*—(Madagascariensis and pusillus *Geoff.* rufus *Schinz.*) Madag.
mustelinus *Geoff.* Madag.
myoxinus *Peters.* Eastern Madag., Mozamb. (?)
Callotus Monteiri *Gray.* West Africa.
Galago Allenii *Waterh.* West Africa, Gaboon, Fer. Po.
conspicillatus *Geoff.* Port Natal.
Demidoffii *Fisch.* W. Afr., Gaboon.
Madagascariensis *Geoff.* Madag.
Maholi *A. Smith.*—(Senegalensis? *Peters.*) S. Africa, Mozamb.
murinus *Murr.* Old Calabar.
Peli *Temm.* Guinea.
Senegalensis *Geoff.*—(Cuvieri and Geoffroyii *Fisch.* Galago *Wagn.*) W. Africa, Senegal, Gambia.
Senegalensis *Ruppel.* Abyssinia.
Sennariensis *Gray.* Sennaar.
Teng *Sundev.* Nile district.
Nycticebus Javanicus *Geoff.* Java.
tardigradus *Van d'Hoev.*—(Bengalensis *Geoff.*) Borneo and Sumat, S. of China.
Do. (var. B. *Blyth.* Malayan Penin.
Loris gracilis *Linn.*—(Ceylanicus *Fisch.*) Ceylon, India, Pondicherry.
Perodicticus Potto *Gmelin.*—(Geoffroyi *Benn.* Guineensis *Desm.*) Sierra Leone.
Arctocebus Calabariensis *J. A. Smith.* Old Calabar.
Tarsius spectrum *Pall.*—(macrotarsus *Nau.* Daubentonii *Fisch.* Bancanus *Horsf.*) Borneo, Celebes, Banca, Sumatra.
Fischeri *Desm.*—(fuscus s. fuscomanus *Fisch.*) Suma., Borneo, Celebes, Banca.

Cheiromyina.

Cheiromys (Daubentonia) Madagascariensis* *Gmelin.*—(psilodactylus *Schreb.*) Madag.

Galeopithecidæ.

Galeopithecus Philippensis *Waterh.*—(macrourus? *Temm.*) Phil. Isles, Coast of New Guinea.
volans *Linn.*—(Temminckii *Waterh.* marmoratus *Temm.* Ternatensis *Geoff.* rufus *Temm.* variegatus *Geoff.* undatus *Linn.*) Java, Borneo, Siam, Sumatra.

CARNIVORA.

Felidæ.

Machairodus cultridens Gerv.—(*Etruscus* Cuv. *cultridens Arvernensis* and *megantereon* Croiz and Job. *Sainzelli* Aym. *maritimus* Gerv.) Pliocene beds of Auvergne and Montpelier.
latidens Owen.—(*cultridens* Blainv.) Bone Cave in Kent, Diluvium at Puys.
neogæus Lund.—(*Smilodon* Blain. *populator* Lund.) Bone Caves in Brazil.
palmidens Blainv. (*brevidens* Pomel.) Miocene beds at Sansans.
primævus Leidy. Lower Miocene of Nebraska.
Felis *antediluviana* Karstens. Darmstadt.
antiqua Cuv. Perhaps the living Leopard—(*Issiodorensis* and *brevirostris*, Croiz and Job.) Diluvium Mid. Europe.
aphanista Kaup. Miocene Sands at Epplesheim.
atrox Leidy. Miocene Mauvaises Terres, Missouri.
aurata *Temm.*—(Moormensis *Hodg.* nigrescens *Hodg.* Temminckii *Vigors.*) Fire Cat of Burma. S.E. Himmal., Burma, Malayan Pen., Sum., Born.?
Bengalensis *Desm.*—(Javanensis and Sumatrensis *Horsf.* minuta *Temm.* pardichrous *Hodg.* Reevesii *Gray.* rubiginosa *Geoff.* servalinus *Gray.* Temminckii *Vigors* undata *Desm.* undulata *Schinz.* Wagati *Elliot.*) S.E. Asia, from Thibet to Java, Timor, Sumatra, Borneo?
brachyura *Swinhoe.* Formosa.
caligata *Temm.*—(Lybica *Oliv.* obscura and Caffra *Desm.* erythrotis *Hodg.* nigripes *Burch.* Jacquemonti *Geoff.*) W. Afr., S. Afr., Egypt, India, S. Asia.
Canadensis *Desm.*—(borealis *Temm.*) Canada Lynx. Northern regions of North America.
Caracal—*Schreber.*—(chrysothrix *Temm.* melanotis *Gray.*) N. and S. Afr., Abyss., Nile Dist., Ind., Central India.
Catus *Linn.* Wild cat. Middle and South Europe, West Asia.
cervaria *Temm.*—(virgata *Nilss.*) South Siberia, East Asia.
Charltoni *Gray.* Upp. Assam, Sikkim, Bhotan.

* This is doubtless the Sciurus Madagascariensis of *Shaw*.

Felis Chaus *Guldens.*—(affinis *Gray.* catolynx *Pall.* Dongolensis *Hemp.* and *Ehrenb.* Kutas *Pears.* Ruppelii *Brandt.*) Egyptian Cat. N.E. Afr., Egypt, Abyss., Nile Dist., S. Africa, S.W. Asia, Mesopotamia, S. Siberia, India, Bengal, Arakan.

Christoli Gerv. Pliocene beds of Montpelier.

colocola *F. Cuv.*—(strigillata *Wagn.*) Guiana, Surinam.

concolor *Linn.*—(discolor *Schreber.*) Puma. North and S. Amer., from Canada to Tierra del Fuego.

cristata Falc. Miocene beds of the Sevalik Hills.

domestica *Brisson.* Domestic Cat. Everywhere.

Dosul *Hodg.*—(Duvancellii ? *Hodg.*) Nepal, Thibet.

elata ? Brav. Miocene beds S. France ?

Enghioliensis Blainv. Belgian Bone Caves.

exilis Lund. Bone Caves in Brasil.

eyra *Desm.*—(unicolor *Traill.*) Guiana, Br. N. Pampas.

fasciata *Raf.* American Red Cat. N. America, Missouri, Washington Territory.

Geoffroyi *Gerv.* Pampas, Patag.

grisea *Gray.*—(armillata *F. Cuv.*) Trop. Amer.

(Cynailurus) guttata *Herm.*—(venatica *A. Smith.*) Senegal, Kordofan, Abyssinia.

Hernandesii *Gray.* Mazatlan, Mexico.

Irbis *Ehrb.* Ounce or Snow Leopard. (uncia *Schreb.* Pardus *Pall,*) High regions of Middle Asia, Siberia.

Isabellina *Blyth.*—(Thibetanus *Hodg.*) Thibet Lynx. Thib.

Jacobita *Cornalis.* Highlands of Bolivia.

Japonensis? *Gray.* Japan ?*

(Cynailurus) jubata *Schreber.* Cheetah. West and S. India, Syria, Arabia, Persia, Mesopot., S. Siber., between Casp. and Aral, Ceylon

Juvillacea ? Brav. Miocene beds S. France.

Leo *Linn.*—(Asiaticus *Auct.* Barbarus *Fisch.* Capensis *Auct.* Gambianus *Mam. Lith.* Goojeratensis *Smee.* Persicus *Swain.* Senegalensis *Fisch.*) All Afr., S.E. Asia, Guzerat in India.

leptorhina ? Brav.—(leptorhyncha *Brav.*) Miocene beds S. France.

lynx *Linn.*—(lyncuta *Nilss.* Kattlo *Schrenk.*) N. and W. Eur., S. Siberia.

macroscelis *Temm.*—(macrosceloides *Hodg.* nebulosa *Griffith.*) Thib., Mountains in S.E. Asia, Sum., Born.

macrura *Wied.*—(Wiedii *Schinz.* elegans *Less.*) Trop. S. Am., Braz., Parag., Peru.

maniculata *Rupp.*—(pulchella *Gray.*) N. Afr.

Manul *Pallas.*—(nigripectus *Hodg.*) Thibet, E. Asia, Amurland.

margarita *Loche.* Algiers.

marmorata *Martin.*—(Diardii *Jard.* Ogilbii *Hodg.*) Malac., Java.

megalotis *Temm.* Timor.

melanura *Ball ?* Trop. Amer.

minuta Wagn. Bone Cave Rabenstein.

mitis *F. Cuv.* (Brasiliensis *F. Cuv.* pardalis *Wied.* Maracaya *Wagn.*) Brazil.

neglecta *Gray.* (servalina *Ogilby.* Senegalensis *Less.?*) Gambia.

Felis Onca *Linn.*—(Panthera *Schreb.* Mexicana *Herm.*) Trop., N. and S. America.

ornata *Gray.*—(Huttoni *Blyth.* inconspicua *Gray.* Servalina *Jard.*) Desert region of N.W. India, Dukkun, Hazara Country.

pajeros *Desm.* Pampas, Patag. to Straits of Magellan.

pardalis *Linn.* Ocelot. (armillata *F. Cuv.* Griffithii *Jard.* catenata *Griff.* pardaloides *Bruno.*) Trop. N. Amer., Mexico, Trinidad, Brazil, Peru, Patagonia, N. Pampas.

Pardina *Temm.* Southern Lynx. S. Europe, Portugal, Spain, Sardin., Sicily, Greece, Turkey.

Pardoides Owen. Red Crag Newbourn.

Pardus *Linn.*—(antiquorum *Griff.* chalybeata *Herm.* fusca *Meyer.* longicaudata *F. Cuv.* Leopardus *Schreber.* melas *Peron.* Nimr. *Ehrenb.* panthera *Erxl.* pœcilura *Valenciennes.* variegata *Wagn.* Chinensis, Ellioti and Horsfieldi *Gray.* Ogilbyi *Hodg.* Nepalensis *Horsf.* varia *Schreber.*) Leopard or Panther. All Africa and S. Asia, Sum., Borneo. Perhaps fossil in Diluvium in Middle Europe.

perniger ? *Hodg.* Nepaul.

pictus *Gray.* Trop. Amer.

planiceps *Vigors.* Penins. of Ind., Coromandel side, Borneo ?

protopanther Lund. Bone Caves in Brazil.

pseudopardalis *H. Smith.* Bay of Campeachy.

rufa *Guldens.*—(montanus *Harl.* maculata *Vig.* fasciatus, Floridanus and aureus *Rafin.*) Bay Lynx. West Coast of N. Am., Mexico.

rutila ? *Waterh.* West Africa.

Serval *Schreb.*—(Capensis *Forst.* Galeopardus *Desm.*) Senegalensis *Less.*) S. Africa.

spelæa Gold.—(*pardinensis* and *Arvernensis* Croiz. and Job.) Bone Caves in Middle Europe, Quedlingburg, Egeln, Gaylenreuth, Luneville, Kirkdale in Yorkshire.

tigrina *Linn.* The Margay. (tigrinoides *Gray.* Mexicana *Sauss.*) Tropical Amer., Mexico, Brazil, Venez.

tigris *Linn.* India, Java, Sum., Burma, China, Nepal, S. Siberia, Amurland.

torquata *F. Cuv.* hybrid between common Cat and F. Bengalensis.

viverrina *Bennett.*—(Himalayana *Warw.* celidogaster *Temm.* viverriceps *Hodg.*) India, Ceylon, Burma, Tenasserim, Lower Valleys of Himal., Malacca, Formosa. (Erroneously said by Temminck to be American.)

Yaguarandi *Desm.*—(Darwinii *Martin.*) Guiana, Braz., Trop. N. Am., Peru, Parag., Pampas.

Pseudailurus quadridentatus Gerv. (*tetradon* Blainv.) Miocene beds at Sansans.

Viverridæ.

Viverra *antiqua* De Blain.—(*primæva* Pom.) Miocene beds in the Department of Allier.

Ashtoni *Swinh.* Foochow, China.

Civetta *Schreb.*—(Poortmanni *Puch.*) W. Africa, Guin., Fern. Po, Gaboon, Nile Dist., Abyss.

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* Mr. Swinhoe writes to Dr. Gray, 27th July, 1864, "I strongly suspect that the animal you procured with a Japanese stamp, was a skin procured by the Japanese at their trading stations. No Leopard is said by the Japanese to inhabit the islands of Japan."

Viverra felina *Thunb.*—(rubiginosa? *Puch.*) S. Afr.
ferreo-jurassica Jäg.
fossa *Schreb.* (Daubentonii *Gray.*) Madag.
Genetta *Linn.*—(vulgaris and maculata *Gray.* afra *F. Cuv.* Bonapartei *Loche.*) S. Eur., all Afr. W. Asia, Mt. Carmel.
gracilis *Müll.*—(Hardwickii *Lesson.* Linsang *Hardw.* prehensilis *Schinz.*) India, Java? Sum.? Malacca? Siam?
incerta? Gerv. Sansans.
Malaccensis *Gmel.*—(Gunda *Ham.* Rasse *Horsf.* Indica *Geoff.* Leveriana *Shaw.* Bengalensis *Gray.* fasciata *Schreb.* Manillensis *Eydoux.* pallida *Gray.* tunga *Peters.*) India, Nep., Burm., Ceylon, Malacca, Java, Sumatra, China, Formosa, Anjuan Is.
pardicolor *Hodg.*—(perdicator *Schinz.*) Nepal.
pardina *Geoff.* (Pöensis *Waterh.* Genettoides *Temm.* Fieldiana *Du Chaill.* Servalina *Puch.*) W. Africa, F. Po., Seneg., Guin., Gab.
pardochrous *Hodg.* Nepal.
Richardsoni *Thomps.*—(Poensis jun. *Waterh.*, genettoides *Temm.*) W. Afr.
Sansanensis Lart. Miocene beds, Sansans, S. France.
Senegalensis *Fisch.*—(Aubryana *Puch.*) N. Afr., W, Africa, Senegal, Gaboon, E. Africa, Abyssinia, Dongola.
Simorrensis Gerv.—Sansans.
Tangalunga *Gray.* Sumatra, Borneo, Celebes, Amb., Mal. Pen.
tigrina *Schreber.* Musk Cat.—(vulgaris, Amer. and Abyssinica *Rupp.* genetta *Peters.*) Cape of Good Hope, Natal, Mosambique, Abyss.
Zibetha *Linn.*—(zibethica *Linn.* undulata *Gray.* civettoides, melanurus, and orientalis *Hodg.*) Ind., Tenas., Malay, Pen., Malacca, Java, Sum., China, Born., Celebes, Amboyna, Formosa.
Bassaris astuta *Licht.*—(fulvescens *Gray.*) Mexico.
Do. var. Sumichrasti *Sauss.* Mexico.
Galidia concolor *Geoff.*—(unicolor *Geoff.*) Madag.
elegans *Geoff.* Madag.
olivacea *Geoff.* Madag.
Hemigalea Boiei *Mull.*—(Hardwickii, Derbyanus, and Zebra *Gray*, Philippensis *Schinz.*) Borneo, Malacca.
Arctitis Binturong *Raffl.*—(penicillatus *Temm.* aureus, albifrons, and ater *F. Cuv.*) Malacca, Sum., Java, Tenass., Arracan, Assam, Nep.
Cynogale Bennettii *Gray.*—(Lamictis Carchanas *Blainv.* Potamophilus barbatus *Müll.*) Borneo.
Paradoxurus binotatus *Gray*—(Hamiltonii *Gray.* annulatus *Wagn.*) Fernando Po., W. Afr., Ashantee, Guinea.
Bondar *Gray.*—(Pennantii *Gray.* hirsutus *Hodg.*) Guinea, Nep. N. Behar.
crassiceps *Puch.* Africa?
Crossii *Gray.* India.
dubius *Gray.* Java.
fasciatus *Desm.*—(Geoffroyi *Fisch.* musanga *Raffl.* quadriscriptus *Hodg.*, setosus *Homb.* and *Jacq.*, Pallasii? Finlaysonii? quinquelineatus? musangoides? and Jourdanii *Gray.* auratus *De Blainv.* leucopus *Ogilb.* var. Javanicus *Horsf.* typus var. Sumatranus *Fisch.*) Nep., Ind, Mala., Java, Sum. Borneo.
Paradoxurus Grayi *Benn.*—(leucopus *Ogilb.* Nipalensis *Hodg.*, auratus *De Blainv.*) Ind. Nep.
laniger? *Hodg.* Nep.
larvatus *Temm.* China.
leucomystax *Gray.*—(Ogilbyii *Fraser.* Jourdanii and leucocephalus *Gray.*) Sum., Borneo.
leucotis *Blyth.* Tenass., Arracan.
macrodus *Gray*? Not known.
nigrifrons *Gray.* Ind.
Philippensis *Camell.*—(aureus *Waterh.*) Philip. Isles.
prehensilis *Gray.* Malay Isl.
stigmaticus *Temm.* Borneo.
strictus *Hodg.* Ind.
trivirgatus *Gray.* Malacca, Java, Sum., Tenass.
typus *F. Cuv.*—(niger *Desm.* hermaphroditus *Pall.* Pallasii *Otto.*) Ind., Bengal, Madras, Ke Isl. near Aru.
Zeylanicus *Schreb.* (Zeylonica *Pall.* Ceylonensis *Bodd.* aureus *F. Cuv.* typicus *De Blainv.*) Ceylon.
Cryptoprocta ferox *Bennett.*—(typicus *A. Smith.*) Madagas.
Galidictis vittata *Gray.* Madag.
striata *Geoff.* Madag.
Herpestes Adailensis *Heugl.* Adail Coast Afr.
albescens *Geoff.* E. Afr., Senaar.
albicaudus *Geoff.*—(albicaudatus *A. Smith.*) S. Afr., Natal, Seneg., Gabon.
apiculatus *Gray.*—(pulverulentus *Wagn.*) S. Afr.
badius *A. Smith.*—(ratlamuchi and Cawii *A. Smith.*) S. Afr., Guinea?
Bennettii *Gray.* Madag.
brachyurus *De Blainv.* Malacca, Borneo.
Caffer *Gmel.*—(Pharaonis *Ver.* not *Geoff.*) S. Afr., Natal.
cancrivorus *Hodg.*—(urva *Hodg.*) Nepal in Caverns, Arakan, Affghan.
crassicauda *Peters.* E. Afr., Tete, Boror.
dorsalis *Gray.*—(Pharaonis, var. *A. Smith.*) S. Afr.
Edwardsii? *Geoff.* Egypt.
exilis *Eydoux.* Tenasserim, Burma, Malacca.
fasciatus *Desm.*—(Zebra *Rupp.* suricata *Child.* ichneumon *Schreb.* mungo *Fisch.*) W. Afr., Central Afr., Lake Tschad, Cape of G. Hope, Abyss., Nile Dist.
fimbriatus *Temm.* India?
fuscus *Waterh.*—(Smithii *Gray*, rubiginosus *Kelaart*, Ellioti *Blyth.*) S. Ind., Madras, Ceylon.
Gambianus *Ogilby.* W. Afr.
gracilis *Geoff.*—(nigricaudatus *Geoff.*) Abyss.
Grantii *Gray.* E. Afr.
griseus *Gm.* (pallidus *Schinz.*) Nep., Ind., Sum.
Ichneumon *Linn.*—(Pharaonis *Geoff.* Ægypti *Tiedem.* Edwardsii *Geoff.* Plinii *Shaw.*) N. Afr., Nile Dist. Senegal.
Javanicus *Horsf.*—(mangusta *Temm.*) Java, Sum., Malay Pen.
Jerdonii *Gray.* Madras.
jodoprymnus *Heugl.* E. Abyssinia.

Herpestes Lefebrii *Des Murs. and Prev.* N.E. Africa.
lepturus *Smith.* S. Africa.
leucurus *Ehren.* Nile Dist., Nubia, Dongola.
loempo *Temm.* Guinea.
Maccarthriæ *Gray*—(fulvescens *Kelaart.*) Ceylon.
Madagascariensis *A. Smith.* Madag.
major? *Geoff.* Egypt?
Malaccensis *F. Cuv.*—(Frederici *Desm.* Leschenaultii and pallidus var. *Schinz.*) Malacca.
melanurus *Martin.* W. Afr., Sierra Leone, Damaraland.
Melleri *Gray.* E. Africa.
mutgigella *Rupp.* Abyss.
Nepalensis *Gray.*—(auropunctatus, Javanicus and griseus *Hody.* pallipes *Blyth.*) India, Nepal, Assam, Affghanistan.
nigricauda *Puch.* Senegal.
nigripes *Puch.* Gaboon.
Numidianus *F. Cuv.* Numidia.
nyula *Hody.*—(nigula *Hody.*) Nep.
ochraceus *Gerrard.* E. Africa.
Ogilbyi *A. Smith.* S. Africa.
ornatus *Peters.* E. Africa.
paludosus *Cuv.*—(urinatrix *A. Smith.* palustris *Rupp.* paludinosus *Peters*, atylax *Schinz.*) S. Afr., Quillimane, E. Afr., Guinea.
parvulus *Sundev.* S. Afr.
penicillata *Cuv.*—(Levaillantii *A. Smith.* albescens *Geoff.* Stedmanni *Ogilby.* typicus *A. Smith.* ruber *Geoff.*) S. Afr.
Persicus *Gray.* Persia.
Pluto *Temm.* Guinea, W. Afr., E. Afr.
puisus *Peters.* E. Afr.
punctatissimus *Temm.* Central and E. Afr.
punctulatus *Gray.*—(badius var. 2 *Temm.*) Natal.
robustus *Gray.* White Nile.
rutilus *Gray.* Cambogia.
sanguineus *Rupp.* Abyssinia.
semitorquatus *Gray.* Borneo.
tænionotus *A. Smith.* S. Afr., Natal.
thysanurus *Wagn.* Ind., Cashmere.
undulatus *Peters.* E. Afr., Mosamb.
Vansire *F. Cuv.*—(galera *Erxl.*) Madag.
venaticus *Gray.*—(badius var. *Gray.*) E. Afr.
vitticollis *Bennett.* Ind., Madras.
Widdringtonii *Gray.* S. Eur., Spain.

Crossarchus obscurus *Geoff.*—(typicus *A. Smith*, dubius *F. Cuv.*) W. Afr., E. Afr.?
rubiginosus *Wagn.* Ind.

Eupleures Goudotii *Doy.* Tamatave in Madag.

Rhyzæna suricata *Erxl.*—(Zenick *Gray.* tetradactyla *Pallas.* typicus *A. Smith.* viverrina *Desm.* Capensis *Desm.*) S. Africa.

Hyænidæ.

Hyæna crocuta *Erxl.*—(maculata *Gray.* Capensis *Desm.*) W. Afr., S. Afr., Abyss., Nile Dist.
brunnea *Thunb.*—(fusca *Geoff.* villosa *Smith.*) S. Africa.
hipparionum Gerv. Pliocene freshwater beds at Vaucluse.
Hyæna *prisca* Serr. (*Montispessulana* and *Perrierensis*, Croiz. and Job, *brevirostris*, Gerv.) Bone Caves at Luneville.
spelæa Goldf.—(*crocuta fossilis* Cuv. *spelæa major* Goldf. *intermedia* Serr. *gigantea* Holl. *Arvernensis* and *dubia* Croiz and Job.) Bone Caves in Middle Europe.
striata *Linn.*—(virgata *Hodg.* vulgaris *Cuv.*) N. Afr., Nile Dist., Mesopot., India.

Proteles Lalandii *Geoff.*—(cristatus *Sparm.* hyænoides *Desm.* typicus *A. Smith.*) S. Afr.

Canidæ.

Cynodon palustre Aym. Freshwater Marls of Puy.
Parisiense Cuv.—(*viverroides* De Blainv. *lacustre* Gerv.) Paris Gypsum, lignite near Apt.
velaunum Aym. Lower freshwater Marls of Puy.

Protocyon troglodotes Lund. Bone Caves in Brazil.
validus Lund. Bone Caves in Brazil.

Speothos pacivorus Lund. Bone Caves, Brazil.

Palæonictis gigantea De Blainv. Lignite of Soissons.

Soricictis elegans? Pomel. Miocene beds in Auvergne.
leptorhyncha? Pomel. Miocene beds in Auvergne.

Elocyon martrides? Aym. Freshwater marls of Puy.

Abathmodon, sp. Lund. Bone Caves, Brazil.

Hyænodon (*Pterodon*) *brachyrhynchus* Blainv. From Rabenstein and the banks of the Tarn.
(*Pterodon*) *dasyuroides* Blainv. Eocene beds, Paris gypsum.
leptorhynchus Laiz and Par. Lower Miocene beds of Cournan and Puy.
(*Taxotherium*) *Parisensis* Lauriell. (*Cuvieri* Pom.) Eocene, Paris gypsum.
Requienii Gerv. (*minor* Gerv.) Freshwater limestone near Apt and Alais.

Otocyon megalotis *Cuv.* (Caffer *Licht.* Lalandii *Desm.*) S. Afr., Zambesia.

Canis alpinus *Pallas.* Mountain or Siberian Red Wolf. Altai, Siber.
antarcticus *Shaw.* Patag., Falkland Isles.
aureus *Linn.*—(adustus *Sund.* Algirensis *Geoff.* anthus *Rupp.* Dalmatinus *Fitz.* lupaster *Ehrb.* mesomelas *Schreb.* micrurus *Reichb.* Syriacus *Erhb.* variegatus *Rupp.* Indicus *C. H. Smith.*) South Europe, N. Africa, Nubia, Nile District, E. Asia, India, Nepal.
Azarae *Wied.*—(Brasiliensis, fulvicaudus, fulvipes? *Waterh.* melanostomus *Wagn.* Aguarachai *Azar.* melampus *Wagn.*) Brazil, Peru, Pampas, Patag.
Bengalensis *Gray.*—(Kokree *Sykes.* Indicus *Hodg.* rufescens, dorsalis, xanthurus, and chrysurus *Gray.* pallipes *Sykes.* pallidus and famelicus *Rupp.* Sabbar *Ehrb.*) From India westward to Sinai, Nile Dist., Kordofan, Dongolas and Darfur, Senegal.
cancrivorus *Desm.* Venez., Guiana.
Caama *A. Smith.* S. Africa, Namaqua Land.
corsac *Linn.* High Steppes in Central Asia, Mesopotamia, from the Wolga and Caspian Sea, to Lake Baikal, Mongolia, and Thibet.
Dingo *Blum.*—(Australasiæ *Desm.*) Australia, New Zealand (introduced.)
Entrerianus *Burm.* Entre Rios, La Plata.

Canis familiaris *Linn.* Domestic Dog. (Sinensis *Rupp.*) EVERYWHERE.

Do. var. *fossilis*, viz.— } Diluvium and Bone caves, and breccias in MIDDLE and SOUTH EUROPE.
brevirostris Croiz.
Issiodorensis Croiz.
juvillaceus Brav.
medius Brav.
Neschersensis Croiz.
propagator Kaup.

gracilis *Burm.* S. AMER.
Grayiformis *Hodg.* NEPAL.
hodophylax ? *Temm.* JAPAN.
incertus D'Orb. From the bank of the PARANA.
jubatus *Desm.*—(campestris *Wied.*) BRAZIL, PAMPAS, PATAGONIA.
laniger *Hodg.* THIBET.
latrans *Say.*—(ochropus *Esch.* frustror *Woodhouse.*) Prairie Wolf. W. NORTH AMER.
littoralis *Baird.* ISLAND OF SAN MIGUEL, CALIFORNIA.
lupus *Linn.* Wolf. EUROPE, NOVA ZEMBLA, SIBERIA, UPPER ASIA.
Do. var. *spelæus* Goldf.—(*spelæus minor* Wagn.) In DILUVIUM and bone caves and bone breccias in EUROPE.
Magellanicus *Gray.*—(griseus *Gray.*) PATAGONIA, STRAITS OF MAGELLAN.
macrourus *Baird.*—(Utah *Aud. and Bach.*) CENTRAL N. AMER.
megamastoides Pom. Tertiary beds of ISSOIRE.
occidentalis *Auct.*—American Wolf. (griseus *Sab.* albus *Sab.* variabilis *Wied.* gigas *Towns.*) OREGON, UPPER MISSOURI.
Do. var. nubilus *Say.* W. AMERICA, NEBRASKA, PUGET'S SOUND.
var. Mexicanus *Gm.* MEXICO.
var. ater *Rich.* SOUTHERN STATES.
var. rufus *Aud. and Bach.* TEXAS.
pallipes ? *Sykes.* Plains of the DECCAN, INDIA.
palustris Meyer.—(*Galecynus Oeningensis* Owen.) Tertiary beds of OENINGENS.
primaevus *Hodg.*—(Himalayensis *Less.* Dukhunensis *Sykes.* rutilans *Müll.* Javanicus *Cuv.* Sumatrensis *Hardw.*) IND., NEPAL, MADRAS, SIAM, JAVA, SUMATRA, BORNEO.
Procyonoides *Gray.*—(viverrinus *Temm.*) AMURLAND, MALACCA, CHINA, JAPAN.
protalopex Lund. Bone-caves of BRAZIL.
robustior Lund. Bone-caves of BRAZIL.
venaticus *Burch.*—(Lycaon *Burch.* hyænoides *Cuv.* pictus *Temm.* tricolor *Brooks.* typicus *A. Smith.*) Hyæna-dog. S. AFRICA.
vetulus *Lund.* BRAZIL, PERU.

Vulpes ferrilatus *Hodg.* NEPAL.
flavescens *Gray.*—(Nipalensis *Gray.* montanus *Hodg.* not *Pears* Griffithii *Blyth*). N.W. HIMMAL., PERSIA.
fuliginosus ? *Hodg.* NEPAL.
fulvus *Desm.* Common American Red Fox. EAST COAST OF N. AMER., MEXICO, JAPAN.
var. decussatus—*Desm.* EAST N. AM.
var. argentatus—*Shaw.* EAST N. AM.
gypsorum Cuv. EOCENE BEDS, PARIS GYPSUM.
lagopus *Linn.*—(fuliginosus *Shaw.* Isatis *Gmel.* Karagau *Pall.*) N. EUROPE, NOVA ZEMBLA, SIBERIA, N. OF NORTH AMERICA.
Vulpes leucopus *Blyth.* Desert regions N.W. INDIA.
montanus *Pears*—(Himalaicus *Ogilby.*) N. W. HIMMAL.
Parisiensis ? Cuv. EOCENE BEDS, PARIS GYPSUM.
pusillus *Blyth.* PUNJAB SALT RANGE.
velox *Say.*—(cinereo-argentatus *Schreb.* microtus *Reich.*) N. AMERICA.
Virginianus *Erxl.* Kit Fox. (cinereo-argentatus *Erxl.*, *Schreb.* griseus *Bodd.* tricolor *Geoff.*) N. AMERICA, from PENNSYLVANIA to CALIFORNIA.
vulgaris *Linn.*—(alba *Pall.* alopex *Linn.* Anubis *Ehrb.* Aegyptiacus *Sonn.* cruciata *Pall.* crucigera *Briss.* Hodgsoni *Gray.* melanotus *Pall.* niger *Scheff.* Niloticus *Desm.* vulpecula *Ehrb.* variegatus *Rupp.* variegatoides *Smith.*) MID. AND S. EUROPE, TURAN., STEPPES S. SIBERIA, N. AFRICA.
var. melanogaster *Bonap.* ITALY, TURKEY, GREECE.
var. *fossilis* Cuv. } In DILUVIUM and Bone-caves and
spelæus Cuv. } breccia over the greatest part of EUR.
Zerda *Zimm.* The Fennec. (Zaarensis *Skiold.* fennecus *Less.* Saharensis *Leuck.* pygmæus *Leuck.* Arabicus *Sonn.* Brucei *Desm.* aurita *Blum.*) N. AFR,, NILE DIST., SAHARA.

MUSTELIDÆ.

Enhydris marina *Stell.*—(Lutris *Linn.* Stelleri *Fisch.*) NORTHERN ASIA, KAMTSCHATKA, JAPAN, W. COAST N. AMERICA, CALIFORNIA.
Pterura Sanbachi *Gray.* DEMERARA.
Latax Canadensis *Sab.*—(Brasiliensis *Harl.* Hudsonica *F. Cuv.* lataxina *F. Cuv.* insularis *F. Cuv.* enudris *F. Cuv.* mollis *Gray.* destructor *Barnst.*) N. AMERICA, ANTILLES.
Californica *Baird.* not *Gray.* CALIF.
Aonyx aurobrunnea *Hodg.* NEPAL.
Calabarica *Murr.* OLD CALABAR.
indigitata *Hodg.*—(Sikimensis *Hodg.*) NEPAL.
inunguis *F. Cuv.*— (Lalandii v. Delalandii *Less.* Capensis *Schinz.* Gambianus *Gray.* Poensis ? *Waterh.*) SOUTH AFRICA, MOZAMB. CAPE OF G. HOPE, FERNANDO PO.
leptonyx *Horsf.*—(cinerea *Illig.* Semul *Raffl.* perspicillata *Geoff. Hodg.* Horsfieldii *Gray.* fusca *Desch.*) JAVA, SUM., BORNEO.
Lutra *antiqua* Meyer. BONE-CAVES, EUROPE.
aterrima *Schrenck.* SEA OF OCHOTSK, AMOURLAND.
aurobrunnea *Hodg.* NEPAL.
barang *F. Cuv.* SUMATRA, MALACCA.
Brasiliensis *Cuv.*—(Brasiliana *Shaw.*) BRAZIL.
Bravardi Pom.—(*elaveris* Croiz.) Pumice-stone alluvium AUVERGNE.
Chilensis *Bennett.* brachydactyla *Wagn.* (Californica *Gray.* felina *Mol.* Platensis *Waterh.* Peruviensis *Gerv.*) PERU, CHILOE, W. TROP. S. AMER., GUATEM., CALIF., STREAMS OF LA PLATA, KAMTSCHATKA.
ferreo-jurassica Jäg. Bone breccia and caves, EUROPE.
maculicollis *Licht.*—(Grayi *Verr.*) S. AFRICA.
montana *Tschudi.* PERU.
monticola *Hody.* NEPAL.
Nair *F. Cuv.*—(Chinensis and Indica *Gray.* Tarayensis *Hodg.*) N. INDIA, FORMOSA, CHINA.

Lutra Nepalensis *Gray*. Nepal.
nudipes? *Melchior*. Denmark, Sea-coast.
Paraguensis *Reng*. Paraguay.
Valletoni Geoff.—(*Clermontensis* Blainv. *Mombachensis* v. Meyer. *robusta* Nordm. *incerta* Gerv.) Sansans, S. France.
vulgaris *Erxl*.—(Roensis *Ogilb*.) M. and S. Eur., Tur., Stepp. S. Sib., China, Mesop., E. Asia, Japan.
Icticyon venaticus *Lund*.—(Melictis Beskii.) Brazil.
Mustela Africana *Desm*. Egypt, Nile District.
agilis *Tschudi*. Peruvian Cordilleras.
albinucha *Gray*.—(Zorilla albinucha *Gray*.) Angola.
alpina *Fisch*.—(Altaica *Pall*.) The high Steppes of E. Siberia, Altai Mountains.
aureoventris *Gray*. Equador.
boccamela *Bonap*. — (subpalmata *Sund*.) S. Eur., Medit. Dist., Nile Dist.
Brasiliensis *Sewast*. — (frenata *Licht*. aureoventris? *Gray*.) Brazil, Mex., Calif.
canigula *Hodg*.—(Hodgsonii *Gray*.) Nepal.
Cicognanii *Bonap*.— (fusca *Aud. and Bach*.) N. Am., Unit. St., West Coast of N. Am.
dubia Blainv. Miocene beds, Sansans, S. Fr.
elongata Gerv. Pliocene beds at Montpelier.
elegans Pom. Miocene beds, Allier.
erminea *Linn*. Stoat or Ermine. N. and M. Europe, N. Africa, Sib., Tur. Stepp., W. Asia, Nep., Amour. (not in N. Am.)
Eversmannii *Less*. S. Russia, Caucasus.
genettoides Blainv. Miocene beds, Sansans.
Horsfieldii *Gray*.—(Italsi *Verr*.) Bhotan, Japan?
Javanica *Sebr*.—(leucogenys *Schinz?*) Java?
longicauda *Bonap*. Centre of N. Amer., Missouri, Nebraska, Yellowstone, Rocky Mountains.
lutreola *Linn*.—(minor *Erxl*.) Eur., Sib.
Kanei *Baird*. Arctic and North Pacific Coast of N. Amer., Sib., Bhering's Straits, Kamtsch.
Kathia *Hodg*.—(auriventer *Hodg*.) Nepal.
nigrescens *Aud. and Bach*. Eastern United States, Massach., New York, Ohio.
nigripes *Aud. and Bach*. N. Amer., Platte Region.
Noveboracensis *Dekay*. East of N. America (not north of Massachussets nor west of Wisconsin.)
nudipes *F. Cuv*. Sum., Borneo, Malayan Pen.
Patagonica *De Blainv*. Patag.
plesictes Laiz and Par.—(*Croizeti* Pom.) Freshwater calcareous beds at Puy de Dome.
pusilla *Dek*.—(vulgaris and cicognani *Rich*.) N. Amer., United St., West Coast of Amer.
putoria *Linn*.—(fœtidus *Klein*. typus *F. Cuv*. communis *Cuv*. vulgaris *Gray*.) Pole Cat. Mid. and S. Eur., Siberia.
Do. var. Furo *Linn*. Ferret. Europe.
Richardsonii *Bonap*. — (agilis *Aud*. and *Bach*., not *Tschudi*.) Whole of N. Amer.
Sarmatica *Pall*.—(peregusna *Guld*. præcincta *Ranz*.) Russia in Eur., Turanian Steppes, W. Asia.
Sibirica *Pall*.—(italsi and Natsi *Temm*.) Sib., Amourland, Nepal.
Sinuensis? *Humb*. Columbia.
Mustela strigidorsa *Hodg*. Sikkim.
subhemachalana *Hodg*.—(humeralis *Blyth*.) Nepal.
taxodon Gerv.—(*Sansansensis* Lart.) Sansans.
Toufaeus *Hodg*. Thibet.
vison *Briss*. — (lutreola *Forst*. lutreocephala *Harl*. Canadensis *Erxl*. Winingus *Barton*. minx *Ord*.) Mink. N. Am., Canada, United States, Vancouver's Isl., Nebraska.
vulgaris *Linn*.—(nivalis *Schreb*.) The Weasel. M. and S. Eur., S. Sib., W. Asia, Amour. Fossil in Bone-caves in France, Belgium, and England.
xanthogenys? *Gray*. Calif.
zorilloides Lart. Miocene beds, Sansans.
Martes abietum *Ray*.— (pinetorum *Ray*. vulgaris *Gray*. sylvestris *Gesn*. sylvatica *Nilss*. var. Altaica *Pall*.) Pine Marten. Europe, England, France, Turanian Steppes, W. Asia, Altai Mountains.
Americana *Turt*.—(vulpina *Raf*. leucopus *Kuhl*. huro *F. Cuv*.) American Sable. Canada and U. States, N.W. Amer.?
brachyura *Temm*. Japan.
Canadensis *Schreb*.—(Pennantii *Erxl*. piscatoria *Less*. melanorhyncha *Bodd*. nigra *Turt*. Godmani *Fisch*. castaneus and ferrugineus *H. Smith*.) Woodshock. N. Amer., from E. to W. Coast.
flavigula *Hodg*.—(Hardwickii *Horsf*. Henricii *Westerm*. lasiotis *Temm*. quadricolor *Shaw*. leucotis *H. Smith*. gwatkinsii and chrysogaster *Jard*.) India, Nepal, Java, Sum. Borneo.
foina *Briss*.—(fagorum *Ray*. domestica *Geoff*.) Beech Marten. M. and S. Eur., W. Asia, Tur. Stepp.
melanopus *Temm*. Japan.
Zibellina *Ray*. The Sable. North Europe, S. Sib. Amour.
Plesiogale angustifrons Gerv.—(*Pomeli* Laur. *plesictes* Blainv. *minuta* Gerv.) Miocene beds, Department of Allier.
ardea Brav.—(*lutroides* Pomel.) Auvergne.
sectoria Gerv. Freshwater calcareous beds of Limoine.
Arctonyx collaris *F. Cuv*. Sand Bear. India, Silhet, Nepal, Assam, Chittagong, Arakan.
Mydaus meliceps *F. Cuv*.—(Javanensis *Desm*.) Java, Sum.
taxoides *Blyth*. Assam, Arakan.
Helictis Nipalensis *Hodg*. Nepal, Java.
orientalis *Horsf*.—(fusca *Geoff*. macrurus *Temm*.) Nep., Java.
personata *Geoff*.—(moschata *Gray*.) Malac., China.
Sinensis *Swinh*. China.
subaurantiaca *Swinh*. Formosa.
Galictis barbara *Linn*.—(canescens *Illig*. gulina *Wied*. galera *Erxl*. barbata *Retz*. vulpecula *Schreb*. poliocephala *Traill*. subfusca *Bron*.) Tropical N. Amer., Mexico, Guiana, Brazil, Paraguay, Peru.
vittata *Schreb* — (Allamandi *Bell*. quiqui and Cuja *Molina*.) The Grison. Pampas, Patag., Chili, Guiana, Brazil.
Zorilla frenata *Sund*.—(multivitta? *Wagn*.) Senaar.
striata *Shaw*. (mustelina *Wagn*. Africana *Licht*. leucomelas *F. Cuv*. Capensis *Waterh*. Lybica *Ehr*.) All Afr., Nub., Abyss., Asia Minor.
Vaillantii *Loebe*. Algeria.

Conepatus nasuta *Gray.*—(mesoleuca and leuconota *Licht.* Marputio *Gmel.* intermedia *Sauss.* longicaudata *Tomes.* Chingu *Molina.*) Mexico, New Grenada, Bogota, California.

Do. var. Humboldtii *Gray.*—(Patagonica *Licht.* Westermannii *Reinh.* conepate *Desm.*)—Mag. Straits.

Do. var. Chilensis *Licht.*—(Amazonicus *Gray.* furcatus *Wagn.* suffocans *Illig.* Quitensis *Humb.*) Chili, S. of Magellan.

Do. var. Lichtenstenii *Gray.* Tropical Amer.

Do. var. Gumillæ *Licht.* Mouths of the Apuro, Orinoko.

Mephitis bicolor *Gray.*—(Zorilla *Licht.* interrupta *Raf.*) Calif., Texas, Miss.

castaneus *D'Orb.* Southern parts of South America.

Fenilleï *Gerv.* Monte Video.

macroura *Licht* (not *Aud.* and *Bach.*)—(Mexicana *Gray.*) Western range of mountains in Mexico.

mephitica *Shaw.*—(Chinga *Tied.* Americana *Desm.* varians *Gray.* mesomelas *Licht.* occidentalis *Baird.*) Skunk. N. Mid. and Central parts of N. Amer. Calif.

Molinæ? *Licht.* Chili.

myotis? *Fisch.* N. Amer., Louisiana.

vittata *Licht.*—(varians *Gray.* macroura *Aud.* and *Bach.*) South-west coast of Mexico, Texas.

Westermanni *Reinh.*

Paleomephitis Steinheimensis Jäger. Freshwater calcareous beds of Steinheim.

Taxidea Americana *Bodd.*—(Labradoria *Gm.* Jeffersonii *Harl.*) Carcajou or American Badger. British Amer., and West. Un. States from Wisconsin, Illinois, and Iowa to the Pacific Ocean.

Berlandieri *Baird.* Texas, Mex., Calif.

Meles anakuma *Temm.* Japan.

(*antediluvianius* Schmerl. *antiquus* Munst.) Bone-caves in Europe.

Morreni Laur. Cigly.

vulgaris *Linn.*—(taxus *Blumenb.* Europæus *Desm.* leucurus *Hodg.* albogularis? *Blyth.*) Badger. Eur., W. Asia, Thibet, S. Sib.

Mellivora ratel *Sparm.*—(Capensis *Gm.*) The Ratel. S. Afr., Mosamb., Zambesia, Nile Dist.

Indicus *Bent.*—(inauritus *Hodg.*) N. India, Mesopotamia?

Gulo *antediluvianus? Kaup.* Epplesheim.

luscus *Linn.*—(borealis *Nilss.* leucurus *Hedenb.* Sibiricus *Pall.* vulgaris *Gray.* arcticus *Desm.*) The Wolverene. N. Eur., Lapl., Finl., Greenl., N. Asia, North of N. Amer.

spelæus Goldf. Bone-caves at Gaylenreuth, Liege.

Arctocyonidæ.

Agriotherium (*Hyænarctos*) *hemicyon* Gerv.—(*Sansanensis* Lart.) Miocene beds of Sansans, S. France.

insigne Gerv. Tertiary marme sand of Montpelier.

Sivalense Cautley and Falc. Miocene beds of the Sivalik Hills.

Palæocyon (*Arctocyon*) *primævus* Blainv. Lower eocene, Freshwater sandstone near La Fere in the Department of Aisne, France.

Amphicyon brevirostris Pict. Clermont, Puy de Dome.

dominans? v. Meyer. Weisenau.

elaverensis Gerv.—(*gracilis* Pomel.) Bourbonnais, Allier Department.

Eseri? Plein. Ulm.

giganteus Laur.—(*major* and *minor* Blainv. *Blainvillei* Gerv. *Lemanensis* Pomel.) Sansans, Auch, Avaray, and Chevilly.

intermedius? Plein. Basin of Mayence.

Tylodon Hombresi? Gerv. Alais.

Plantigrada.

Cercoleptes caudivolvulus *Illig.*—(flavus *Tied.* megalotis *Mart.* brachyotis *Mart.*) The Kinkajou. Guiana, N. Granada, Peru and Mexico, Antilles, Trop. part of S. Amer.

Ailurus fulgens *F. Cuv.*—(ochraceus *Hody.*) Nep.

Nasua *Brasiliensis* Lund. Bone caves, Brazil.

monticola *Tschudi.* Peru.

Narica *Linn.*—(obfuscata *Illig.* quasie *Gmel.* fusca *Desm.* leucorypha *Tschudi.*) Trop. Amer., Surinam.

socialis *Wied.*—(rufa *Desm.* Nasua *Linn.* annulata *Desm.* striata *Shaw.*) Coati. Mex., N.W. of S. Am., Peru, N. Pampas.

solitaria *Wied.*—(nocturna *Wied.*) Guiana, Brazil, Santa Fé de Bogota.

Procyon cancrivorus *Illig.* Guiana, Brazil, Trop. Amer.

var. psora? *Gray.* Calif.

Lotor *Linn.*—(obscurus *Wiegm.* vulgaris *Tied.* nivea *Gray.* alba *Briss.* brachyurus *Weigm.* gularis *Smith.*) Racoon. All North America, from the Antilles to N. Canada, and from Atlantic to Pacific.

var. Hernandezii *Wagl.* Mexico, N. Am., Texas.

var. Mexicana *Baird.* Mexico.

priscus Lec. Pliocene, Illinois, N. Amer.

Ursus (*Sub-gen.* Thalassarctos) maritimus *Linn.*—(marinus *Pall.* polaris *Shaw.* albus *Briss.*) N. Eur., Nova Zembla, N. Sib., Greenl., N. Am.

(*sub-gen.* Euarctos) amblyceps *Baird.* W. Amer.

Americanus *Pall.*—(niger-Americanus *Schinz.* gularis *Geoff.*) N. Amer.

var. fossilis *Leidy.* Pliocene. N. Amer.

amplidens Leidy. Pliocene. N. Amer.

(*Sub-gen.* Ursus). arctos *Linn.*—(fuscus *Albert.* cadaverinus *Evers.*) N., Mid., and S. Eur., Sib., E. Asia, Central Asia.

var. collaris *F. Cuv.* Kamtschatka, Amourland, Japan.

var. grandis *Gray.* N. Europe.

var. Ildgeesdjur *Worm.* Norway.

var. meridionalis *Midden.* Caucasus.

var. niger *Albert.* Sweden.

var. Polonicus *Gray.* Poland.

var. *priscus* Goldfuss. Europe.

var. Pyrenaicus *F. Cuv.* Pyrenees.

var. Rossicus *Gray.* Russia.

Ursus var. Scandinavicus *Gray*. Sweden.
var. Sibiricus *Gray*. Sib.
var. stenorostris ? *Gray*. Poland.
arctoideus Blum. Bone-caves, Europe.
Arvernensis Croiz—(*minimus* Devez.) Puy de dome, Auvergne.
cinnamomeus *Bachm.*—(luteolus *H. Smith.*) Mexico.
ferox *Lewis and Clark.*—(cinereus *Desm.* griseus *Desm.* horribilis *Ord.* candescens *H. Smith.*) Grizzly Bear. W. half of N. Amer.
Formosanus ? *Swinh.* Formosa.
horriaceus *Baird.* New Mexico, Sonora.
inornatus ? *Puch.* Ceylon.
Isabellinus *Linn.* Nep., N. Circass., Syria, Thibet, Cashmere.
Japonicus *Sclat.*—(Tibetanus *Temm.*) Japan.
Leodiensis ? Schmerl. Bone-caves in Eur.
spelæus Rosenm.—(*dentifricius* Meyer. *ferreojurassicus* Jäg. *formicatus* Schmerl. *giganteus* Schmerl. *metopoleianus* Serr. *Metoposcairnus* Serr. *Neschersensis.* Croiz. *Pittorrii* Serr.) Bone-caves in Europe.
Syriacus *Hemp. and Ehrenb.* Syria.
torquatus *Schinz.*—(isabella *Gray.* Tibetanus *F. Cuv.* Malayanus *Horsf.* non *Auct.*) High Central Asia, Nepal, Silhet, N. India, E. Siberia. (Notwithstanding Cuvier's name, not found in Thibet, *fide Hodgson.*)
var. arboreus *Gray*. Darjeeling.
(*Sub-gen.* Myrmarctos) formicarius *Eversm.*—(longirostris *Eversm.* Eversmanni *Gray.* Beringiana *Middend.* Norvegicus *F. Cuv.*) Ant-bear. Norway.
(*Sub-gen.* Helarctos) Crowtheri *Schinz.* N. W. Africa, Mountainous regions in Morocco, Tetuan.
euryrhinus *Nilss.* Hungary.
frugilegus *Tschudi.* Andes of Peru.
Malayanus *Raffles.*—(euryspilos *Horsf.*) Malay District, Malayan Peninsula, Sumatra, Borneo, Java.
ornatus *F. Cuv.* Cordilleras, S. Amer.
minutus Gerv. Marine beds of Montpelier.
(*Sub-gen.* Melursus) labiatus *Desm.*—(longirostris *Tied.* ursinus *Shaw.* ursiformis *Shaw.* Lybius *Meyer.*) India, South Mahratta Country, Nepal, Benares, Deccan.

Pinnigrada.

Lobodon carcinophaga *Homb. and Jacq.*—(serridens *Owen.* antarctica *Peale.*) Antarctic Ocean.
Stenorhynchus leptonyx *Blainv.*—(Homei *Less.*) Antarctic Oc.
Leptonyx Weddellii *Lesson.* Antarctic Oc.
leopardina *Wagn.* Falkland Islands, S. Georgia, Macquarrie.
Monachus albiventer *Bodd.*—(Atlantica *Gray.* leporina *Verr.* leucogaster *Per.* Hermanni *Less.* Mediterraneus *Nillss.*) Medit., Madeira.
Ommatophoca Rossii *Gray.* Antarctic Ocean.
Callocephalus annellatus *Nilss.*—(fœtidus *Müll.* hispidus *Fab.* non *F. Cuv.* equestris *Pall.* discolor *F. Cuv.* Frederici *Less.* octonotata and undulata *Kutong.*) North Sea.
Callocephalus Do. var. Lake Baikal.
hispidus *F. Cuv.* N. Sea.
Largha *Pall.*—(nummularis *Schl.*) N. Pacific, Japan, E. shore of Kamtschatka, Mouth of Amour.
occitana Serres. Montpelier.
vitulinus *Linn.*—(communis *Linn.* canina *Pall.* littorea *Thien.* variegata *Nilss.* Linnæi *Less.*) Common Seal. N. Sea, Greenland, both sides of Atlantic.
Do. *fossil* in Tertiary beds at Osnabruck.
Do. var. ? Capsicus *Nilss.* Caspian Sea.
Halicyon Richardii *Cray.* Fraser's River, and Vancouver's Island.
Pagophilus Grœnlandicus *Müll.*—(oceanica *Lepech.* semilunaris *Bodd.* dorsata *Pall.* Mulleri *Less.* lagurus *F. Cuv.* albicauda *Desm.* Pilayi *Less.*) N. Sea.
Phoca barbata *Fab.*—(Parsonii *Less.* albigena *Pall.* leporina *Lepech.* Lepechinii *Less.*) N. Sea, Mouth of Amour, Japan ?
Lachtak ? *Stell.* Bhering's Straits.
tropicalis ? *Gray* ? Jamaica.
Wymani Leidy. Miocene deposits, N. Amer.
Phocodon Sp. Agass. Miocene deposits, N. Amer.
Halichœrus Grypus *Nilss.*—(Ochotensis *Pall.* griseus *Nilss.* scopulicolus and Thienemanni *Less.*) N. Coast of Eur., Ireland, Scotland, Norway, etc.
Trichechus Rosmarus *Linn.*—(arcticus *Pall.* obesus and divergens *Illig.*) Spitzbergen, Greenland, Zembla, Bhering's Straits.
Virginianus Dekay. Pliocene, Virginia, N. Amer.
Morunga elephantina *Gray.*—(leonina *Linn.* Ansonii *Desm.* proboscidea *Nilss.* dubia *Fisch.* Patagonica *Gray.* Patachonicus *Brookes.*) S. Oc., Antarctic Oc., Cape of G. Hope.
Cystophora Antillarum *Gray.* W. Ind.
cristata *Erxl.*—(mitrata *Cuv.* leonina *Linn.* borealis *Nilss.* cucullata *Bodd.* dimidiata *Cretzsch.* leucopla *Thien.*) N. Atlantic.
Arctocephalus australis *Quoy. and Gaim.* S. Coast of Aust., King George's Sound.
Chilensis *Müll.*—(Ulloæ *Tschudi.*) Chili.
cinereus *Peron.*—(albicollis *Peron.*) S. Coast of Australia.
Delalandii *F. Cuv.* C. of Good Hope.
Falklandicus *Shaw.*—(Forsteri, Shawii, Uraniæ, Hauvillei, and Molinæi *Less.* parva *Bodd.* pusilla *Schreb.* Peronii, and porcina *Desm.* flavescens and longicollis *Shaw.*) Antarctic Ocean, Falkland Islands, New Georgia, South Orkney, S. Shetland, C. of Good Hope, Chili.
Gillespii *McBain.* Calif.
Hookeri *Gray.* Falkland Islands, Cape Horn.
lobatus *Gray.*—(Stelleri *Temm.*) N.W. Coast of Aust., Port Essington, Houtman's Abrolhos.
Monteriensis *Gray.* Calif.
nigrescens *Gray.* Falkland Islands.

Callorhinus ursinus *Fab.*—(marinus *Stell.* Fabricii and Krachenninikovii *Less.*) N. Pacific, Kamtschat., Kurile Islands, Mouth of Amour.

Otaria leonina *Blainv.*—(Pernettii *Less.* jubata *Schreb.* Byronii *Blainv.* platyrhynchus *Müll.* molossina *Less.*) W. Coast of S. Amer., S. Pacific, Patag.

Stelleri *Less.*—(marinus *Stell.* jubata *Gmel.* Californiana *Less.*) N. Pacific Oc.

UNGULATA.

Monodactyla.

Solidungula.

Equus *Americanus* Leidy. Pliocene deposits, Mississippi.

asinus *Linn.* Nubia, Upper Egypt, Arabia, Socotra.

Burchellii *Gray.*—(zebra *Burch.* montanus *F. Cuv.* festivus *Wagn.*) Plains in South Africa.

Do. var. Chapmanni *Layard.* S. Africa, 200 miles in the interior from Walwich Bay.

caballus *Linn.*—(*fossilis, Adamiticus, priscus, brevirostris, Piscenensis, pristinus, magnus,* and *juvillaceus* Cuv.) Domesticated everywhere; introduced and become wild in South and North America, Pampas, Patagonia, La Plata, and Paraguay, Texas, and along the base of the Rocky Mountains, South of Russia in Europe, and thence to the Sea of Japan, also Fossil in Diluvial beds throughout Europe.

curvidens Owen. In Pliocene Deposits in S. and N. America.

hemionus *Pall.*—(Kiang *Moorcroft.* equioides and polyodon *Hodg.*) Thibetan Region, and East Turkistan.

hemippus? *Geoff.* Syria, Mesopotamia, and North Arabia.

Namadicus Falc. and Cautl. In the Miocene beds of the Sivalik Hills.

neogæus Lund. Brazil.

onager *Pall.* The Ghorkhur. Sandy deserts north-west of India.

plicidens Owen. Cave at Preston, England.

principalis Lund. Brazil.

Quagga *Gmel.*—(Isabellinus *H. Smith.*) South Africa.

Sivalensis Falc. and Cautl. Miocene beds of the Sivalik Hills.

tæniopus *Heuglin.* Abyssinia, East Africa.

zebra *Linn.*—(antiquorum *H. Smith.* montanus *Burch.*) Mountainous and sandy districts in South Africa.

Elasmotherium Fischeri Meyer.—(*Stereocerus Galli* Duv.) Siberia, and in the diluvium of the Rhine.

Keyserlingi Fisch. Kirghis Steppes near the Caspian Sea.

Hipparion diplostylum? Gerv. Freshwater marl of Cucuron, at Vaucluse.

mesostylum? Gerv. Freshwater marl, Cucuron, Vaucluse.

prostylum Gerv. Freshwater marl, Cucuron, Vaucluse.

venustum Leidy. Pliocene, N. America.

Hippotherium antilopinum Falc. and Caut. Sivalik beds.

gracile Kaup. Middle tertiary beds of the Mentz basin, at Bohnerz, in the Swabian Alps, and at the Pentelicon in Greece.

Anchitherium Aurelianense Blainv.—(*Ezquirrae* v. Meyer. *Monspessulanum* Cuv. *equinum* Lart. *hippoides* Blainv.) Montpelier.

Bairdii Leidy. Nebraska.

Dumasii Gerv. Eocene formations, France.

Arctiodactyla.

Ruminantia.

Camelidæ.

Camelus Bactrianus *Erxl.* Only known in domesticity. Tartary, Mongolia, China, and South Siberia, to the Sea of Baikal.

dromedarius *Linn.*—(Arabicus *Desm.* vulgaris *Forsk.* monotophus *Walther.*) Only known in domesticity, and spread over Arabia, Syria, Babylonia, Egypt, and Abyssinia, into Senegambia.

Sivalensis Cautl. and Falc. Miocene beds of the Sivalik Hills.

Merycotherium Sibiricum Bojan. Siberian drift.

Oreodon (*Merycoidodon*) *Culbertsonii* Leidy.—(*priscus* and *Corylops speciosa* Leidy.) Lower Miocene, Nebraska.

gracilis Leidy. Nebraska. Miocene beds.

major Leidy. Nebraska. Miocene beds.

Eucrotaphus auritus Leidy. Nebraska. Miocene beds.

Jacksoni Leidy. Nebraska. Miocene beds.

Agriochœrus antiquus Leidy. Nebraska. Miocene beds.

sp. Lund. Bone-caves of Brazil.

Procamelus sp. Miocene beds, Nebraska.

Camelops sp. Miocene beds, Nebraska.

Leptauchenia sp. Miocene beds, Nebraska.

Auchenia guanaco *H. Smith.* From the Equator to Tierra del the Andes, in Peru, Bolivia, and Chili, Patagonia, the eastern islands of Tierra del Fuego.

Llama *Brandt.*—(Peruana *Desm.*) North Peru, on the mountains near Abangara, at an elevation of about 3000 feet high.

Paco *Desm.* Middle of Bolivia to middle of Peru, at an elevation of about 8000 feet high.

Vicuna *Fisch.* Peru, southern part of the Republic of Ecuador, to the middle of Bolivia, not less than 13,000 feet high.

Bovidæ.

Bos Americanus *Gmel.*—(Bison *Auct.*) On the Prairies and eastern base of the Rocky Mountains.

bombifrons (*Bootherium*) Harl. In Diluvium and recent deposits in N. America.

brachycerus *Gray.* W. Africa, Gaboon.

bubalus *Linn.*—(var. macroceros and speiroceros *Hody.* arni *Pall.*) Originally from East Indies and the Malayan District, now spread over most of Asia, and North of Africa, China, Thibet, Persia, Armenia, to the Caspian and Black Seas, Arabia, Syria, and whole north of Africa.

Caffer *Sparrm.* From S. Africa to Guinea on the west, and Abyssinia on the east.

Bos *cavifrons* (*Bootherium*) Leidy. Pliocene; N. America.
frontalis *Lamb.*—(gavæus *Colebr.* Sylhetanus *F. Cuv.*) Gayal, both wild and domesticated. India, Hill regions west of Brahmaputra River, Assam to Thibet.
gaurus *Traill.*—(aculeatus *Wagl.* asseel *Horsf.* subhemachalus and cavifrons *Hodg.*) India, and formerly Ceylon, Assam, Burma, and Malayan Peninsula, but not the Islands.
grunniens *Linn.*—(poephagus *H. Smith.*) Ladak, Thibet, north of China, Mongolia, and in the Himmalayah to an elevation of from 10 and 17,000 feet.
Indicus *Linn.*—(gibbosus *H. Smith.*) Domestic. Tropical Asia, India, and part of Africa.
longifrons Owen. Diluvium in Ireland.
latifrons Leidy. Pliocene N. America.
moschatus (Ovibos) *Gmel.* N. E. of North America
Pallasei (*Ovibos*) Dekay. Diluvium in North America, Siberia, and into Middle Europe.
pegasus? *H. Smith.* Congo and Angola.
primigenius Bojan—(*velaunus* Robert, *giganteus* and *intermedius* Croiz.) Peat-bogs and diluvium throughout Europe.
priscus Boj. Peat-bogs and diluvium throughout Europe and Siberia, more to the north than *B. primigenius.*
reclinis? *Blyth.*—(Atlantinus *Blyth.*) N. W. Africa.
Sondaicus *Müll.*—(Banteng *Raffl.* leucoprymnos *Quoy* and *Gaim.* Urus Javanicus *Wagn.*) Java, Bali (Borneo, perhaps introduced).
taurus *Linn.* Domesticated everywhere; become wild in La Plata, Paraguay, &c.
trochocerus v. Meyer. Diluvium at Sienna.
urus *Linn.* Formerly over all the wooded districts of Europe, now confined to protected ground in Lithuania, to the Caucasus, the south of Russia in Asia, and perhaps the Carpathian Mountains.

Capridæ.

Ovis argali *Bodd.*—(ammon *Linn.* Hodgsonii *Blyth.* ammonoides *Hodg.*) Thibet, North and Middle Asia
aries *Linn.*—(longipes, Guineensis, steatopygos, platyura, strepsiceros, brachyura, polycerata, and recurvicauda *Auct.*) Domesticated Everywhere.
burrhel *Blyth.*—(nahura *Hodg.* cylindricornis *Blyth.*) Glacier region of the Himmalayahs, 15,000 feet above the sea, Nepaul and Thibet, Caucasus.
cycloceros? *Hutton.*—(Vignei *Blyth*, pars.) Afghanistan, Alpine Punjaub (represented in Nineveh sculptures), Ladak.
mammilaris? Hildreth. Pliocene. North America.
montana *Cuv.*—(Ammon *Harl.* pygargus *H. Smith.* Cervina *Desm.* Californiana *Dougl.*) Rocky Mountains.
musimon *Schreb.*—(Vignei *Blyth.* pars. orientalis *Gmel.* Gmelini *Blyth.* Cyprius *Blas.* Ophion *Blyth.*) Mountains; Cors., Sard. (formerly Spain and Balearic Isles), Greece and the Ceraunian Mountains of Persia.
nivicola *Esch.* N. E. Siberia.
Polii? *Blyth.* Pass of Pamir, Sha of Thibet.
tragelaphus *Desm.* Mountains of N. Africa.
Capra ægagra *Gmel.* West, Middle and North Asia, Caucasus, and Taurus.
Capra Beden *Wagn.*—(Arabica *Rupp.* Tæla *Griff.* Sinaitica *Ehrenb.*) Mountain district of middle Egypt, Syria, and Arabia Petræa, chiefly from Sinai.
Caucasica *Gould.* Caucasus.
Cebennarum Gerv. Bone-cave of Mialet, between Alais and Anduze.
hircus *Linn.* Domesticated throughout the World.
hispanica *Schimp.* Sierra Nevada, and Sierra of Ronda.
hylocrius *Ogilb.*—(warryato *Gray.*) India, Neilgherries S. Malabar.
ibex *Linn.* Formerly throughout the whole chain of the Alps, now scarce.
Jemlaica *H. Smith.*—(jhazal and quadrimammis *Hodg.*) Himmalayah.
megaceros *Hutton.*—(Falconeri *Hugel.*) Lesser Tartary, and the higher mountain district between the Indus and the Hindoo Kusch, Affghanistan, Kashmir.
Pyrenaica *Schinz.* Pyrenees, almost exterminated on the French side of the mountains.
Rozeti? Pomel. Puy de Dome.
Sibirica *Pall.*—(Pallasii *Schinz.* Sakeen and Himmalayana *Blyth.*) Mountains of Siberia, Tartary, and Kamtschatka, Kashmir.
Walei *Rupp.* Abyssinian Mountains, borders of perpetual snow.
Haplocerus (Nemorhadus) bubalinus *Hodg.*—(thar *Wagn.*) Nepal.
Christoli Serres. Bone-caves of Bize in department of Aude, France.
crispus *Temm.* Islands of Nippon and Sikok, in Japan.
dichotoma Gerv. Diluvial sand in the department of Gers, France.
Goral *Hardw.*—(Duvaucelii *H. Smith.*) Nepal.
rubidus? *Blyth.* Arakan Hills.
Sumatrensis *Shaw.*—(interscapularis *Goldf.*) Mountains of Sumatra.
Swinhoii *Gray.* Formosa.
taxicolor *Hodg.* Mishmi Hills, Assam.
Antilocapra Americanus *Ord.*—(hamatus *Blainv.* furcifer *H. Smith.* palmata *Smith.* anteflexa? *Gray.*) N. America, southwards from the Saskatchewan River, in 53° N.L. into Mexico, and westward from Missouri River across Rocky Mountains to Cascade Range of California and Oregon.
montanus *Rich.*—(Americana *Blainv.* lanigera *H. Smith.* Columbiana *Desm.*) Higher portions of Rocky Mountains, and Cascade Ranges.
rupicapra *Erxl.* Chamois. Pyrenean and Swiss Alps, formerly more widely distributed.

Antilopidæ.

Leptotherium major Lund. Bone-caves, Brazil.
minor Lund. Bone-caves, Brazil.
Antilope clavata Gerv. Middle tertiary of Sansans.
Cordieri Christol.—(*recticornis* Serres.) Marine sand of Montpelier.
deperdita Gerv. Cucuron.

Antilope major Jäger. WURTEMBERG.
maquinensis Lund. Bone-caves, BRAZIL.
minor Jäger. WURTEMBURG.

Bovina.

(Anoa) depressicornis *Smith.* CELEBES.
(Damalis) oreas *Pall.*—(canna *Griff.*) The Eland. S. AFR.
var. Derbianus *Gray.* GAMBIA.
Livingstonii *Sclater.* E. AFRICA.
(Catoblepas) Gnu *Zimm.* S. AFRICAN PLAINS.
taurina *Smith.*—(gorgon *Griff.* Brooksii *Smith.*) S. AFRICA, northwards from the ORANGE RIVER.
(Bubalus) addax *Licht.*—(suturosa *Otto.* gibbosa *Savi.* naso-maculata *Blainv.* mytilopes *Smith.*) Sandy steppes of NUBIA, EGYPT, ARABIA.
bubalis *Pall.*—(Mauritanica *Sund.*) N. AFRICA, the DESERT OF SAHARA, and up to EGYPT.
Caama *Cuv.* The Hartebeeste. SOUTH AFRICA.
Lichtenstenii *Peters.* Grassy plains in MOSAMBIQUE.
lunatus *Smith.*—(Kobai *Erxl.* Senegalensis *Cuv.*) S. AFRICA, BECHUANA LAND.
(Oryx) gazella? *Pall.* Gemsbok. SENEGAL, E. AFRICA (perhaps not distinct from O. oryx.)
leucoryx *Pall.*—(ensicornis *Hemp. and Ehr.* algazella *Ehrb.* eleotragus *Schreb.* Tao *Smith.*) ARABIA, PERSIA, UPPER NILE to CORDOFAN and SENAAR.
oryx *Pall.*—(bezoartica *Pall.* Capensis *Harris.* beisa *Rupp.* Beatrix? *Gray.*) From the coast of the RED SEA to the CAPE OF GOOD HOPE.
(Aegoceros) equinus *Desm.*—(glauca *Forst.* Osanne *Geoff.* barbata *Griff.* Truteri *Fisch.* Aethiopica *Schinz.*) SOUTH AFRICA.
leucophæus *Pall.* Supposed to be extinct, but found by Capt. Speke. E. AFRICA.
niger *Harris.* S. AFRICA.
(Gazella) Arabica *Ehrb.*—(cora *H. Smith.* Cuvieri *Ogilb.*) NORTH AFRICA, ARABIA, PERSIA.
Bennettii *Sykes.*—(Christii *Gray.* hazenna *Geoff.*) IND.
dama *Cuv.*—(ruficollis *H. Smith.* addra *Bennett.*) Steppes of SENAAR, NUBIA, and KORDOVAN.
var. mohrr. *Benn.* MOROCCO.
var. nanguer *Benn.* SENEGAL.
dorcas *Pall.*—(corinna *Cuv.* Kevel *Buff.* Isidis *Sund.* Isabella *Gray.* rufifrons *Gray.* lævipes *Sund.*) Whole of NORTH AFRICA and ARABIA.
var. leptoceros? *F. Cuv.* SENAAR.
euchore *Forst.*—(marsupialis *Zimm.* dorsata and saliens *Lacep.* saltatrix *Link.*) The Springbok. S. AFRICA.
picticaudata *Hodg.* THIBET.
pygarga *Pall.*—(personata *Wood.* albifrons *Harris.*) The Bontebok. Interior of SOUTH AFRICA.
Sommeringii *Rüpp.* ABYSSINIA.
Spekei *Blyth.* SOMALI LAND.
subgutturosa *Güld.* WESTERN ASIA, as far west as CONSTANTINOPLE, south as ISPAHAN, and east as BOCHARA, AFFGHANISTAN.
(Tragelaphus) Angassii. E. AFRICA.
decula *Rüpp.* ABYSSINIA.
scripta *Pall.*—(phalerata *H. Smith.* maculata *Thunb.*) Middle part of WEST AFRICA.
(Tragelaphus) strepsiceros *Pall.*—(Kudu *Gray.* tendal and chora *Rüpp.* Capensis *A. Smith.* excelsus *Sund.* strepsiceros *Gray.* tendal and doria *Ogilb.* zebra *Gray.* albovittatus *Du Chaill.*) The Koodoo. ABYSS., E. AFR., MOSAMB., S. AFR., S. LEONE, GUIN.
Spekii *Sclater.* E. AFRICA.
sylvaticus *Sparrm.* S. and S. E. AFRICA, CAFFRARIA, MOSAMBIQUE.
Tianyàne *Livingst.* CENTRAL AFRICA.
(Antilope) adenota *H. Smith.* W. AFRICA.
cervicapra *Pall.* (bilineata *Temm.*) E. INDIA.
forfax *H. Smith.*—(annulipes *Gray.*) W. AFRICA.
gutturosa *Pall.* DAURIA, MONGOLIA, and the deserts between THIBET and CHINA.
Hodgsoni *Abel.*—(Kemas *H. Smith.* chiru *Less.*) UPPER THIBET, and Northern HIMMALAYAH.
melampus *Licht.* BECHUANA LAND.
saiga *Pall.* W. ASIA, from the borders of POLAND to the IRTISCH and ALTAI.
(Redunca) capreolus *Licht.*—(lanata *Desm.* villosa *H. Smith.*) CAPE OF GOOD HOPE.
eleotragus *Lichtst.*—(fulvo-rufula *Afz.* subellina *Afz.* arundinacea *Shaw.* Lalandii *Desm.* acuticornis and grandicornis *Blainv.*) CAPE OF GOOD HOPE.
ellipsiprymna *Ogilb.* SOUTH AFRICA.
hastata *Peters.* MOSAMBIQUE.
leucotis *Licht. and Pet.* E. AFRICA.
montana *Cretz.* High plains of ABYSSINIA.
redunca *Pall.*—(bohor *Rüpp.*) SENEGAL and ABYSSINIA.
scoparia *Schreb.*—(melanura *Bechst.* ouralis *F. Cuv.*) CAPE OF GOOD HOPE.
Singsing *Gray.*—(defassa *Rüpp.*) WESTERN ABYSSINIA, southwards from SENAAR and in CORDOVAN.
unctuosa *Laur.* SENEGAL.
n. sp. fide *Sclater.* The Ndjezza. E. AFRICA.
(Oreotragus) melanotis *Forst.*—(grisea *Smith*, rubro-albescens *Desm.* subulata *H. Smith.*) CAPE OF GOOD HOPE.
saltatrix *Bodd.*—(oreotragus *Forst.*) CAPE OF GOOD HOPE.
tragulus *Forst.*—(rufescens, pallida, and rupestris *H. Smith.* pediotragus *Afz.* campestris *Thunb.* fulvo-rubescens *Desm.*) CAPE OF GOOD HOPE.
(Cephalolophus) altifrons *Peters.*—(coronatus *Gray.*) MOSAMBIQUE.
bicolor *Gray.* NATAL.
Friderici *Laur.*—(pygmæa *F. Cuv.* Maxwellii *H. Smith.* philantomba *H. Smith.* punctulatus *Gray.*) SENEGAL.
grimmia *Pall.*—(mergens *Blainv.* Burchellii, platous, and ptox *H. Smith.* nictitans *Thunb.* ocularis *Peters.* Campbelliæ *Gray.* rufilatus *Gray.* Madoqua *Rüpp.*) S. AFRICA, GUINEA, ABYSSINIA.
Hemprichanus *Ehrb.*—(saltiana, grimmia, Madoka, and Hemprichi *Rupp.*) ABYSSINIA, CHAPANI, near ZANGUEBAR.
longiceps *Gray.* GABON.
monticola *Thunb.*—(pygmæa *Pall.* perpusilla and cœrulea *H. Smith.*)

(Cephalolophus) moschatus *Duben.* Coral Island, Somali Land.
Natalensis *A. Smith.* Port Natal.
Ogilbyi *Waterh.* Fernando Po.
quadriscopa *H. Smith.* Senegal.
spinigerus *Temm.* Guinea.
sylvicultrix *Afz.* Sierra Leone.
Whitfieldii. S. Africa.

Portax picta *Pall.*—(tragocamelus *Pall.* albipes *Erxl.* risia *H. Smith.*) Nylghau. India, not Ceylon.

(Tetracerus) quadricornis *Blainv.*—(chikara *Hardw.* striaticornis *Leach.* subulata and acuticornis *Blainv.* albipes *F. Cuv.* subquadraticornis *Elliot.* iodes and paccerois *Hodg.*) Continent of India, not Ceylon.

Camelopardalidæ.

Camelopardalis *biturigum Duv.* Clay slate, of doubtful age, near Issoudun.
giraffa *Gmel.*—(Senaariensis and Capensis *Geoff.*) From the borders of the Cape Colony, northwards to Nubia, excepting the mountainous regions.

Sivatherium giganteum Cautl. Falc. Miocene beds of the Sivalik Hills.

Cervidæ.

Extinct species of doubtful place among the sections.

Cervus *Bertholdi* Kaup. Middle tertiary. Germany.
curtoceros? Kaup. Epplesheim.
dicranocerus? Kaup. Epplesheim.
dicrocerus Gerv. France.
elegans Lart. Miocene. Sansans.
grandis Lart. Miocene. Sansans.
Larteti Gieb. Miocene. Sansans.
nanus Kaup. Middle tertiary. Germany.
Partschii Kaup. Middle tertiary. Germany.
pygmæus Pict.—(*parvus* Gieb.) France.
trigonoceros? Kaup. Epplesheim.

(Platycerus) dama *Linn.*—(platyceros *Ray.* vulgaris *Gesm.*) Mediterranean Dist., Spain, Sardinia, Italy, Greece, Asia Minor, and Tunis.
Somonensis Desm.—(*Dama giganteus* Laur. *Dama Polignacus* Robert.) Diluvial deposits near Abbeville, Gergovia, Germany, etc.

(Alce) Alces *Linn.* European Elk. North Europe, Prussia, Poland, Lithuania, Russia, Caucasus, Siberia, Tartary, and the deserts of Altai and Baikal.
antiquorum, *resupinatus*, and *Sabinus* Rouill. Diluvium in Europe.
Americanus *Jard.*—(machlis *Ogilb.* malchis *Gray.* orinal *Reich.* lobatus *Agass.* muswa *Rich.*) Moose. N. Amer., from the Atlantic to the Pacific, on the eastern side from 65° N.L. through Canada to Maine, New Hampshire, Vermont, and northern parts of New York, on the west coast from the shores of the Arctic Ocean, nearly to Columbia River, fossil in pliocene deposits in the N. America.

(Alce) *megacerus* Hart.—(*euryceros* Aldr. *giganteus* Blum. *islandicus* Blainv. *Hibernicus* Owen.) Peat-bogs, diluvium in England, Ireland, France, Germany.
(Rangifer) Caribou *Kerr*—(hastalis *Agass.*) N. America, south of Hudson's Bay, to Lake Superior.
arcticus *Baird.* Barren Grounds, north-east corner of N. Amer., along the Polar Sea, bounded on the west by Slave Lake, and Coppermine River, and to the south by Churchill River.
Do. var. Grœnlandicus *Kerr.* Greenland.
Do. var. Spitzbergensis *Murr.* Spitzbergen.
tarandus *Linn.*—(platyrhynchus *Vrolick.*) All the north of Europe and Asia, along the Icy Sea from Norway to the Lena, as far north as 70° N.L., introduced into Iceland.
Do. var. Sibiricus *Murr.* Siberia, Kamtsch.
Guettardi Desm. *tarandoides* Brav. *leptoceros* Eichw. and *Bucklandi* Owen. In diluvium and bone-caves throughout middle and south Europe.

(Elaphus) affinis *Hodg.* E. Thibet.
Antisiensis *D'Orb.* Cordillera of Peru, and Andes.
Aristotelis *Cuv.*—(hippelaphus, equinus, and Leschenaultii *Cuv.* Malaccensis *F. Cuv.* Kuhli *Mull.* lepidus *Sund.* maximus and niger *Blainv.* Bengalensis *Schinz.* russa *S. Müll.* Pennantii *Gray.* unicolor *Schreb.* Larai *Hodg.*) The Sâmur. India, Malabar, Coromandel, Bengal, Sylhet, Nepal, on the Indus, Malacca, Borneo?
Arvernensis Croiz. Miocene beds, Auvergne.
auritus? *Gray.* Brazil.
axis *Erxl.*—(maculatus *Gray.* major, minor, porcinus *Hodg.* pseudaxis *Gerv.* nudipalpebra *Ogilb.*) India and Ceylon, not east of Bengal, China.
campestris *Cuv.*—(leucogaster *Goldf.*) Wide open plains from Brazil to the River Negro in Patagonia.
Canadensis *Briss.*—(strongyloceros *Schreb.* Wapiti *Leach.* major *Ord.* occidentalis *Smith.*) North America, from Atlantic to Pacific, and as far north as 57° N.L.
Do. *fossilis* Harl. Diluvium, N. Amer.
Chilensis? *Molina.* Cordillera, Chili.
cariacus *Sauss.* Mexico.
Columbianus *Rich.*—(Lewisii *Peale.* macrotis *Rich.* punctulatus *Gray.*) Oregon and California.
Duvaucelii *Cuv.*—(euryceros *Knowsley Menagerie.* elaphoides and bahraiya *Hodgs.*) Upper Bengal, Valley of Nepal, Assam, Nerbudda Territory, E. Sunderban.
elaphus *Linn.*—(vulgaris *Linn.* nobilis *Klein.* Germanicus *Briss.* Mediterraneus *Blain.* Corsicanus, *Wagn.*) All Europe, and across Asia to Lake Baikal and the Lena.
Do. (*primigenius*, *priscus*, *Bresciensis*, *fossilis*, *intermedius*, *coronatus*, *antiquus*, *Destremii*, *Reboulii*, *pseudo-virginius*, *Dumasii*, *Costrizensis*, *diluvianus*, Auct.) The same distribution as the existing species, in diluvium, peat-bogs, bone-caves, and bone-breccias.
Do. var. barbarus *Bennett.* Tunis.

(Elaphus) Do. var. Corsicanus *Wagn.* Corsica.
Eldi *Guthrie.*— (frontalis *M'Lell.* dimorphus *Hodg.* Smithii? acuticornis, and platyceros *Gray.* lyratus *Schinz.*) From Valley of Munnipore to Pegu, Siam, Mergui, Cochin China.
etuearium Croiz. and Job. Miocene. Auvergne.
Goudoti? *Gerv.* New Grenada.
gymnotis *Wiegm.* Cayenne, Bogota, and on the Orinoko.
leucotis *Gray.* Patagonia.
leucurus *Dougl.* N. America, Upper Missouri and Upper Platte, along eastern plains of Rocky Mountains into Texas.
macrotis *Say.* — (auritus *Warden.* macropus? *H. Smith.*) Head-waters of the Arkansas, Upper Missouri, and Saskatchewan, head of the Des Chutes River Oregon? (doubtful if the species from the Des Chutes is the same.)
Mantchuricus *Swinh.* Newchwang, Mantchuria.
Marianus *Desm.*—(Philippinus *Fisch.* albipes *F. Cuv.*) The Marianne Islands.
Mexicanus *Gmel.* Sonora, and southwards to beyond the City of Mexico.
paludosus *Desmar.*—(palustris *Desm.* dichotomus *Illig.* comosus *Wagn.*) Brazil, Paraguay, Bolivia, Argentine Republic, Patagonia.
pardinensis Croiz. and Job. Miocene, Auvergne.
Philippinus *H. Smith.* Phil. Isles.
porcinus *Gmel.*— (pumilio *H. Smith.* dodur? *Royle.* Oryzeus *Kelaart.*) Bengal, Nepal, Assam, Indo-Chinese Countries, Deyra Doon, Sindh, South Malabar, Ceylon.
punctulatus? *Gray.* Brazil.
Sartorii *Sauss.* Mexico.
savannarum? *Caban and Schomb.* British Guiana.
Schomburgki *Blyth.* Siam.
Sika *Schleg.*—(Japonica *Gray.*) Japan.
spinosus? *Gerv.* Cayenne.
superciliaris *Gray.* Brazil.
Swinhoei *Sclater.* Formosa.
Taivanus *Blyth.* Formosa.
Toltecus *Sauss.* Mexico.
tunjuc *Vigors.*—(Peronii *Cuv.* rusa *Mull.* Moluccensis *Quoy.* Timoriensis *Leyd. Mus.*) Java, Timor, Buru, Amboyna, not Borneo or Sumatra.
Virginianus *Bodd.*—(strongylocerus *Autenreith* in *Schrb.* ramosicornis *Blainv.* clavatus *H. Smith.* macrurus? *Fisch.* similis? *Puch.*) North America, east of Missouri, and south of Maine, N. York, Pennsylvania, Maryland, Virginia, and States to the south.
Wallichii *Cuv.*—(elaphus of Asia *Pall.* Caspianus and and Cashmiriensis *Falc.* affinis and Nareyanus *Hodg.*) Nepal and Silhet.
(Capreolus) capreolus *Linn.*—(pygargus *Pall.* Europæus *Sund.* capræa *Gray.*) Roe Deer. All Europe, in the north, and absent in the greatest part of Russia.
Do. Australis Serres (*Tournalii* Serres. *cusanus* Croiz. *Cauvieri* and *Tolozani* Christ. *Solilhacus* Robert.) In peat-bogs, bone-breccias and caves, and in diluvium and fresh-water deposits.
(Subulo) nemorivagus *F. Cuv.*—(simplicicornis *Wagn.* nemoralis *Desm.*) Cayenne, Brazil, Paraguay, Peru, both in plains and mountains.
Pudu Gay *Molini.*— (humilis *Benn.*) Cordillera, Chili.
rufus *F. Cuv.*—(simplicicornis *H. Smith.* dolichurus *Wagn.* rufinus *Puch.*) Plains and mountains in Guyana, Brazil, Paraguay, Peru, Quito.
(Stylocerus) *anoceros* Kaup. Epplesheim.
Cambojensis *Gray.* Cambogia.
Muntjac *Zimm.*—(vaginalis *Bodd.* aureus *H. Smith.* moschatus and subcornutus *Blainv.* moschus *Desm.*) India, Ceylon, Indo-Chinese region, Malayan Peninsula, Sumatra, Java, Borneo, Philippines.
Reevesii *Ogilb.* China, Formosa.
stylocerus? *Wagn.*—(ratwa *Hodg.* albipes *Wagler.* melas *Ogilb.*) India.

Moschidæ.

Moschus moschiferus *Linn.*—(chrysogaster, leucogaster, and saturatus *Hodg.*) Central Asia, from the Alta, to basin of the Amour, Tartary, Mongolia, Cashmir, Thibet, and interior of Siam.
Dremotherium Feignouxii Geoff. Fresh-water limestone of Auvergne.
nanum Geoff. Fresh-water limestone of Auvergne.
Poëbrotherium Wilsonii Leidy. Lower miocene, Nebraska.
Dorcatherium Guntianum Kaup. Molasse of Gunsburg.
Nani Kaup. Epplesheim.
Vindobonense Kaup. Vienna beds.
Xiphodon Gelyense Gerv. Montpelier.
gracile Cuv.— (*Dichobune obliquum* Cuv.) Paris gypsum and freshwater limestone near Apt.
Dichobune cervinum Owen. Eocene, England.
leporinum Cuv. Paris gypsum.
murinum Cuv. Paris basin.
Robertanum? Gerv. France.
suillum? Gerv. France.
Acotherulum saturninum Gerv. Apt.
Aphelotherium Duvernoyi Gerv. Apt.

Tragulidæ.

Tragulus Bengalensis *Pent.* Bengal.
Javanicus *Pall.*—(Indicus *Gmel.* affinis *Gray.*) Malayan Peninsula, Sumatra, Java, Borneo.
var. fuscatus *Blyth.*—(Malaccensis? *Gray.*) Java, Singapore.
var. Napu *F. Cuv.* Sumatra.
var. Stanleyanus *Gray.* Malacca and Ceylon.
var. Pelandoc *Raffl.* Sumatra.
meminna *Erxl.*—(Indica *Gray.* mimenoides *Hodg.* ecaudatus *Sund.*) India, Ceylon.
Meyeri Goldf. Lignite, Seven Mountains near Rott,
pygmæus *Linn.*—(Kanchil *Raffl.* fulviventer *Gray.*) Tenasserim, Malayan Peninsula, Sumatra, Java, Borneo?
Hyomoschus aquaticus *Ogilb.* W. Afr., from Senegal to Gabon.
crassus Lart. Miocene formations of Sansans.
Palæomeryx ardeus? Croiz. and Job. Puy de Dome.
aurelianensis Cuv. Miocene. Germany

Palæomeryx Bojani v. Meyer. Miocene. GERMANY.
Cusanus? Croiz. and Job. PUY DE DOME.
eminens v. Meyer. Miocene. GERMANY.
Gergovianus? Croiz. and Job. PUY DE DOME.
Issiodorensis? Croiz. and Job. PUY DE DOME.
medius v. Meyer. Miocene. GERMANY.
minimus v. Meyer. Miocene. GERMANY.
minor v. Meyer. Miocene. GERMANY.
Nicolati v. Meyer. Miocene. GERMANY.
Pierrieri? Croiz. and Job. PUY DE DOME.
pygmæus v. Meyer. Miocene. GERMANY.
ramosus? Croiz. and Job. PUY DE DOME.
Scheuchzerii v. Meyer. Miocene. SWITZERLAND.

ANOPLOTHERIDÆ.

Hoplotherium (*Hyægulus*) *collotarsus* Pomel. Middle tertiary AUVERGNE.
(*Cainotherium*) *commune* Brav. Tertiary beds, PUY DE DOME.
(*Microtherium*) *concinnum* v. Meyer. From WEISENAU.
(*Microtherium*) *Curonense* Bravard. From WEISENAU.
(*Cainotherium*) *elegans* Pom. Middle tertiary, AUVERGNE.
(*Cainotherium*) *gracile* Pom. Middle tertiary, AUVERGNE.
(*Cyclognathus*) *laticurvatum* Geoff. Indusial limestone of AUVERGNE.
leptognathum Laiz. and Par. Tertiary sandstone in AUVERGNE.
(*Cainotherium*) *medium* Brav. WEISENAU.
(*Cyclognathus*) *metapius* Pom. Middle tertiary, AUVERGNE.
(*Cainotherium*) *minimum* Brav. Tertiary beds, PUY DE DOME.
(*Hyægulus*) *murinus* Pom. Middle tertiary, AUVERGNE.
(*Microtherium*) *Renggeri* v. Meyer. Molasse of AARAU.
Chalicotherium antiquum Kaup. Middle tertiary, EPPLESHEIM.
Goldfussi Kaup. Middle tertiary, EPPLESHEIM.
Dichodon cuspidatus Owen. Tertiary sand, HORDLE in ENGLAND.
Anoplotherium commune Cuv.—(*Duvernoyi, platypus, Laurillardii,* and *Cuvieri* Pom.) PARIS Basin, near APT, GERMANY, ENGLAND.
posterogenium Falc. and Caut. Miocene beds, SIVALIK HILLS.
secundarium Cuv. PARIS basin.
Sivalense Falc. and Caut. Miocene, SIVALIK HILLS.
*Sargodon sp.** Pleininger. Bone breccia WURTEMBERG.
Anthracotherium Alsaticum Cuv. Lignite near WEISSENBURG, in ALSATIA.
magnum Cuv. Lignite of CADIBONA, marl of LIMAGNE, near EPPLESHEIM, ETC.
minimum Cuv. Ditto.
Anthracotherium velaunum Cuv. Freshwater marl of PUY-EN-VELAIS.
Cyclognathus Gergovianus Gerv. ISSOIRE.
onoideus Gerv. NEWVILLE.
Silistrensis Pentl. Tertiary beds in BENGAL.

NON-RUMINANTIA.

DICOTYLIDÆ.

Harlanus Americanus Harl. GEORGIA, N. AMERICA.
Dicotyles *costatus* Leconte. N. AMERICA.
labiatus *Cuv.* BRAZIL, PARAGUAY, PERU.
major Lund. BRAZIL CAVES.
sp. Lund. BRAZIL CAVES.
sp. Lund. BRAZIL CAVES.
sp. Lund. BRAZIL CAVES.
sp. Lund. BRAZIL CAVES.
torquatus *Cuv.*—(albirostris *Fraser?*) N. AMERICA, south of 34° N.L., MEXICO, GUATEMALA, and the whole of SOUTH AMERICA, east of the ANDES; *fossil* in pliocene deposits, N. AMERICA.
Platygonus compressus Leconte. NORTH AMERICA, Pliocene in VIRGINIA, ILLINOIS, KENTUCKY, IOWA, and MISSOURI.
Hyops depressifrons Lec. Pliocene, NORTH AMERICA.
Protochærus prismaticus Lec. Pliocene, N. AMERICA.
Euchærus macrops Leidy. Pliocene, N. AMERICA.

SUIDÆ.

Phacochærus Aethiopicus *Cuv.*—(Pallasii? *V. d. Hoev.*) ÆTHIOPIA.
Potamochærus Africanus *Cuv.*—(Æliani *Cretz.* incisivus *Geoff.* Harcia *Ehr.*) KORDOFAN, and from the Eastern district of ABYSSINIA to SENEGAL.
larvatus? *F. Cuv.* MADAGASCAR and CAPE OF GOOD HOPE.
penicillatus. Red River Hog.
Sus Andamensis *Blyth.* ANDAMAN ISLANDS.

Fossil species, the remains of which are not sufficiently distinct to allow them to be allotted among the above genera.

antiquus Kaup. Middle tertiary, near EPPLESHEIM, and MONTAUBSARD.
armatus Pom. Diluvium, PICARDY.
Arvernensis Croiz. and Job.—(*Provincialis* Gerv.) Upper miocene in AUVERGNE, Marine Sand at MONTPELIER.
barbatus *Müll.* BORNEO.
Celebensis *Müll.* CELEBES.
leucomystax *Temm.* JAPAN.
Papuensis *Müll.* NEW GUINEA.
pliciceps *Gray.*
scrofa *Linn.* EUROPE, ASIA, and NORTH AFRICA.
var. Bengalensis *Blyth.* BENGAL.
var. Indicus *Blyth.*—(cristatus *Wagn.*) INDIA and CEYLON.
var. C. fide *Blyth.* TENASSERIM.
var. Zeylanensis *Blyth.* CEYLON.

* Doubtful whether the remains (incisor teeth) belong to a fish or an Anoplothere.

Sus Timoriensis *Müll.* Timor.
verrucosus *Müll.* Java.
vittatus *Müll.* Java and Sumatra.
n. sp. fide *Blyth.* Nicobar Islands.
chœrotherium Pom.—(*lemuroides* Pom.) Middle tertiary near Sansans.
leptodon Pom. Lignite of Liguria.
palæochœrus Kaup.—(*antediluvianus* Kaup. *belsiacus* Gerv. *Lockharti* Blainv. *major* Gerv. *chœroides* Blainv.) Middle tertiaries near Epplesheim, Madrid Basin, Fahluns of Anjou, near Averay and Orleans, Montabusard, Cucuron.
priscus Goldf. Sandwich Cave.
Serresii Gieb. Caves of Lunevieille.
Sivalensis Falc. Miocene, Sivalik Hills.
Calydonius tener v. Meyer. Tertiary beds of La Chaux de Fonds.
trux v. Meyer. Tertiary, La Chaux de Fonds.
Porcula Salviana *Hodg.* Saul Forest, Himmalayah.
Taivana *Swinh.* Formosa.
Babyrussa Alfurus *Less.*—(orientalis *Briss.*) Molucca Islands, Celebes, Buru, Ternate, Mindanoa, Banca.
Palæochœrus major Gerv. Indusial limestone, Allier Department.
typus Pom. Indusial limestone, Allier Department.
Entolodon magnum Aym. Tertiary, calcareous marl of Ronzon, in the Department of Puy.
Ronzoni Gerv. Tertiary marl, Ronzon, Puy.
Archæotherium Mortoni Leidy. Miocene, Nebraska.
robustum Leidy. Nebraska.
Chæromorus mammillatus? Lart. Freshwater limestone, Sansans.
Chœropotamus affinis Gerv.—(*Bothriodon platyrhynchus*, *B. leptorhynchus* Aym. *Hyopotamus crispus* Pom. *Ch. Matritensis* Kaup.) Near Apt.
Parisiensis Cuv. Eocene beds of the Parisian basin, of Apt, and the Isle of Wight.
Hyopotamus annectens Owen.—(*Ancodus macrorhinus* Pomel.) Eocene.
bovinus Owen. Hempstead Series.
Vectianus Owen. Hempstead Series.
Hippohyus Sivalensis Cautl. and Falc. Miocene beds, Sivalik Hills.
Hyracotherium leporinum Owen. London Clay, Herne Bay.
cuniculus Owen. Eocene sand below Red Crag at Kingston, in Suffolk.
Hyotherium Meissneri v. Meyer.—(*medium?* v. Meyer.) Middle tertiary, near Wiesbaden.
Soemmeringi v. Meyer. Middle tertiary, from Georgensmund, Elgg, Chaux de Fonds, etc.
Syodon sp. Keyserl. Germany.
Adapis Parisiensis v. Meyer. Gypsum of Montmartre.
Tapiroporcus sp. Jaeger. Germany.

Hippopotamidæ.

Hippopotamus amphibius *Linn.*—(Capensis *Desm.* Senegalensis *Mort.*) In all the large African rivers, from the Cape to the Sahara.*
Irawadicus Cautl. and Falc. Miocene, Sivalik Hills.
major Cuv. Pliocene, Sicily, Italy, France, England, Ireland, Germany, etc.
minor Cuv. Dax in the Department of the Landes.
Namadicus Cautl. and Falc. Miocene, Sivalik Hills.
palæindicus Cautl. and Falc. Miocene, Sivalik Hills.
Sivalensis Cautl. and Falc. Miocene, Sivalik Hills.
Chæropsis Liberiensis *Morton.* Liberia.
Merycopotamus dissimilis Cautl. and Falc. Miocene, Sivalik Hills.

MULTUNGULA.

Palæotheridæ.

Palæotherium annectens Gerv. Eocene beds of Hordle in England, lignite of Gargas.
Argentonicum Gerv. Eocene. Near Argenton.
aurelianense Cuv. Eocene. Paris gypsum.
crassum Cuv. Eocene. Paris gypsum, and Lignite of Apt.
curtum Cuv. Eocene. Paris gypsum, and Lignite of Apt.
giganteum Leidy. Miocene. Nebraska.
indeterminatum? Cuv. Paris gypsum.
Isselanum Cuv. On the Issel and Buschweiter.
latum Cuv. Paris gypsum.
magnum Cuv.—(*Aniciense* Gerv. *Girondicum* Blainv.) Gypsum of Paris basin, Lignite of Apt, Isle of Wight, Gypsum Marl of Puy-en-Velais, Lignite of Dordogne.
medium Cuv. Eocene. Paris gypsum, lignite of Apt and Dordogne, near Alais and Bourdeaux.
minimum Cuv.—(*parvulum?* Serres *Schinzi* Meyer.) Swiss Molasse, Paris Gypsum, Castelnaudry.

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* The following is Morton's synopsis of the species of Hippopotamus:—

Tetraprotodon *palæindicus.* Europe, India.
amphibius. Africa.
Senegalensis. Africa.
Capensis. Africa.
Tetraprotodon *annectens.* Africa.
minor? Europe.
(Chœropsis) Liberiensis. W. Africa.
Hexaprotodon Iravaticus. India.
Sivalensis. India.
Namadicus. India.
Merycopotamus dissimilis. India.

Palæotherium minus Cuv. Paris Basin, near Apt, Dordogne, Saillaus.
ovinum Aym. Freshwater marl of Puy.
velaunum Cuv. Puy-en-Velais ?
Lophiodon anthracoideum Gerv.—(*Coryphodon Eocenus* Owen.) Eocene beds near Soissons, Laon, Mendon, Camberwell.
cervulum Gerv. Freshwater marl of Alais.
Cesserassicum Gerv.—(*Pachynolophus Vismœi* Pom.)
Duvali Gerv.—(*mastolophus* Pom. *leptognathus* Gerv.) Paris Basin.
(*Tapirulus*) *hyracinum* Gerv. Near Apt.
medium? Cuv.—(*minutum?* and *minimum?* Cuv.) Argenton.
Monspessulanum? Cuv. Montpelier.
Occitanum? Cuv. Issel.
Parisiense Gerv. Eocene beds of Paris Basin.
tapiroides Cuv. — (*Tapirotherium* and *Buschovillanum* Cuv.) Near Buschweiler.

Nesodontidæ.

Nesodon imbricatus Owen. Patagonia.
magnus Owen. Patagonia.
ovinus Owen. Patagonia.
Sullivani Owen. Patagonia.
Macrauchenia Boliviensis Huxley. Bolivia.
Patachonica Owen.— (*Opisthorhinus Falconeri* Brav.) Patagonia.

Tapiridæ.

Tapirus Americanus *Linn.*—(suillus *Wagn.*) From the foot of the Cordilleras to the Atlantic Ocean, and from Central America to near Buenos Ayres in Peru, it reaches an elevation of 3000 feet.
Do. (*mastodontoides* Harlan. *giganteus* auct. Amer. *Americanus fossilis* Leidy.) Fossil. Kentucky, and Texas.
Arvernensis Croiz. and Job.—(*minor* Serres, and *Poivieri* Pom.) Tertiary beds of Issoire, Puy-en-Velay and Montpelier, miocene of the Bourbonnais.
Haysii Leidy. Pliocene, N. America.
Indicus *Desm.*—(Malayanus *Raffl.* bicolor *Wagn.* Sumatranus *Gray.*) Sumatra, Malacca, the southwest Provinces of China, Southern Tenasserim Provinces.
priscus Kaup.—(*Helveticus?* Meyer. *pusillus?* Jager.) Tertiary sands Epplesheim, lignite of Briber, in Croatia, lignite of Switzerland, molasse of Othmarsinger, the Paludina chalk of Wiesbaden, and the freshwater chalk of Hasslach.
Roulini *Fisch.*— (pinchaque *Roul.* villosus *Wagn.*) Higher regions of the Andes, 7000 to 8000 feet high, from Peru to Central America.
Suinus Lund. Bone-caves in Brazil.

Nasicornia.

Rhinoceros bicornis *Linn.*—(Africanus *Camp.* Brucei and Gordonii *Blainv.* niger and Camperi *Schinz.*) Africa, from the Galla Country to the Cape of Good Hope.
brachypus Lart. Middle tertiary, Department of Gers.
Cimorrhensis Lart. Middle tertiary, Simorre.
cucullatus *Wagn.* South of Abyssinia.
incisivus Cuv.—(*minutus* Cuv. *tetradactylus, hemitæchus* Falc. *longirostris* and *brevirostris* Lart. *Brivalensis* and *medius* Gerv. *Goldfussi* Kaup. *Sansanensis* Lartet. *Steinheimensis?* and *molassicus* Jäg. *gannatense, pleuroceros,* and *typus* Duv.) Middle tertiary near Sansans, Avaray, Gannal in the Mayence Basin, near Epplesheim, Georgensmund, Vienna Basin, &c.
Javanicus *F. Cuv.*—(Sondaicus *Mull.*) Raymahal Hills (where now verging on extinction) Bengal Sunderbund, Indo-Chinese Region, Malayan Peninsula, Java, Upper Siam, Cambodia, Province of Quangsi in China.
Keitloa *Smith.* Interior of South Africa.
Kiaboaba *Livingst.* Central Africa.
leptorhinus Cuv.—(*protichorhinus?* Duv. *Monspessulanus* Serres. *Kirchbergense* Jäg. *Merki* Kaup.) Pliocene. South of France, Italy, England, e.g. Montpelier, Pisa, Issoire, Tuscany, Cladon. Its occurrence in Germany requires confirmation.
megarhinus Gerv.—(*Schleiermacheri* Blainv.) Tertiary beds, France.
minutus Serres. (*Lunellensis* Gerv.) Cave at Lunevieille.
Nebrascensis Leidy. Nebraska.
occidentalis Leidy. Nebraska.
platyrhinus Cautl. and Falc. Miocene beds, Sivalik.
Simus *Burch.*— (Burchelli *Desm.* Camus *Geoff.*) Bechuana Land, Interior of South Africa, chiefly north of Tropic of Capricorn.
var. Oswellii. Interior of Africa.
Sivalensis Cautl. and Falc. Miocene beds, Sivalik.
Sumatranus *F. Cuv.*—(Crossii *Gray.*) Burmese Country, Malayan Peninsula, Sumatra (Borneo doubtful.)
Tapirinus? Pom. Langenslengen and Essingen.
tichorhinus Cuv.—(*antiquitatis* Fisch. *Sibiricus* Desm.) In frozen ice and banks in Siberia, and shores Icy Sea, in Pliocene Alluvium and Bone-caves throughout Europe and Asia.
unicornis *Linn.*—(Indicus *Cuv.* Asiaticus *Blumenb.* inermis *Less.*) Tarai Region at base of East Himmalayahs, inclusive of the Valley of the Upper Brahmapootra, or Province of Assam.
Do. fossil in the Sivalik miocene beds.
Titanotherium Proutii Leidy.—(*Rhinoceros Americanus* Leidy.) Nebraska.

PROBOSCIDEA.*

Mastodon (*Trilophodon*) *Andium* Cuv.—(*australis* Owen.) Post-pliocene. S. AMERICA, ANDES, CHILI, BOLIVIA, PERU.
angustidens Cuv. — (*Simorrense* Lart. *Cuvieri* Pomel.) Upper Miocene. FRANCE, GERMANY, SWITZERLAND.
Borsoni L. Hays.—(*Buffonis* Pomel.) Pliocene. FRANCE, PIEDMONT.
giganteus auct.—(*Ohioticus* Blum. *maximus* Cuv.) Post-pliocene. NORTH AMERICA.
Humboldtii Cuv. Post-pliocene. S. AMERICA, ANDES, COLUMBIA, BUENOS AYRES, BRAZIL.
Pandionis? Falc. Pliocene. S. INDIA.
Pyrenaicus (Lart.) Upper Miocene. FRANCE.
tapiroides Cuv. — (*Turicensis* Schinz.) Upper Miocene. FR., SWITZERLAND.
(*Tetralophodon*) *Arvarnensis* Croizet and Jobert. Pliocene. ENGLAND, FRANCE, ITALY.
latidens Clift. Miocene. S. INDIA, BIRMA.
longirostris Kaup. Upper Miocene. EPPLESHEIM, HESSE DARMSTADT
mirificus Leidy. Upp. Miocene. MAUVAISES TERRES, NIOBRASKA, NORTH AMERICA.
Perimensis Falc. Miocene. S. INDIA, WEST INDIA, ISLAND OF PERIM.
Sivalensis Falc. Upper Miocene. SIVALIK HILLS, HIMMALAYAHS.
Elephas (*Stegodon*) *bombifrons* Falc. Upper Miocene. SIVALIK HILLS, HIMMALAYAHS.
Cliftii Falc. Miocene. S. INDIA, BIRMA.
Ganesa? Falc. Upper Miocene. SIVALIK HILLS, HIMMALAYAHS.
insignis Falc. Upper Miocene. SIVALIK HILLS, HIMMALAYAHS. Pliocene, CENTRAL INDIA, NERBUDDA VALLEY.
(*Loxodon*) Africanus *Blumb.* AFRICA.
Falconeri Busk. Pliocene. MALTA.
Melitensis Falc. Pliocene. MALTA.
meridionalis Nesti. Pliocene. ENGLAND, FRANCE, ITALY.
planifrons Falc. Upper Miocene. SIVAIJK HILLS, HIMMALAYAHS.
priscus Goldf. Pliocene. ENG., LOMBARDY.
(*Euelephas*) *antiquus* Falc. Pliocene. ENGLAND, FRANCE, ITALY.
Armeniacus Falc. Pliocene? ARMENIA, ERZEROUM.
Columbi Falc.—(*Jacksoni* Sillim. Journ. *probolotes* Fisch. *Texianus* Owen and Blake.) Post-pliocene? MEXICO, GEORGIA AND ALABAMA.
(*Euelaphus*) *Hysudricus* Falc. Upper Miocene. SIVALIK HILLS, HIMMALAYAHS.
imperator Leidy. Upper Miocene. LOUP RIVER BEDS, NIOBRARA, N. AMERICA.
Indicus *Linn.*—(Sumatranus *Temm.*) CONTIN. INDIA, ASSAM, TENASS., CEYLON, BIRMA, MAL. PENINS., SUMATRA, SIAM, COC. CHINA.
Namadicus Falc. Pliocene. NERBUDDA, CENTRAL INDIA.
primigenius Blum.—The Mammoth. Post-pliocene. EUROPE, ASIA.
Do. var. Americanus Leidy. N. AMERICA.

SIRENIA.

Dinotherium giganteum Kaup.— (*Cuvieri, secundarium, medium, maximum, Bavaricum* and *proavum* Auct.) Middle tertiary. EUROPE, EPPLESHEIM, HESSE DARMSTADT, SWITZERLAND, ALPS, GEORGENSMUND, VIENNA, GERS IN FRANCE, GREECE, ETC.
Indicum Falc. SIVALIK HILLS.
Kœnigii? Kaup. GERMANY.
Halitherium (*Metaxytherium*) *Beaumonti* Gerv. Middle and upper tertiary. GERMANY, FRANCE, ITALY.
fossile Gerv.—(*Hippop. medius* Cuv.) Middle and upper tertiary. GERMANY, FRANCE, ITALY.
Serresi Gerv.—(*Cuvieri* Christol. *Schinzi* Kaup.) Middle and upper tertiary. GERMANY, FRANCE, ITALY.
Guettardi Gerv. Middle and upper tertiary. GERMANY, FRANCE, ITALY.
Halianassa Studeri? v. Meyer. MOLASSE, FLONHEIM, GERM.
Collinii? v. Meyer.—(*Christolii* Fitzinger.) Tertiary sand, LINZ.
Ischyrotherium antiquum Leidy. From Judith river on the Missouri, near the MAUVAISES TERRES.
Pontotherium Appenninum Bruno. Tertiary marl, MONTIGLIO.
Trachytherium Rankini Gerv. Marine limestone in the GIRONDE.
mastodontoideus? Blainv. Molasse of MALTA.
Manatus *sp.* Harlan. MARYLAND, NORTH AMERICA.
Australis *Tilesius.*—(Americanus *Desm.* borealis *Flem.*) SOUTH AMERICA, COAST OF VENEZUELA, BRAZIL, ETC. ORINOKO, AMAZONS.
latirostris *Harlan.* FLORIDA, WEST INDIAN ISLANDS, GULF OF MEXICO, HONDURAS?
Senegalensis *Desm.*—(nasutus *Wyman.* Vogeli *Owen.* Owenii *Du Chaill.*) W. COAST OF TROP. AFR. RIVERS NIGER AND BINUÉ, and perhaps LAKE TSCHAD.
Halicore australis *Owen.* STRAITS OF TIMOR, NORTH COAST OF AUSTRALIA?
cetacea *Illig.*—(Indica *Desm.* Dugong *Erxlb.* marinus *Tiad.* tabernacularum *Rupp.*) EAST COAST OF AFRICA, RED SEA, COAST OF PERSIA, EAST INDIES, CEYLON, BIRMA, MALAYAN PENINSULA, INDIAN ARCHIPELAGO, JAVA, SUMATRA, BORNEO, MALACCA, ETC.
Rhytina Stelleri *Desm. Extirpated.* BHERING'S ISLAND, BHERING'S STRAITS, KAMTSCHATKA, ALEUTIAN ISLANDS, NORTH-WEST COAST OF AMERICA, GREENLAND?

* *Apud Falconer.*

CETACEA.

BALÆNIDÆ.

Balæna Antipodarum *Gray*. NEW ZEALAND.
(Eubalæna) australis *Desm.*—(marginata *Gray.*) S. SEAS.
Biscayensis *Esch.* TEMPERATE LATITUDES OF NORTH ATLANTIC.
Lamanoni Desm. TERTIARY BEDS AT PARIS.
mysticetus *Linn.*—(borealis *Less.* Grœnlandica *Linn.* vulgaris *Briss.* glacialis *Lacep.*) NORTHERN SEAS.
palæatlantica Leidy. Miocene. N. AMER.
prisca Leidy. Miocene. N. AMER.
Megaptera longimana *Rudolphi.*—(sulcata-antarctica *Schleg.* Lalandii *Fisch.* Boops *Fab.* australis *Less.* antarcticus *F. Cuv.* Americana *Gray.*) SEAS IN BOTH HEMISPHERES. Examples have been found stranded at the Bermudas, the Cape, and the mouth of the Elbe.
fossilis Dekay. Pliocene. N. AMER.
Cetotherium Rathkei Brandt. Pliocene marine limestone. Peninsula of TAMAN, ANAPA.
Balænoptera Boops *Linn.*—(sulcata-arctica *Schleg.* Jubartes *Lacep.*) POLAR SEAS, NORTH ATLANTIC, AND NORTH PACIFIC.
Cuvieri Desm.—(*Cortesii?* Desm.) IN A CLAY BED AT PULGNASCO.
Indica *Blyth.* INDIAN OCEAN, BAY OF BENGAL, ARABIAN SEA.
Sibbaldius laticeps *Gray.*—(Schlegelii *Flower.*) NORTH SEA, INDIAN ARCHIPELAGO.
microcephala *Esch.* NORTHERN SEAS.
musculus *Linn.* N. ATLANTIC AND MEDITERRANEAN SEA.
rostrata *Fab.*—(minor *Esch.*) N. ATLANTIC AND POLAR SEAS.

DELPHINIDÆ.

Physeter *antiquus* Gerv. Pliocene beds MONTPELIER, Department GIRONDE.
australis *M'Leay.* AUSTRALIAN SEAS.
Krefftii *Gray.* AUSTRALIAN SEAS.
macrocephalus *Linn.*—(Catodon, microps, and tursio, *Linn.* trumpo *Robertson.* gibbosus *Schreb.* cylindricus, orthodon, and sulcatus *Lacep.* polycyphus *Quoy and Gaim.* pterodon *Less.*) THE TROPICAL SEAS, MORE ESPECIALLY THE PACIFIC, EXTENDING AS FAR NORTH AS 45° OR 40°, AND AS FAR SOUTH AS LAT. 60°.
Stereodelphus brevidens Gerv. MOLASSE OF KASTRIES.
Phocæna affinis *Gray.*—(melas *Owen.*) NORTH SEA.
communis *Cuv.* N. ATLANTIC OCEAN, AS FAR N. AS GREENLAND, ON THE COASTS OF EUROPE, IN THE EAST AND NORTH SEA, AND THE MEDITERRANEAN, ON THE AMERICAN COASTS TO NEW YORK.
Cortesii Cuv. Tertiary near PLACENTIA.
Phocæna crassidens *Owen.* NORTH SEA, *Fossil* IN PEAT IN LINCOLNSHIRE.
(Physalus) globiceps *Cuv.*—(melas *Traill.* deductor *Scoresby.* Svinveal, Sieboldii, affinis, and macrorhynchus *Gray.* phocænoides *Schleg.* latirostris *Flow.*) POLAR AND NORTH ATLANTIC AND NORTH PACIFIC SEAS, ON THE COAST OF GREENLAND, NOVA ZEMBLA, ICELAND, FAROE ISL., ORKNEYS, SCOTLAND, FRANCE, AMERICA.
griseus *Cuv.*—(Cuvieri *Gray.* carbonarius *Bennett.* ventricosus *Lacep.*) ATLANTIC OCEAN, ENGLISH AND FRENCH COASTS.
Heavisidii *Gray.*—(Capensis *Cuv.* cephalorhynchus *F. Cuv.* hastatus *Quoy.*) CAPE OF GOOD HOPE.
incrassatus *Gray.* BRITISH CHANNEL.
Indicus *Blyth.* BAY OF BENGAL.
melas *Schleg.*—(phocænoides *Cuv.*) SEAS OF JAPAN.
meridionalis *Flower.* TASMANIA.
Orca *Cuv.*—(grampus *Gunt. and Desm.* gladiator and Duhameli *Lacep.*) NORTH ATLANTIC AND NORTH PACIFIC OCEAN, FROM FRANCE TO JAPAN, AND THE POLAR SEA.
Rissoana *Cuv.*—(aries *Riss.*) MEDITERRANEAN.
spinipennis *Burm.* MOUTH OF THE RIVER PLATA.
tuberculifera *Gray.* MOUTH OF THAMES.
Delphinus Abusalam *Rupp.*—(hamatus? *Schreb.*) RED SEA.
acutus *Gray.*—(Eschrichtii *Van Bened.*) NORTH SEA, FAROE ISLANDS, YARMOUTH, OSTEND.
Algiriensis *Loche.* BAY OF ALGIERS.
Blainvillei *Gerv.* COAST OF PATAGONIA, AND MOUTH OF THE PLATA.
Boryi? *Desm.* MADAGASCAR.
Bredaensis *Fisch.*—(Chamissonis? *Wiegm.* Santonicus? *Less.* rostratus *Cuv.* planiceps *Schleg.*) COASTS OF FRANCE AND HOLLAND.
Calvertensis Harlan. Miocene. N. AMER.
cæruleo-albus *Meyen.* EAST COAST OF S. AMERICA, NEAR THE PLATA.
Catalania *Gray.* CAPE MELVILLE, within great barrier reefs of AUSTRALIA.
Conradi Leidy. Miocene. N. AMER.
coronatus *Freminville.* SPITZBERGEN.
cruciger *D'Orb.*—(bivittatus *Less.* albigena *Quoy and Gaim.*) BETWEEN CAPE HORN AND NEW HOLL.
Dalionum Laurill. MIOCENE BEDS AT DAX.
Delphis *Linn.*—(vulgaris *Lacep.* Pernettensis *Blain.* Thetyos *Gerv.*) ALL THE SEAS OF THE NORTHERN HEMISPHERE.
Do. Fossil in marine sand at MONTPELIER, and at the DOWNS OF SALLE.
Euphrosine *Gray.*—(Holböllii *Eschr.*) NORTH SEA.
Eurynome *Gray.* INDIAN OCEAN, BAY OF BENGAL.
frenatus *Cuv.* CAPE OF GOOD HOPE.
frontatus *Cuv.*—(Reinwardtii *Schleg.*) IND. OCEAN, BAY OF BENGAL, RED SEA.
leucopleurus *Rasch.* NORTH SEA, CHRISTIANA.
leucorhamphus *Per.*—(Peroni *Less.* Commersoni *Lacep.*) SEAS OF THE SOUTHERN HEMISPHERE, VAN DIEMAN'S LAND, NEW GUINEA, STRAITS OF MAGELLAN, ETC.

Delphinus longirostris *Gray*.—(Capensis *Gray*.) Seas of Japan, Malabar, and Cape.
lunatus *Less.* Coast of Chili.
macrogenius Laur. Dax.
maculatus ? *Less.* South Sea.
Malayanus *Less.* — (plumbeus *F. Cuv.* Capensis *Rupp.* dubius *Cuv.* frontalis *Dussum.* loriger *Schreb.*) Indian Archipelago.
marginatus *Duv.* Dieppe.
Mediterraneus *Loche.* Bay of Algiers.
minimus ? *Less.* Solomon Islands.
Nilssonii *Gray*.—(obscurus *Nilss.*) Coast of Sweden.
Novæ Zelandiæ *Quoy and Gaim.* New Zealand, New Caledonia, Norfolk Isles.
perniger *Elliot.* Bay of Bengal.
pseudodelphis Wiegm. Locality unknown.
Renovi Laur. Miocene in Dep. of Orne, France.
superciliosus *Less.*—(obscurus? *Gray.* Fitzroyi? *Waterh.*) Coasts of Van Dieman's Land, Cape Horn, Patagonia, and Cape of Good Hope.
Tursio *Fab.*—(truncatus *Mont.*) N. Atlant. Ocean.
velox ? *Cuv.* Between Ceylon and the Equator.
Vermontanus? Thomps. Pliocene. Vermont, N. Amer.

Inia Amazonica *Spix and Mart.* — (Boliviensis *auct.*) River Amazon and its larger Tributaries, up to the foot of the Cordillera.

Platanista Gangetica *Cuv.* In the Ganges and the branches of its Delta.
Indi *Blyth.* In the Indus and its Delta.

Squalodon (*Rhizoprion*, *Phocodon*) *Bariense* Jourdain. Marine chalk. Lower Miocene, near Bari, S. France.
Grateloupe Meyer. Miocene beds. Gironde, Herault, Linz, Montpellier.

Hyperoodon Butzkopf *Thompson.* — (bidens *Turton.* Hunteri *Desm.* borealis *Nilss.* rostratum *Wesm.*) N. Atlantic Ocean.
Desmarestii *Risso.* — (Doumetii *Gray.* Philippii *Cocco.* cavirostris *Gerv.* Gervaisii *Duvern.*)
latifrons *Gray.*—(Butzkopf (male) *Esch.*) British Seas.

Berardius Arnuxi *Duvern.* Coast of New Zealand.

Ziphius *planirostris* Cuv.—(*longirostris?* Cuv.) Tertiary formations at Antwerp.
Sowerbiensis *Blainv.* — (bidens *Gray.* Sowerbii *Desm.* micropterus *Desm.* Dalei *Wagler.*) North Sea, Elgin, Havre, etc.

Arionius servatus Meyer. Molasse of Baltringen.

Balænodon affinis Owen. Red crag, Suffolk.
definitus Owen. Red crag, Suffolk.
emarginatus Owen. Red crag, Suffolk.
gibbosus Owen. Red crag, Suffolk.
Lentianus Meyer. Tertiaries of Linz.
physaloides Owen. Red crag, Suffolk.

Priscodelphinus grandævus Leidy. Miocene marl. New Jersey.
Harlani Leidy. Miocene. New Jersey.*

Hoplocetus crassidens Gerv. Miocene, Drome; Marine sand. Montpelier.

Smilocamptus Bourgueti Gerv. Fahluns of Salele-Gironde.

Delphinapterus (Beluga) leucas *Pallas.* Polar Sea, North Pacific, Mouth of Amour, Bhering's Straits.

Monodon monocerus *Linn.* Polar Sea, Baffin's Bay, and New Siberia, Bhering's Straits.

Zeuglodontidæ.

Zeuglodon (*Basilosaurus*) *cetoides* Owen.—(*macrospondylus* Müll.) Eocene. Malta, Alabama, S. Carolina, Arkansas.
serratus Gibbes (*brachyspondylus* Müll.) Eocene S. Carolina.

Pontogeneus priscus Leidy.— (*Zeuglodon pygmæus?* Müll.) Eocene, S. Carolina.

EDENTATA.

Gravigrada.

Scelidotherium Agassii (*Platyonyx*) Lund. Pliocene? Brazil.
Blainvillei (*Platyonyx*) Lund. Pliocene? Brazil.
Brongniartii (*Platyonyx*) Lund. Pliocene? Brazil.
Bucklandi Owen. Pliocene? Brazil.
Cuvieri Owen. Pliocene? Brazil.
leptocephalum Owen. Pliocene epoch? in Brazil.
minutus Owen. Pliocene epoch ? in Brazil.

Cælodon Maquinense Lund. Pliocene. Brazil.

Sphenodon sp. Lund. Pliocene. Brazil.

Mylodon Darwinii Owen. Southern parts of South America.

Orycterotherium Missuriense Harl. (*O. Oregonense* Perkins. *Eubradys antiquus* Leidy. *Mylodon Harlani* Owen. *laqueatus* Harl. *potens* Leidy.) Miocene beds, Nebraska, and Niobrara, Oregon, Mississippi, South Carolina.
robustus Owen. La Plata.

Megalonyx Jeffersoni Cuv. *laqueatus* Harl. From Virginia to the Straits of Magellan.
gracilis Lund. Brazil.
dissimilis Leidy. Brazil, Nebraska, Miocene beds.

Megatherium Cuvieri Desm. From 40° N. Lat. to 40° S. Lat. in America, Buenos Ayres, Lima, Paraguay, Venezuela.
mirabile Leidy. North America, Georgia, South Carolina.

Gnathopsis Oweni Leidy. South America.

Ereptodon priscus Leidy. N. America, Mississippi.

Ochotherium giganteum Lund. Bone-caves, Brazil.

Tardigrada.

Cholœpus didactylus *Linn.* Guiana, Surinam.
Hoffmanni *Peters.* Costa Rica.

Bradypus infuscatus *Wagl.* North-west Brazil and Peru.
torquatus *Olf.*—(crinitus and affinis *Gray.*) Eastern Brazil, and Peru.
tridactylus *Cuv.* East Coast of Brasil, near Rio Janeiro.
cucullifer *Wagl.* North-Eastern parts of South America.

* Erroneously referred to the Greensand.

DASYPODIDÆ.

Chlamydotherium gigas Lund. Pliocene. BONE-CAVES IN BRAZIL.
Humboldtii Lund. Pliocene. BONE-CAVES IN BRAZIL.
Pachytherium magnum? Lund. BONE-CAVES IN BRAZIL.
Glyptodon (*Hoplophorus*) *clavipes* Owen. Pliocene Deposits. BUENOS AYRES.
euphractus Lund. BONE-CAVES, BRAZIL.
minor Lund. BONE-CAVES, BRAZIL.
ornatus Owen. BUENOS AYRES.
reticulatus Owen. BUENOS AYRES.
Sellowi Lund. BONE-CAVES, BRAZIL.
tuberculatus Owen. BUENOS AYRES.
Heterodon diversidens Lund. BONE-CAVES OF BRAZIL.
Eurodon latidens Lund. BONE-CAVES IN BRAZIL.
Psephophorus polygonus v. Meyer. VIENNA.
Dasypus *brevirostris* Lund. Pliocene. BONE-CAVES IN BRAZIL.
conurus *Burm.* LA PLATA.
gigas *Cuv.*—(giganteus *Geoff.*) GUIANA, SURINAM, BRAZIL, PARAGUAY, AND WHOLE OF S. AMERICA, EAST OF THE ANDES.
gymnurus *Illig.*—(duodecimcinctus *Schreb.* Tatuay *Desm.* unicinctus *Linn.*) PERU, BRAZIL, PARAGUAY, AND GUIANA?
hirsutus. GUYAQUIL.
hispidus *Burm.* BRAZIL.
hybridus *Desm.*—(septemcinctus *Schreb.*) PARAGUAY, AND SOUTHWARDS.
minutus *Desm.*—(Patagonicus *Desm.*) PATAGONIA TO GUATEMALA, IN AMERICA FROM 36° TO 50° SOUTH LAT.
novemcinctus *Linn.*—(octocinctus *Buff.* longicaudatus *Wied.* tricinctus *Linn.*) BRAZIL, PARAGUAY, AND GUIANA?
nudicaudis Lund. BRAZIL.
Peba *Desm.* TEXAS, MEXICO, CENTRAL AMER., GUIANA?
punctatus Lund. BONE-CAVES IN BRAZIL.
sexcinctus *Linn.*—(gilvipes *Illig.* setosus *Wied.*) PARAGUAY, BRAZIL, AND GUIANA.
uroceras *Lund.* BRAZIL AND PARAGUAY.
villosus *Desm.* PAMPAS, BETWEEN 35° AND 39° SOUTH LAT.
Chlamydophorus truncatus *Harl.* MENDOZA IN CHILI.
retusus *Burm.* LA PLATA.
Glossotherium Darwini Owen. BANDA ORIENTAL, S. AMERICA.

SCUTATA.

Manis aspera *Foc.* SUMATRA.
Dalmanni *Sundev.* CANTON DISTRICT IN CHINA.
Guy *Foc.* AFRICA.
Javanica *Desm.*—(aspera *Sundev.*) JAVA, SUMATRA, BORNEO, CELEBES, AND THE MALAYAN PENINSULA.
macrura *Erxl.*—(tetradactyla *Linn.* longicaudata *Shaw.* Africana *Desm.* Ceonyx *Sundev.*) SIERRA LEONE, GUINEA, SENEGAL.
Manis pentadactyla *Linn.*—(brachyura *Erxl.* macroura *Desm.* laticaudata *Illig.* crassicaudata *Geoff.* aurita *Hodg.* leptura *Blyth.* leucura *Blyth.*) CEYLON, MADRAS, PONDICHERRY, BENGAL, ASSAM, NEPAL, ARRACAN, THE MALAYAN PENINSULA.
Temminckii *Smuts.* SOUTH AFRICA, CAPE OF GOOD HOPE, MOSAMBIQUE, SENNAAR.
tricuspis *Sund.*—(multiscutata *Gray.* tridentata *Focill.*) GUINEA.
tridentata *Foc.* MOSAMBIQUE.
Macrotherium giganteum Cuv.* Miocene beds at SANSANS, S. FRANCE.

VERMILINGUIA.

Orycteropus Æthiopicus *Sundev.* S. NUBIA, NEAR THE WHITE NILE.
Capensis *Geoff.* CAFFRARIA, S. W. AFRICA.
Senegalensis *Less.* SENEGAL.
Myrmecophaga didactyla *Linn.* GUIANA, BRAZIL, PERU.
gigantea Lund. Bone-caves, BRAZIL.
jubata *Linn.* WHOLE OF S. AMERICA, EAST OF THE ANDES, AND NORTH OF LA PLATA.
tetradactyla *Linn.*—(tamandua *Desm.* bivittata *Desm.* nigra *Geoff.* ursina *Griff.* crispa *Rupp.*) GUIANA, BRAZIL, PARAGUAY, GUATEMALA, PERU.

INSECTIVORA.

TALPIDÆ.

Chrysochloris inaurata *Wagn.*—(Asiatica *Linn.* Capensis *Desm.* affinis *Wagn.* holosericea *Licht.* albirostris *Wagn.* Hottentotta *Smith.* Damarensis *Ogilby.* rutilans *Wagn.*) CAPE OF GOOD HOPE.
obtusirostris *Peters.* MOSAMBIQUE, CAFFR.
villosa *Smith.* PORT NATAL.
Condylura macrura *Hart.* radiata *Shaw.* prasinata *Harris.* longicaudata *Desm.* cristata *Linn.* NORTH AMERICA, HALIFAX, NOVA SCOTIA TO FORT RIPLEY AND TO CARLISLE, PENNSYLVANIA, OREGON. Ranges from lat. 40° 12′ to 46° 20′, long. to 63° 30′ to 94° 20′.
Talpa Europea *Linn.* ALL EUROPE, NORTH AFRICA, AND A GREAT PART OF ASIA.
Do. *fossil* in BONE-CAVES AND SUPERFICIAL DILUVIUM.
cœca *Savi.* ITALY, GERMANY, fossil.
Do. *fossil* in ITALY.
insularis *Swinh.* FORMOSA.
leucura *Blyth.* SILHET, KHASYAH HILLS, TENASSERIM.
microura *Hodgs.* NEPAL, SIKKIM, ASSAM.
Wogura *Temm.* ALL THE JAPANESE ISLANDS.
minuta Blainv.—(*brachychir.* Meyer.) MIOCENE DEPOSITS AT SANSANS, SOUTH FRANCE.
Dimylus paradoxus Meyer. MIOCENE BEDS AT WEISSENAU.
Geotrypus acutidens Pom. MIOCENE BEDS OF AUVERGNE.
antiquus Pom. FRESHWATER MIOCENE OF AUVERGNE.

* Doubtful whether this class does not belong to the Dasypodidæ.

Hyporyssus telluris Pom. Miocene beds of Sansans, South France.

Galeospalax mygdaloides Pom. Tertiary beds, Auvergne.

Palæospalax magnus Owen. Forest bed, both in Norfolk and Ostend.

Scalops aquaticus *Linn.*—(Canadensis *Desm.* Pennsylvanicus *Harl.* Talpa flavescens *Erxl.* fuscus and purpurascens *Shaw.*) The greater part of North America, from 42° to 27° N. Lat.—Massachussets, New Jersey, Connecticut, Pennsylvania, Virginia, Carolina, S. Carolina, Georgia, Florida, Alabama, Mississippi, Tenessee, etc.

argentatus *Aud. and Bach.* Prairies of N. America, Michigan, Illinois, Kansas, Arkansas, Ohio, from Lat. 42° 20′ to Louisiana, Long. 83° to 97°.

Breweri *Bach.* Connecticut, and New York to Cleveland, Ohio.

latimanus *Bach.* Mexico and Texas.

Townsendii *Bach.*—(aeneus *Cup.* tæniata *Lee.* Californicus *Ayres.*) Oregon Mole. West Indies, to San Francisco, Steilacoom, California.—Range on Pacific Coast from Lat. 47° 10′ to 37° 48′.

Urotrichus talpoides *Temm.* Japan.

Gibbsii *Baird.* Cascade Mountains, North California.

Soricinæ.

Sorex.

§ Crossopus.

fimbripes *Bach.* Pennsylvania.

fodiens *Pall.*—(Daubentoni *Erxl.* hydrophilus *Pall.* carinatus and constrictus *Herm.* amphibius, natans, stagnatilis, rivalis *Brehm.* musculus and psilurus *Wagl.* nigripes *Melchior.* Pennanti *Gray.* Linneana *Gray.* Hermanni *Duv.* ciliatus *Sowerby.* remifer collaris and lineatus *Geoff.*) Most of Europe, and Siberia.

Do. *fossil* in Sardinian Bone-Breccia, in Diluvium, in Crevices in the Gypsum, Paris, Freshwater Deposits in Norfolk.

palustris *Rich.* North America, from Hudson's Bay to the Rocky Mountains.

Himalayicus *Gray.* Himmalayah.

Hoyii *Baird.*—(Thomsoni? *Baird.*) Ohio, Wisconsin.

§ § Amphisorex.

alpinus *Schinz.* Switzerland, Banks of the Reuss at St. Gotthardt, Ursernthal at an elevation of 5000 to 6000 feet, Himmalayah, Sikkim.

Cooperi *Bach.*—(Leseuri *Wagn.*) North America, Massachussetts.

Forsteri *Rich.* N. America, Hudson's Bay to New York.

pachyurus *Baird.* Minnesota, North America.

personatus *Geoff.*—(longirostris *Bach.* Haydeni? *Baird.*) North America, Nebraska.

platyrhinus *Dekay.*—(platyrhynchus *Linsley.*) N. America, from Massachussetts to Ohio, and to Vermont.

pygmæus *Pall.*—(minutus *Linn.* minimus *Geoff.* exilis *Gmel.* pumilio *Wagl.* cæcutiens *Laxm.* pumilus *Nilss.*) North Africa, Germany, Russia to Siberia.

Richardsonii *Bachm.*—(parvus? *Rich.*) Wisconsin.

Suckleyi *Baird.* California.

Trowbridgei *Baird.* Oregon.

vagrans *Baird.* Washington, and Oregon Territory, California.

vulgaris *Linn.*—(araneus *Linn.* tetragonurus *Herm.* fodiens, eremita, and cunicularis *Bechst.* concinnus, rhinolophus, and melanodon *Wagl.* labiosus, castaneus, Hibernicus, and rusticus *Jen.* constrictus *Geoff.*) Europe, from North Italy to Sweden.

§ § § Crocidura.

albinus *Blyth.* China, Amoy.

agilis *Le Vaill.* Mauritius.

annellatus *Peters.* Mosambique.

araneus *Schreb.*—(moschata, major, rufa, and poliogastra *Wagl.* pachyurus *Küst.* inodorus *Savi.* Hedenborgi, and sericeus *Sund.*) Middle and South Europe, and North Africa.

Do. *Fossil* from the Miocene of Auvergne.

canescens *Peters.* Mosambique.

cinnamoneus *Lichst.*— (varius *Smuts.* flavescens *Geoff.*) Caffraria.

crassicaudus *Ehrb.*— (sacer *Ehrb.* religiosus and myosurus *Geoff.*) Egypt, Arabia, Old Calabar, West Africa.

cyaneus *Duv.*—(infumatus *Schreb.* viarius *Geoff.*) Elephant River, South Africa.

Etruscus *Sav.*—(suaveolens *Pall.*) Mediterranean Dist., Italy, Algeria, Crimea.

feroculus *Kelaart.* Ceylon.

fuliginosus *Blyth.* Tenasserim.

gracilis *De Blainv.* Cape of Good Hope.

Griffithii *Horsf.* Khasya Hills.*

herpestes *Duv.* Cape of Good Hope.

heterodon *Blyth.* Khasya Hills.

hirtus *Peters.* Mosambique.

Indicus *Geoff.*—(Sonnerati and cœrulescens *Shaw.* giganteus and Capensis *Geoff.* nemorivagus, saturatior, and soccatus *Hodg.* Francicus, *Schinz.* and Perotteti *Duv.* melanodon *Blyth.* fulvaster? *Sund.* Hodgsoni *Blyth.*) India, Nepal, Bengal, Egypt, Isle of Franca, Assam.

Kelaartii *Blyth.* Ceylon.

leucodon *Herm.*—(Guldenstaedti *Pall.*) France, Germany, and West Russia.

leucops *Hodg.* Sikkim.

Madagascariensis *Coquer.* Madagascar.

Mariquensis *Smith.* South Africa.

micronyx *Blyth.* North-west Himmalayah.

montanus *Kelaart.*—(ferrugineus *Kelaart.*) Ceylon.

morio *Gray.* Cameroon Mountains.

murinus *Linn.*—(myosurus *Pall.*) Malay Countries, Java, and Japan, China.

niger? *Horsf.* Madras.

* Affghanistan, as reported, is a mistake. See Blyth's "Catalogue."

Sorex.
nudipes *Blyth.*—(Newera-Ellia *Kelaart.* atratus? *Blyth.* Soriculus nigrescens? *Gray.* var.) Ceylon, Burmese Countries, India.
platycephalus *Temm.* Japan.
Poensis *Fraser.* Fern. Po.
purpurascens *Templ.* Ceylon.
sacralis *Peters.* Mosambique.
serpentarius *Geoff.*—(Kandianus *Kelaart.*) Ceylon.
tenuis *Müll.* Timor.
Tytleri *Blyth.* India.
umbrinus *Temm.*—(Ezi-Nezumi *Temm.*) Japan.

§ § § § Diplomesodon.

pulchellus *Licht.* Kirghis Steppes.

Fossil species, the remains of which are not sufficiently distinct to allow them to be allotted in the above sections.

Sorex arvernensis Pomel. Auvergne.
brachygnathus Pomel. Miocene of Auvergne.
Desnoyersanus Lartet. Sansans, South France.
Najadum Pomel. Auvergne.
Prevostanus Lartet. Sansans.
pusillus v. Meyer. Mainz.
Sansanensis Lartet. Sansans.
Mysarachne Picteti Pomel. Miocene of Auvergne.
Plesiosorex Talpoides Pomel.—(*Erinaceus soricoides* De Blainv.) Miocene of Auvergne.
Blarina angusticeps *Baird.* North America, Vermont.
Berlandieri *Baird.* Mexico.
brevicauda *Say.* Iowa, Illinois, Wisconsin, Nebraska.
Carolinensis *Bachm.* North America, South Carolina, Mexico.
cinerea *Bach.* North America, Pennsylvania, South Carolina, Florida, Georgia.
exilipes *Baird.* North America, Virginia, Mississippi, Tennessee.
talpoides *Gapper.*—(Dekayi *Bach.*) North America, Massachussetts, Connecticut, New York, Pennsylvania, Virginia, Ohio, Illinois, Lake Superior, Georgia, Canada, Michigan, Wisconsin.
Myogale moschata *Brandt.*—(Moscovitica *Desm.*) South-east Russia, between the Don and Wolga.
Pyrenaica *Geoff.* Pyrenees.
Sansanensis Lart.—(*antiqua* Pom.) Miocene beds Sansans.
Potamogale velox *Du Chaillu.*—(Bayonia velox *Barboza de Boc.*) Gaboon, West Africa.
Solenodon paradoxurus *Brandt.* St. Domingo.
Cubanus *Peters.* Cuba.

Macroscelides.

Macroscelides brachyrhynchus *Smith.*—(melanotus *Ogilby?*) Caffraria.
Edwardsi *Smith.* Elephant river, S. Africa.
fuscus *Peters.* Mosambique.
Intufi *Smith.* Mosambique.
Rozeti *Duv.* Oran, in Algeria.
Macroscelides rupestris *Smith.*—(typus *Geoff.* Alexandri *Ogilb.*) South Africa.
tetradactylus *Peters.* Mosambique.
typicus *Smith.*—(jaculus *Licht.*) Cape of Good Hope, and East Coast of South Africa.
Rhynchocyon Cirnei *Peters.* Mosambique.

Tupaiadæ.

Cladobates (Tupaia) Belangeri *Wagn.*—(Peguana *Geoff.*) Pegu, Valley of the Sitang, Tenasserim.
Ellioti *Waterh.* India, Eastern Ghats.
ferrugineus *Raffl.*—(glis *Diard.*) Sumatra, Borneo, Java, Malayan Peninsula, Pegu, Arracan, Tenasserim, Khasya Hills.
Javanicus *Horsf.* Java, Sumatra, Borneo.
murinus *Müller.* West Coast of Borneo.
splendidula *Gray.* Borneo.
tana *Raffl.*—(speciosus *Wagn.*) Sumatra, Borneo.
Ptilocercus Lowii *Gray.* Borneo.
Hylomys suillus *Müll.* Java and Sumatra, Borneo.
Peguensis. *Blyth.* Valley of the Sirang, Tenasserim.
Gymnura Rafflesii *Horsf.*—(gymnura *Raffles.*) Sumatra and Malacca.
Oxygomphius frequens v. Meyer. Upper miocene limestone at Weissenau.

Erinacidæ.

Erinaceus Æthiopicus *Ehrb.*—(Ægyptius *Geoff.* brachydactylus *Geoff.* platyotis *Sund.*) Deserts of Dongola.
albiventris *Wagn.* India.
Algirus *Duv.* Algeria.
Arvernensis de Blainv. Lower Miocene, Auvergne.
auritus *Pall.*—(hypomelas *Brandt.* megalotis *Blyth.*) South Russia, Greater Tartary, and Siberia.
collaris *Gray.* Punjab, North-West India.
concolor *Martin.* Asia Minor.
Deserti *Loche.* Sahara.
dubius Lart. Miocene beds of Sansans.
Europæus *Linn.*—(inauris *Linn.* auriculatus *Hill.* caninus and suillus *Geoff.* Sibiricus *Bell.*) Across whole of Eur. and Asia.
Do. fossilis de Blainv. (*major* Pomel.) Fossil in diluvial deposits in Europe.
frontalis *Smith.* Cape of Good Hope.
Grayii *Benn.*—(spatangus? *Benn.*) India.
Libycus *Ehrb.* Lybian Desert.
micropus *Blyth.* Neilgherries, Ceylon.
mentalis? (*Gray.*) Himmalayah.
nanus Aym. Miocene beds of Auvergne.
priscus v. Meyer. Weisenau.
Pruneri *Wagn.*—(heterodactylus *Sund.*) Egypt, Sennaar.
Sansansensis Lart. Miocene beds of Sansans.
Galerix Viverroides Pom. Upper freshwater miocene beds at Auch near Sansans.

Centetidæ.

Centetes ecaudatus *Ill.*—(setosus *Desm.* armatus *Geoffr.* variegatus *Gray.*) Madagascar and Mauritius.

Centetes semispinosus *Cuv.*—(Madagascarensis *Shaw.*) Madag.
setosus *Blainv.*—(spinosus *Desm.*) Madag.
Ericulus nigrescens *Geoff.* Madag.
Echinogale *Laurillardi* Pom. Freshwater miocene marl at Perrier-Issoire.
spinosus *Desm.* Madag.
Telfairi *Mart.* Madag.

Cheiroptera.

Frugivora.

Pteropus Ægyptiacus *Geoff.*—(Geoffroyi *Temm.*) Egypt, Senegal.
Alecto *Temm.* Celebes.
amplexicaudatus *Geoff.* Timor, Amboyna, Sumatra, Siam.
collaris *Illig.*—(Leachii *Temm.*) Cape of Good Hope, Mosambique.
conspicillatus *Gould.* Fitzroy Island, off E. coast of Australia.
ecaudatus *Temm.* Sumatra.
edulis *Geoff.*—(Javanicus and Assamensis *Horsf.* chrysoproctus *Temm.* cœleno *Herm.*) Indian Archip., Java, Amboyna.
Edwardsii *Geoff.*—(medius *Temm.* leucocephalus *Hodgs.* Assamensis *M'Clell.*) India, Ceylon, Madagascar.
funereus *Temm.* Timor, Amboyna, Borneo, Sumatra, North Australia.
giganteus *Fitzing.* Nicobar Island.
griseus *Geoff.*—(dasymallus *Temm.* rubricollis *Sieb.*) Timor and Neighbouring Islands.
Hottentottus *Smith.* Cape of Good Hope.
hypomelanus *Temm.* Labuan.
jubatus *Esch.*—(pyrrhocephalus *Meyer.*) Luzon, Philippine Isles.
Leschenaultii *Desm.*—(seminudus *Kel.*) South India, Ceylon.
MacDonaldii *Gray.* Fiji Islands.
Mackloti *Temm.* Timor.
marginatus *Geoff.*—(Tittæcheilus *Temm.* Duvaucelii brevicaudatus and Diardii *Cuv.* pyrivorus *Hodg.* Horsfieldii and affinis *Gray.*) India, Ceylon, Burmese and Malay Countries, Nicobar, Borneo.
Marianus *Desm.* Marian Islands.
melanocephalus *Temm.* Java.
melanotus *Blyth.* Nicobar Island.
Nicobaricus *Fitz.* Nicobar Island.
pallidus *Temm.* Malacca.
personatus *Temm.* Ternate (Moluccas).
poliocephalus *Temm.* New Holland and Van Dieman's Land.
phaeops *Temm.* Celebes, Amboyna.
pselaphon *Temm.* Bonin Isles, near Japan.
rubricollis *Geoff.*—(collaris *Licht.* fuscus *Briss.*) Bourbon Isle and Madag.
scapulatus *Peters.* Cape York, North Australia.
Scherzeri *Fitzing.* Nicobar Islands.
stramineus *Geoff.* Senegal, Sennaar.
vulgaris *Geoff.*—(vampyrus? *Linn.*) Isle of Bourbon, Mauritius, Madagascar, Africa?
Epomophorus crypturus *Peters.*—(Wahlbergi? *Sund.*) Mosambique, Zambesia.
Franqueti *Tomes.* Gaboon.
Gambianus *Ogilb.* Gambia.
labiatus *Temm.* Abyssinia.
macrocephalus *Ogilb*—(epomophorus and Whitei *Benn.* megacephalus *Swains.*) Gambia.
Schœnsis *Rupp.* Abyssinia, Gambia, Gaboon.
Cynopterus albiventer *Gray.* Morty Island.
Macroglossus minimus *Geoff.*—(rostratus *Horsf.*) Java, Burmah, Siam, Malayan Countries, Tenasserim.
Harpyia cephalotes *Pall.*—(Pallasii *Geoff.*) Amboyna.
Hypoderma Peronii *Geoff.*—(palliatus *Geoff.* Moluccensis *Quoy* and *Gaim.*) Amboyna, Timor, Samao Island, Banda, Borneo, Sumatra.
Hypsignathus monstrosus *Allen.*—(Sphyrocephalus labrosus *Murr.*) Old Calabar.

Entomophaga.

Istiophora.

Diphylla ecaudata *Spix.* Brazil.
Desmodus murinus *Wagn.* Mexico, N. America.
Orbignyi *Waterh.* Coquimbo in Chili.
rufus *Wied.*—(cinerea *d'Orbigny.* fuscus *Lund.*) Brazil, Bolivia, Guatemala.
Phyllorhina aurita *Tomes?*
bicolor *Temm.* Java, Amboyna, Timor.
Caffra, *Peters.* Zambesia, Port Natal, and Island of Ibo, near Mosambique.
cineraceus *Blyth.* Punjab Salt Range.
diadema *Geoff.*—(Commersoni *Geoff.*) Timor.
gigas *Wagn.* Benguela.
gracilis *Peters.* Mosambique, Zambesia.
insignis *Horsf.*—(vulgaris and deformis *Horsf.*) Java and Neighbouring Islands.
Labuanensis *Tomes.* Labuan, Borneo.
murinus *Elliot.* (fulvus *Gray.* fulgens *Elliot.* ater *Templ.* atratus *Kelaart.*) South India, Ceylon, Tenasserim, Malay Pen., Nicobar Islands.
nobilis *Horsf.*—(armiger and tragatus *Hodg.* lankadivus *Blyth*). Nepal, Ceylon, Java, Timor, Burmese and Malayan Countries.
speoris *Wagn.*—(Templetoni *Blyth.* Voulha *Templ.* Dukhunensis *Sykes.* crumeniferus *Peron.* apiculatus and penicillatus *Gray.* larvatus *Horsf.* griseus *Meyer.*) India, Timor, Amboyna, Aracan.
tricuspidata *Temm.* Molucca Islands, Borneo, Java, Sumatra.
tridens *Geoff.* Egypt, Nubia.
vittata *Peters.* Island of Ibo, near Mosambique.
Rhinolophus affinis *Horsf.*—(rubidus and fulvidus *Blyth.* cinerascens *Kelaart.* galeritus *Cantor.* Rouxii *Temm.*) Malay Countries, Tenasserim, S. Malabar, Bengal, Java, Sumatra, Ceylon, China (Amoy).
aurantius *Gray.* Cobourg Peninsula, North Australia.
brevitarsus *Blyth.* Sikkim.
Capensis *Blas.* Cape of Good Hope and Egypt.
cervinus *Gould.* Cape York, North Australia, Sandstone caves, Albany Island.

Rhinolophus clivosus *Rüpp.* Dalmatia, Levant, Egypt, Nubia, North Africa, Sahara.
cornutus *Temm.* Japan.
Euryale *Blas.* North Italy.
euryotis *Temm.*—(Philippensis *Waterh.*) Moluccas, Philippine Islands.
fumigatus *Rüpp.* S. East of Abyssinia.
ferrum-equinum *Leach*—(unihastatus *Geoff.*) From the South of England and Germany to the Mediterranean, and over the whole of Afr.; Lebanon, Japan?
hippocrepis *Bonap.*—(hipposideros *Leach.* minutus *Mont.* bihastatus *Geoff.*) Middle and South Europe to the Caucasus and Asia Minor.
Lauderi *Mart.* Fernando Po.
lobatus *Peters.* Mosambique, Zambesia.
luctus *Temm.*—(morio *Gray.* perniger *Hodg.*) Java, Sumatra, Malacca, Himmalayah, Nepal, Sikkim.
macrotis *Hodg.* Himmalayah, Khasia Hills.
minor *Horsf.*—(lepidus and sub-badius *Blyth.* pusillus *Temm.*) Java, Sumatra, Timor, Bengal, Philippine Isles, Celebes.
megaphyllus *Gray.* Moreton Bay, New Holland.
mitratus *Blyth.* Central India.
Nippon *Temm.* Japan.
Pearsoni *Horsf.* Sikkim.
trifoliatus *Temm.* Java, Borneo.

Megaderma (Cœlops) Frithii *Blyth.* Lower Bengal.
frons *Geoff.* Senegal and Upper Nile District.
lyra *Geoff.*—(Carnatica *Elliot.*) India.
Philippensis *Waterh.* Philippine Isles, Cashmere.
spectrum *Hügel*—(schistaceum *Hodg.*) Bengal.
trifolium *Geoff.*—(spasma *Schreb.*) Java, Ternate.

Tylostoma Mexicana *Sauss.* Mexico.

Macrotus Californicus *Baird.* California.
Mexicanus *Sauss.* Mexico.
Waterhousii *Gray.* Hayti, Cuba, Jamaica, and other West Indian Islands.

Mormoöps Blainvillei *Leach.* Cuba, Mexico.

Aëllo (Chilonycteris) cinnamomea *Schinz.* Cuba.
gymnota *Wagn.*—(personata *Wagn.* Pteronotus Davyi *Gray.*) Brazil, Trinidad.
Cuvieri *Leach.*—(M'Leayi *Gray.* fuliginosa *Gray.*) Cuba, Hayti.
Osburni *Tomes.* Jamaica.
quadridens *Sch.*—(grisea *Gosse.*) Cuba.
rubiginosa *Wagn.* Brazil.

Phyllodia Parnellii *Gray.* Jamaica.

Nyctophilus Geoffroyi *Leach.* Indian Ocean, W. and South-West Australia.
Gouldii *Tomes.* Moreton Bay.
Timoriensis *Geoff.* Bathurst, West Australia, (not Timor.)
unicolor. Van Dieman's Land.

Nycteris Capensis *Smith.* S. Africa.
fuliginosa *Peters.* Mosambique, Zambesia.
hispidus *Schr.* Senegal.
Javanica *Geoff.* Java.
Thebaica *Geoff.*—(Geoffroyi *Desn.* albiventris *Wagn.* discolor *Wagn.*) Senegal, Egypt, and Nubia.

Phyllostoma angusticeps *Gerv.* South America.
auricularis *Sauss.* Brazil.
auritum *Peters.* Mexico and Guiana.
Azteca (Carollia) *Sauss.* Mexico.
bidens *Wagn.*—(soricinus *Spix.* bicolor and amblyotis *Wagn.*) Brazil.
bilabiatum *Wagn.* Brazil.
calcaratum *Wagn.* Brazil.
cirrhosum *Spix.*—(fuliginosum *Gray.*) Parag.
crenulatum *Geoff.* Locality not known.
discolor *Wagn.* Brazil.
dorsale *Lund.* Brazil.
elongatum *Geoff.* North Brazil.
excisum *Burm.*—(albescens and fumarium *Burm.* rotundatum *Gray.* oporophilum *Tschud.*) Brazil and Peru.
hastatum *Geoff.*—(perspicillatum *Schreb.*) Generally distributed throughout Brazil.
humerale *Lund.* Brazil.
infundibulum *Reng.*—(rotundum *Geoff.*) Paraguay.
leucostigma *Lund.* Brazil.
longifolium *Wagn.* Brazil.
macrophyllum *Wied.*—(megalotis and Mimon *Gray.*) Brazil.
nigrum *Bonap.* Ecuador.
plecotus *Lund.* Brazil.
spectrum *Geoff.* Brazil, Guiana.

Lophostoma sylvicolum *D'Orbigny.* Bolivian Cordillera.
n. sp. Guatemala.

Centurio flavigularis *Gray.* Cuba.
Mexicanus *Sauss.* Mexico.
senex *Gray.* Brazil.

Schizostoma minutum *Gerv.* South America.

Pteronotus Davyi? *Gray.* Trinidad.

Lonchorhina aurita *Tomes.* West Indies?

Glossophaga (Phyllophora) amplexicaudata *Geoff.* Brazil, Surinam, West Indies.
(Hemiderma) brevicaudum *Wied.*—(Grayi *Waterh.* Childreni *Gray.*) Brazil and Surinam.
(Anoura *Gray.* Chœronycteris *Licht.*) ecaudata *Geoff.*—(Geoffroyi *Gray*). Brazil.
(Monophyllus) Redmanni *Leach* (caudifera *Geoff.* Leachii *Gray.*) Brazil, about Rio Janeiro, Jamaica, Guatemala.
Mexicana *Tschudi.* Mexico.
Peruana *Tschudi.* Eastern slope of Peruvian Cordillera.
soricina *Pall.* Surinam, Caribbean Islands, Jamaica.
villosa *Rengg.* Paraguay.

Dermanura cinereum *Gerv.* South America.

Sturnira Chilense *Gerv.* Chili.
lilium *Gerv.* South America.

Arctibeus brachyotus *Wied.* (Jamaicensis, Achradophilus, and sulphureus *Gosse.*) Brazil, Jamacia.

Arctibeus Floresii *Bonap.* Ecuador.
lineatus *Geoff.* — (lilium *Geoff.* personatum and pusillum *Wagn.*) Brazil, Paraguay, Ecuador.
perspicillatus *Geoff.* — (planirostre *Spix.* superciliatum and obscurum *Wied.* Lewisii *Leach.* Jamaicense *Leach.* falcatus *Gray.*) Brazil and Antilles, Jamaica, Cuba.
undatus *Gerv.* South America.
Rhinopoma macrophyllum *Geoff.*—(Hardwickii *Gray.*) Egypt, India.
Brachyphylla badia *Gray*—(cavernarum *Grag.*) Cuba and St. Vincent's.
Stenoderma Chilense *Gray.* Chili.
rufum *Geoff.* South America.
Tolteca *Sauss.* Mexico.
Phyllonycteris Poeyi *Gundlach.* Jamaica.

Gymnorrhinæ.

Noctilio Americanus *Tomes.* Jamaica.
leporina *Burm.*—(rufipes and affinis *D'Orbigny.* unicolor and dorsatus *Wied.* rufus and albiventris *Spix.* mastivus *Gosse.*) Bolivia, Paraguay, Brazil, Surinam, Jamaica.
Mormopterus jugularis *Peters.* Madagascar.
Nyctinomus macrotis *Gray.* Cuba.
nasutus *Spix.*—(Brasiliensis *Geoff.* murinus *Gray.* cynocephala *Lee.* fuliginosa *Cooper.* Carolinensis *Gundlach.* naso *Wagn.* Mexicanus *Sauss.*) North America, West Indies, South America, Buenos Ayres.
Mystacina tuberculata *Forst.* New Zealand.
Miniopterus Australis *Tomes.* Australia, Timor.
blepotis *Temm.*—(morio *Gray.* Eschscholtzii *Water.*) Japan, Amboyna, Australia.
Schreibersii *Kuhl.*—(Ursini *Bonap.* Orsini and dasythrix *Temm.*) South Europe, Italy, to 8000 feet high in Mount Como, N. Africa, Algeria, in Asia, from Japan to Java, Borneo, Sumatra.
scotinus *Tomes.* Natal.
tibialis *Tomes.* Amboyna.
Antrozous pallidus *Lec.* California, Oregon.
Nyctellus lepidus *Gerv.* Cuba.
Thyroptera bicolor *Cantr.* Surinam.
tricolor *Spix.*—(thyropterus *Schinz.*) Banks of the Amazon.
Emballonura afra *Peters.* Mosambique.
bilineata *Temm.* Surinam.
calcarata *Temm.* — (Maximiliani *Fisch.* brevirostris *Wagn.*) Brazil.
canina *Temm.* Brazil.
n. sp. fid. *Gerv.* Sunda Isles.
fuliginosa *Tomes.* Feejee Islands.
leptura *Schreb.*—(marsupialis *Mull.*) Surinam.
monticola *Temm.* Java, Sumatra.
saxatilis *Temm.* — (naso *Wied.* rivalis *Spix.*) Brazil.
Diclidurus albus *Wied.*—(Freyersi *Neuwied.*) Brazil.
Ischnoglossa rivalis *Sauss.* Mexico, Orizaba.
Celæno Brooksiana *Leach.* Habitat not known.

Dysopes abrasus *Temm.*—(holosericeus *Wagn.*, castaneus *Geoff.*) Brazil, Paraguay.
acetabulosus (Natalensis) *Smith.* West Africa, Mauritius, Natal.
Ægyptiacus *Geoff.*—(Geoffroyi *Temm.* pumilus *Rüpp.*) Egypt.
albus *Wagn.* Brazil.
amplexicaudatus *Geoff.* Guiana.
ater *Gray?*
aurispinosus *Peale.* Brazil.
Aztecus *Sauss.* Mexico.
brachypterus *Peters*—(dubius *Peters.*) Mozamb.
cœcus *Wagn.*—(auritus *Wagn.*) Paraguay, Brazil.
Cestoni *Savi.* Italy.
crassicaudatus *Geoff.* Paraguay.
fumarius *Wagn.*—(obscurus *Temm.*) Brazil, Surinam.
glaucinus *Wagn.* Brazil.
gracilis *Wagn.* Brazil.
insignis *Blyth.* Amoy.
laticaudatus *Geoff.* Paraguay.
limbatus *Peters.* Mozambique.
longimanus *Wagn.*—(leucopleura *Wagn.* ferox *Pöppig*) Peru, Brazil, Surinam.
macrotis *Gray.* Cuba.
Mexicanus *Sauss.* Mexico.
Midas *Sund.* Sennaar.
multispinosus *Burm.* La Plata.
nasutus *Wagn.* Brazil.
Norfolkensis *Gray.* Norfolk Island.
olivaceus *Wagn.* Brazil.
perotis *Wied.*—(rufus *Geoff.*) Brazil.
plicatus *Temm.*—(Bengalensis *Geoff.*) Bengal.
Rüppellii *Temm.* Egypt.
Temminckii *Lund.* Brazil.
tenuis *Temm.*—(dilatatus *Horsf.* plicatus *Blyth.*) Java, Sumatra, Banda, Malay Countries.
torquatus *Wagn.*—(cheiropus *Temm.*) West Asia, Java, Sum., Born.
ursinus *Wagn.*—(alecto *Temm.*) Interior of Brazil, Surinam.
velox *Temm.*—(tropidorhynchus *Gray*, Moxensis *D'Orb.*) Bolivia, Brazil, Surinam, Cuba.
Furipterus horrens *Cuv.* Guiana.
cærulescens *Tomes.* South Brazil.
Natalus stramineus *Gray.*—(Nyctiellus lepidus and Spoctrellum macrourum *Gerv.*) South America, S. Brazil, North America, Cuba, Jamaica.
Hyonycteris albiventer *Tomes.* Rio Nasso, near Quito.
discifera *Licht. and Peters.* Puerto Caballo, Central America.
Taphozous Australis *Gould.* North Australia.
leucopterus *Temm.* S. Africa, Mosambique.
longimanus *Hardw.*— (bicolor *Temm.* fulvidus brevicaudus and Cantori *Blyth.*) India, Ceylon, Burmese Countries.
melanopogon *Temm.* — (Philippinensis *Waterh.*) Indian Peninsula, Malay Peninsula, Java, Sunda Isles.
perforatus *Geoff.*— (nudiventris *Rüpp.* Senegalensis *Geoff.* Mauritianus *Geoff.*) Egypt, Nubia.

Taphozous Saccolaimus *Temm.*—(pulcher *Elliot.* crassus *Blyth.*) INDIAN PEN., MALAY PEN., JAVA, BORNEO.
Nycticejus atratus *Blyth.* SIKKIM.
Australis *Gray.* AUSTRALIA.
Bonariensis *Burm.* LA PLATA.
Borbonicus *Temm.* ISLE OF BOURBON.
canus *Blyth.*—(Maderaspatanus *Gray.*) INDIA.
castaneus *Gray.* MALAY COUNTRIES, E. BENGAL.
crespuscularis *Allen.*—(creeks *F. Cuv.* humeralis? *Raf.*) UNITED STATES, NEW ORLEANS, NEBRASKA, TEXAS, WASHINGTON TERRITORY.
Dingana *Smith.* S. AFRICA.
Heathii *Horsf.* INDIA, CALCUTTA, MADRAS.
leucogaster *Rupp.* KORDOFAN.
luteus *Blyth.* BENGAL, SILHET, ASSAM, BURMAH.
macrotus *Poepp.*— (villosissimus *Geoff.* sericeus *Lund.*) ANTUCO IN CHILI.
mystax *Desm.* KENTUCKY.
nidicola *Kirk.* ZAMBESIA.
nigrita *Temm.* SENEGAL.
nivicolus *Hodg.* NEPAL.
ornatus *Blyth.* HIMMALAYAH, KHASYA HILLS.
planirostris *Peters.* MOSAMBIQUE.
pumilus *Gray.* AUSTRALIA.
Sicula *Desm.* SICILY.
Swinhœi *Blyth.* AMOY.
Temminckii *Horsf.*— (Belangeri *Geoff.* noctulinus *Geoff.*) JAVA, BORNEO, SUMATRA, BANDA, TIMOR, PONDICHERRY.
Tickelli *Blyth.* CENTRAL INDIA, CEYLON.
viridis *Peters.* MOSAMBIQUE.
Lasiurus caudatus *Tomes.* PERNAMBUCO.
cinereus *Palisot.*—(pruinosus *Say.*) NORTH AMERICA, CANADA, UNITED STATES, CALIFORNIA, NEW MEXICO.
Grayii *Tomes.* SANDWICH ISLANDS, CHILI, NESQUALLY, SAN JUAN DE FUCA?
intermedius *Allen.* MEXICO.
Noveboracensis *Erxl.*—(lasiurus *Gmel.* rubellus *Palisot.* villosissimus *Geoff.* monachus and tessellatus *Raff.* rufus *Harl.* Blossevillii and Bonariensis *Less.* varius *Poepp.*) Red Bat. Universally distributed over temperate regions of NORTH AMERICA, northwards from RIO GRANDE, TEXAS, and CAPE ST. LUCAS.
Pearsonii *Horsf.* S.E. HIMMALAYAHS, AMBOYNA.
suillus *Temm.*—(lasiura *Hodg.* Pearsonii *Blyth.*) S.E. HIMMALAYAHS, SUMATRA, JAVA.
vulpinus *Temm.* ?
Scotophilus Bellii *Gray.* WEST INDIES.
borealis *Nilss.*—(Nilsonii *Blas. and Keys.* Kuhlii *Nilss.* brachyotis *Temm.*) SCANDINAVIA, RUSSIA, and the HARTZ.
Carolinensis *Geoff.* NORTH AMERICA, PENNSYLVANIA, NEBRASKA, WASHINGTON TERRITORY.
Coromandelianus *F. Cuv.* INDIA, BURMAH, CEYLON, MALAYAN PENINSULA, NICOBAR.
Cubensis *Leach.* CUBA.
discolor *Kuhl.*—(serotinus *Pall.*) South of SWEDEN, ENGLAND, SWITZERLAND, CRIMEA.
falcatus? *Gray.* INDIA.
ferrugineus *Temm.* DUTCH GUIANA.
Scotophilus fuliginosus *Hodg.* NEPAL.
fulvidus *Blyth.* TENASSERIM.
fulvus? *Gray.* JAVA, MADRAS.
fuscus *Palisot.*—(arcuatus *Say.* phaiops *Raff.* ursinus *Temm.* gryphus *F. Cuv.* Greenii? *Gray.*) NORTH AMERICA, MASSACHUSSETTS, PENNSYLVANIA, MISSISSIPPI, NEBRASKA, WASHINGTON TERRITORY, OREGON, CALIFORNIA, ETC.
Georgianus *F. Cuv.*—(monticola *Bach.* crassus? *F. Cuv.* salarii? *F. Cuv.*) NORTH AMERICA, PENNSYLVANIA, VIRGINIA, GEORGIA, ARKANSAS, MEXICO.
Gouldii *Gray.* NEW SOUTH WALES, S. AUSTRALIA.
Greyii *Gray.* PORT ESSINGTON, N. AUSTRALIA.
hesperus *Allen.* CALIFORNIA.
Hodgsonii? *Gray.* INDIA, CALCUTTA.
innoxius *Gerv.* SOUTH AMERICA.
Leachii *Gray.*—(Kuhlii *Leach.*) INDIA.
Leisleri *Kuhl.*—(dasycarpus *Leisl.*) GERMANY, ENGLAND.
lobatus *Gray.* INDIA.
MacLeayii *Gray.* CUBA.
murinus *Linn.*—(myotis *Bechst.* submurinus *Brehm.*) MIDDLE AND SOUTH EUROPE, NORTH AFRICA, MID. ASIA, TO THE HIMMALAYAHS.
Do. Fossil in diluvium and bone-caves, EUROPE.
noctivagans *Lec.*—(Auduboni *Harl.* pulverulentus *Temm.*) NORTH AMERICA, from the ATLANTIC to the ROCKY MOUNTAINS.
noctula *Daub.*—(lasiopterus *Schreb.* labiata *Hodg.* præterus *Kuhl.* altivolans *White.* ferrugineus *Brehm.* serotinus *Geoff.*) ALL TEMPERATE EUROPE AND ASIA TO JAPAN AS FAR SOUTH AS NORTH ITALY AND THE CASPIAN SEA.
pachyonix *Tomes.* INDIA.
pumiloides *Tomes.* AMOY, CHINA.
serotinus *Daub.*—(noctula *Geoff.* murinus *Pall.* Okenii, Wiedii, and rufescens *Brehm.*) ALL EUR. AND ASIA, TO THE HIMMALAYAHS.
velatus *Geoff.*—(bursa *Lund.* Dutertreus *Gerv.* furinalis *D'Orb.*) BRAZIL, BOLIVIA, ARGENTINE REPUBLIC, CUBA?
Vespertilio Abramus *Temm.* JAPAN.
adversus *Horsf.* JAVA, BENGAL, TENASSERIM, CEYLON, PENANG.
aenobarbus *Temm.* SOUTH CAROLINA, GUATEMALA.
ærosa *Tomes.* EAST COAST OF SOUTH AFRICA.
affinis *Allen.* NORTH AMERICA, ARKANSAS.
albescens *Geoff.*—(lævis *Geoff.*) BRAZIL.
akokomale *Temm.* JAPAN.
Arsinoe *Temm.* SURINAM.
Aristippe *Bonap.*—(Alcythoe *Bonap.*) SICILY.
auritus (Plecotus) *Linn.*— (cornutus *Fab.* brevimanus *Bonap.* homocrous *Hodg.* Darjilingensis *Hodg.* Peroni *Geoff.* megalotis *Rafin.*) ALL EUR. FROM 60° N. L. TO THE CAUCASUS, GEORGIA, HIMMALAYAH, AND N. AFR.
Do. Fossil IN THE BONE-CAVE OF BEZE, IN THE DEPARTMENT OF AUDE, FRANCE.
ater *Bonap.* ECUADOR.

Vespertilio Barbastellus *Schreb.*— (communis *Bonap.* Daubentoni *Bell.*) England, Sweden, France, Germany, Italy, Himmalayah.
Bechsteini *Kuhl.* Middle and South Europe.
Berdmorei *Blyth.* Tenasserim.
Blythii *Tomes.* India (Nasirabad).
caliginosus *Tomes.* India.
Capaccini *Bonap.*—(megapodius *Temm.*) Sicily and Sardinia.
Chiloensis *Waterh.* Chiloe.
Chinensis *Tomes.* China.
ciliatus *Blas.*— (emarginatus *Geoff.* Schranki *Koch.*) Germany, near Cologne.
circumdatus *Temm.* Java.
Darwinii *Tomes.* Canary Isles.
dasycnemus *Boic.* (limnophilus *Temm.*) Middle Europe.
Daubentoni *Kuhl.*—(ædilis *Jenyns*, Volgensis *Eversm.*) Sardinia, Sicily, Germany, Holland, England, Middle and South Sweden.
epichrysis *Smuts.* Cape of Good Hope.
erythrodactylus *Temm.*— (monachus *Desm.*) Philadelphia.
evotis *Allen.* North America, Pacific Coast from Puget Sound to Lower California.
formosus *Hodg.* Nepal, China.
fuliginosus *Hodg.* Nepal.
Geoffroyi *Leach.*—(pacificus *Gray.*) Himmalayah.
Hardwickii *Horsf.* Java and Sumatra, Philippine Isles.
Harpyia *Temm.* Java.
Hilarii *Geoff.*—(Brasiliensis *Desm.* polythrix *Geoff.* parvulus *Temm.* Isidori *D'Orb.*) Brazil, Argentine Republic.
Horsfieldii *Temm.*—(macellus *Gray.*) Java, Borneo.
imbricatus *Horsf.*—(pipistrelloides *Kuhl.* Javanus *Cuv.* Hasselti *Temm.*) Java.
insignis Meyer. Mayence Basin.
irretitus *Cantor.* Chusan, Hong Kong.
Isidori *Burm.* La Plata.
isabellinus *Temm.* Tripolis.
Kuhlii *Kuhl.*—(Pipistrellus *Bonap.*) South Europe, Italy.
lanosus *Smith.* S. Africa.
Lecontei *Cooper.*—(Synotus macrotis *Lec.*) North America.
Leibii *Bachm.* Michigan.
Leisleri *Kuhl.*—(lasycarpus *Leisl.*) Germany, England.
lepidus *Blyth.* India.
Leucippe *Bonap.* Sicily.
leucogaster *Wied.* Brazil.
leucomelas *Rüpp.* Arabia Petræa.
limbatus (Molossus) *Peters.* Mosamb.
lucifugus *Lec.*—(brevirostris *Wied.*) N. America, United States, Mexico, and Central America, as far south as Panama.
macrodactylus *Temm.* Japan.
macropus *Gould.* South Australia.
macrotarsus *Waterh.* Philippine Isles.
Vespertilio macrotis *Temm.* Sumatra.
macuanus *Peters.* Mosamb.
Madagascariensis *Tomes.* Madagascar.
marginatus *Rüpp.*—(albolimbatus *Kuster.*) Sardinia, N. Africa, Algeria, Oran, Nubia, Arabia Petræa.
Maugei *Desm.* Porto Rico.
maurus *Blas.* Mt. Blanc, St. Gotthardt.
maximus *Geoff.*—(nasutus *Say.*) Guiana.
megalurus *Temm.*—(Capensis *Smith.*) S. Africa.
Mexicanus *Sauss.* Hot regions of Mexico.
Meyeni *Walch.* Philippine Isles.
microdon *Tomes.* South Australia, Van Dieman's Land.
minutus *Temm.*—(hesperida *Temm.*) S. Africa, Abyssinia.
molossus *Temm.* Japan.
murinoides Lartet. Sansans, S. France.
mystacinus *Kuhl.* Germany, France, England, and to the middle of Sweden.
nanus *Peters* (subtilis *Sander.*) Mosamb., Zambesia.
Nattereri *Kuhl.* From the middle of Sweden to the Mediterranean.
Nathusii *Blas.*—(Ursula *Wagn.*) Germany, Greece.
Nicobaricus *Fitzroy.* Nicobar Islands.
nigricans *Wied.* Brazil, Paraguay.
nigricans *Cresp.* Corsica.
nigrogriseus *Gould.* Moreton Bay.
nitidus *Tomes.* Labuan, Borneo.
nitidus *Allen.* Oregon and North America, west of Rocky Mountains.
noctuloides Lartet. Sansans, S. France.
pachomus *Tomes.* India.
pachypus *Temm.* Java and Sumatra.
pallidus *Blyth.* Central India.
pallidus *Lec.* White Bat. California.
papillosus *Temm.* Java and Sumatra, Bengal, Ceylon.
Parisiensis Cuv. Paris Gypsum.
parvipes *Blyth.* Cashmir.
pellucidus *Waterh.* Philippine Isles.
picatus *Gould.* Interior of South Australia.
pictus *Pall.*—(Kerivoula *Bodd.* Malayanus *Cuv.* Oreias and brachypterus *Temm.*) India, Java, Sumatra, and Borneo, Ceylon, Burmah, Malay Countries.
pipistrellus *Daub.*—(pygmæus *Leach.* Alcythoe *Bonap.* minutissimus *Schinz.*) From South Sweden and England to Spain and Greece, Asia to Japan.
Do. Fossil from a Bone-cave at Antibes.
platycephalus *Smuts.* Cape of Good Hope.
præcox Meyer. Mayence Basin.
ruber *Geoff.* Argentine Republic.
rufopictus *Waterh.* Philippine Isles.
Ruppellii *Fisch.*—(Temminckii *Rupp.*) Nubia.
Savii *Bonap.* Tuscany, Rome, Sicily.
semicaudatus *Peale.* Samoan Islands.
sericeus *Tomes.* Habitat not known.

Vespertilio splendidus *Wiem.* St. Thomas Island.
Siligorensis *Hodg.* India.
subflavus *F. Cuv.* Georgia.
subulatus *Say.*—(Californicus *Bachm.* Caroli *Temm.* lanceolatus *Wied.* lucifugus *MacMurris.* domesticus *Green.* lepidus *Gerv.*) N. America, Pennsylvania, Cuba.
Tasmaniensis *Gray.* Tasmania, Philippine Isles, India.
Theobaldi *Blyth.*—(pallidiventris *Hody.*) Himmalayah.
Timoriensis *Geoff.* Timor, Borneo?
Townsendi (Synotus.) *Wagn.* N. America.
trilatitius *Horsf.*—(tenuis *Temm.*) Java and Sumatra.
tricolor *Smuts.* Cape of Good Hope.
tristis *Waterh.* Phillippine Isles.
Turcomanus *Eversm.* South Russia.
Virginianus *Bach.* Virginia, United States.

RODENTIA.

Toxodontidæ.

Toxodon Paranensis D'Orb. Paraguay.
Platensis Owen. Rio Negro, Bahia Blanca, Monte Video.

Hystricidæ.

Cavinæ.

Hydrochærus Capybara *Erxl.* Eastern parts of S. America, from Guiana in the North, to the Rio de la Plata in the South, and from the Atlantic to the Lowlands of Peru and Bolivia.
sulcidens Lund. Bone-caves in Brazil.
Dolichotis Patagonica *Shaw.* Patagonia, from 48° 30′ S. L. to 37° 30′ on the East Coast, and extending into La Plata, as far North as Mendoza.
Anœma leucoblephara *Burm.* La Plata,
Cavia *antiquum* D'Orb. S. America.
aperea *Linn.* Banks of River Plata, and extends Northwards into Paraguay, Bolivia, and Brazil.
aperoides Lund. Bone-caves, Brazil.
Australis *Geoff.*—(Kingii *Bennett.*) Patagonia, from 39° S.L. to the Straits of Magellan.
bilobidens Lund. Bone-caves, Brazil.
Boliviensis *Meyen.*—(Galea musteloides *Mey.*) Throughout Bolivia at great elevations, high Table-land between Cochabamba and La Paz.
Cobaya? *Marcg.*—(porcellus *Linn.*) Restless Cavy or Guinea Pig. Domesticated, not known wild, unless it be descended from C. aperea.
Cutleri *Tschudi.* Peru, West of Andes?
flavidens *Brandt.*—(nigricans *Wagn.* obscurus *Rupp.* saxatilis *Lund.*) Bahia, Brazil.
fulgida *Wagl.*—(rufescens *Lund.*) Minas Geraes, Brazil.
leucopyga *Brandt.*—(Azarae *Wagn.*) Brazil.
rupestris *Wied.*—(Moco *F. Cuv.* sciureus *Geoff.*) Brazil in rocky places.
Spixii *Wagl.* Brazil, Rio de Janeiro, Bahia, Amazon.

Chinchillinæ.

Lagostomys trichodactylus *Brookes.*—(Viscacha *Geoff.* maximus *De Blain.*) La Plata and Entre Rios.
Lagidium Cuvieri *Bennett.*—(Peruanum *Meyen.* aureus *Geoff.*) Andes of Chili, Bolivia, and Peru.
pallipes *Bennett.* Andes of Bolivia and Peru, extending North to Ecuador.
Chinchilla brevicaudata *Waterh.*—(Chinchilla *Licht.*) Peru.
laniger *Geoff.* Andes of Chili, Bolivia, and Peru, extending Northwards on East side of Andes to 9° S. L., and at an elevation of from 8000 to 12,000 feet.
Archæomys chinchilloides Gerv.—(Arvenensis *Laiz* and *Par.*) Freshwater Marl, Issoire.
Laurillardii Gerv. Freshwater Marl, Issoire.

Octodontinæ.

Habrocoma Bennettii *Waterh.*—(helvina *Wagn.*) Chili.
Cuvieri *Waterh.* Chili, near Valparaiso, abundant in dry Hills partly covered with Bushes.
Octodon Bridgesi *Waterh.* Province of Colchagua, Chili.
degus *Molina.*—(Cumingii *Bennett.* pallidus *Wagn.* var. Peruana *Tschudi.*) Central parts of Chili, between 28° and 35° S. L.
gliroides *D'Orb. and Gerv.* Bolivian Andes, La Paz.
Schizodon fuscus *Waterh.* Val de las Cuevas on the Eastern side of the Andes, about 35° S.L.
Spalacopus noctivagus *Pœpp.*—(cyaneus *Molina.*) Chili.
Pœppigii *Wagl.*—(ater *F. Cuv.*) Chili.
Ctenomys Boliviensis *Waterh.*—(opimus *Wagn.*) Plains of St. Cruz de la Sierra.
Brasiliensis *De Blain.*—(Nattereri *Wagn.* torquatus *Licht.*) Brazil, Paraguay, La Plata, and Bolivia.
leucodon *Waterh.* Bolivia, Department of La Paz.
Magellanicus *Bennett.* Port Gregory, Straits of Magellan.

Echimyinæ.

Capromys pilorides *Say.*—(Fournieri *Desm.*) Forests in Cuba.
prehensilis *Pœppig.*—(Pœyi *Guer.*) Forests in Cuba.
Plagiodonta ædium *F. Cuv.* St. Domingo.
Myopotamus Coypus *Molina.*—(casteroides *Barrow.* Bonariensis *Reugger.* Popelairi *Wesmael.* Chilensis *Less.*) Coypu. Rivers and streams of great part of S. America, on both sides of the Andes. On eastern side from Peru southwards to the Rio Chupat in 43° 20′. On the western side from valleys of Central Chili in 33° to 48°, S. L., or even somewhat further, but not into Tierra del Fuego. Chiloe, River Maypo, near Santiago, Brazil, Buenos Ayres, etc.
Cercomys cunicularius *F. Cuv.* Minas Geraes, Brazil.
Petromys typicus *Smith.* South Africa, Rocky Hills near the Mouth of the Orange River.
Dactylomys amblyonyx *Wagn.* Ypanema in Brazil.
typus *Geoff.*—(dactylinus *Desm.*) Supposed to be from Brazil.
villosus (Lasiuromys) *Deville.* St. Paul's on the Upper Amazon.

Loncheres armata *Geoff.*— (hispida *Licht.* Brasiliensis *Lund.*) Cayenne.
bistriata *Wagn.* Rio Guapure.
Blainvillei *Jourdan.*— (grandis? nigrispina? and unicolor *Wagn.*) Brazil in the vicinity of Bahia, and in the Isle of Deos near Bahia, Amazon River, Ypanema.
cristata *Geoff.*—(paleacea? *Geoff.* chrysurus *Licht.*) Guyana and Parag.?
macrura *Wagn.* Borba, Brazil.
obscura *Wagn.*—(didelphoides and semivillosa *Geoff.*) Supposed to be from Brazil.
pachyura *Wagn.* Brazil.
pagurus *Wagn.* Borba, Brazil.
picta *Pictet.* Bahia, Brazil.

Mesomys ecaudatus *Wagn.*—(brachyurus *Wagn.* spinosus *Desm.* rufus *Licht.*) Paraguay and Bolivia, Chuore, N. side of Andes of Cochabamba, Assumption, Borba, Brazil.

Echimys albispinosus *Geoff.* Bahia, Brazil.
antricola *Lund.*—(apereoides *Lund.* crassicaudatus and pachyurus *Wagn.*) Lives in the Caves of the Chalk Mountains of Minas Geraes.
Cayennensis *Geoff.*—(setosus *Geoff.* myosuros *Licht.* leptosoma *Brants.* cinnamomeus *Licht.* anomala *Kuhl.* longicaudatus *Reuss.* fuliginosus *Wagn.* elegans *Lund.*) Guyana and Brazil.
hispidus *Geoff.* Bahia, Brazil.
inermis *Pictet.* Jacobina in Bahia, Brazil.

Carterodon sulcidens Lund —(*Nelomys sulcidens* Lund. *Aulacodus Temminckii* Lund.) Bone-caves in Brazil.

Aulacodus Swinderianus *Temm.* Sierra Leone, Gambia, and South Africa.

Dasyproctinæ.

Cœlogenys *laticeps* Lund. Bone-caves in Brazil.
major Lund. Bone-caves in Brazil.
Paca *Linn.*—(fulvus and subniger *F. Cuv.* platycephala *Harl.*) The Paca. South America from Cayenne to Paraguay, Peru (rarely), some of West Indian Islands, New Grenada, Bogota, Minas Geraes, Guatemala.

Dasyprocta acouchy *Erxl.*—(leptura *Wagn.* exilis *Wagl.* leporina *Gray.* albida? *Gray.*) West Indian Islands, St. Lucia and Grenada, Guyana, and North Brazil.
Aguti *Linn.* The Agouti. Guyana, and N. of Brazil.
Azaræ *Licht.*—(punctata *Gray.* acuti *Rengg.* caudata *Lund.*) Paraguay, Bolivia, S. Brazil, Minas Geraes.
capreolus Lund. Bone-caves of Brazil.
cristata *Desm.*—(fuliginosa *Wagl.* nigricans *Wagn.* nigra *Gray.* variegata *Tsch.*) Surinam, Peru? North Brazil, Amazon, Borba, Rio Negro.
croconota *Wagl.* Brazil.
Mexicana *Sauss.* Mexico.
prymnolopha *Wagler.* Guyana.

Hystricinæ.

Chætomys subspinosus *Kuhl.*—(tortilis *Illig.* moricaudi *Pictet.*) Middle and North Brazil.

Cercolabes bicolor *Tschudi.* Peru, east of the Andes.
dubia Lund. Bone-caves of Brazil.
fossilis Waterh. Caves of Minas Geraes.
magna Lund. Bone-caves of Brazil.
melanurus *Wagn.* Surinam, and North Brazil.
Novæ Hispaniæ *Briss.*—(Mexicana *Shaw.* Liebmanni *Reinhardt.*) East Coast of Mexico.
pallidus *Waterh.* West Indies.
prehensilis *Linn.*—(cuandu *Desm.* Boliviensis *Gray.* platycentrotus *Brandt.*) Guiana, Brazil and Bolivia.
villosus *F. Cuv.*—(insidiosus, affinis, and nigricans *Brandt.* variegatus *Gray.* nycthemera *Kuhl. and F. Cuv.* spinosus *Rengg.*) Brazil.

Erethizon dorsatus *Linn.*—(pilosus *Rich.* Hudsonius *Briss.*) Upper Missouri, from the Barren-Grounds in the North to Northern Pennsylvania, on the South, and from the Atlantic in the East to the Missouri on the West.
epixanthus *Brandt.* North America, West of the Missouri, Unalaska, California.
nov. gen. (Erethizon *Gray.*) rufescens *Gray.* Columbia.

Hystrix Africana *Gray.*— (fasciculata *Benn.*) Sierra Leone, Fernando Po.
Africæ-Australis *Peters.* South Africa.
cristata *Linn.*—(Cuvieri *Gray.*) Italy, and North and West Africa, Gambia.
refossa Kuhl. Alluvium of Issoire.
fasciculata *Shaw.*—(macroura *Gerv.*) Siam, and the Malayan Penin., Sumatra.
hirsutirostris *Brandt.*—(leucurus *Sykes.*) Continental India, and westwards to Syria, and Lycia, Persia.
Javanica *F. Cuv.*— (Hodgsoni *Gray.* alophus *Hody.* torquata and ecaudata *Van der Hoev.* fasciculata *Müll.* longicaudata *Marsd.* brevispinosa *Wagn.*) Nepal, Sikkim, Arakan, Malayan Penin., Indo-Chinese region, Java, Sumatra, and Borneo.
Malabarica *Sclater.* Malabar.

Theridomys aquatilis Gerv. Ronzon.
Blainvillei Gerv. Freshwater Marl, Issoire.
Lembronica Gerv. Issoire.

Hyracidæ (Lamnungia).

Hyrax Abyssinicus? *Hempr.*—(zamar *Cuv.*) Abyssinia.
arboreus *Smith.* S. Africa, W. Africa, Loando.
Capensis *Pall.* S. Africa.
dorsalis *Fraser.* Fernando Po.
sylvestris *Temm.* Guinea.
Syriacus *Schreb.*— (ruficeps and Dongolanus *Ehrenb.*) From the coast of the Red Sea northwards to Syria.
n. sp. fide *Kirke.* Zambesia.

Leporidæ.

Lagomys alpinus *Pall.* Siberia, from the River Irtisch into Kamtschatka.
Corsicanus Bourd. Bone Breccia, Corsica.
Hyperboreus *Pall.* North-East Siberia.
Meyeri Meyer. Pliocene Freshwater Marl of Oeningen.

Lagomys Nepalensis *Hodg.*—(Roylii *Ogilby*. rufescens *Gray*. Hodgsonii *Blyth*.) Nepaul, Thibet, Cashmere, Cabool, Affghanistan, Central Asia, Dauria.

Oeningensis Cuv. Pliocene Freshwater Marl at Oeningen.

ogotona *Pall.* Mongolia, China, Subalpine Dist., beyond Lake Baikal.

princeps *Rich.* Rocky Mountains, from 42° N.L. to 60°, North America.

pusillus *Pall.* Southern Districts of the Volga, and Ural Mountains, South Siberia, to the River Obi.

Sansanensis Lart. Miocene beds at Sansans.

Sardus Wagn.—(spelæus *Owen*.) Bone Breccia of Cagliari, Britain.

Titanomys trilobus Gerv. Tertiaries at St. Geraud le Puy in the Department of Allier, France.

Visenoviensis Meyer. Middle Tertiary at Weisenau.

Lepus Ægyptius *Geoff.*—(Arabicus *Hempr. and Ehrb*. Sinaiticus Syriacus, Æthiopicus, and Habessinicus *Hempr. and Ehrb*. isabellinus *Rüpp*.) Egypt, Arabia, Arabia Petræa, near Mount Sinai, Syria, Nubia, Abyssinia, Egypt, as far North-West as the Oasis of Guerrera.

Americanus *Erxl.*—(Hudsonius *Pallas*. nanus *Schreb*. Virginianus *Harlan*. borealis *Schinz*.) North-East of United States, and as far North as Lat. 68°, and as far South as North of Pennsylvania, and along the Alleghany Range into Virginia.

aquaticus *Bach.*—(Douglasii var. *Gray*.) Swampy tracts bordering the Mississippi, Louisiana, Wet grounds of New Madrid, Missouri.

artemisia *Bach.*— (Nuttallii *Bach*.) Oregon, Nebraska, Missouri, N. Mexico, Texas.

Audubonii *Baird*. Coast of California.

brachyurus *Temm*. Japan.

Bachmanni *Waterh*. Texas.

Brasiliensis *Linn.*—(Tapeti *Pall*.) Brazil, also found in parts of Peru, Bolivia, and Paraguay.

Californicus *Gray.*—(Richardsonii *Bach*. Bennettii *Gray*.) California, from the Colorado to Oregon.

callotis *Wagl.*—(nigricaudatus *Bennett*. flavigularis *Wagn*.? Texianus *Waterh*.?) Mexico, Texas, Oregon.

campestris *Bach.*—(Townsendii *Bach*. Virginianus *Rich*.) North parts of United States, from Missouri to Columbia, as far S. as the Platte at Fort Kearney, Fort Boisé.

Capensis *Linn.*—(ochropus *Wagn*. arenarius *Geoff*.) Cape of Good Hope.

crassicaudatus *Geoff.*—(rupestris *Smith*. melanurus *Rüpp*.) Cape of Good Hope, and Port Natal.

cuniculus *Linn*. South and West Europe, greater part of Germany, North Africa.

diluvianus Cuv. Diluvial Deposits at Quedlingburg, Bone Breccia, Gibraltar, Cette, and Pisa.

glacialis *Leach*. Arctic Portions of N. America, to Labrador and Newfoundland, not further S. than 64° N. L., McKenzie River, and Slave Lake, Greenland.

Lepus hispidus *Pears.*—(Sinensis *Gray*. Peguensis *Blyth*.) Banks of the Teesle, Assam, China, Formosa.

hybridus *Desm.*—(Altaicus *Gray*. aquilonius *Blas*. medius *Nilss*.) Russia between 55° and 60° N.L., Altai Mountains, Zealand.

Issiodorensis? Croiz. Alluvium in Auvergne.

Mandshuricus *Radde*. Burega Mountains, E. Siberia.

Mediterraneus *Wagn.*—(meridionalis *Gené*.) Sardinia, Gibraltar, Italy, Spain, France, North Africa, Tunis, Algiers, and extends through the whole of the Sahara, and to the Sea-Coast.

Neschersensis Croiz. Alluvium of Auvergne.

nigricollis *F. Cuv.*—(melanauchen *Temm*. Kurgosa *Gray*.) Sind., Punjaub, Deccan (not Bengal), Ceylon (introduced into Java and the Mauritius).

palustris *Bach.*—(Douglasii var. 2, *Gray*.) North America, South Atlantic States, through South Carolina to Georgia, and Florida.

ruficaudatus *Geoff.*—(macrotis *Hodg*.) North India, Plains of Ganges to Delhi, Nepal.

saxatilis *F. Cuv.*—(rufinucha *Smith*. longicaudatus *Gray*. fumigatus *Wagn*.) Cape of Good Hope, Rocky and Mountainous Situations.

sylvaticus *Bach.*—(nanus *Schreb*.) Iowa, Wisconsin, Illinois, Kansas, Missouri, Nebraska, Texas, Alabama, Mississippi, Louisiana, Massachussetts.

timidus *Linn.*—(Europæus *Pall*. campicola and Granatensis *Schimp*.) Europe and Asia, France, England, Spain, Andalusia, Germany.

Tolai *Pall.*—(Thibetanus? *Waterh*. pallipes *Hodg*. Ocostelus *Hodg*. Caspicus? *Ehrb*.) Exclusively an inhabitant of the high Steppes of Central Asia, Baikal District, Mongolian Deserts.

Trowbridgii *Baird*. Coast of Calif.

variabilis *Pallas.*—(albus *Jen*. Hibernicus *Bell*. alpinus *Schimper*.) Ireland, Scotland, as far as Cumberland in England, Scandinavia to Arctic Ocean, Siberia, north of 55° parallel to Kamtschatka, Bavaria, Switzerland, eastwards as far as Salzburg.

Do. var. canescens *Nilss*. Southern Scandinavia.

Do. var. borealis *Nilss*. Northern Scandinavia.

Washingtonii *Baird*. Washington Territory, Oregon, and West of Puget's Sound, to Lat. 54° 40′.

n. sp. Eastern Siberia, Amourland.

Myoxini.

Glis *Cuvieri* Giebel. Montmartre Gypsum.

Sansanensis Giebel. Miocene deposits at Sansans.

spelæus Fisch.—(*Parisiensis* Cuv.) Montmartre Gypsum.

vulgaris *Klein*. South and Temperate Europe, as far as Georgia and the Wolga.

Muscardinus avellanarius *Linn*. Temperate and North Europe.

elegans *Siebold*. Japan.

mumbyanus *Pomel*. Sahara.

Eliomys melanura *Wagn.*—(nitidula *Pall*.) Mount Sinai.

nitela *Pall.*—(quercinus *Linn*. Dryas *Schreb*.) France, Germany, Switzerland, and Poland, in the Alps to the height of 5000 feet.

orobinus *Cuv*. Senaar.

Platacanthomys lasiurus *Blyth.* S. Malabar.
Graphiurus Capensis *Cuv.*—(Catoirii *F. Cuv.* elegans *Ogilby.*) From the Cape to the West Coast of Africa, as far as Senegal.
murinus *Gieb.* South Africa.
Anomalurus Beecroftii *Fraser.* W. Africa, Gabon.
Derbianus *Gray.*—(Fraseri *Waterh.* Beldeni? *De Chaillu.*) W. Africa, Fernando Po, Gabon.
Pelei *Temm.* North Coast of Africa.

Sciuridæ.

Xerus marabutus *Less.* Senegal.
ocularis? *Smith.* Plattenburg, S. Africa.
prestigiator *Less.* Senegal.
rutilus *Cretz.*—(brachyotus *Hemp. and Ehr.*) Coast of Abyssinia, Somali Land.
setosus *Forst.*—(erythropus *Cuv.* Levaillantii *Kuhl.* prætextus *Schreb.* albovittatus *Desm.* leuco-umbrinus *Rupp.* Namaanensis *Licht.* Capensis *Thumb.*) Cordovan, Senaar, Abyss., E. W. and S. Africa.
simplex? *Less.* Senegal.
Rhinosciurus tupaoides *Gray.*—(laticaudatus? *Müll.*) Malayan Peninsula, Sumatra, Borneo.
Sciurus Aberti *Woodh.*—(dorsalis *Woodh.*) San Francisco Mountains, New Mexico.
æstuans *Linn.*—(Brasiliensis *Briss.* pusillus *Desm.*) Brazil, Guiana.
Assamensis? *MacLell.*—(Blythii *Tytl.* subflaviventris *Horsf.*) Assam.
atrodorsalis *Gray.* India, common on the Hills about Moulmein.
aureogaster? *F. Cuv.* Monterey, California.
Barbei *Blyth.* Tenasserim Provinces, Siam.
Berdmorei *Blyth.* Martaban, Margui, Tenasserim.
bicolor *Sparzm.*—(giganteus *Mac Lell.* auriventer *Geoff.* affinis *Raff.* macrouroides *Hody.*) S.E. Himmalayah, Assam, Sylhet, Munipur, Malayan Penin., Sumatra, Tenasserim.
Blandfordii *Blyth.* Vicinity of Ava.
Boothiæ *Gray.* Honduras.
Carolinensis *Gmel.*—(cinereus *Schreb.* leucotis *Bach.* vulpinus? *Dekay.* migratorius *Aud. and Bach.* Pennsylvanicus *Ord.* niger *Godm.* fuliginosus? *Bach.*) N. Amer., Georgia, N. and S. Carolina, Pennsylvania, Mississippi, Illinois, Missouri, Arkansas, Iowa, Michigan, Ohio, Massach., N. York, Wisconsin.
castanonotus *Baird.* New Mexico.
castaneoventris *Gray.*—(griseopectus *Blyth.*) China.
cepapi *Smith.*—(superciliaris *Wagn.*) S. Africa.
chrysonotus *Blyth.* Tenasserim Provinces, southwards.
cinereus *Linn.*—(vulpinus *Schreb.* hyemalis *Ord.*) N. Amer., Pennsylvania, Maryland, Virginia.
cinnamomeiventris? *Gray.* China.
Clarkii *Smith.* N. Amer.
Clellandii? *Horsf.* Bengal and Assam.
Colliæii *Rich.* San Blas, Mexico.
dimidiatus *Waterh.* S. Amer.
Douglasii *Bach.*—(Townsendii *Bach.* mollipilosus *Aud. and Bach.* Belcheri *Gray.* Suckleyi *Baird.*) Washington, and Oregon Ter., Calif., Petaluma, Puget's Sd.
Sciurus Elphinstonei *Sykes.* N. Malabar.
ephippium *Mull.* Borneo.
erythræus *Pall.*—(hippuris var. *McLell.*) Khasya Hills.
erythrogaster *Blyth.* Munipur Hills, Hills east and south of Upper Assam.
erythrogenys *Waterh.* Fernando Po.
exilis *Müll.* Mountainous regions in Sumatra and Borneo.
Feignouxii Laur. Miocene limestone, Auvergne.
ferrugineiventris *Aud. and Bach.* California.
ferrugineus *F. Cuv.*—(Keraudrenii *Geoff.*) Hilly regions of Arakan and Pegu.
Finlaysonii *Horsf.* Island of Sichan in the Gulf of Siam.
flavivittis *Peters.* Mosamb.
fossor *Peale.*—(Heermanni *Lec.* leporinus? *Aud. and Bach.*) Whole mountain region of California, from San Diego, as far north as Columbia River at the Dalles.
Fremontii *Towns.* Sawatch Pass, Rocky Mountains.
Gambianus *Ogilb.* Gambia.
Gervaisianus Lart. Miocene. Sansans.
Gerrardii *Gray.* New Grenada.
getulus *Linn.* West coast of Barbary.
gilvigularis *Wagn.*—(rufoniger? and chrysurus? *Puch.*) Mouth of the River Madeiro, falling into the Amazon.
griseo-caudatus *Gray.* West Coast South America.
hippurus *Geoff.*—(castaneoventris, rufogaster *Gray.*) Java, Sumatra, Canton, Assam, Bhotan.
Hudsonius *Pall.*—(Carolinus *Ord.* rubrolineatus *Desm.*) North America, throughout the Atlantic States, as far north as Labrador, and to the Mississippi River.
hyperythrus *Blyth.*—(erythræus var. A. *Gray.*) Tenasserim Provinces, Hills between Pegu and Martaban.
hypopyrrhus? *Wagn.* Mexico.
igniventris *Wagn.*—(pyrrhoventer *Wagn.*) Rio Negro, S. America.
Indicus *Erxl.*—(macrourus *Forst.* Ceylonensis *Bodd.*) India, Malabar Coast, Malacca, Ceylon, and Sumatra.
insignis *Cuv.* Java, Sumatra, Borneo.
isabella *Gray.* Cameroon Mountains.
Javensis *Schreb.* Java, Cambogia.
Langsdorffii *Brandt.* Brazil.
lanigerus *Aud. and Bach.* Northern California.
Layardii *Blyth.* Mountain regions of Ceylon.
Leschenaultii *Desm.*—(hypoleucus *Horsf.* albiceps *Desm.* humeralis *Coulon.* affinis *Raff.*) Sumatra and Java.
leporinus *Aud. and Bach.* Northern California.
leucomus *Müll.* Celebes.
Lokriah *Hodg.*—(sub-flaviventris *McLell.*) Nepal, Sikkim, Assam, Khasya, Aracan, in the Mountains.
Lokroides *Hodg.* Nepal, Sikkim, Bhotan, in the Terai.
Ludovicianus *Harl.*—(rufiventer *Geoff.* macrourus *Say.* magnicaudatus *Harl.* Sayi rubicaudatus and occidentalis *Aud. and Bach.* Audubonii var. and subauratus *Bach.* Lewisii? *Smith.* limitis? *Baird.*) S. and Central

North Amer., Illinois, Iowa, Missouri, Louisiana, Arkansas, Texas? Ohio, Nebraska, Michigan, Wisconsin.

Sciurus MacLellandii *Horsf.*—(Pembertonii *Blyth.*) Sikkim, Bhotan.

macrotis *Gray.* Sarawak, Borneo.

maximus *Temm.*—(Malabaricus *Schinz.*) S.E. Asia and its Archipelago, as far east as Java and Borneo, S. Malabar.

melanotis *Schlegel.* Borneo, Java, Sumatra.

minutus Lart. Miocene beds, Sansans.

minutus *De Chaillu.* Gabon.

modestus *Mull.*—(concolor *Blyth.*) Vicinity of Malacca, Sumatra, and Borneo.

Mouhotii *Gray.* Cambogia.

multicolor *Rüpp.* Abyssinia, Mountains on the coast.

murinus? *Müll.* Sumatra.

mustelinus *Aud. and Bach.* California.

mutabilis *Peters.* Mosamb.

nigrescens *Bennett.* Lower California.

nov. spec.? fide *Baird.* N. Mexico, Nuevo Leon.

ornatus *Gray.* Natal.

palliatus *Peters.* Mosamb.

palmarum *Linn.*—(tristriatus *Waterh.* Kelaarti and Brodiei *Layard.* penicillatus *Leach.*) India generally, Hindostan, Punjaub, avoiding the Plains.

Philippensis *Waterh.* Philippine Islands.

Plantanii *Lyngh.*—(nigrovittatus *Horsf.* vittatus *Raffl.* bivittatus and bilineatus *Desm.* griseiventer, flavimanus, and pygerythrus *Geoff.* Phayrei *Blyth.* ginginianus *Kuhl.* notatus *Bodd.*) Java, Sumatra, Borneo, Ava, Canton, Malacca.

Prevostii *Desm.*—(Rafflesii *Vigors.* rufo-gularis and rufoniger *Gray.* redimitus *Van der Hoev.*) Malayan Peninsula, Borneo.

priscus Gieb. Diluvium, Quedlingburg.

Pyladei *Less.* Realejo Mexico.

pyrrhopus *Cuv.*—(Congicus *Kuhl.* rubripes *Du Chaillu.*) W. Africa, Fernando Po, Gabon.

Richardsonii *Bach.*—(Hudsonius var. β. *Rich.* lanuginosus *Bach.*) Rocky Mountains, Washington Territory.

rubriventer *Müll.* Celebes.

rufobrachiatum *Waterh.*—(subalbidus *Du Chaillu.* Spermophilus annulatus *Aud. and Bach.**) Fernando Po.

Sansanensis Lart. Miocene. Sansans.

setosus *Forst.*—(Levaillantii *Kuhl.* albovittatus *Desm.*) Cape of Good Hope.

Siamensis *Gray.* Siam.

simplex? *Less.* Senegal.

socialis *Wagn.* Mexico.

splendens? *Gray.* Cambogia.

Stangeri *Waterh.*—(Nordhoffii, eburivorus and Wilsonii *Du Chaillu.*) Fernando Po.

sublineatus *Waterh.*—(Delessertii *Gmel.*) Mountains of S. India and Ceylon.

Sciurus Syriacus *Ehrb.*—(russatus and anomalus *Schreb.* Caucasicus? *Pall.*) Syria, Turkey.

Tennentii *Layard.* Highlands of Ceylon.

tenuis? *Horsf.* Malayan Penins., Java, Borneo, and Sumatra.

tricolor *Tschudi.* North-east Peru, and adjoining parts of Brazil.

variabilis *Geoff.* Colombia.

variegatoides *Ogilb.* West Coast of S. Amer.

variegatus? *Erxl.* Mexico.

varius? *Wagn.* Mexico.

vulgaris *Linn.*—(Europæus *Linn.* varius *Pall.* niger and albus *Erxl.* alpinus *F. Cuv.* Italicus *Bonap.*) Whole of Europe and Siberia.

vulpinus *Gmel.*—(niger *Linn.* capistratius *Bosc.* rufiventer *McMurt.* Texianus *Bach.*) N. America, North Carolina, South Carolina, Florida, Georgia, New Orleans.

Pteromys (Sciuropterus) alpinus *Wagn.*—(sabrinus var. β *Rich.*) Columbia River.

alboniger *Hodg.* S. E. Himmal., Nep., Sikkim, Bhotan.

Baberi? *Blyth.* North of the Himmal.

caniceps *Gray.*—(senex *Hodg.*) Sikkim.

fimbriatus *Gray.*—(Turnbulli *Gray.*) India.

fuscocapillus *Blyth.* S. Malabar.

Hudsonius *Gmel.*—(sabrinus *Rich.*) N. Amer., Maine, Nova Scotia, Minnesota.

Kaleensis *Swinh.* Formosa.

Layardi *Kelaart.* Mountains of Ceylon.

Oregonensis *Bach.* California, Oregon and Washington Territories.

Phayrei? *Blyth.* Pegu, Tenasserim.

sagitta *Desm.*—(aurantiacus *Wagn.* genibarbis and lepidus *Horsf.* Horsfieldii *Waterh.*) Java, Borneo.

spadiceus *Blyth.* Aracan.

villosus? *Blyth.* Sikkim, Bhotan, Assam.

volans *Blas.*—(rotans *Linn.* Sibiricus *Geoff.* vulgaris *Wagn.*) North-east Europe and Siberia, not beyond the Lena.

volucella *Pall.* Canada, Montreal, Massachusetts, N. York, Georgia, Illinois, Wisconsin, Mississ., Louisiana.

(Pteromys) cinerascens *Blyth.* Arakan, Pegu, Tenasserim.

elegans *Müll.*—(inornatus *Geoff.*) Mountain districts of Java.

grandis *Swinh.* Formosa.

griseoventer *Gray.* Malayan Peninsula.

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* Dr. Baird says that Audubon and Bachman had been deceived in the locality of the species which they described under this name, supposing it to have been an American Spermophile, while, in fact, it was a West African Squirrel.

Pteromys (Pteromys) magnificus *Hodgs.*—(chrysothryx *Hodgs.* nobilis *Gray.*) Assam, S. E. Himmal.
momoga *Temm.* Indian Arch. Cambogia.
nitidus *Desm.*—(Leachii, melanotus, albiventer, and punctatus *Gray.* leucogenys *Temm.* Petaurista *Pall.*) Java, Sumatra, Borneo, Malabar, Malacca, and Siam.
Philippensis *Gray.* Philippine Isles.
punctatus *Gray.* Malayan Peninsula.

Tamias dorsalis *Baird.* Fort Webster, New Mexico.
Pallasii *Baird.* From the Ural, through the whole deserts of Siberia to the Sea of Ochotsk, and the Gulf of Anadyr.
var. Uthensis *Pall.* Amoorland.
quadrivittatus *Say.*—(minimus *Bachm.*) N. America, Mauvaises Terres, Nebraska, Yellowstone River, New Mexico, Oregon Territory, Columbia Biver, Cascade Mountains.
striatus *Linn.*—(Americanus *Kuhl.* Lysteri *Rich.*) Canada, New York, Wisconsin, Missouri.
Townsendii *Bach.*—(Hindsii *Gray.* Cooperi *Baird.*) Washington and Oregon Territories, Columbia River, Cascade Mountains, Calif.

Spermophilus Beecheyi *Rich.*—(Californicus? and Bottæ? *Less.*) California, Gila River.
brevicauda *Brandt.*—(mugosarius *Eversm.* intermedius *Brandt.*) District South of the Altai.
citillus *Blas.*—(Germanicus *Brisson.* undulatus *Temm.*) Bohemia, Silesia, Poland, Austria, Hungary. Not in Russia or Siberia.
Couchii *Baird.* Mexico.
Douglasii *Rich.* Oregon, Columbia River.
erythrogenys *Brandt.* Siberia, between the Ob and Irtisch and the Balchas Sea.
Eversmanni *Brandt.*—(Altaicus *Evers.* Iacutensis *Brandt.*) E. Siberia.
Franklini *Rieh.* N. Amer., Iowa, Wisconsin.
fulvus *Blas.*—(leptodactylus *Licht.* Turcomanus *Eischa.* concolor *Geoff.*) Steppes of the Southern Ural.
grammarus *Say.* Texas, New Mexico, Mexico, Plateau of Perote.
guttatus *Temm.*—(guttulatus *Schinz.* leucostichus and Dauricus *Brandt.*) Volhynia, Bessarabia, From the Don to the Volga, and thence onwards to the Lena.
Harrisii *Aud. and Bach.* Mohave desert.
lateralis *Say.* Oregon Territory, Nebraska.
macrurus *Bennett.* West Coast of Mexico?
Mexicanus *Erxl.* Matamoras, Mexico, Texas, New Mexico.
mugosaricus *Blas.* On the slopes of the Mugosarskian Mountains, in the Kirghis Steppes.
musicus *Menetr.*—(xanthoprymnus *Bennett.*) Higher regions of the Caucasus near the perennial snow.
Parryi *Rich.* North and north-west of North America, Bhering's Straits, Island of Arikamtchitchi, Bhering's Straits.
Richardsonii *Sab.* Rocky Mountains, Lake Michigan, Saskatchewan.
rufescens *Blas.*—(undulatus *Eversm.*) About the Ural Mountains, between 49° and 60° N.L.
spilosoma *Bennett.*—(Mexicanus *Aud. and Bach.*) Sonora, New Mexico.
superciliosus Kaup.—(*speciosus* v. Meyer.) Diluvial deposits and Bone Breccias in France and Germany.
tereticaudus *Baird.* Fort Yuma, Calif.
tridecemlineatus *Mitch.*—(Hoodii *Sabine.*) Wisconsin, Michigan, Illinois, Minnesota, Missouri, Nebraska, Arkansas, New Mexico.
Townsendii *Bach.*—(guttatus *Rich.*) Rocky Mountains.

Cynomys Gunnisonii *Baird.*—(brachyurus *Rafin.* Columbianus *Ord.* Lewisii *Aud. and Bach.*) North America, Columbia River? Rocky Mountains, Nebraska.
Ludovicianus *Ord.*—(socialis *Raf.* griseus *Raf.* Missouriensis *Ward.* latrans *Harl.*) Missouri Prairie Dog. Nebraska, Missouri, Rocky Mountains, Arkansas, New Mexico, Texas.

Plesiarctomys Gervaisii Brav. Freshwater limestone of Apt, near the mouth of the Rhone.

Arctomys *Arvernensis* Gerv. fossil.—(*primigenius* Kaup.) Volcanic alluvium in Auvergne.
Baibacina? *Brant.* Altai.
bobac *Pall.* Mountainous districts of Poland and Galicia, through Russia and Siberia, to the neighbourhood of Kamtschatka.
Do. Fossil in the diluvium of Russia.
caudatus *Geoff.*—(Tataricus *Jameson.*) At an elevation of 12,000 feet in the Valley of Gombur.
flaviventer *Aud. and Bach.* Oregon, Nebraska.
monax *Linn.*—(Canadensis *Erxl.* empetra *Pall.* melanopus *Kuhl.* Camtschatica *Brandt.*) N. America, from Hudson's Bay to S. Carolina, and westwards to Rocky Mountains, Massach., New York, Pennsylvania, Wisconsin, Illinois, Missouri.
pruinosus *Gmel.*—(caligatus *Eschsch.* Okanaganus *King.* sibila *Wolf.* monox *Midden.*) The borders of the Rocky Mountains, between the Columbia and Fraser Rivers. Also said to be found in Kamtschatka.
nov. sp. Mountainous region of Baikal.
spelæus Fisch. Diluvium Russia.

Brachymys ornatus Meyer. Upper miocene limestone of Weissenau.

Oromys Aesopi Leidy. Pliocene beds at Nebraska.

Pectinatoridæ.

Ctenodactylus Massoni *Gray.* Tripoli.
n. sp. fide *Tristram.* Sahara.
n. sp. fide *Tristram.* Sahara.

Pectinator Spekei *Blyth.* Somali Land.

MURIDÆ.

CASTORINÆ.

Aplodontia leporina *Rich.*— (Anisonyx rufa *Ruf.*) PUGET'S SOUND, WASHINGTON TERRITORY, OREGON TERRITORY, CALIFORNIAN MOUNTAINS.

Castor Canadensis *Kuhl.*—(Americana *F. Cuv.* fiber *Linn.*) N. AMERICA FROM THE ARCTIC CIRCLE TO THE GULF OF MEXICO, CANADA, HUDSON'S BAY, LAKE SUPERIOR, NEBRASKA, MISSOURI, CALIFORNIA, TEXAS, MEXICO.

Do. Fossil in Carlisle Caves.

Eseri? v. Meyer. FRESHWATER CHALK OF ULM.

fiber *Linn.* Formerly over whole north of EUROPE and ASIA, from 67° to 33° North Lat.; now very rare; said still to be met with occasionally on the RHONE, very scarce in GERMANY, NORWAY, and SWEDEN, somewhat oftener in POLAND, AND RUSSIA, also in SIBERIA, TARTARY, AND THE CASPIAN SEA; not in the BLACK SEA, nor the MEDITERRANEAN, nor in ITALY; not in eastern SIBERIAN or in AMOURLAND.

Do. Fossil in Bone-caves and peat-bogs.

Issiodorensis? Gerv. ISSOIRE.

Jaegeri? (*Chalicomys*) Kaup.— (*Chelodus typus* Gieb.) MIDDLE TERTIARY BEDS.

minutus? v. Meyer. FRESHWATER CHALK OF ULM.

Sansanensis Gerv.—(*Myopotamus?*) MIOCENE. SANSANS.

sigmodus (*Castoromys*) Gerv. MONTPELIER.

spelæus? Münster. ISSOIRE.

Viciacensis Gerv.—(*subpyrenaicus* Gerv.) LOWER MIOCENE BEDS OF THE DEPARTMENT OF ALLIER.

Castoroides Ohiensis Fost. IN CLYDE, NEW YORK, LACUSTRINE FORMATION SUBSEQUENT TO THE DRIFT, OHIO.

Trogontherium Werneri Fisch. ENGLAND, EUROPE, from the banks of the ROSTOFF SEA.

ARVICOLINÆ.

Fiber Zibethicus *Linn.*—(Oosoziensis *Lord.*) N. AMERICA from the ATLANTIC to the PACIFIC, and from RIO GRANDE to the BARREN GROUNDS of ARCTIC AMERICA.

Arvicola agrestis *Selys Longet.*—(vulgaris *Desm.* arvalis *Sund.* insularis *Nilss.* neglectus *Jen.*) SWEDEN, BELGIUM.

alborufescens? *Emmons.* MASSACHUSETTS.

alliaria *Less.* SIBERIA.

alpina *Wagn.*—(nivalis *Mart.* nivicola *Schinz.* leucurus and Lebruni *Gerb.* petrophilus *Wagn.*) Higher regions in the ALPS, at an elevation of from 5000 to 10,000 feet.

ambiguus Pom. Bone-breccia, ALLIER.

amphibia *Desm.*— (aquaticus *F. Cuv.* ater *M'Gill.*) All EUROPE and N. ASIA, to the ICY SEA.

Do. Fossil in bone-caves and bone-breccias of the MEDITER., KIRKDALE, &c.

argentoratensis? *Desm.* ALSATIA and the ALPS.

Amurensis *Schrenck.* AMOUR district.

arvalis *Sel. Longch.*—(gregarius *Linn.* vulgaris *Desm.* agrestis *Jenyn.* arvensis *Sch.* pratensis *Baill.* rufescentifuscus *Schinz.* cunicularius, fulvus, subterraneus, and duodecimcostatus *Selys d'Longch.*) EUROPE AND SIBERIA.

Arvicola austera *Lec.* WISCONSIN, ILLINOIS, LOUISIANA.

Blumenbachii? *Fisch.* SENEGAL.*

borealis *Rich.* North of N. AMERICA, BARREN GROUNDS.

Breweri *Baird.* ISLAND OF MUSKEEGET, on east of MASSACHUSSETTS.

Brecciensis Giebel. Bone-caves in EUROPE.

Californica *Peale.* CALIF.

campestris *Blas.* GERMANY.

cinnamomea *Baird.* MINNESOTA.

destructor? *Savi.*—(Musignani *S. Longch.* terrestris *Bon.*) NORTH ITALY.

Drummondii *Aud. and Bach.*—(Nove-boracensis *Rich.*) E. AMER.

edax *Lec.* CALIFORNIA, MONTEREY, SAN DIEGO.

Gapperi *Vigors.*—(fulva and Dekayi *Aud. and Bach.*) NOVA SCOTIA, MASSACHUSSETTS, LAKE SUPERIOR.

glareola *Sund.*— (Hercynicus *Mehlis.* rubidus, and rufescens *Longch.* pratensis *Bell.* riparia *Tars.*) MIDDLE EUROPE, DENMARK, SWEDEN, FINLAND to the WOLGA.

gregalis *Desm.* EASTERN SIBERIA, on both sides the OB.

Haydenii *Baird.* NEBRASKA.

hirsuta? *Emmons.* MASSACHUSSETTS.

hypoleuca? *Wagn.* LABRADOR.

longirostris *Baird.* CALIF., UPPER PIT RIVER.

Maximowiczii *Schrenck.* AMOUR district.

modesta *Baird.* ROCKY MOUNTAINS, SAWATCH PASS.

montana *Peale.* OREGON, CALIF., NEBRASKA.

monticola? *Selys. Lonch.* PYRENEES.

Nageri *Schinz.* URSERNTHAL in the ST. GOTTHARDT.

nasuta *Aud. and Bach.* MASSACHUSSETTS.

occidentalis *Peale.* PUGET'S SOUND.

ochrogaster? *Wagn.* N. AMERICA.

œconoma *Desm.* From IRTISCH to the EASTERN OCEAN, and northwards to the ICY SEA.

Oneida? *Dekay.* NEW YORK.

Oregoni *Bachm.* SHOALWATER BAY, WASHINGTON TERRITORY, CALIFORNIA.

pinetorum *Lec.*—(scalopsoides *Aud. and Bach.* Apella *Lec.*) GEORGIA, LOUISIANA, S. CAROLINA, VIRGINIA, PENNSYLVANIA, ILLINOIS.

ratticeps *Blas.*—(medius *Nilss.*) WOLOGDA.

Richardsonii *Dekay.* ROCKY MOUNTAINS IN BRITISH NORTH AMERICA, 62°.

riparia *Ord.*—(palustris *Harl.* Pennsylvanica *Aud. and Bach.*) N. AMER., MIDDLE STATES to ARCTIC SEA.

Roylei *Gray.* KASHMIR.

rubricata *Rich.* BHERING'S STRAITS.

rufescens? *Dekay.* NORTHERN NEW YORK.

rufidorsum *Baird.* MASSACHUSSETTS.

rutila *Palt.* SWEDEN, FINLAND, north of RUSSIA, SIBERIA to KAMTSCHATKA.

Savii *Sel. Long.*—(incerta *Sel. Long.*) ITALY.

saxatilis *Desm.* EAST SIBERIA.

Sayi? *Bachm.* N. AMERICA.

socialis *Pall.*—(Astrachanensis *Desm.* Syriacus? *Brants.* cinerasceus *Wagn.*) SYRIA, to the CASPIAN SEA.

spelæa Giebel. Bone-caves in EUROPE.

* This species and its locality seem very questionable. I do not believe that any species of Arvicola occurs in Africa.

Arvicola terrestris *Schrenck.* Amour.
Texiana? *Aud. and Bach.* Texas.
Townsendii *Bachm.* West coast of North America, Puget's Sound, Shoalwater Bay, Cascade Mountains.
xanthognathus *Leach.* North America, as far north as the Arctic Sea.
Synaptomys Cooperi *Baird.* N. Amer., New York, Iowa?
Myodes bicolor? *Fatio.* Canton of Berne.
lagurus *Pall.* Steppes of Jaik, Jenisei, and Irtisch, Ural River.
lemmus *Pall.*— (norvegicus *Desm.*) Scandinavia, Norway, Sweden.
Obensis *Brants.*—(helvolus *Richardson.* trimucronatus *Rich.* albigularis *Wagn.*) N. Amer., Siberia.
schisticolor *Wegel.* Norway, and west coast of Sea of Ochotsk.
torquatus *Pall.*—(Hudsonius *Wagn.* Lenensis *Pall.* ungulatus *Baer.* Grœnlandicus *Richard.*) Circumpolar Shores and Islands, Siberia and N. America, Greenland, Iceland?

Spalacinæ.

Rhizomys badius *Hodg.*—(castaneus *Blyth.* minor *Gray.*) Terai region of Nepal and Sikkim, Arracan.
macrocephalus *Rupp.* Schoa, S. of Abyss.
pruinosus *Blyth.* Khasyah Hills.
splendens *Wagn.* Abyss.
Sumatrensis *Gray.*—(Javanus *Cuv.* Dekan *Temm.*) Malacca, Malayan Penin. and Archip., Tennasserim Provinces.
Heterocephalus glaber *Rupp.* Schoa, S. of Abyss.
Spalax Pallasii *Nordm.* Hungary, S. Russia, Ekaterinslov.
typhlus *Pall.* S.E. of Europe, Moldavia, Bessarabia, Greece, Syria.
Siphneus Aspalax *Brants.*—(Zokor *Desm.*) Mountains of Altai.
Ellobius luteus *Wagn.* Sandy district near the Sea of Aral.
talpinus *Fisch.* South and East of Russia, Northwards to 55° N.L. Common in the Crimea, and the Steppes of Astrachan.
Bathyerges suillus *Wagn.*— (maritimus *Gmel.*) Sand-hills near the Coast at the Cape of Good Hope.
Georychus albifrons *Gray.* Cape of Good Hope.
Capensis *Wiegm.*—(Buffoni *F. Cuv.*) Cape of G. Hope.
Damarensis *Ogilb.* Damara Land, S. Afr.
holosericeus *Wagn.* Cape of G. Hope.
Hottentottus *Less.*—(cœcutiens *Licht.* Ludwigii *Smith.*) Cape of G. Hope.
pallidus? *Gray.* E. Africa.
Heliophobius argenteocinereus *Peters.* Mosambique.

Saccomyinæ.

Geomys breviceps *Baird.* Texas, Louisiana.
bursarius *Shaw.*—(saccatus *Mitchell.* Canadensis *Licht.* Oregonensis *Lec.*) Missouri, Eastern Kansas and part of Nebraska, W. and S. Illinois, Iowa, W. Wisconsin, part of Minnesota, Canada.
Geomys castanops *Baird.* Bent's Fort, New Mexico.
Clarkii *Baird.* W. Texas.
hispidus *Lec.* Between Vera Cruz and the City Mexico.
Mexicanus *Brants.* Mexico.
Pinetis *Raf.*—(Floridana *Aud. and Bach.*) N. Amer., South-Eastern States, Florida, Georgia, Alabama, Missouri.
Quachil *Gray.* Coban, Central Amer.
Thomomys borealis *Rich.*—(Townsendii *Bach.* Douglasii *Rich.* fuliginosus *Schinz.*) Valleys of the Columbia River towards Rocky Mountains, Puget's Sound.
bulbivorus *Rich.* Coast of California, from Tejon Pass to some distance north of San Francisco.
fulvus *Woodh.* Valley of the Colorado and tributaries, from San Francisco Mountains to Fort Yuma, and across to San Diego.
laticeps *Baird.* Humboldt Bay, Northern California.
rufescens *Wied.*—(Bottæ *Eyd.*) Upper Missouri, Nebraska, and Saskatchewan.
talpoides *Rich.* Shores of Hudson's Bay.
umbrinus *Rich.* Western Texas and New Mexico, along eastern slope of Rocky Mountains, and along the mountains into Sonora.
Dipodomys agilis *Gambel.* California, Monterey, San Diego, Fort Yuma.
Hermanni *Lec.* Sierra Nevada.
Ordii *Woodh.*—(montanus? *Baird.*) New Mexico, Missouri, Texas, Sonora, Mexico.
Phillippi *Gray.*—(Macrocolus halticus *Wagn.**) S. California, Los Angelos, Monterey, Californ., Oregon.
Wagneri *Lec.*? North America, district doubtful.
Perognathus fasciatus *Wied.* Kansas, Chihuahua City, Mex.
hispidus *Baird.* Mexico, twenty-four leagues west of Matamoras.
monticola *Baird.* West of Rocky Mountains, St. Mary's.
penicillatus *Woodh.* San Francisco Mountains, New Mexico, Colorado River and Desert California, Fort Yuma.
Cricetodipus flavus *Baird.* Nebraska, Salt Lake, Utah, Rocky Mountains, 38°, Camaroon River, New Mexico, Texas, Sonora, Matamoras.
parvus *Peale.* King's River, Calif.
Saccomys anthophilus *F. Cuv.* Supposed to have come from N. America, from the unique specimen from which is was described, having a North American plant in its pouches.

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* Although Wagner expressly says that this species has no cheek-pouches, Baird finds it corresponds so exactly with D. Phillipii, in every thing else, that he thinks the cheek-pouches must have been overlooked, especially as Wagner mentions that his specimen was in alcohol. See Baird, op. cit. p. 409.

CRICETINÆ.

Saccostomus fuscus *Pet.* MOSAMB.
lapidarius *Pet.* MOSAMB.
Cricetomys Gambianus *Waterh.* SENEGAMBIA AND MOSAMB.
Cricetus accedula *Brants.* URAL MOUNTAINS, AND THE VOLGA.
arenarius *Pall.* SANDY STEPPES OF BARABA ON THE IRTISCH, ON THE WOLGA, URAL MOUNTAINS, CRIMEA.
auratus *Waterh.* ALEPPO.
frumentarius *Pall.*—(vulgaris *Desm.*) MIDDLE AND SOUTH GERMANY, POLAND, HUNGARY, MIDDLE SOUTH RUSSIA, AND SIBERIA TO THE RIVER OB.
furunculus *Pall.* DAURIA, AND ON THE OB, HIGH STEPPES OF MONGOLIA, VALLEY OF THE ONON, NORTH OF MONGOLIA.
fuscatus *Brandt?* Habitat not known.
nigricans *Brandt.* MOUNTAINS OF CAUCASUS, AND ABASIA.
phaeus *Pall.* STEPPES ON THE WOLGA AND CASPIAN SEA AS FAR AS INTO PERSIA.
Songarus *Pall.* SIBERIA ON THE IRTISCH, HIGH STEPPES OF MONGOLIA.
Cricetodon Gerardeanus Gerv. MARLS OF LIMAGNE.
Gergovianus? Gerv. MARLS OF LIMAGNE.
medium Gerv. TERTIARY BEDS, SANSANS.
minus Gerv. TERTIARY BEDS, SANSANS.
Sansanense Gerv. TERTIARY BEDS OF SANSANS, S. FRANCE.

SIGMODONTES.

Neotoma cinerea *Ord.*—(Drummondii *Rich.*) YELLOWSTONE RIV., NEBRASKA, FALLS OF THE MISSOURI.
ferruginea *Tomes.* GUATEMALA.
Floridana *Say and Ord.* S. ATLANTIC AND GULF STATES, FLORIDA, GEORGIA, NEW YORK, S. CAROLINA, up the MISSOURI RIVER, ARKANSAS.
fuscipes *Baird.* PETALUMA, CALIFORNIA, SANTA CLARA, CALIFORNIA.
magister Baird. CAVES OF PENNSYLVANIA.
Mexicana *Baird.*—(Floridana *Geoff.*) MEXICO, CHIHUAHUA, SONORA, PECOS, NEW MEXICO, COLORADO BOTTOM, SAN DIEGO, CALIF.
micropus *Baird.* SANTA ROSALIA, CHARCO ESCONDIDO, MEXICO.
occidentalis *Baird.*—(Drummondii *Aud. and Bach.*) WASHINGTON TERRITORY, OREGON TERR., STRAITS OF DE FUCA.
Sigmodon Berlandieri *Baird.* MEXICO, COAHUILA, N. LEON, TAMAULIPAS, SANTA ROSALIA, MATAMORAS, W. OF SAN ANTONIO, EASTERN TEXAS, RINGGOLD BARRACKS, LOS NOGALES, SONORA.
hispidum *Say and Ord.*—(hortensis and ferrugineus *Harl.*) S. CAROLINA, GEORGIA, FLORIDA.

Reithrodon.

(South American type)

chinchilloides *Waterh.* S. COAST of STRAITS OF MAGELLAN.
cuniculoides *Waterh.* PATAGONIAN COAST.
typicus *Waterh.* PATAGONIAN COAST.

Reithrodon

(North American type)

Carolinensis? *Aud. and Bach.* Swamps in the Maritime districts of N. CAROLINA.
humilis *Aud. and Bach.*—(Lecontei *Aud. and Bach.*) S. CAROLINA, GEORGIA, MISSOURI.
longicauda *Baird.* SAN FRANCISCO AND PETALUMA, CALIF.
megalotis *Baird.* SONORA.
mexicanus *Sauss.* MEXICO.
montanus *Baird.* ROCKY MOUNTAINS.

HESPEROMYINÆ.

Hesperomys austerus *Baird.* STEILACOOM, EASTERN PART OF WASHINGTON TERRITORY.
Aztecus *Sauss.* MEXICO.
Bairdii? *Hoy and Kennic.* PRAIRIES, ILLINOIS.
Boylii *Baird.* WASHINGTON TERRITORY, OREGON TERRITORY.
Californicus *Gambel.* ST. CLARA, CALIF.
campestris? *Lec.* NEW JERSEY.
cognatus *Lec.*—(polionotus *Wagn.*) N. CAROLINA, S. CAROLINA, MISSISSIPPI, GEORGIA.
eremicus *Baird.* FORT YUMA, AND COLORADO, CALIFORNIA.
fulvescens *Sauss.* MEXICO.
Gambellii *Baird.* WASHINGTON TERRITORY, OREGON TERRITORY, CALIFORNIA, PETALUMA, SAN FRANCISCO, MONTEREY, POSABRUK.
gossypinus *Lec.* GEORGIA, S. CAROLINA.
leucopus *Raf.*—(sylvaticus var. *Erxl.* agrarius *Godm.* Noveboracensis *Selys.* maniculatus? *Wagn.* Emmonsii *Dekay.*) HUDSON'S BAY, NOVA SCOTIA, MASSACHUSSETTS, CONNECTICUT, NEW YORK, PENNSYLV., VIRGINIA, MINNESOTA, WISCONSIN, ILLINOIS, OHIO, MISSOURI.
Mexicanus *Sauss.* MEXICO.
Michiganensis *Aud. and Bach.* Open woods near RACINE, WISCONSIN, MISSOURI.
myoides *Gapper.*— Hamster Mouse. (leucopus *Thomps.* gracilis *Lec.*) VERMONT, NEW YORK, MONTREAL, UPPER CANADA, LAKE SIMCOE.
Nuttallii *Harl.*—(aureolus *Aud. and Bach.*) PENNSYLVANIA, S. CAROLINA, MISSISSIPPI, TENNESSEE, MISSOURI, ILLINOIS, GEORGIA.
Sonoriensis *Lec.*—(leucopus? *Rich.*) UPPER MISSOURI, SONORA, TEXAS, NEW MEXICO, SASKATCHEWAN, ROCKY MOUNTAINS, BLACK HILLS, NEBRASKA, YELLOWSTONE.
Sumichrasti *Sauss.* East slope of MEXICAN CORDILLERA.
Texanus *Woodh.* TEXAS, NEW MEXICO.
Toltecus *Sauss.* CORDILLERA OF VERA CRUZ.
Myoxomys bicolor *Tomes.* GUATEMALA.
latimanus *Tomes.* GUATEMALA.
Salvinii *Tomes.* GUATEMALA.
Onychomys leucogaster *Wied.*—(Missouriensis *Aud. and Bach.*) NEBRASKA, MISSOURI RIVER.
Oryzomys palustris *Harlan.*—(orizivora *Aud. and Bach.*) S. CAROLINA, GEORGIA.

Calomys anguya *Wagn.*—(leucodactylus and concolor *Wagn.*) Paraguay and Brazil.
eliurus *Wagn.*—(longicaudus *Lund.* pygmæus *Wagn.*) Near Rio Janeiro, and Lagoa Santo.
expulsus *Gieb.*—(bimaculatus and gracilipes *Waterh.* masculipes *Pictet.*) Lagoa Santa.
flavescens *Waterh.* La Plata.
fuliginosus *Wagn.*—(caniventris *Wagn.*) St. Paulo.
lasiotis *Burm.* Lagoa Santa.
lasiurus *Burm.*—(cinnamomeus *Pict.*) Lagoa Santa.
laticeps *Burm.*—(cephalotes *Desm.* subflavus *Wagn.*) Lagoa Santa.
longicaudatus *Waterh.* Chili.
Magellanicus *Waterh.* Port Famine, in Straits of Magellan.
orobius *Wagn.*—(auritus *Pictet.* brachyurus *Wagn.*) Near Rio Janeiro.
pyrrhorhinus *Wagn.* Bahia.
typus *F. Cuv.*—(elegans *Waterh.* longitarsus *Rengg.* nigripes *Desm.*) Bahia Blanca, Buenos Ayres.

Habrothrix (including Phyllotis) arvicoloides *Wagn.*—(Renggeri *Pict.*) Near Rio Janeiro.
auritus *Wagn.*—(callosus *Rengg.* pyrrhogaster and Boliviensis *Waterh.*) Coast district between Rio Janeiro and Bahia.
Darwinii *Waterh.* Coquimbo in Chili.
Galapagoensis *Waterh.* Chatham Island, in the Galapago Archipelago.
griseo-flavus *Waterh.* Sandy Hills on the Rio Negro, N. Patagonia.
longipilus *Waterh.* Coquimbo in Chili.
micropus *Waterh.*—(obscurus and arenicola *Water.*) Santa Cruz in Patagonia.
nigrita *Licht.* — (canescens and xanthorhinus *Waterh.*) Rio Janeiro.
principalis Lund. Bone-caves in Brazil.
xanthopygus *Waterh.* Santa Cruz in Patagonia.

Oxymycterus (including Scapteromys) hispidus *Pictet.* Bahia.
nasutus *Waterh.* Maldonado on La Plata River.
Peruvianus? *Peale.* Peru.
rufus *Desm.*—(rostellatus *Wagn.* dasytrichos *Wied.* fossorius *Lund.*) Paraguay, and Coast District, near Rio Janeiro, Brazil.
tumidus *Waterh.*—(tomentosus *Licht.*) Maldonado, Uruguay.
scalops *Gay.* Chili.

Holochilus Brasiliensis *Waterh.*—(vulpinus *Licht.*) From the south of Brazil to the borders of Patagonia.
physodes *Wagn.*—(leucogaster *Brandt.* russatus *Wagn.* mystacalis and vulpinus *Lund.*) St. Paulo, South Brazil.
robustus *Burm.*—(Brasiliensis *Pictet.*) Bahia.
squamipes *Burm.*—(sciureus *Wagn.* anguya *Brandt.* canellinus *Wagn.*) St. Francisco and St. Paulo, S. Brazil.

Akodon Boliviense *Meyer.* Table-lands of Peru, 14,000 feet above the sea.

Drymomys parvulus *Tschudi.* Peru.

Murinæ.

Mus Abotti *Waterh.* Asia.
Abyssinicus *Rupp.* Abyss.
æquicaudatus? *Hodg.* Nepal.
agrarius *Pall.* Germany and Middle Russia to Siberia.
albipes *Rupp.*—(fuscirostris *Wagn.*) Abyss., and Nubia.
albo-cinereus *Gould.* W. Australia.
Allani *Waterh.* Fernando Po.
Andamensis *Blyth.* Andaman Islands.
Algiricus *Pomel.* Algeria.
arboreus *Peters.* Mosamb.
argenteus *Temm.* Japan.
Asiaticus? *Gray.* India.
assimilis *Gould.* New S. Wales, King George's Sound, West Australia?
badius *Blyth.* Valley of the Sitang.
barbarus *Linn.* Algeria.
castaneus? *Waterh.* Australia.
chamæropsis *Levaill.* Algerian Sahara.
colonus *Licht.* Algoa Bay.
concolor *Blyth.* Upper and Lower Burma, Malayan Peninsula.
Caraco *Pall.* Eastern Siberia, and China.
cervicolor *Hodg.*—(strophiatus *Hodg.* albidiventris *Blyth.*) Nepal, Lower Bengal, S. Malabar?
cervinipes *Gould.* Brushes of the eastern part of New S. Wales.
cinnamomeus? *Blyth.* Lower Pegu and Martaban.
cunicularis *Blyth.* Khasia Hills.
Darjilingensis *Hodg.* Nepal.
decumanus *Pallas.*—(norvegicus *Briss.* brunneus *Hodg.* decumanoides *Hodg.* brunneusculus *Hodg.?*) Spread over whole the world, wherever commerce has reached.
Do. var. Hibernius *Thoms.* Ireland.
Do. var. Javanicus *Herm.* Java, Sumatra.
Do. var. maurus *Waterh.* Maldonado, Mouth of La Plata.
delicatulus *Gould.* Port Essington.
dolichurus *Smuts.* Cape of Good Hope.
Dombeensis *Rüpp.* Abyss.
dorsalis *Smith.* S. Africa.
Ellioti *Gray.*—(infralineatus *Elliot and Blyth.*) S. India.
erythrotis *Blyth.* Khasia Hills.
fallax *Peters.* Mosamb.
fulvidiventris *Blyth.* Ceylon, Trincomalee.
gentilis *Brants.* Egypt and Nubia.
gerbillinus *Blyth.*—(Theobaldii and Bactrianus? *Blyth.*) Alpine Punjab, Affghanistan, Kandahar.
Gerardianus Gerv. Indusial Chalk in the Department of Allier, France.
giganteus *Hardw.*—(Malabaricus, and perchal *Shaw.* nemorivagus *Hodg.*) The Bandicoot. Coromandel, Mysore, Bengal, Nepal, introduced into Van Dieman's Land.
Gouldii *Waterh.*—(fuscipes *Waterh.* Greyii and lutreola *Gray.*) Interior of New South Wales, W. Australia, and probably intermediate parts.
gliroides *Blyth.* Khasia Hills.
Hardwickii *Gray.* India.

Mus Hayi *Waterh.* Morocco.
homourus *Hodg.* Sub-Himmalayan Region.
horeites *Hodg.* Nepal.
hortulanus *Nordm.* In Botanic Garden, Odessa.
Hovelli ? *Gray.* Australia.
hydrophilus *Hodg.* Margins of ponds, Nepal.
imberbis *Rupp.* Abyssinia.
Jerdoni *Blyth.* Sikkim.
kok *Gray.*—(Indicus *Gray.* providens *Elliot.* Huttonii *Blyth.* Griffithii *Horsf.* pyctoris *Hodg.* dubius *Kelaart.*) India.
lehocla *Smith.* S. Africa.
lepidus *Elliot.*—(booduga *Gray.*) S. India.
leucosternum *Rüpp.*—(limbatus and maculatus *Wagn.*) Senaar, Abyss.
lineatus *F. Cuv.*—(pumilio *Brants.* vittatus *Schreb.*) Cape of Good Hope.
lineolatus *Gould.*—(gracilicaudatus *Gould.*) N. S. Wales.
longipilis *Gould.* Banks of Victoria River.
macropus *Hodg.* Nepal.
manicatus *Gould.* Port Essington.
maurus *Gray.* Cameroon Mountains.
meltada ? *Gray ?* India ?
microdon *Peters.* Mosamb.
minimus *Peters.* Mosamb.
minutoides *S. Long.* Cape of Good Hope.
minutus *Pall.*—(messorius *Shaw.* soricinus, parvulus, and pendulinus *Herm.* arenarius *Wolf.* campestris *F. Cuv.* pratensis *Ockshay.* Wagneri *Evers.* agilis *Dehne.*) Mid. Europe, to Siberia, England, France, Germany, etc.
molossinus *Temm.* Japan.
modestus *Wagn.* Cape of Good Hope.
muscardinus *Wagn.* Cape of Good Hope.
musculus *Linn.*—(brevirostris *Waterh.* islandicus *Thien.* Adelaidensis *Gray.*) House Mouse. Nearly cosmopolitan, (not in India.)
myothrix *Hodg.* Nepal.
nanus *Gould.* Interior of West Australia.
Natalensis *Smith.* S. Africa.
nemoralis *Blyth.* Bengal, Ceylon.
nitidulus *Blyth.* Valley of the Sitang, Burma.
nitidus *Hodg.* Nepal.
Novæ Hollandiæ *Waterh.* New South Wales.
Novaræ *Fitzinger.* Nicobar Islands.
oleraceus *Benn.*—(dumeticola and Povensis *Hodg.*) Deccan Plains of India.
orientalis *Cretz.* Whole north of Africa.
Palmarum *Fitzinger.* Nicobar Islands.
Peguensis *Blyth.* Valley of the Sitang, Burma.
platythrix *Benn.* S. India.
platurus ? *Gray.* Australia.
prætextus *Licht.* Arabia and Syria.
pulchellus—(Golunda *Gray.*) E. Africa.
rattus *Linn.* Spread over all Europe, established in Persia, India, Africa, N. America, S. America.
var. Jacobiæ *Waterh.* James Island, Galapagos.
var. insularis *Waterh.* Ascension Island.
var. rattoides *Hodg.* Nepal.
robustulus *Blyth.*—(flavescens *Blyth.* Berdmorei *Blyth.*) Common House-Rat of Rangoon and Moulmein. Lower Pegu.
Mus rufescens *Gray.*—(flavescens and rufus *Elliot.* arboreus *Horsf.* Kandianus, montanus, and tetragonurus *Kelaart.* caudatior, and niviventer *Hodg.*) India generally, and Ceylon.
setifer *Horsf.* Java, Borneo, Sumatra.
silaceus *Wagn.* Cape of Good Hope.
sordidus *Gould.* Darling Downs, New South Wales.
speciosus *Temm.* Japan.
spinulosus ? *Blyth.* Punjab, Malabar.
sylvaticus *Linn.*—(flavicollis *Melchior.*) All Europe, and part of Siberia.
Do. Fossil in the Bone Breccia of Corsica.
Tanezumi *Temm.* Japan.
tectorum *Javi.*—(Alexandrinus *Geoff.* flaviventris *Brants.* setosus *Linn.* latipes *Benn.*) Egypt, Nubia, west coast of Arabia, introduced into Italy, into N. America, and Brazil.
terricolor *Blyth.* Lower Bengal, S. India.
urbanus *Hodg.*—(musculus *Elliot.* dubius *Hodg.* Manei *Gray.*) House Mouse of plains of India.
variegatus *Licht.*—(discolor *Wagn.* Niloticus *Geoff.* testicularis *Sundev.*) Arabia, Egypt, Nubia, Abyss., Bahr el Abiad.
sp. fide Lart. Fossil in the freshwater deposits of Sansans.
sp. fide Lart. Fossil in the freshwater deposits of Sansans.
sp. fide Lart. Fossil in the freshwater deposits of Sansans.
sp. fide Pomel. Fossil. Clermont.
sp. fide Pomel. Fossil. Clermont.
Steatomys edulis *Peters.* Mosamb.
Krebsii *Peters.* South Africa.
Pseudomys australis *Gray.* Sandy Hills, New South Wales.
Dendromys melanotis *Smith.* Cape of Good Hope.
mesomelas *Lichi.*—(typicus *Smith.* pumilio *Wagn.*) Cape of Good Hope.
Micromys Aniciensis Aym. Freshwater Marl, Ronzon.
Aymardi Geoff. Freshwater Marl, Ronzon.
minutus Aym. Freshwater Marl, Ronzon.
ornatus v. Meyer. Tertiary deposits of Weisenau.
Lithomys parvidens v. Meyer. fossil. Tertiary deposits of Weisenau.

Sminthinæ.

Acomys cahirinus *Geoff.* Egypt.
dimidiatus *Rüpp.*—(megalotis *Licht.* hispidus *Brants.*) Arabia Petræa, Egypt, Nubia.
perchal *Shaw.* India.
platythrix *Benn.* Dekkan.
russatus *Wagn.* Sinai.
spinosissimus *Peters.* Mosamb.
Sminthus subtilis *Brandt.* From Sweden eastwards to the River Jenisei, and southwards to the Ischim Steppe in Asiatic Russia.
var. betulinus *Nilss.* Siberian Steppes,
var. loriger *Nath.*—(Nordmanni *Keys.* lineatus *Licht.*) Crimea, and Bucharest.
var. vagus *Wagn.* Spread from the Ural Mountains to the Jenisei over the frozen steppes.

Phlœomys Cummingii *Waterh.* Luzon, Philippine Islands.
Hydromys chrysogaster *Geoff.*—(apicalis *Kuhl.*) New South Wales, and Van Dieman's Land.
fuliginosus *Gould.* King George's Sound, and waters near Perth, S.W. Australia.
fulvolavatus *Gould.* Borders of River Murray, and Lake Albert.
leucogaster *Geoff.* Banks of Rivers Hunter and Clarence, New South Wales.
lutrilla *McLeay.* Elizabeth Bay, New South Wales.

Merionides.

Meriones Africanus *F. Cuv.*—(Schlegeli *Smuts.* afer *Gray.* sericeus *Temm.*) S. Africa.
auricularis? *Smith.* S. Africa.
binotatus? *Licht.*
brevicaudatus? *F. Cuv.* S. Africa?
Burtoni *F. Cuv.* Darfur.
caffer? *Licht.* S. Africa.
campestris *Le Vaill.* Sahara.
Cuvieri *Waterh.* India.
Gerbii *Loche.* Sahara.
Indicus *Hardw.* Hindostan.
lacernatus *Rupp.* Abyss.
leucogaster *Peters.* Mozamb.
melanurus *Rüpp.*—(Lybicus *Licht.*) Sandy districts in N. Africa and Arabia Petræa, Sahara, Aïn Oösera, and Aïn el Ibel.
meridianus *Licht.*—(longipes *Pall.* fulvus *Evers.*) Steppes about the Caspian Sea.
minutus *Blainv.* Sahara.
montanus *Wagn.* S. Africa, north of the Orange River.
myosurus *Wagn.* Syria.
obesus *Rüpp.* Alexandria.
opimus *Licht.*—(Tamariscinus *Evers.* pallidus *Wagn.* crassus *Sund.*) S.E. Russia.
otarius? *F. Cuv.* East Indies.
pygargus *F. Cuv.*—Aegyptius *F. Cuv.* gerbillus *Rüpp.* venustus *Sund.* longicaudus *Wagn.* dasyurus *Wagn.*) Senegal, Egypt, Nubia.
pyramidum *F. Cuv.*—(murinus *Sund.*) Egypt.
robustus *Rüpp.* Kordofan.
rufescens? *Licht.*
Schousbœii *Loche.* Sahara.
Shawi *Duv.*—(robustus *Wagn.*) Algeria, Sahara.
Selysii *Pomel.* Sahara.
tæniurus *Wagn.* Syria.
tamaricinus *Kuhl.* Low and flat lands near the Caspian Sea.
tenuis *Smith.* S. Africa.
Mystromys albicaudatus *Smith.* S. Africa, north of the Orange River.
lanuginosus *Licht.*—(albipes *Wagn.*) Caffraria.
typicus *Smith.* Cape of Good Hope.
Otomys bisulcatus *Cuv.*—(irrorata *Licht.*) Extreme south of Africa.
Brantsii *Smith.* Near the mouth of the Orange River.
Otomys rufifrons *Rüpp.*—(pallida *Wagn.*) Cape of Good Hope.
unisulcatus *Cuv.* Cape of Good Hope.
Hapalotis albipes *Licht.*—(constructor *Ogilb.*) New South Wales, Victoria, and South Australia.
apicalis *Gould.* Van Dieman's Land? South Australia.
arboricola *McLeay.* Elizabeth Bay, New South Wales.
cervinus *Gould.* Interior of S. Australia.
conditor *Gould.* Interior of New South Wales and Victoria.
hemileucura *Gray.* Interior of north-east provinces of Australia.
hirsutus *Gould.* Port Essington, North Australia.
longicaudatus *Gould.* Interior of W. Australia.
Mitchellii *Ogilby.*—(Gouldii *Gray.*) West and South Australia.
murinus *Gould.* Interior of New South Wales, and Victoria.
penicillatus *Gould.*—(melanura *Gray.*) North Australia.

Dipodinæ.

Dipus Ægyptius *Licht.*—(bipes *Licht.* Gerboa *Oliv.* Mauritanicus *Duv.*) North Arabia, Lower Egypt, Tripolis, southern portions of the Sahara.
Deserti *Loche.* Waregli, in the Desert of Sahara.
hirtipes *Licht.*—(macrotarsus *Wagn.*) Upper Nile, and west coast of Arabia.
Jerboa *Desm.* North Africa.
lagopus *Licht.* Steppes of the Aral Sea.
sagitta *Schreb.* Steppes between the Don and the Wolga, the southern Steppes about Irtisch, the whole of Zongarea and Mongolia, and on both sides of the Baikal range.
telum *Licht.* The Kirghisian Steppes, and eastern shores of the Caspian Sea.
Alactaga acontion *Pall.*—(pygmæus *Illig.* Indica *Gray.* Bactriana *Blyth.* saltator *Evers.*) Kirghis Steppes.
arundinis *Cuv.* Barbary, Sahara.
aulacotis? *Wagn.* West coast of Arabia.
elater *Licht.* Kirghis Steppes.
haltica *Illig.*—(brachyurus *Blainv.*) Kirghis Steppes, and Siberia.
jaculus *Pall.*—(spiculum *Licht.* decumanus *Wagn.* vexillarius *Evers.*) Crimea, Steppes between the Don and Donau to Great Tartary, north-west of the Altai Mountains, from Barnaal to the Ob, southern slope of the Urals.
platyurus *Licht.* Near the River Kuwar, Darja, near the Aral Sea.
tetradactylus *Brandt.*—(Abyssinicus *Meyer.*) Libyan Desert.
Jaculus Hudsonius *Zimm.*—(longipes *Zimm.* Canadensis *Shaw.* Americanus *Barton.* Labradorius *Harlan.* microcephalus *Harl.* nemoralis *Geoff.* Acadicus *Daws.*) From the Atlantic to the Pacific across the northern half of N. America, Canada, Slave Lake, Nova Scotia,

Massachusetts, Vermont, Connecticut, New York, Long Island, New Jersey, Philadelphia, Pennsylvania, Wisconsin, Illinois, Missouri, Nebraska, Washington Territory, Oregon Territory, California, Rocky Mountains, 38° Lat.

Pedetes Caffer *Illig.*— (Capensis *Desm.*) Cape of Good Hope.

MARSUPIALIA.

Entomophaga.

Antechini.

Antechinus albipes *Waterh.* S. Australia, W. Australia, and Van Dieman's Land.
- apicalis *Gray.* W. Australia, Swan River.
- fuliginosus *Gould.* W. Australia.
- crassicaudatus *Gould.* West and South Australia.
- ferruginifrons *Gould.* New South Wales.
- flavipes *Waterh.* — (rufogaster *Gray.* Stewartii *M'Lell.*) New South Wales, and South Australia.
- leucogaster *Gray.* King George's Sound.
- leucopus *Gray.* Van Dieman's Land.
- macroura *Gould.* New South Wales.
- maculatus *Gould.* Queensland.
- melas *Müll.* New Guinea.
- minimus *Temm.*—(affinis *Gray.*) Tasmania.
- minutissimus *Gould.* Queensland.
- murinus *Waterh.* New South Wales.
- Swainsonii *Waterh.* Van Dieman's Land.
- unicolor *Gould.* New South Wales.

Phascogales.

Phascogale calura *Gould.* W. Australia.
- lanigera *Gould.* Interior of New S. Wales.
- penicillata *Shaw.* New S. Wales, S. Australia, and W. Australia.

Sarcophaga.

Dasyurus Geoffroyi *Gould.* Western Australia, S. Australia, and New South Wales.
- hallucatus *Gould.* Port Essington, North Australia.
- *laniarius* Owen. fossil. Caves of Wellington Valley.
- maculatus *Shaw.*—(macrourus *Geoff.*) Van Dieman's Land.
- ursinus *Harris.* Van Dieman's Land.
- viverrinus *Shaw.*—(Maugei *Geoff.* Topoa tafa *White.*) New South Wales and Van Dieman's Land.

Thylacinus cynocephalus *Harris.*—(Harrisii *Temm.*) Van Dieman's Land.
- *spelæus* Owen. Caves Wellington Valley.

Didelphides.

Hyracodon fuliginosus *Tomes.* Ecuador.

Didelphys affinis *Wagn.* Brazil.
- *affinis* Gerv. Lignite near Apt.
- agilis *Burm.*—(elegans *Lund.*) Minas Geraes.
- albiventris *Lund.* Brazil.
- *Do. Fossil, fide* Lund. In Bone-caves, Brazil.
- *Arvernensis* Croiz. Freshwater limestone of Issoire in Auvergne.
- Azaræ *Temm.*—(aurita *Wied.* leucotis *Wagn.*) Brazil, Paraguay, Bolivia.
- *Do. Fossil, fide* Lund. In Bone-caves, Brazil.
- *Bertrandi ?* Gerv.—(*elegans* Aym.) Freshwater marl of Ronzon.
- *Blainvillei* Croiz.—(*antiqua* Blainv.) Freshwater limestone of Issoire.
- brachyura *Schreb.*—(Hunteri *Waterh.*) Guiana and Brazil, and south as far as River Plata.
- Californica *Benn.*—(breviceps *Benn.* pruinosa *Wagn.*) California adjoining Mexico.
- cancrivora *Gmel.*—(marsupialis *Gmel.*) Northern parts of S. America, Guiana.
- cinerea *Temm.* Brazil.
- *Colchesteri* Owen. Eocene sand of Kingston near London.
- *crassa ?* Aym. Freshwater marl of Ronzon.
- crassicaudata *Desm.*—(mustelina *Geoff.*) Brazil, Paraguay, and as far south as River Plata.
- *Cuvieri* Fisch. Eocene Tertiary, Paris Basin.
- Derbiana *Waterh.*—(ornata *Tschudi.*) Peru.
- dichura *Wagn.* Brazil.
- domestica *Wagn.* Cuyaba, Brazil.
- dorsigera *Linn.* Surinam.
- elegans *Waterh.*— (hortensis *Reid.*) Throughout Chili, as far north as Cobija, and south as Curico.
- *Do. Fossil, fide* Lund. In Bone-caves, Brazil.
- grisea *Desm.* Paraguay.
- glirina *Wagn.* Mamoré, Brazil.
- incana *Lund.* Brazil, Province of Minas Geraes.
- *Do. Fossil, fide* Lund. In Bone-caves, Brazil.
- impavida *Tschudi.* Peru.
- lanigera *Desm.* Paraguay.
- *Laurillardii* Gerv. Eocene. Paris Gypsum.
- macrotarsis *Wagn.* Brazil.
- microtarsis *Wagn.* Brazil.
- *minuta* Aym. Freshwater marl of Ronzon.
- murina *Linn.* Guiana, Brazil, Peru, Mexico.
- musculus *Schomb.* British Guiana.
- noctivaga *Tschudi.* Peru.
- nudicaudata *Desm.*—(myosurus *Temm.*) Brazil and Guiana.
- *Do. fide* Lund. Fossil in Bone-caves, Brazil.
- ochropus ? *Wagn.* Brazil.
- opossum *Linn.* Guiana and Brazil.
- *parva* Gerv.—(*antiqua* Gerv.) Lignite at Apt.
- Philander *Linn.*—(cayopollin *Desm.*) North of S. America, Surinam, Brazil.

Didelphys pœcilotis *Wagn.* Brazil, Agaba.
pusilla *Desm.* Paraguay.
Do. Fossil, fide Lund. In Bone-caves, Brazil.
Quica *Temm.* Brazil, Guiana, and Surinam.
tricolor *Desm.*—(brachyura *Pall.*) Guiana.
tristriata *Kuhl.*—(Brasiliensis *Erxl.*) Brazil
unistrata *Wagn.* Ylarare, Brazil.
velutina *Wagn.* Ypanema, Brazil.
Virginiana *Wagn.* N. America.
Waterhousei *Tomes.* Gualaquiza, Ecuador.
Phascalotherium Bucklandi Owen. Lower Oolite, England.
Chironectes variegatus *Illig.*—(minima *Zimm.* Sarcovienna *Shaw.* Yapock *Desm.* palmata *Fisch.*) Guiana and Brazil.

Phalangistidæ.

Dromicia concinna *Gould.* Swan River District, Western and South Australia.
Neillii *Waterh.* King George's Sound.
unicolor *Krefft.* New South Wales.
nana *Desm.*— (gliriformis *Bell.*) Van Dieman's Land.
Phalangista canina *Ogilb.* Interior of New South Wales.
Cookii *Desm.*—(Bougainvillei *Wagn.* Banksii *Gray.*) New South Wales.
lanuginosa *Gould.* New South Wales.
vulpina *Shaw.*—(felina and melanura *Wagn.* fuliginosa *Ogilb.* Cuvieri *Gray.*) New South Wales, Western Australia, N. Australia.
viverrina *Ogilb.* Van Dieman's Land, and Western Australia.
xanthopus *Ogilb.* Glenelg River, Australia.
Cuscus brevicaudatus *Gould.*—(nudicaudatus *Gould.*) Cape York District.
Celebensis *Gray.*—(chrysorrhos *Temm.*) Celebes, New Guiana.
maculatus *Desm.*— (macrourus *Less.*) Banda, Molucca, Waygeroo, New Guinea.
orientalis *Pall.*—(rufa and alba *Geoff.* Papuensis *Quoy.* Quoyii *Quoy and Gaim.* Amboynensis *Lacep.* cavifrons *Temm.*) Aru, Amboyna, Banda, Timor and New Ireland, Waygeroo.
ursinus *Temm.* Celebes.
Dactylopsila trivirgata *Gray.* New Guinea.
Myoictis Wallacei *Gray.* New Guinea.
Phascalarctos cinereus *Goldf.*—(fuscus *Desm.* Flindersii *Less.*) New South Wales.

Volitantia.

Petaurus ariel *Gould.* N. Australia, Port Essington.
australis *Shaw.*—(macroura *Shaw.* flaviventer *Desm.*) New South Wales.
breviceps *Waterh.* New South Wales.
notatus *Gould.* Victoria.
pygmæus (Acrobata) *Shaw.* New South Wales.
sciureus *Shaw.* New South Wales.
taguanoides *Desm.*— (Peronii *Desm.*) New South Wales.

Rhizophaga.

Phascolomys *Mitchellii* Owen. Wellington Valley Caves.
lasiorhinus *Gould.* Victoria and S. Australia.
latifrons *Owen.* S. Australia.
niger *Gould.* S Australia.
Wombat *Peron and Less.*—(fossor *Sevast.* Wombatus *Leach.* fusca *Desm.* Bassii *Less.* ursinus *Gray.*) New South Wales, S. Australia, Van Dieman's Land, and some of the islands in Bass's Straits.
Diprotodon Australe Owen. Wellington Valley, Condamine River, Melbourne.
Nototherium inerme Owen. Condamine River.
Mitchellii Owen. Bed of Condamine River.

Poephaga.

Dendrolagus inustus *Müll.* New Guinea.
ursinus *Müll.* New Guinea.
sp. N. Australia.
Macropus *affinis* Owen. Newer tertiary deposits, Condamine River, west of Moreton Bay.
agilis *Gould.*—(Binoei *Gould.*) N. Australia.
antilopinus *Gould.* N. Australia.
atlas Owen. Newer tertiary deposits Condamine River, west of Moreton Bay, and Wellington Valley, Bone-caves.
Bennettii *Gould.* Van Dieman's Land.
Billardieri *Desm.*—(rufiventer *Ogilb.* Tasmanei *Gray.* brachytarsus *Wagn.*) Van Dieman's Land.
brachyotus *Gould.* North-west coast of Australia.
brachyurus *Quoy and Gaim.*—(brevicaudatus *Gray.*) King George's Sound, Augusta, W. Australia.
Brunii (Dorcopsis) *Schreb.*—(cascalica *Pall.* veterum *Less.*) The Filander. Aru Island.
concinnus *Gould.* North-west coast of Australia.
conspicillatus *Gould.* Barrow Island, North-west coast of Australia.
dama *Gould.* Houtman's Abrolhos, W. Australia.
Derbianus *Gray.*—(Houtmanni *Gould.*) W. and S. W. Australia, Houtman's Abrolhos, N. Australia.
dorsalis *Gray.* New South Wales.
Eugenii *Desm.*—(dama and gracilis *Gould.*) Moore's River, Wangan Swamps, W. Australia.
fasciatus *Peron and Less.*— (elegans *Cuv.* albipilis *Gould.*) W. Australia.
frænatus *Gould.* Near New South Wales, Brezi on the River Mokai, and thence into the interior.
fuliginosus *Desm.* Kangaroo Isles.
giganteus *Schreb.*—(major *Shaw.* labiatus *Desm.* griseo-fuscus *Goldf.* ocydromus *Gould.* melanops *Gould.*) New South Wales, S. and W. Australia, Van Dieman's Land.
Goliath Owen. Darling Downs.
gracilis *Gould.* Scrubs interior of W. Australia.
Greyi *Gray.* South Australia.
gymnotus? *Blyth.* Australia.
hirsutus *Gould.* W. Australia.
inornatus *Gould.* North coast of Australia.
irma *Jourd.*—(manicatus *Gould.*) W. Australia.

Macropus isabellinus *Gould.* W. Australia.
lateralis *Gould.* Swan River District, W. Australia.
Leichardti *Gould.* Country bordering the Gulf of Carpentaria.
leporoides *Gould.* S. Australia.
lunatus *Gould.* Swan River District, W. Australia.
manicatus *Gould.* W. Australia.
melanops *Gould.* S. and W. Australia.
ocydromus *Gould.* New South Wales.
parma *Gould.* New South Wales.
Parryi *Bennett.*—(elegans *Lamb.*) New South Wales.
penicillatus *Gould.*—(albogularis? *Jourd.*) New S. Wales.
robustus *Gould.* Mountain-ranges of interior of New South Wales.
ruficollis *Desm.*—(elegans and ualabatus *Gray.* rufogriseus *Desm.* griseo-rufus *Goldf.* leptonyx *Wagn.* Bennettii. *Waterh.* fruticus *Ogilb.*) New S. Wales, and King's Island.
rufus *Desm.*—(laniger *Gaim.*) Murrumbidge and Darling, probably the whole great basin in the interior, of Australia.
stigmaticus *Gould.* N. E. of Australia.
Thetidis *F. Cuv.*—(Eugenii *Gray.* nuchalis *Wagn.*) Brushes of New South Wales.
Titan Owen. Newer tertiary deposits at Condamine River, Wellington Valley Caves.
ualabatus *Less.*—(Brunii *Desm.* Lessonii *Gray.* nemoralis *Wagn.*) New South Wales.
unguifer *Gould.* North-west coast of Australia.
xanthopus *Gould.* S. Australia.
Hypsiprymnus apicalis *Gould.* Van Dieman's Land.
campestris *Gould.* South Australia.
cuniculus *Ogilb.*—(setosa *Gray.*) Van Dieman's Land.
Gaimardi *Desm.*—(Whitei and lepturus *Quoy and Gaim.* Philippi and formosus *Ogilb.* minor *Cuv.*) New South Wales, and South Australia.
Gilbertii *Gould.*—(micropus *Waterh.*) King George's Sound.
Graii *Gould.*—(Leseurii *Quoy and Gaim.*) W. and S. Australia.
murinus *Illig.*—(minor *Shaw.* setosus *Ogilb.* Peronii *Quoy and Gaim.*) New South Wales.
Ogilbyi *Gould.*—(Gouldii *Gray.*) New South Wales.
penicillatus *Waterh.*—(albus and lepturus *Quoy and Gaim.* minor *Cuv.*) New South Wales.
platyops *Gould.* W. Australia.
rufescens *Gray.*—(melanotus *Gould.*) New S. Wales.
spelæus Owen. Wellington Valley Caves.

Peramelidæ.

Perameles Bougainvillei *Quoy and Gaim.* Peron's Peninsula, Shark Bay, W. Australia.
Doreyanus *Quoy and Gaim.* New Guinea.
fasciata *Gray.* Liverpool Plains, and S. Australia.
Perameles Gunnii *Gray.* Van Dieman's Land.
macroura *Gould.* N. Australia.
myosuros *Wagn.*—(arenaria *Gould.*) Swan River District, W. Australia, King George's Sound.
nasuta *Geoff.*—(aurita *Paris Mus.* Lawsonii *Quoy and Gaim.*) New South Wales.
obesula *Shaw.*—(fusciventer and affinis *Gray.*) New South Wales, S. and W. Australia, and Van Dieman's Land.
Peragalea lagotis *Reid.* Swan River District, S. W. Australia.
Chœropus Castanotis *Gray.*—(ecaudatus *Ogilb.*) Interior of New South Wales, South Australia, West Australia.

Stereognathidæ.

Stereognathus soliticus Owen. Stonesfield, Oolitic slate.
Pliolophus vulpicops Owen. London Clay.

Linguales.

Tarsipes rostratus *Gerv. and Verr.*—(Spenserae *Gray.*) West. Australia.
Myrmecobius fasciatus *Waterh.*—(Dimenensis *Gray.*) Near Perth, Swan River District, Murray Scrubs between W. Australia and S. Australia.

Microlestidæ.

Thylacotherium (*Amphilestes*) *Broderipii* Owen. Stonesfield Oolitic slates near Cheltenham.
(*Amphitherium*) *Prevostii* Owen. Oolitic slates, Stonesfield.
Microlestes antiquus Plein. Trias, Germany and Eng.
Spalacotherium tricuspidens Owen. Purbeck beds.
Plagiaulax Becclesii Falc. Purbeck beds.
minor Falc. Purbeck beds.
Triconodon mordax Owen. Purbeck beds.
Dromatherium sylvestre Emmons. Triassic or Liassic coal-beds America.
Galethylax Blainvillei Gerv. Eocene beds, Paris Gypsum.
Spalacodon sp. Eocene Headon beds, Hampshire.

MONOTREMATA.

Echidna hystrix *Cuv.*—(aculeata *Schreb.* longiaculeata *Tied.*) New South Wales, Islands in Bass's Straits, Victoria, S. Australia, W. Australia.
setosa *Cuv.*—(breviaculeata *Tiedm.*) Van Dieman's Land.
Ornithorhynchus anatinus *Shaw.*—(paradoxus *Blum.* fuscus and rufus *Peron.* brevirostris *Ogilb.* crispus and lævis *M'Gillvray.*) New South Wales, Van Dieman's Land, Victoria, South Australia.

IV. Mammals of Special Districts.

Note.—The chief purpose of the following Lists is to show the general character of the Fauna of the different districts, not to supply a minute or exhaustive enumeration of their species. Wherever, therefore, I have found a special Fauna already made out for a district by any naturalist or traveller of eminence, I have not thought it necessary to take much pains to make it more perfect, unless when characteristic species were omitted; neither have I attempted to make the arrangement or the nomenclature of these Faunas correspond with each other or my own list. A reference to the Synonymes in that list will easily extricate any discrepancy in the names, and I have thought that I could employ the time which would have been required for reconciling these, more profitably both for the reader and myself.

To save space the authorities for the names are not given here unless in special cases. The reader is referred for them to the preceding Synonymic List.

SPITZBERGEN.

Picked out from a paper by Malmgren, in Wiegman's "Archiv." 1864.

Ursus maritimus
Mustela erminea?
Canis lagopus
Odobænus rosmarus
Cystophora cristata
Halichærus grypus
Phoca barbata
Grœnlandica
hispida (annellata)
Cervus tarandus
Delphinapterus leucas
Monodon monoceros
Chænocetus rostratus (Hyperoodon rostratus)

Not found there according to Malmgren:

Phoca vitulina
Balænoptera gigas
rostrata
Balæna mysticetus

NOVA ZEMBLA.

From K. E. Von Baer's Acc. in Wiegman's "Archiv," 1839, Part II.

Canis lupus
Canis vulpes lagopus var.
Ursus maritimus
Myodus Grœnlandicus
Myodus sp.
A little white mammal, species uncertain. (Ermine? Lemming?)
Cervus tarandus
Trichechus rosmarus
Phoca barbata
Grœnlandica
hispida
Cystophora borealis
Balænoptera, sp.
Delphinus leucas
Orcas
phocæna
Monodon monoceros

NORTH GEORGIAN ISLANDS, in Lat. 75°.

Ursus maritimus
Gulo luscus
Mustela erminea
Canis lupus
lagopus
Lemmus Hudsonius
Lepus glacialis
Bos moschatus } Summer
Cervus tarandus } visitants.

GREENLAND.

Chief authority, Otho Fabricius, "Fauna Grœnlandica," 1780.

Homo Grœnlandicus
Trichechus rosmarus
manatus. Islands Auvodejak.
Phoca ursina
leonina
vitulina
Grœnlandica
fœtida
Phoca barbata
Canis familiaris
lagopus
Mustela gulo
Ursus maritimus
luscus
Lepus glacialis
Myodes Hudsonius
Cervus tarandus, var. arcticus
Monodon monoceros
spurius
Balæna mysticetus
physalus
boops
musculus
rostrata
Physeter macrocephalus
catodon (tursio)
microps
Delphinus orca
phocæna
delphis
tursio
albicans (leucas)

Note.—Fabricius includes Bos grunniens from mutilated remains on ice, but this is obviously a mistake for a Musk-ox.

ICELAND.

From Sir George Mackenzie's "Travels in Iceland," 1811; Olafsen's and Povelsen's "Iceland," and Henderson's "Residence in Iceland."

Ursus maritimus (occasional visitant)
Felis domestica (introduced)
Canis familiaris (introduced)
Vulpes lagopus, var. fuliginosus
Mus decumanus, vel rattus (introduced)
musculus (introduced)
sylvaticus *
Cervus tarandus (introduced)
Capra hircus (introduced)
Ovis aries (introduced)
Bos taurus (introduced)
Equus caballus (introduced)
Sus scrofa (introduced)
Phoca vitulina
leporina
Phoca barbata
Grœnlandica
Balæna mysticetus
physalus
Delphinus bidens ?

FAROE.

From list furnished by Professor Heddle of St. Andrews.

Lutra vulgaris ?
Canis familiaris
Felis domestica
Phoca vitulina
barbata
Mus musculus
rattus
Bos taurus
Ovis aries
Equus caballus
Sus scrofa
Delphinus phocæna
orca
Delphinus deductor
albicans
Balæna mysticetus
musculus

SHETLAND.

From Professor Heddle's list.

Probably all the species found in Orkney, with the following additions and exceptions:—

Additions.—Mustela vulgaris Manatus? Monodon monoceros Balæna physalus

Exceptions.—There are no Deer nor Water-rats in Shetland, and probably no Bats.

ORKNEY.

From Professor Heddle's list.

Mustela furo
Lutra vulgaris
Canis familiaris
Felis domestica
Phoca vitulina
barbata
Phoca hispida
Grœnlandica

* Probably a mistake for the Greenland Lemming—*Myodes Hudsonius*.

ORKNEY, *continued*:—

Phoca cristata
Halichærus griseus
Trichechus rosmarus
Sorex araneus
fodiens
Vespertilio sp.
Mus sylvaticus
musculus
rattus
Mus decumanus
cricetus ?
Arvicola agrestis
aquatica
Lepus timidus
cuniculus
variabilis (formerly)
Bos taurus
Ovis aries
Capra hircus
Cervus elaphus
tarandus (formerly)
Equus caballus
asinus
Sus scrofa
Delphinus delphis
phocæna
orca
Delphinus deductor
albicans
Aodon Dalei
Catodon Sibbaldii
Physeter tursio
microps
Balæna mysticetus
Balænoptera boops
musculus

OUTER HEBRIDES.

From list by JOHN M'GILLIVRAY, "Annals of Nat. Hist." viii. 7, 1842.

Lutra vulgaris
Phoca vitulina
Phoca Grœnlandica
Halichærus griseus
Delphinus phocæna
Mus musculus
Mus decumanus
Lepus cuniculus
Cervus elaphus (smaller than on mainland.)

SCOTLAND.

Chief authority, FLEMING's "British Mammals," 1828.

Vespertilio murinus
emarginatus
noctula
Plecotus auritus
Erinaceus Europeus
Sorex araneus
fodiens
Talpa Europea
Meles taxus
Ursus Arctos
Canis familiaris
lupus
Vulpes vulgaris
Mustela vulgaris
erminea
putorius
Martes fagorum
abietum
Felis catus
Lutra vulgaris
Phoca vitulina
barbata
Trichechus rosmarus
(straggler)
Mus musculus
sylvaticus
rattus
decumanus
Sciurus vulgaris
Lepus timidus
cuniculus
variabilis
Myoxus avellanarius (rare)
Arvicola agrestis
aquaticus
Castor fiber
Bos taurus
Capra hircus
Ovis aries
Cervus elaphus
capreolus
dama
Equus caballus
asinus
Sus scrofa
Manatus borealis ?
Balænoptera musculus
boops
Physalus vulgaris
Balæna mysticetus
Delphinus phocæna
orca
melas
Delphis
Tursio
Delphinaptera albicans
Hyperoodon bidens
Monodon monoceros
Physeter tursio
microps
Catodon macrocephalus
Sibbaldii

BRAEMAR, NORTH OF SCOTLAND.

From the "Natural History of Deeside," 1855.

Vespertilio pipistrellus
Plecotus auritus
Erinaceus Europaeus
Sorex tetragonurus
rusticus
Hydrosorex fodiens
Talpa Europea
Meles taxus
Mustela putorius
erminea
vulgaris
Lutra vulgaris
Martes foina
Felis catus
Vulpes vulgaris
Mus decumanus
musculus
sylvaticus
Hypudæus ater
Arvicola agrestris
Lepus timidus
variabilis
cuniculus
Cervus elaphus
Capreolus dorcas

GREAT BRITAIN.

Chief authority, Bell's "British Mammals," 1837.

Felis catus
domestica
Canis familiaris
vulpes
Mustela vulgaris
erminea
putorius
furo
martes
abietum
Lutra vulgaris
Meles vulgaris
Phoca vitulina
Grœnlandica
Halichærus gryphus
Trichechus rosmarus
Sus scrofa
Equus caballus
Asinus vulgaris
Manatus sp.
Cervus elephas
dama
capreolus
Bos taurus
var. Scoticus
Capra hircus
Ovis aries
Delphinus delphis
tursio
Phocæna communis
Orca
melas
Beluga leucas
Hyperoodon Butzkopf
Diodon Sowerbyi
Monodon monoceros
Physeter macrocephalus
Balæna mysticetus
Balænoptera boops
Erinaceus Europæus
Talpa Europæa
Sorex araneus
fodiens
remifer
Vespertilio noctula
Leisleri
discolor
pipistrellus
pygmæus
serotinus
murinus
Bechsteinii
Nattereri
emarginatus
mystacinus
Plecotus auritus
brevimanus
Barbastellus Daubentonii
Rhinolophus ferrum - equinum
hipposideros
Sciurus vulgaris
Myoxus avellanarius
Mus messorius
sylvaticus
musculus
rattus
decumanus
Arvicola amphibius
agrestis
pratensis
Lepus timidus
variabilis
var. Hibernicus
cuniculus

TWIZEL in NORTHUMBERLAND. (Northern District.)

From list by P. J. Selby, in "Mag. Zool. and Bot." i. 423, 1837.

Vespertilio pipistrellus
Plecotus auritus
Mustela putorius
vulgaris
erminea
Lutra vulgaris
Canis vulpes
Talpa Europæa
Sorex araneus
fodiens
Sorex remifer
Erinaceus Europæus
Mus sylvaticus
musculus
decumanus
Arvicola amphibia
agrestis
Lepus timidus
cuniculus

SHROPSHIRE.

From list by T. C. Eyton, "Mag. Zool. and Bot." ii. 539, 1838.

Vespertilio noctula
pipistrella
Plecotus auritus
Erinaceus Europæus
Talpa Europæa
Sorex araneus
fodiens
Meles taxus
Mustela putorius
erminea
vulgaris
foina
Martes abietum
Lutra vulgaris
Canis vulpes
Phoca vitulina
Sciurus vulgaris
Myoxus avellanarius
Mus messorius
sylvaticus
decumanus
Arvicola amphibius
arvalis
Lepus timidus
cuniculus
(*extinct species*)
Phocæna delphinus
Canis lupus
Castor fiber
Mus rattus

HEREFORDSHIRE.

From list by Mr. Lingwood, "Ann. Nat. Hist." v. 184, 1840.

Meles taxus
Mustela putorius
vulgaris
erminea
Lutra vulgaris
Canis vulpes
Talpa Europæa
Sorex araneus
fodiens
Erinaceus Europæus
Rhinolophus hipposideros
Vespertilio noctula
Vespertilio pipistrellus
auritus
Sciurus vulgaris
Myoxus avellanarius
Mus sylvaticus
musculus
Mus decumanus
Arvicola agrestis
riparia
amphibia
Lepus timidus
cuniculus

ISLE OF MAN.

British Species not found in Isle of Man.

Authority, Edward Forbes in "Report on Fauna of Ireland," W. Thompson in "Reports of Brit. Assoc." 1840 and 1841.

Talpa Europæa
Sciurus vulgaris
Myoxus avellanarius
Cervus capreolus
Lepus variabilis

IRELAND.

Chief authority, "Natural Hist. of Ireland," by William Thompson.

Scotophilus Leisleri
pipistrellus
Vespertilio Nattereri
Daubentonii
mystacinus
Plecotus auritus
Rhinolophus hipposiderus
Erinaceus Europæus
Sorex rusticus
tetragonurus
Meles taxus
Lutra vulgaris
Mustela erminea
Martes abietum
Vulpes vulgaris
Sciurus vulgaris, (recently introduced.)
Mus sylvaticus
musculus
var. Hibernicus? (black rat with a white breast)
rattus
Mus decumanus
Lepus variabilis
cuniculus
Cervus elaphus
Phoca vitulina
Halichærus gryphus
Delphinus delphis
phocæna
orca
melas
Hyperoodon Butzkopf
Physeter macrocephalus
Physeter var. tursio
Balæna mysticetus
Balænoptera Boops

The following extinct since habitation by man.

Ursus arctos
Canis lupus
Bos taurus
Cervus alces
megaceros
Sus scrofa

British Species not found in Ireland.

Chief authority, W. Thompson, "Report Brit. Assoc." 1840.

Vespertilio noctula
pygmæus
serotinus
murinus
Bechsteinii
emarginatus
ædilis
Plecotus brevimanus
Barbastellus Daubentonii
Rhinolophus ferrum-equinum
Talpa Europæa
Sorex fodiens
ciliatus
castaneus
Mustela vulgaris
Mustela putorius
Felis catus
Arvicola amphibius
arvalis
rubidus
Myoxus avellanarius
Mus minutus?
Lepus timidus
Cervus capreolus
Phoca Grœnlandica
barbata
Trichechus rosmarus
Delphinus tursio
Beluga leucus
Diodon Sowerbæi
Monodon monoceros

FINMARK.

Picked out from paper by Malmgren, in Wiegman's "Archiv," 1864.

Sorex vulgaris
Ursus maritimus
arctos
Lutra vulgaris
Cystophora cristata
Halichærus grypus
Phoca barbata
Grœnlandica
hispida (annellata)
Mus decumanus
musculus
Lemmus amphibius
Lemmus agrestis
rufo-canus
Norvegicus
Cervus tarandus
Delphinus delphis
Orca gladiator
Phocæna communis
Delphinapterus leucas
Chænocetus rostratus
Balænoptera musculus
rostratus
Balæna mysticetus

SWEDEN.

From Retzius "Fauna Suecica," 1800.

Vespertilio murinus
auritus
noctula
barbastellus
pipistrellus
Phoca vitulina
Canis familiaris
lupus
vulpes
lagopus
Felis catus
lynx
Mustela lutra
lutreola
martes
foina
putorius
erminea
Mustela vulgaris
nivalis
Ursus arctos
Gulo borealis
Meles taxus
Sus scrofa

SWEDEN, *continued*:—

Erinaceus Europæus
Sorex araneus
fodiens
Talpa Europæa
Lepus timidus
cuniculus
Castor fiber
Mus decumanus
rattus
Mus musculus
sylvaticus
amphibius
paludosus
gregarius
lemmus
Myoxus muscardinus
Sciurus vulgaris
volans
Sciurus striatus
Cervus alces
elaphus
tarandus
dama
capreolus
Capra hircus
Ovis aries
Bos taurus
Equus caballus
Trichechus rosmarus
Monodon monoceros
Balæna mysticetus
physalus
Physeter macrocephalus
Delphinus phocæna
orca

SCANDINAVIA.

From NILSSON's "Fauna Scandinavica," 1847.

Vespertilio murinus
borealis
noctula
Natthusii
pipistrellus
mystacinus
Daubentonii
Nattereri
auritus
barbastellus
Talpa Europæa
Sorex vulgaris
pygmæus
pumilus *Nilss.*
fodiens
Erinaceus Europæus
Felis domestica
catus
lynx
var. cervaria
virgata
Gulo borealis
Mustela putorius
lutreola
erminea
Mustela vulgaris
(Martes) foina
sylvestris
Lutra vulgaris
Meles taxus
Ursus Arctos
spelæus
Canis lupus
familiaris
vulpes
Canis lagopus
Phoca vitulina
annellata
Grœnlandica
barbata
Halichærus grypus
Cystophora cristata
Trichechus rosmarus
Sminthus betulinus
Mus decumanus
rattus
sylvaticus
musculus
agrarius?
minutus?
Hypudæus amphibius
medius
glareolus
rufocanus
rutilus
Arvicola agrestis
Norvegicus
schisticolor
Myoxus avellanarius
Pteromys volans
Sciurus vulgaris
Castor fiber
Lepus canescens
borealis
Europæus (timidus)
cuniculus
Sus scrofa (domesticated)
Do. (wild)
Equus caballus
asinus
Cervus alces
dama
tarandus
elaphus
capreolus
Capra hircus
Ovis aries
Bos taurus
urus
frontosus
longifrons
bison
Delphinus delphis
euphrosyne?
obscurus?
leucopleurus
Ibsenii
tursio
orca
globiceps
leucas
phocæna
Monodon monoceros
Hyperoodon borealis
Balæna rostrata
physalus
prisca
mysticetus

GERMANY AND THE BORDERING LANDS OF MIDDLE EUROPE.

From "Fauna der Wirbelthiere Deutschlands," von J. H. BLASIUS, 1857.

Rhinolophus hipposideros
ferrum-equinum
clivosus
Euryale
Plecotus auritus
Synotus barbastellus
Miniopterus Schreibersii
Vesperugo noctula
Leisleri
Nathusii
pipistrellus
Kuhlii
Maurus
Vesperus discolor
Vesperus Nilssonii
serotinus
Vespertilio murinus
Bechsteinii
Nattereri
ciliatus
mystacinus
Vespertilio Daubentonii
dasycneme
Talpa Europæa
cœca
Crossopus fodiens
Sorex alpinus
vulgaris

GERMANY, *continued*:—

Sorex pygmæus
Crocidura leucodon
araneus
suaveolens
Erinaceus Europæus
Felis catus
domestica
lynx
Canis lupus
aureus
vulpes
Ursus arctos
Meles taxus
Gulo borealis
Mustela martes
foina
Fœtarius putorius
var. furo
Sarmaticus
ermineus
vulgaris
lutreola
Lutra vulgaris
Pelagius monachus
Phoca vitulina
fœtida
Grœnlandica
Halichærus grypus
Cystophora cristata
Trichechus rosmarus
Pteromys volans
Sciurus vulgaris
Spermophilus citillus
Arctomys marmota
bobac
Myoxus quercinus
dryas
glis
avellanarius
Sminthus vagus
Cricetus frumentarius
Mus decumanus
Alexandrinus
rattus
musculus
sylvaticus
agrarius
minutus
Arvicola (Hypudæus) glareolus
Arvicola (Paludicola) amphibius
nivalis
ratticeps
(Agricola) agrestis
(Arvicola) campestris
arvalis
(Microtus) subterraneus
Savii
Spalax typhlus
Castor fiber
Lepus timidus
variabilis
cuniculus
Cavia cobaya (introduced)
Alces palmatus
Cervus elaphus
dama
capreolus
Ovis aries
Capra ibex
hircus
ægagrus ?
Capella rupicapra
Bos bison
priscus
taurus
Equus caballus
asinus
Sus scrofa
Delphinus delphis
leucopleuros
rostratus
tursio
Phocæna communis
melas
orca
grisea
leucus
Ceratodon monodon
Hyperoodon rostratus
micropterus
Physeter macrocephalus
Balænoptera musculus
rostrata
boops
Balæna mysticetus

FRANCE.

Both Living and Fossil Species.

From P. Gervais' "Zoologie et Palæontologie Françaises," 1859.

Pliopithecus antiquus
Semnopithecus Monspessulanus
Rhinolophus ferrum-equinum
hipposideros
Vespertilio serotinus
Parisiensis
barbastellus
noctula
pipistrellus
nigricans
discolor
auritus
Bechsteinii
mystacinus
emarginatus
murinus
Erinaceus Europæus
major
Arvernensis
Tetracus nanus? Aym.
Mygale Pyrenaica
antiqua
naiadum
Plesiosorex soricinoides
Mysarachne Picteti
Sorex tetragonurus
pygmæus
Sorex fodiens
Etruscus
Savi
araneus
leucodon?
Talpa Europæa
fossilis
cœca (living and fossil.)
acutidentata
antiqua
telluris
minuta
Sciurus vulgaris
alpinus
Spermophilus superciliosus
Arctomys marmota
primigenia
Castor fiber (living and fossil.)
Issiodorensis
sigmodus
Viciacensis
Myoxus glis
nitela
avellanarius
spelæus
Mus decumanus
tectorum
Mus rattus
sylvaticus
minutus
musculus
Aymardi
Aniciensis
Cricetus vulgaris
Arvicola amphibius
monticola
terrestris
fulvus
subterraneus
arvalis
duodecim-costatus
Selys. S. France.
agrestis
rubidus *Baill.* North France.
Issiodoromys pseudanæma
Theridomys breviceps
Archæomys chinchilloides
Hystrix cristata?
Cavia cobaya (introduced)
Lepus variabilis
alpinus
timidus
meridionalis
Lepus *diluvianus*
domesticus
cuniculus
priscus
Issiodorensis
Neschersensis
Lagomys Corsicanus
Elephas primigenius
Mastodon brevirostris
longirostris
Arvernensis
Borsonii
Dinotherium giganteum
intermedium
Cuvieri
Rhinocerus tichorhinus
megarhinus
Sansaniensis
brachypus
Cimogorrhensis
minutus
tetradactylus
Lunellensis
leptorhinus
Tapirus Arvernensis
Poirieri
Listriodon Larteti

FRANCE, *continued*:—

Lophiodon anthracoideum
Parisiense
tapiroides
tapirotherium
Buchsowillanum
medium
occitanicum
minutum
Cesserasicum
minimum
Duvallii
parvulum
cervulum
(Tapirulus) hyracinus
Palæotherium Isselanum
Argentonicum
magnum
Girondicum
crassum
indeterminatum
medium
velaunum
latum
curtum
ovinum
annectens
minus
Anchitherium Dumasii
Aurelianense
Hipparion mesostylum
diplostylum
prostylum
Equus Piscenensis
asinus
caballus
Bos primigenius
taurus
bonasus
Ibex alpinus
Pyrenaicus
Cebennarum
Rozeti
Capra ægagrus?
hircus
Ovis musimon
aries
primæva
Dremotherium Feignouxii
Antilope rupicapra
Christolii
dichotoma
Cordieri
clavata
deperdita
Camelopardalis Biturigum
Cervus alces
martialis
tarandus
Dama
Somonensis
Cervus *giganteus*
polycladus
ardens
elaphus
Corsicanus?
Issiodorensis
Perrieri
Etuariarum
Pardinensis
Arvernensis
Solilhacus
Tournalii
capreolus
Cusanus
Cauvieri
Australis
dicrocerus
Aurelianensis
Amphitragulus communis
elegans
murinus (*Anoplotherium minimum* Cuv.)
obliquum
armatus
Xiphodon gracile
Gelyense
Chalicotherium grande
Anoplotherium commune
secundarum
Acotherulum Saturninum
Cainotherium commune
Dichobune leporinum
suillum
Hyopotamus velaunus
crispus
Chœropotamus Parisiensis
Anthracotherium magnum
onoideum
Alsaticum
minimum
Gergovianum
Hippopotamus major
minutus
Sus scrofa
priscus
Arvernensis
provincialis
major
chæroides
chærotherium
Lockharti
Belsiacus
lemuroides
Palæochærus typus
Entelodon magnum
Adapis Parisiensis
Ursus spelæus
Arctos
arvernensis
Ursus minutus
Palæocyon primævus
Tylodon Hombresii
Canis familiaris
lupus
Neschersensis
Issiodorensis
Borbonides
brevirostris
Parisiensis
vulpes
Amphicyon major
Blainvillei?
elaverensis?
Viverra Parisiensis
mastrides
velaunum
palustre
lacustre
genetta
Sansaniensis
antiqua
primæva
exilis?
zibethoides?
Lutra vulgaris
Bravardi
dubia
Meles taxus
Gulo Arcticus
Mustela *hydrocyon*
foina
martes
elongata
genettoides
taxodon
plesictis
angustifrons
putorius
erminea
vulgaris
incerta
Hyæna hipparionum
prisca
Arvernensis
Perrieri
intermedia
brevirostris
spelæa
Felis spelæa
antiqua
Pardinensis
Serval
Christolii
catus
domestica
lynx
brevirostris
Issiodorensis
Machairodus cultridens
palmidens
Pseudælurus quadridentatus
Hyænodon leptorhynchus
brachyrhynchus
Requieni
minor
Parisiensis?
Pterodon dasyuroides
Palæonictis gigantea
Galethylax Blainvillei
Didelphis Cuvieri
Laurillardi
Arvernensis
Blainvillei
Bertrandi (*elegans*, Waterh.)
crassa
minuta
Macrotherium giganteum
Phoca vitulina
leporina
discolor
monachus
Cystophora cristata
Phoca occitana
Halitherium Serresii
fossile
Beaumontii
Guettardi
dubium
Trachytherium Raulinii
Delphinus phocæna
orca
melas
Risso anus
griseus
tursio
rostratus
delphis
dubius
pseudodelphis
dationum
Renovi
Squalodon Grateloupii
Stereodelphis brevidens
Champsodelphis macrogenius
Bordæ
Smilocamptus Bucgueti
Hoplocetus crassidens
curvidens
Mesoplodon Sowerbiensis
Ziphius cavirostris
Hyperoodon Butzkopf
Physeter macrocephalus
antiquus
Rorqualus musculus
Balænoptera physalus
Balæna *Lamanoni*

MIDDLE EUROPE.

Chief authority SCHMARDA's "Geographische Verbreitung der Thiere," 1853.

Rhinolphus ferrum-equinum
hipposideros
Vespertilio barbastellus
auritus
murinus
Bechsteinii
Nattereri
mystacinus
Daubentoni
dasycnemus
serotinus
discolor
Nilssonii
Leisleri
Natthusii
pipistrellus
Erinaceus Europæus
Sorex fodiens
vulgaris
alpinus
pygmæus
Sorex araneus
leucodon
Myogale moschata
pyrenaica
Talpa Europæa
Ursus Arctos
Meles vulgaris
Mustela martes
foina
putorius
Sarmatica
erminea
vulgaris
lutreola
Gulo borealis
Lutra vulgaris
Canis lupus
vulpes
Felis lynx
cervaria
catus
Sciurus vulgaris
Pteromys vulgaris
Tamias striatus
Spermophilus citillus
Arctomys marmotta
bobac
Myoxus glis
nitela
dryas
muscardinus
Dipus sagitta
Spalax Pallasii
typhlus
Ellobius talpinus
Mus decumanus
rattus
musculus
sylvaticus
agrarius
minutus
Cricetus frumentarius
Hypudæus amphibius
arvalis
agrestis
ratticeps
alpinus
glareola
rutilus
Sminthus betulinus
Castor fiber
Lepus timidus
variabilis
aquilonius
Sus scrofa
Cervus alces
elaphus
capreolus
Antilope rupicapra
Pyrenaica
saiga
Capra ibex
Bos bonasus

ITALY.

From BONAPARTE's "Iconographia della Fauna Italica," 1837 *et seq.*

Canis melanogaster
Mustela martes
boccamela
Lutra vulgaris
Capra musimon
Cervus dama
Dysopes Cestonii
Plecotus auritus
brevimanus
Vespertilio emarginatus
capuccinii
Daubentoni
murinus
Vespertilio pipistrellus
Savii
Bonapartii
albo-limbatus
noctula
serotinus
alcythoe
leucippe
aristippe
Ursinii
Barbastellus communis
Rhinolophus ferrum-equinum
hippocrepis
Rhinolophus clivosus
Talpa cœca
Europea
Sorex araneus
alpinus
Antinorii
Crossopus fodiens
ciliatus
Pachyura Etrusca
Capensis
Crocidura musaranea
thoracica
leucodon
Crocidura flavescens
pygmæus
Sciurus Italicus
Mus tectorum
(var. fuliginosus)
decumanus
sylvaticus
musculus
Arvicola arvalis
terrestris
amphibius

ALGERIA.

From "Catalogue des Mammifères en Algérie, by Capitaine LOCHE," 1858.

Pithecus inuus
Lupulus aureus
Vulpes Algeriensis
Niloticus
Vulpes famelicus
Fennecus Brucei
Hyæna striata
Mangusta Numidica
Genetta Afra
Bonapartei
Felis leo
pardus
Felis serval
jubata
caracal
Lybicus

ALGERIA, *continued*:—

Felis catus
margarita
Putorius vulgaris
communis
erminea
Boccamela
Meles taxus
Zorilla Vaillantii
Lutra vulgaris
Ursus arctos
Phoca monacha
vitulina
Tursiops tursio
Sus scrofa
Camelus dromedarius
Cervus elaphus
Dama vulgaris

Antilope addax
Gazella dorcas
Corinna
Alcephalus bubalus
Musimon tragelaphus
Ovis (domestic)
Vespertilio murinus
Nattereri
Miniopterus Schreibersii
Pipistrella noctula
pipestrella
Plecotus auritus
Rhinolophus unihastatus
hippocrepis
Sorex tetragonurus
Crocidura aranea
leucodon

Pachyura agilis
Crossopus fodiens
Macroscelides Rozeti
Myogalea moschata?
Erinaceus Algiricus
deserti *Loche*
Myoxus Mumbyanus
Dipus Gerboa
Mauritanicus
deserti *Loche*
Alactaga arundinis
Gerbillus Shawii
campestris
Selysii
Gerbii *Loche*
Schousbœii *Loche*
robustus

Gerbillus minutus
Ctenodactylus Massonii
Mus decumanus
rattus
Alexandrinus
sylvaticus
Algiricus *Pomel.*
musculus
chamæropsis *Levaill.*
barbarus
Hystrix cristata
Lepus Mediterraneus
Cuniculus Algirus *Lereboullet*
Sciurus getulus
(Mole not yet found.)

THE SAHARA.

From Tristram's "Great Sahara," 1860.

Myotis murinus
Miniopterus Schreibersii
Rhinolophus clivosus
Felis leo
pardus
jubata
caracal
Lybicus
catus
margarita
Hyæna striata
Herpestes Numidicus
Genetta Afra
Buonapartii
Canis aureus

Vulpes vulgaris
Niloticus
famelicus
Fennecus Brucei
Putorius Boccamela
Zorilla Vaillantii
Macroscelides Rozeti
Sorex tetragonurus
araneus
agilis
Erinaceus Algirus
Deserti
Mus rattus
Alexandrinus
sylvaticus

Mus musculus
barbarus
dichrurus
chamæropsis
Psammomys obesus
Hystrix cristata
Lepus Mediterraneus
Ægyptius
Dipus jerboa
Ægyptius
Deserti
Alactaga arundinis
Gerbillus melanurus
campestris
Shawii

Gerbillus Selysii
Gerbii
Schoönbæii
minutus
Myoxus Mumbyanus
Ctenodactylus Massonii
Gazella dorcas
corinna
Kevella
Addax nasomaculatus
Musimon tragelaphus
Alcephalus bubalis
Equus Onager
Sus scrofa

TURANIAN STEPPES

Chief authority, SCHMARDA'S "Geographische Verbreitung der Thiere," 1853.

Rhinolophus ferrum-equinum
hipposideros
Vespertilio barbastellus
auritus
murinus
serotinus
Turcomannus
discolor
noctula
pipistrellus
Erinaceus auritus
hypomelas
Sorex fodiens
pygmæus
araneus
leucodon
Etruscus
pulchellus

Myogale moschata
Talpa Europæa
Meles vulgaris
Mustela martes
foina
putorius
Sarmatica
erminea
vulgaris
Lutra vulgaris
Canis vulpes
corsac
melanotus
Felis chaus
manul
Spermophilus citillus
guttatus

Spermophilus Mugosaricus
fulvus
rufescens
Dipus telum
lagopus
Scirtetes jaculus
vexillarius
acontion
elater
platyurus
Ellobius talpinus
Mus decumanus
hortulanus
agrarius
minutus
Cricetus arenarius
accedula

Cricetus phæus
Rhombomys pallidus
tamaricinus
meridianus
Hypudæus amphibius
arvalis
socialis
Myodes lagurus
Sminthus loriger
Castor fiber
Hystrix hirsutirostris
Lepus timidus
Lagomys pusillus
ogotona
Sus scrofa
Antilope saiga
subgutturosa
Phoca Caspica

MESOPOTAMIA.

Authority, SCHMARDA's "Verbreitung Geographische," 1853.

Rhinolophus ferrum-equinum
Erinaceus auritus
Sorex pusillus?
Ursus sp.
Ratelus sp.
Lutra vulgaris
Canis Corsac
Hyæna striata
Felis leo
pardus
jubata
chaus
Myoxus sp.
sp.
sp.
Siphneus sp.
Dipus sagitta
Castor fiber
Lepus sp.
Equus sp.
Sus scrofa
Antilope dorcas

SIBERIA WEST OF AMOURLAND.

From list by GUSTAVE RADDE, "Bericht über reisen in Suden von Ost-Siberien," 1862.

Felis tigris
irbis
manul
undata
domestica
lynx
Canis familiaris
procyonides
Corsac
vulpes
alpinus
lupus
Lutra vulgaris
Mustela vulgaris
erminea
alpina
Sibirica
putorius
zibellina
(Martes) flavigula
borealis
Gulo borealis
Meles taxus
Ursus Tibetanus
Arctos
Phoca annellata
Moschus moschiferus
Cervus capreolus
elaphus
axis
tarandus
alces
Antilope gutturosa
crispa
Ovis argali
montanus
nivicola? KAMTSCHATKA and STANOWOI RANGE.
aries
Sibiricus
Capra hircus
Bos taurus
grunniens
Camelus Bactrianus
Sus scrofa
Equus caballus
asinus
hemionus
Talpa Europæa
Wogura
Erinaceus Europæus
auritus
Sorex fodiens
vulgaris
pygmæus
Plecotus auritus
Vesperugo borealis
Vespertilio Daubentonii
mystacinus
Nattereri
Rhinolophus sp.
Lagomys hyperboreus
octogona
alpinus
Lepus variabilis
tolai
mandshuricus
Castor fiber
Siphneus aspalax
Arvicola amphibius
rufocanus
rutilus
schisticolor
Brandti
Arvicola arvalis
Mongolicus
(nine other species)
Mus minutus
agrarius
sylvaticus
musculus
caraco
decumanus
Cricetus Songarus
furunculus
Sminthus vagus
Dipus jaculus
(speculum *Licht.*
vexillaris *Eversm.*
decumanus *Licht.*)
Arctomys bobac
sp. Mountains of BAIKAL RANGE.
Spermophilus Eversmanni
Dauricus
Tamias striatus
Sciurus vulgaris
Pteromys volans

AMOURLAND.

From list by LEOP. v. SCHRENK, "Reisen und Forschungen in Amoorland," 1858.

Ursus Arctos
Meles taxus
Gulo borealis
Mustela zibellina
Mustela Sibirica
erminea
vulgaris
Lutra vulgaris
Lutra aterrima
Enhydris marina
Canis lupus
alpinus
Canis vulpes
lagopus
procyonoides
familiaris

AMOURLAND, *continued* :—

Felis lynx
tigris
irbis
domestica
Lagomys hyperboreus
Phoca nummularis
barbata
Ochotensis
equestris
Otaria ursina
Trichechus rosmarus
Moschus moschiferus
Cervus capreolus
Cervus tarandus
elaphus
alces
Antilope crispa
Ovis (Ægoceros) montana
aries
Bos taurus
Sus scrofa
Equus caballus
asinus
Balæna australis
Balænoptera longimana
Delphinapterus leucas
Erinaceus Europæus
auritus
Sorex vulgaris
pygmæus
Vesperugo borealis
Vespertilio mystacinus
Daubentonii
Plecotus auritus
Pteromys volans
Sciurus vulgaris
Tamias striatus
uthensis
Spermophilus Eversmanni
Arctomys Bobac
Mus decumanus
musculus
Arvicola (Hypudæus) Amurensis
rutilus
amphibius
saxatilis
Maximowiczii
Siphneus aspalax
Castor fiber
Lepus variabilis

JAPAN.

From Temminck's "Fauna Japonica," 1833.

Innuus speciosus
Pteropus dasymallus
pselaphon
Rhinolophus Nippon
cornutus
Vespertilio molossus
noctula
blepotis
macrodactylus
Abramus
akakomuli
Talpa Wogura
Urotrichus talpoides
Sorex (Crossopus) platycephalus
Sorex Indicus
Dzi-nezumi
umbrinus
Erinaceus Europæus (said to have been introduced).
Ursus ferox (Japonicus *Gray*)
Thibetanus
maritimus ?
Meles Anakuma
Mustela melampus
brachyura
Itatsi
Lutra vulgaris
Enhydris marina
Canis hodopylax
vulpes
Nyctereutes viverrinus
Sciurus brachyurus
varius
lis
Pteromys leucogenys
(Sciuropterus) momonga
setosus
Mus argenteus
molossinus
Tanezumi
speciosus
Myoxus elegans
Bos bubalus
Cervus tarandus
Sika
Antilope crispa
Sus leucomystax
Otaria Stelleri
Phoca barbata
nummularis
Delphinus longirostris
orca
melas
globiceps
Balæna antarctica
Balænoptera antarctica
arctica
Physeter cachelot

CHINA (Amoy.)

Chiefly from notices by Mr. Swinhoe.

Rhinolophus Rouxii
Nyctinomus insignis
Nycticejus Swinhœi
Scotophilus pumiloides
Canis familiaris
Felis tigris
Felis catus
Mustela Sibirica
Sorex albinus
murinus
Sciurus reductus
castaneoventris
Mus decumanus
Lepus Sinensis
Equus caballus
asinus
Sus scrofa
Cervus Reevesii
Capra hircus
Ovis aries
Manis aurita

CHINA (Chusan.)

From Dr. Cantor's "List in Annals Nat. Hist.," 1842.

Vespertilio irretitus *Cantor*.
Canis Sinensis
Felis domestica
sp.
Manis pentadactyla
Sus scrofa. var. Sinensis
Equus caballus
asinus
Capra hircus
Bos taurus

FORMOSA.

From list by Mr. Swinhoe, "Proc. Zool. Soc." 1862, p. 347.

Macacus Cyclopes
Ursus Thibetanus
Leopardus brachyurus
Felis viverrina
Viverra pallida
Paradoxurus (Paguma) larvatus
Helictis subaurantiaca
Talpa insularis
Kerivoula picta?
Molossus sp.
Sciurus erythræus
McLellandii
Pteromys grandis
Sciuropterus Kaleensis
Lepus Sinensis
Porcula Taivana
Cervulus Reevesii
Capricornis Swinhoii
Cervus taivanus
Swinhoii

MARIANNE ISLANDS.

Pteropus Marianus
Cervus Moluccensis

PHILIPPINE ISLANDS.

Cynopithecus nigrescens
Galeopithecus Philippensis
Viverra Tanggalunga
Felis catus
Canis familiaris
Pteromys Philippensis
Mus decumanus
rattus
Equus caballus
Equus asinus
Cervus Muntjac?
Capra hircus

CELEBES.

Chief authority, "British Museum Catalogue of Mammalia and Birds of New Guinea," 1859.

Innuus fusco-ater
cynomolgus
Cynopithecus niger
Tarsius spectrum
Pteropus edulis
funereus
phaiops
Alecto
chrysoproctus
Macklotii
personatus
griseus
Pteropus pallidus
Xantharpya amplexicaudata
Cephalotes Peronii
Macroglossus minimus
Harpyia Pallasii
Rhinolophus nobilis
diadema
bicolor
tricuspidatus
euryotis
minor
Hipposideros speoris
Miniopteris blepotis
Nycticejus Temminckii
Taphozous saccolaimus
Sorex myosurus
tenuis
Felis megalotis
Viverra zibetha
Paradoxurus musanga
Cuscus maculatus
orientalis
Cuscus ursinus
Celebensis
Mus decumanus
Sciurus leucomus
rubriventer
Halicore australis
Sus Timorensis
Babirousa alfurus
Cervus Moluccensis
Kuhlii
Anoa depressicornis

TERNATE.

Chief authority, "Brit. Mus. Cat. of Mammals and Birds of New Guinea," 1859.

Macacus cynomolgos
Pteropus edulis
funereus
phaiops
chrysoproctus
Macklotii
personatus
griseus
pallidus
Xantharpya amplexicaudata
Cephalotes Peronii
Macroglossus minimus
Harpyia Pallasii
Rhinolophus nobilis
diadema
bicolor
tricuspidatus
euryotis
minor
Hipposideros speoris
Miniopteris blepotis
Nycticejus Temminckii
Taphozous Saccolaimus
Sorex myosurus
tenuis
Felis megalotis
Viverra zibetha
Paradoxurus musanga
Cuscus maculatus
orientalis
ornatus
Mus decumanus
Halicore Australis
Sus Timorensis
Babirousa alfurus
Cervus Moluccensis
Kuhlii

TIMOR.

Chief authority, "British Museum Catalogue of Mammals and Birds of New Guinea," 1854.

Macacus cynomolgos
Pteropus funereus
Macklotii
Pteropus griseus
Xantharpya amplexicaudata
Cephalotes Peronii
Macroglossus minimus
Rhinolophus nobilis
diadema
bicolor
minor
Hipposideros speoris
Miniopteris blepotis
Nycticejus Temminckii
Sorex tenuis
Felis megalotis
Paradoxurus musanga
Cuscus orientalis
Mus decumanus
Halicore Australis
Sus Timorensis
Cervus Moluccensis

AMBOYNA.

From "Brit. Mus. Cat. of Mammals and Birds of New Guinea," 1859.

Macacus cynomolgos
Pteropus edulis
funereus
phaiops
chrysoproctus
Macklotii
griseus
pallidus
Xantharpya amplexicaudata
Cephalotes Peronii
Macroglossus minimus
Harpyia Pallasii
Rhinolophus nobilis
diadema
bicolor
tricuspidatus
Rhinolophus euryotis
minor
Hipposideros speoris
Miniopteris blepotis
Nycticejus Temminckii
Sorex myosurus
tenuis
Felis megalotis
Viverra zibetha
Paradoxurus musanga
Cuscus maculatus
orientalis
Mus decumanus
Halicore Australis
Sus Timorensis
Cervus Moluccensis

BANDA, NEAR NEW GUINEA.

From "Brit. Mus. Cat. Mammals and Birds of New Guinea," 1859.

Macacus cynomolgos
Pteropus edulis
funereus
phaiops
Macklotii
griseus
pallidus
Xantharpya amplexicaudata
Cephalotes Peronii
Macroglossus minimus
Rhinolophus nobilis
diadema
bicolor
minor
Hipposideros speoris
Miniopteris blepotis
Nycticejus Temminckii
Sorex myosurus
tenuis
Felis megalotis
Paradoxurus musanga
Cuscus orientalis
Mus decumanus
Halicore Australis
Sus Timorensis
Cervus Moluccensis

NEW GUINEA.

From "British Museum Catalogue of Mammals and Birds of New Guinea," 1859.

Macacus cynomolgos
niger
Tarsius spectrum
Pteropus edulis
funereus
phaiops
alecto
chrysoproctus
Macklotii
argentatus *Gray*
personatus
Pteropus griseus
pallidus
Xantharpya amplexicaudata
Cephalotes Peronii
Macroglossus minimus
Harpyia Pallasii
Rhinolophus nobilis
diadema
bicolor
tricuspidatus
euryotis
minor
Hipposideros aruensis *Gray*
speoris
Miniopteris blepotis
Nycticejus Temminckii
Taphozous saccolaimus
Sorex myosurus
Sorex tenuis
Felis megalotis
Viverra zibetha
Paradoxurus musanga
hermaphrodita
Belideus ariel
Cuscus maculatus
orientalis
ursinus
Celebensis
chryorrhos
Dendrolagus ursinus
inustus
Dorcopsis Asiaticus
Perameles Doreyanus
Phascogale melas
Myoictis Wallacii
Dactylopsila trivirgata
Mus decumanus
Halicore Australis
Sus sp.
Timorensis
Papuensis
Babirousa Alfurus
Cervus Moluccensis
Kuhlii
Anoa depressicornis

MALDIVES AND LACCADIVES.

Pteropus Edwardsii

NEW ZEALAND.

Chief authority, J. E. Gray in "Dieffenbach's Travels in New Zealand," 1843.

Vespertilio tuberculatus.*
Dusky Bay
Phoca leonina
Uwona
Otaria jubata. Southern islands, islets to the south-west of the Island of Victoria.
Arctocephalus ursinus. Dusky Bay.
Delphinus Zelandiæ. Cook's Straits.
orcia?
Physeter macrocephalus
optera
Balæna gibbosa
physalus
Boops
Balænopterus musculus
Balæna antipodum †
Mus sp. Known only by report.
Hapalotis sp. } Conjectured to exist from footsteps in mud and snow.
Lutra sp. }
The following have been introduced,—
Canis dingo *Blum.* From Aust.
Mus rattus
musculus
Felis domestica
Sus scropha
Equus caballus
Asinus vulgaris
Ovis aries
Bos taurus

* According to Polack the *Pakapeka*, or Bats, and various small Batlets, are very common in the island, but none of the Vampire species (Pteropus? or Glossophaga?) They are among the smallest of the Australian species.—Polack, i. 304. Dr. Gray says that there is apparently only one species.

† Recorded as having been found in New Zealand, but not seen or verified by Dr. Gray.

SANDWICH ISLANDS.

Lasiurus Grayi

AUSTRALIA.

Chief authorities, GOULD's "Mammals of Australia," 1845. WATERHOUSE "Nat. Hist. of Mammals," I. 1846, and Dr. GRAY's Lists in Appendix to Capt. GREY's "Travels in North-west Australia," 1841.

MARSUPIALIA.
Ornithorhynchus anatinus
Echidna hystrix
setosa
Myrmecobius fasciculus
Tarsipes rostratus
Chæropus castanotis
Peragalea lagotis
Perameles fasciata
Gunnii
myosurus
nasuta
macroura
obesula
Bougainvillei
Phascalarctos cinereus
Phalangista fuliginosa
vulpina
canina
Cookii
viverrina
laniginosa
Cuscus brevicaudatus
Petaurista Taguanoides
Belideus flaviventer
sciureus
breviceps
notatus
ariel
Acrobata pygmæa
Dromicia gliriformis
concinna
unicolor
Phascogale penicillata
calura
lanigera
Antechinus Swainsoni
leucopus
ferruginifrons
unicolor
leucogaster
apicalis
flavipes
Antechinus fuliginosus
albipes
murinus
maculatus
minutissimus
Podabrus macrourus
crassicaudatus
Sarcophilus ursinus
Dasyurus maculatus
viverrinus
Geoffroyi
hallucatus
Thylacinus cynocephalus
Thylacoleo carnifex
Phascolomys wombat
gigas
latifrons
lasiorhinus
niger
Diprotodon Australis
Nototherium inerme Mitchelli
Macropus major
ocydromus
fuliginosus
melanops
Osphranter rufus
antilopinus
isabellinus
robustus
Parryi
Halmaturus ruficollis
Bennettii
Greyi
manicatus
ualabatus
agilis
dorsalis
Parma
Derbianus
Houttmani
Dama
gracilis
Thetidis
Halmaturus stigmaticus
Billardieri
brachyurus
Petrogale penicillata
lateralis
xanthopus
inornata
brachyotis
concinna
Onychogalea unguifer
frænata
lunata
Lagorchestes fasciatus
leporoides
hirsutus
conspicillatus
Leichardti
Bettongia penicillata
Ogilbyi
cuniculus
Graii
rufescens
campestris
Hypsiprymnus murinus
apicalis
Gilberti
platyops
RODENTIA.
Hapalotis albipes
apicalis
hemileucura
hirsutus
penicillatus
conditor
murinus
longicaudatus
Mitchellii
cervinus
arboricola
Mus fuscipes
vellerosus
longipilus
Mus cervinipes
assimilis
manicatus
sordidus
lineolatus
Gouldi
nanus
albocinereus
Novæ Hollandiæ
delicatulus
Hydromys chrysogaster
fulvolavatus
leucogaster
fuliginosus
lutrilla
CHEIROPTERA.
Pteropus poliocephalus
conspicillatus
funereus
scapulatus
Molossus Australis
Taphozous Australis
Rhinolophus megaphyllus
cervinus
aurantius
Nyctophilus Geoffroyi
unicolor
Timoriensis
Scotophilus Gouldi
morio
microdon
picatus
nigrogriseus
Greyi
pumilus
Vespertilio macropus
Tasmanensis
CARNIVORA.
Arctocephalus lobatus
Stenorhynchus leptonyx
Canis dingo

NORTH AUSTRALIA.

Macropus unguifer
antilopinus
agilis
Macropus brachiotis
inornatus
concinnus
Dendrolagus sp. ?
Phalangista vulpina
Petaurus breviceps, var. ariel
Perameles macroura
Dasyurus hallucatus

NEW SOUTH WALES; EAST AND SOUTH-EAST COAST OF AUSTRALIA.

Ornithorhynchus anatinus
Echidna hystrix
Chæropus castanotis
Perameles fasciata
nasuta
Phascalarctos cinereus
Phalangista vulpina
canina
Cookii
lanuginosa
Petaurista Taguanoides
Belideus flaviventer
sciureus
breviceps
Acrobata pygmæa
Dromicia unicolor
Phascogale penicillata
calura
Phascogale lanigera
ferruginifrons
unicolor
flavipes
murinus
maculatus
minutissimus
Podabrus macrourus
Dasyurus maculatus
Macropus major
Osphranter rufus
robustus
Parryi
Halmaturus ruficollis
ualabatus
Halmaturus dorsalis
Parma
Thetidis
Petrogale penicillata
inornata
Onychogalea unguifer
frenata
lunata
Bettongia penicillata
rufescens
Hypsiprymnus murinus
Hapalotis albipes
hemileucura
conditor
murinus
Mus fuscipes
cervinipes
assimilis
sordidus
lineolatus
Mus Gouldi
Novæ Hollandiæ
Hydromys chrysogaster
leucogaster
lutrilla
Pteropus poliocephalus
conspicillatus
Rhinolophus megaphyllus
Nyctophilus Geoffroyi
Scotophilus Gouldi
morio
picatus
nigrogriceus
pumilus
Arctocephalus lobatus
Canis Dingo

VAN DIEMAN'S LAND AND ISLANDS AT BASS'S STRAIT.

Ornithorhynchus anatinus
Echidna hystrix
setosa
Perameles Gunnii
obesula
Phalangista fuliginosa
viverrina
Dromicia gliriformis
Antechinus Swainsoni
leucopus
Petaurus sciureus (introduced)
Sarcophilus ursinus
Dasyurus maculatus
viverrinus
Thylacinus cynocephalus
Phascolomys wombat
Macropus major
Halmaturus Bennettii
Billardieri
Bettongia cuniculus
Hypsiprymnus apicalis
Hapalotis apicalis
Hydromys chrysogaster
Nyctophilus unicolor
Scotophilus microdon
Vespertilio Tasmanensis
Arctocephalus lobatus
Stenorhynchus leptonyx

SOUTH AUSTRALIA.

Macropus giganteus
lunatus
leporoïdes
fasciatus
rufus
Greyi
Eugenii
Macropus Derbianus. From islands off the coast.
Hypsiprymnus Grayi
penicillatus
Gaimardi
campestris
Phascolomys wombat
Phascolomys latifrons
Phascolarctos cinereus
Phalangista vulpina
Cookii
concinna
Petaurus Australis
Perameles obesula
Dasyurus Geoffroyi
Perameles fasciata
Chæropus castanotis
Myrmecobius fasciatus
Phascogale penicillata
flavipes
albipes
crassicaudata

SOUTH-WEST AUSTRALIA, Augusta, Swan River, and King George's Sound.

Macropus brachyurus
Derbianus
Eugenii
giganteus
lateralis
Macropus lunatus
Hypsiprymnus Gilbertii
Graii ?
Dromicia concinna
Neillii
Tarsipes rostratus
Perameles lagotis
myosurus
Myrmecobius fasciatus
Phascogale albipes ?
Phascogale crassicaudata
leucogaster
penicillata
Dasyurus Geoffroyi

WESTERN AUSTRALIA.

Echidna aculeata
Macropus giganteus
(giganteus) ocydromus
lunatus
isabellinus
fasciatus
hirsutus
Macropus conspicillatus. Barrow Island.
irma
Derbianus
brachyurus. King George's Sound
lateralis
Hypsiprymnus Grayi
Hypsiprymnus penicillatus
Gilbertii
K. George's Sound.
platyops
Phalangista vulpina
var. xanthopus
Cookii
Phalangista concinna
Neillii. King George's Sound.
Tarsipes rostratus. Swan River, and King George's Sound.

BORNEO.

Chief authority, Müller's "Verhandlungen Natuurlike Nederland Overz." 1835.

Simia Satyrus
Morio?
Wurmbii?
Hylobates leuciscus
Semnopithecus melalophus
maurus
auratus
frontatus
nasicus
Innuus nemestrinus
cynomolgus?
Nycticebus tardigradus
Tarsius spectrum
Galeopithecus volans
Pteropus funereus
griseus
amplexicaudatus
Pachysoma brachyotis
Harpya cephalotes
Rhinolophus nobilis
Rhinolophus tricuspidatus
trifoliatus
Taphozous saccolaimus
Cheiromeles torquatus
Vespertilio macellus
tenuis
Hardwickii
Timoricus
Schreibersii
Cladobates tana
ferrugineus
Javanicus
murinus
Ptilocercus Lowei
Hylomys suillus
Ursus Malayanus
Mustela nudipes
Lutra leptonyx
simung
Viverra zibetha
Tanggalunga
Hemigalea Boiei
Paradoxurus musanga
leucomystax
stigmaticus
Herpestes brachyurus
semitorquatus
Cynogale barbata
Canis rutilans
Felis pardus?
macrocelis?
Bengalensis
planiceps
catus
aurata?
Sciurus ephippium
maximus
Prevostii
Sciurus Plantanii
tenuis
modestus
insignis
laticaudatus
melanotis
exilis
Pteromys nitidus
sagitta
Hystrix Javanica
longicaudatus
Manis Javanica
Sus barbatus
sp.?
sp.?
Tragulus Javanicus
Kanchil?
Cervus Muntjac
Aristotelis

INTRODUCED.

Elephas Indicus
Bos Sondaicus

DOUBTFUL.

Rhinoceros Sumatranus
Tapirus bicolor?

SUMATRA.

Chief authority, Müller's "Verhandlungen," 1835.

Simia Abelii?
bicolor?
Satyrus
Hylobates agilis
syndactyla
Innuus nemestrinus
cynomolgos
Semnopithecus maurus
auratus
comatus
fascicularis
melalophus
Nycticebus tardigradus
Galeopithecus volans
Pteropus edulis
amplexicaudatus
Cynopterus marginatus
Megaderma spasma
Rhinolophus affinis
nobilis
Cheiromeles torquatus
Vespertilio suillus
Canis rutilans
familiaris
Viverra Tanggalunga
Paradoxurus musanga
leucomystax
Cynogale Bennettii

SUMATRA, *continued* : —

Herpestes Javanicus
Felis tigris
pardus
macrocelis
marmorata?
Bengalensis
planiceps
catus
aurata
Mustela flavigula
Lutra leptonyx
Ursus Malayanus
Gymnura Rafflesii
Cladobates tana
ferruginea
Javanica
Pteromys nitidus
Sciurus maximus?
bicolor
hypoleucos
redimitus
hippuris
Sciurus tenuis
vittatus
nigrovittatus
laticaudatus
Mus decumanus
rattus
Rhizomys Sumatrensis
Hystrix longicauda
Elephas Indicus
Tapirus Malayanus
Equus caballus
asinus
Rhinoceros Sumatranus
Sus vittatus
Cervus Aristotelis
Muntjac
Tragulus Javanicus
Kanchil
Capricornis Sumatrensis
Canis Javanica

JAVA.

Chief authority, MÜLLER'S "Verhandlungen," 1835.

Hylobates leuciscus
syndactyla
Semnopithecus melalophus
comatus
Innuus cynomolgus
Nycticebus savanicus
Galeopithecus variegatus
Pteropus edulis
amplexicaudatus
pallidus
griseus
personatus
Pachysoma titthaecheilus
Harpya cephalotes
Hypoderma Peronii
Megaderma spasma
Cynopterus marginatus
Rhinolophus bicolor
tricuspidatus
euryotis
luctus
trifoliatus
larvatus
affinis
minor
Rhinolophus nobilis
pusillus
Nycteris Javanica
Taphozous melanopogon
saccolaimus
Emballonura monticola
Cheiromeles torquatus
caudatus
Dysopes tenuis
dilatatus
Vespertilio pachypus
circumdatus
imbricatus
harpyia
Hasseltii
Horsfieldii
adversus
suillus
tenuis
pictus
Hardwickii
tralatitius
Cladobates ferruginea
Javanicus
Hylomys suillus
Mydaus meliceps
Ursus Malayanus
Helictis orientalis
Mustela flavigula
nudipes
Lutra leptonyx
Viverra zibetha
gracilis
Herpestes Javanicus
Paradoxurus musanga
trivirgatus
Canis rutilans
familiaris
Felis tigris
pardus
marmorata
Bengalensis
catus
Sciurus bicolor
hypoleucus
Plantanii
maximus?
nigrovittatus
insignis
tenuis
Sciurus melanotis
hippuris
Pteromys nitidus
elegans
genibarbis
lepidus
Mus decumanus
rattus
Pithechis melanurus
Hystrix brevispinosa
longicauda
Lepus nigricollis
Manis Javanica
Equus caballus
asinus
Rhinoceros Sondaicus
Sus verrucosus
vittatus
Tragulus Javanicus
Kanchil
Cervus rusa
Muntjac
Bos Sondaicus
Capra hircus
Mulleri

NICOBAR ISLANDS.

Innuus cynomolgus — Pteropus melanotis — Cynopterus marginatus — Rhinolophus murinus
Scotophilus Coromandelianus — Sus scrofa — Sus n. sp. fid. *Blyth.*

ANDAMAN ISLANDS.

Paradoxurus musanga — Mus Andamensis — Mus urbanus — Sus Andamensis

MALAYAN PENINSULA.

Chief authority, BLYTH's "Catalogue," 1863.

Hylobates agilis
lar
Innuus nemestrinus
cynomolgos
Semnopithecus obscurus
albocinereus
pruinosus
Stenops tardigradus
Galeopithecus volans
Pteropus Edwardsii
edulis
amplexicaudatus
minimus
Cynopterus marginatus
Megaderma spasma
Rhinolophus affinis
nobilis
murinus
Nycteris Javanica
Rhinopoma Hardwickii
Taphozous Saccolaimus
melanopogon
Nyctinomus plicatus
Nycticejus Temminckii
Nycticejus castaneus
Scotophilus Coromandelianus
Vespertilio pictus
adversus
Canis rutilans
familiaris
aureus
Viverra zibetha
Tanggalunga
Viverricula Malaccensis
Hemigalea Derbiana
Paradoxurus musanga
trivirgatus
leucomystax
Cynogale Bennettii
Arctitis Binturong
Herpestes Malaccensis
Nipalensis
brachiurus
Javanicus
Felis tigris
pardus
macrocelis
marmorata
Felis Bengalensis
planiceps
catus
aurata
Mustela flavigula
nudipes
Lutra nair
leptonyx
Ursus Malayanus
Gymnura Rafflesii
Sorex murinus
Pteromys nitidus
punctatus
Sciuropterus aurantiacus
genibarbis
Sciurus bicolor
Rafflesii
hippuris
tenuis
vittatus
nigrovittatus
laticaudatus
Mus bandicota
decumanus
Mus rattus
concolor
Rhizomys Sumatrensis
Hystrix longicaudata
fasciculata
Elephas Indicus
Tapirus Malayanus
Equus caballus
asinus
Rhinoceros Sondaicus
Sumatranus
Sus scrofa
Cervus lyratus
Aristotelis
Muntjac
Tragulus Javanicus
Kanchil
Bos Sondaicus
gaurus
Capricornis Sumatrensis
Capra hircus
Ovis aries
Manis Javanica

COCHIN CHINA.

Innuus silenus
Cheiromeles torquatus
Nycticejus Temminckii
Canis familiaris
Felis tigris
Bengalensis?
catus
Hystrix fasciculata
Elephas Indicus
Equus caballus
asinus
Rhinoceros Sondaicus
Cervus Muntjac?
Capra hircus
Ovis aries

SIAM.

Galeopithecus volans
Pteropus amplexicaudatus
minimus
Canis familiaris
Felis tigris
pardus
catus
Hystrix fasciculata
Elephas Indicus
Equus caballus
asinus
Rhinoceros Sondaicus
Sus scrofa
Cervus lyratus
Muntjac?

CAMBODIA.

From List of Species collected by MOUHOT in "Proc. Zool. Soc." 1861.

Hylobates pileatus
Pteropus Edwardsii
Leopardus viverrinus
Paradoxurus Pallasii
Viverra Malaccensis
Herpestes rutilus, *Gray*
Pteromys momoga *Temm.*
Sciurus splendens
Javensis *Schr.*
MacLellandii
Mouhotii *Gray*
Elephas Indicus
Equus caballus
asinus
Rhinoceros Sondaicus
Rusa Peronii *Cuv.*
Rusa Kuhlii *Müll.*
Cervulus Cambogensis
Tragulus affinis *Gray*
Sus sp.
Manis pentadactyla

TENASSERIM PROVINCES.

Chief authority, BLYTH's "Catalogue," 1863.

Hylobates lar
Innuus nemestrinus
Semnopithecus Potenziani
Pteropus Edwardsii
edulis
minimus
Cynopterus marginatus
Megaderma Horsfieldii
Rhinolophus affinis
murinus
Scotophilus fulvidus
Vespertilio adversus
Berdmorei
Canis familiaris
Paradoxurus trivirgatus
Arctitis Binturong
Felis tigris
pardus
macrocelis
Bengalensis
celidogaster
catus
Cladobates ferruginea
Sorex cœrulescens
fuliginosus
nudipes
Talpa leucura
Pteromys cineraceus
Sciuropterus Phayrei
Sciurus bicolor
hyperythus
chrysonotus
atrodorsalis
Phayrei
Berdmorei
Barbei
Hapalomys longicaudatus
Mus decumanus
rattus
Rhizomys Sumatrensis
Hystrix fasciculata
Elephas Indicus
Tapirus Malayanus
Equus caballus
asinus
Rhinoceros Sondaicus
Sumatranus
Sus scrofa
Cervus lyratus
Bos gaurus
Capricornis Sumatrensis
Capra hircus
Ovis aries
Manis Javanica

BURMA.

Chief authority, BLYTH's "Catalogue," 1863.

Macacus cynomolgos
carbonarius
Stenops tardigradus
Pteropus Edwardsii
edulis
minimus
Cynopterus marginatus
Rhinolophus nobilis
Taphozous longimanus
Nycticejus luteus
Temminckii
Scotophilus Coromandelianus
Vespertilio pictus
Canis rutilans
familiaris
Canis aureus
Paradoxurus leucotis
Felis tigris
macrocelis
Bengalensis
catus
aurata
Lutra nair
Aonyx leptonyx
Ursus Malayanus
Cladobates ferruginea
Hylomys Peguensis
Pteromys cineraceus
Sciuropterus Phayrei
Sciurus ferrugineus
Sciurus hyperythrus
pygerythrus
Blandfordii
Mus decumanus
rattus
robustulus
cinnamomeus
concolor
Peguensis
nitidulus
badius
Rhizomys castaneus
Hystrix longicauda
fasciculata
Lepus Peguensis
Elephas Indicus
Rhinoceros Sondaicus
Sumatranus
Sus scrofa
Cervus lyratus
Aristotelis
porcinus
Muntjac
Tragulus Kanchil
Bos Sondaicus
gaurus
Capra hircus
Ovies aries
Manis Javanica

ARAKAN, TIPPERAH, AND CHITTAGONG.

Hylobates Hoolock
Innuus leoninus
Macacus carbonarius
Semnopithecus pileatus
Phayrei
Barbei
Stenops tardigradus
Pteropus Edwardsii
Rhinolophus larvatus
Canis familiaris
Paradoxurus leucotis
Grayi
Arctitis Binturong
Urva cancrivora
Herpestes Nipalensis
Felis macrocelis
catus
chaus
Mustela flavigula
Helictis Nipalensis
Mydaus collaris
Ursus Malayanus
Cladobates ferrugineus
Sorex Griffithii
Pteromys cineraceus
Sciuropterus spadiceus
Sciurus bicolor
ferrugineus
Assamensis
Lokriah
Mus decumanus
rattus
Rhizomys castaneus
Hystrix Bengalensis
longicauda
fasciculata
Elephas Indicus
Equus caballus
asinus
Rhinoceros Sondaicus
Sumatranus?
Sus scrofa
Cervus Aristotelis
porcinus
Muntjac
Bos gaurus
frontalis
Capricornis rubida
Capra hircus
Ovis aries

ASSAM AND KHASIAH HILLS.

Chief authority, List by Dr. McLelland in "Annals of Nat. Hist.," vi. 366, 1841.

Hylobates Hoolock
Macacus Assamensis
Stenops tardigradus
Pteropus Assamensis
Edwardsii
Nycticejus luteus
Vespertilio sp.
Canis familiaris
Bengalensis
Arctitis Benturong
Mangusta auropunctata
Felis tigris
macrocelis
Charltoni
Bengalensis
Felis celidogaster
chaus
Helictis Nipalensis
Mydaus collaris
Ursus Thibetanus
labiatus
Sorex heterodon
atratus
Griffithii
Talpa microura
leucura
Pteromys magnificus
Sciuropterus villosus
Sciurus bicolor
erythræus
Sciurus hippurus
Lokriah
Lokroides
Assamensis
McLellandii
Mus cunicularis
erythrotes
oleraceus
gliroides
Rhizomys pruinosus
Hystrix Bengalensis
Lepus hispidus
ruficaudatus
Manis brachyura
Sus scropha
Rhinoceros Indicus
Sumatrensis
Equus caballus
asinus
Elephas Indicus
Cervus porcinus
Duvaucellii
pumilio
Bos gaurus
frontalis
Budorcas taxicolor
Capra hircus
Ovis aries

SYLHET.

Hylobates Hoolock
Semnopithecus pileatus
Stenops tardigradus
Pteropus Edwardsii
Rhinolophus larvatus
Nycticejus luteus
Canis familiaris
Paradoxurus leucotis
Felis tigris
pardus
macrocelis
Bengalensis
Felis catus
Helictis Nepalensis
Mydaus collaris
taxoides
Sorex Griffithii
Talpa leucura
Pteromys magnificus
Equus caballus
asinus
Sus scrofa
Capra hircus
Ovis aries

SIKKIM.

Rhinolophus perniger
Pearsoni
brevitarsus
armiger
Nycticejus ornatus
atratus
Vespertilio Pearsonii
Suillus
Darjilingensis
Plecotus auritus
Canis familiaris
Prionodon pardicolor
Paradoxurus Grayi
Felis tigris
pardus
macrocelis
Charltoni
Bengalensis
catus
Mustela strigidorsa
Aonyx Sikkimensis
Ailurus fulgens
Cladobates ferruginea
Sorex soccatus
Hodgsoni
alpinus
Talpa microura
Pteromys magnificus
Sciuropterus caniceps
villosus
alboniger
Sciurus Lokriah
Lokroides
McLellandii
Mus rufescens
nitidus
homourus
Jerdoni
Rhizomys badius
Neodon Sikkimensis
Equus caballus
asinus
Sus scrofa
Capricornis bubalina
Næmorhedus goral
Hemitragus Jemlaicus
Capra hircus
Ovis nahura
aries
Manis aurita

NEPAL AND THIBET.

Chief authority, "Brit. Mus. Catalogue," of Mr. Hodgson's Collection, 1863.

Presbytes Entellus
Macacus Rhesus
Pelops
n. sp. *Hodg.*
Rhinolophus tragulus
macrotis
perniger
Hipposideros armiger
Megaderma schistacea
Pteropus pyrivorus
Edwardsii
Cynopterus marginatus
Kerivoula formosa
Scotophilus fuliginosus
Coromandelicus
Noctiluca labiata
Vespertilio muricola
pallidiventer
Siligorensis
suillus
Daubentonii
Darjilingensis
Plecotus? Darjilingensis
homochrous
Lasiurus nivicolus
Pearsonii?
Nycticejus nivicolus
Felis tigris
varius
perniger
dosul
uncia
Charltoni
macrosceloides
Moormensis
nigrescens
Ellioti
celidogaster
manul
domestica
Lyncus Tibetanus
Viverra zibetha
Malaccensis
Linsang pardicolor
Prionodon pardochrous
Urva cancrivora
Herpestes nyula
Herpestes Nepalensis
Paguma Grayi
lanigera
Paradoxurus quadriscriptus
bondar
Hyæna virgata?
strictus
Cuon primævus
Grayiformis
Lupus laniger
Canis familiaris
aureus
Vulpes flavescens
Bengalensis
ferrilatus
montanus
fuliginosus
Martes flavigula
Martes? toufæus
Mustela erminea
canigula
cathia vel auriventer
subhemachalana
strigidorsa
Putorius Tibetanus
Mustela (putorius) temon
Mellivora ratel
Helictes Nipalensis
Taxidea leucurus
Arctonyx collaris
Taraiyensis
Isonyx
Lutra aurobrunnea
Chinensis
monticola
Taraiyensis
Sinensis
Aonyx Sikkimensis
indigitatus
Helarctos Tibetanus
Ursus Isabellinus
Melursus Libycus
Ailurus fulgens
Talpa micrura
macrura
Sorex murinus
pygmæus
Sorex Sikkimensis
nemorivagus
leucops
caudatus
homourus
oligurus
macrurus
saturatior
holosericeus
sp.
soccatus
Corsira nigrescens
caudata
Mus bandicota
decumanus
Indicus
pyctoris
niveiventer
nitidus
fulvescens
dumecolus
cervicolor
Nepalensis
dubius
Koc
urbanus
caudatior
Taraiyensis
plurimammis
æquicaudalis
morungensis
Nesokia hydrophila
Arvicola? thricoles
Neodon Sikkimensis
Hystrix alophus
leucurus
Lepus macrotus
taloc
œmodias
(Caprolagus) hispidus
Lagomys Nepalensis
Curzoniæ
Pteromys caniceps
nobilis
magnificus
Sciuropterus alboniger
Sciurus purpureus
Sciurus macrouroïdes
Europæus
lokria
Lokroides
sp.
MacClellandii
Arctomys bobac
Tibetanus
Rhizomys badius
Bos taurus, var. Indicus
Bibos frontatus
Bubalus buffelus
Bison poëphagus
Budorcas taxicolor
Kemas Hodgsoni
Tetracerus quadricornis
Cervicapra bezoartica
Gazella Bennettii
Procapra picticaudata
Nemorhedus goural
Capricornis bubalina
Capra hircus
Hemitragus Jemlaica
Ovis burhel
ammonoides
aries
var. Changluk
Moschus moschifer
chrysogaster
leucogaster
Muntjacus vaginalis
Cervus Wallichii
affinis
Axis maculatus
porcinus
Bucervus Duvaucellii
Rusa dimorpha
hippelaphus
Panolia Eedii
Equus caballus
Asinus kiang
Elephas Indicus
Porcula Salvania
Rhinoceros unicornis
Manis pentadactyla

CONTINENT OF INDIA, South of the Himmalayahs.

Chief authority, Blyth's "Catalogue of Mammals in Museum of Asiatic Soc." 1863.

Innuus Silenus
Rhesus
Macacus radiatus
Semnopithecus entellus
Johnii
Priamus
cucullatus
Stenops tardigradus
Loris gracilis
Pteropus Edwardsii
Leschenaultii
Cynopterus marginatus
Megaderma lyra
Rhinolophus mitratus
affinis
Rouxii
speoris
murinus
Cœlops Frithii
Rhinopoma Hardwickii
Taphozous saccolaimus
melanopogon
longimanus
Nyctinomus plicatus
Nycticejus Heathii
luteus
Temminckii
castaneus
Tickellii
canus
Scotophilus Coromandelianus
pachyonyx
Vespertilio Blythii
caliginosus
pictus
Vespertilio pallidus
adversus
papillosus
Canis rutilans
familiaris
pallipes
aureus
Bengalensis
Hyæna striata
Viverra civettina
zibetha
Viverricula Malaccensis
Paradoxurus musanga
Herpestes vitticollis
Smithii
Malaccensis
griseus
Nipalensis
fuscus
Felis leo
tigris
pardus
Bengalensis
celidogaster
catus
ornata
chaus
caracal
jubata
Mustela flavigula
Mellivora ratel
Lutra nair
Ursus labiatus
Erinaceus collaris
micropus
Cladobates Ellioti
Sorex cœrulescens
murinus
serpentarius
niger
melanodon
Hodgsonii
Phocæna Indica
melas
Delphinus perniger
frontatus
Eurynome
Platanista Inda
Gangetica
Pteromys petaurista
Sciuropterus fuscocapillus
Sciurus maximus
Elphinstonei *Blyth*
macrourus
Assamensis
palmarum
tristriatus
sublineatus
Platacanthomys lasiurus
Gerbillus Indicus
Mus bandicota
Indicus
decumanus
rattus
nemoralis
rufescens
infralineatus
homourus
urbanus
cervicolor
Mus terricolor
oleraceus
spinulosus
platythrix
lepidus
Golunda Ellioti
Hystrix leucura
Bengalensis
Lepus ruficaudatus
nigricollis
Elephas Indicus
Equus caballus
asinus
Rhinoceros Indicus
Sondaicus
Sus scrofa
Halicore Dugong
Camelus dromedarius
Cervus Duvaucellii
Aristotelis
maculatus
porcinus
Muntjac
Tragulus meminna
Zebus gibbosus
Bos gaurus
bubalus
Portax pictus
Tetraceras quadricornis
Antilope Bezoartica
Bennettii
Hemitragus hylocrius
Capra hircus
Ovis aries
Manis pentadactyla

CEYLON.

Chief authorities, Kelaart's "Fauna of Ceylon," 1852, and Sir Emerson Tennent's "Ceylon," 1859.

Presbytes cephalopterus
ursinus
Priamus
Thersites
Macacus pileatus
Loris gracilis
Pteropus Edwardsii
Leschenaultii
Cynopterus marginatus
Megaderma spasma
lyra
Rhinolophus affinis
Hipposideros murinus
speoris
armiger
vulgaris
Kerivoula picta
Taphozous longimanus
Scotophilus Coromandelicus
adversus
Temminckii
Tickellii
Heathii
Sorex cœrulescens
ferrugineus
serpentarius
montanus
Feroculus macropus
Corsira purpurascens
Ursus labiatus
Lutra nair
Canis aureus
Viverra Indica
Cynictis Maccarthiæ
Herpestes vitticollis
griseus

CEYLON, *continued* :—

Herpestes Smithii
fulvescens
Paradoxurus typus
Ceylonicus
Felis pardus
chaus
viverrinus
Sciurus macrurus
Tennentii
penicillatus
Sciurus trilineatus
Sciuropterus Layardi
Pteromys petaurista
Mus bandicota
Ceylonus
Kok
rufescens
nemoralis
Indicus
fulviventris
Nesokia Hardwickii
Golunda neuera
Elliotti
Gerbillus Indicus
Lepus nigricollis
Hystrix leucurus
Manis pentadactyla
Elephas Indicus
Sus Indicus
Zeylanicus
Moschus Meminna
Stylocerus muntjac
Axis maculata
Cervus orizus
Rusa Aristotelis
Halicore Dugung

Note.—No Wild Ox, Tiger, Wolf, Hyena, Cheetah, Antelope, or Gazelle.

WESTERN HIMMALAYAH.

Chief authority, Dr. A. Leith Adams, in "Proc. Zool. Soc." 1858, p. 512.

Semnopithecus schistaceus
entellus
Macacus rhesus
Pteropus Edwardsii
Rhinolophus macrotis
tragatus
Scotophilus serotinus
sp.
Vespertilio Leisleri
murinus
pipistrellus
Theobaldii
pallidiventris
barbastellus
Geoffroyi
Canis familiaris
Vulpes montanus
Felis tigris
pardus
Felis catus
ornata
varius
uncia
Felis Horsfieldii
torquatus
Bengalensis
chaus
Hyæna striata
Cuon primævus
Canis familiaris (exactly similar to Shepherd's Dog.)
aureus
lupus
Vulpes Bengalensis
pusillus
flavescens
montanus
Herpestes griseus
nyula
Martes flavigala
abietum
subhemachalana
Mustela erminea
Ursus isabellina
Helartos Thibetanus
Sorex soccatus
micronyx
Erinaceus collaris
Mus bandicota
Hystrix leucurus
Lepus nigricollis
macrotus
oiostolus
Lagomys Roylei
sp.
Gerbillus Indicus
Pteromys inornatus
Sciuropterus fimbriatus
Sciurus palmarum
Arctomys bobac
Thibetanus
Pantholops Hodgsoni
Tragops Bennettii
Antilope Bezoartica
Tetracerus quadricornis
Capricornis bubalina
Nemorhedas Goral
Procapra picticauda
Portax tragocamelus
Hemitragus Jemlaicus
Capra Himalayana
Caucasica
hircus
Hircus megaceros
Caprovis Vignei
argali
Ovis aries
Pseudois Nahoor
Moschus moschiferus
Poephagus grunniens
Cervus Cashmeriensis
Axis maculata
Hyelaphus porcinus
Cervulus vaginalis
Equus Hemionus
onager
caballus
asinus
Sus scrofa

PUNJAB SALT RANGE

Chief authority, Blyth's "Catalogue," 1863.

Rhinolophus cinerascens
Canis familiaris
Vulpes pusillus
leucopus
Felis catus
Erinaceus collaris
Mus spinulosus
Arvicola Roylei
Lepus nigricollis
Equus caballus
asinus
Sus scrofa
Capra hircus
Ovis cycloceros
aries

AFFGHANISTAN.

Vulpes Griffithii
Herpestes Nepalensis
Felis pardus
catus
chaus
Erinaceus auritus
Alactaga Bactriana
Gerbillus Indicus
erythrourus
Mus Indicus
gerbillinus
Myospalax (Georychus) fusco-capillus
Hystrix leucura
Lepus ruficaudatus?
Lagomys rufescens
Equus caballus
asinus
onager?
Sus scrofa
Gazella subgutturosa
Capra megaceros
hircus
Ovis cycloceros
aries

NORTH AND NORTH-EAST AFRICA.

Chief authorities, Geoffroy St. Hilaire in "L' Expédition en Egypte," and Ruppel, "Neue Wirbelthiere," 1835, &c.

Innuus ecaudatus
Dysopes Cestoni
pumilus
Geoffroyi
Rhinolophus ferrum-equinum
clivosus
hippocrepis
tridens
Capensis
unihastatus
Vespertilio murinus
noctula
isabellinus
marginatus
pipistrellus var.
Nattereri
Temminckii
leucomelas
marginatus
Schreibersii
Plecotus auritus
Nycteris Thebaica
albiventris
Rhinopoma microphilum
Pteropus Geoffroyi
Taphozous nudiventris
Nycticejus leucogaster
Erinaceus Algiricus
Myogalea moschata
Sorex pygmæus
tetragonurus
Sorex fodiens
araneus
leucodon
etruscus
Macroscelides Rozeti
Lutra vulgaris
Ursus Atlanticus
Meles taxus
Rhabdogale mustelina
Mustela furo
vulgaris
communis
erminea
sub-palmata
boccamela
Viverra genetta
afra
Bonapartei
Herpestes Pharaonis
Numidicus
Zorilla Vaillantii
Canis aureus
famelicus
Niloticus
variegatus
pallidus
vulpes
zerda
Lycaon pictus
Hyæna striata
Felis leo
Felis leopardus
serval
caracal
jubata
caligata
Lybicus
Chaus
catus
maniculata
margarita
Dipus Ægyptius
Scirtetes arundinis
Ctenodactylus Massonii
Mus decumanus
tectorum
rattus
musculus
sylvaticus
orientalis
chamæropsis
Barbarus
Algericus
dimidiatus
Cahirsinus
Gerbillus pyramidum
Selyssii
gerbillus
Shawii
longicaudis
Gerbii
Gerbillus pygargus
robustus
melanurus
minutus
Psammomys obesus
Myoxus Mumbyanus
Sciurus rutilus
getulus
Hystrix cristata
Sus scrofa
Pus Aeliani
Cervus dama
elaphus
Antilope dorcas
redunca
corunna
Mhorr
dama
bubalus
montana
addax
Soemmeringii
Saltiana
Camelopardalis Giraffa
Ovis tragelaphus
aries
Camelus dromedarius
Equus caballus
Hippopotamus amphibius

NILE DISTRICT.

Chief authority, SCHMARDA, "Geogr. Verbreit. d. Thiere," 1853.

Cercopithecus griseo-viridis
pyrrhonotus
ecaudatus?
Cynocephalus hamadryas
babuin
anubis
Otolicnus teng
Pteropus labiatus
stramineus
Geoffroyi
Megaderma frons
Rhinolophus ferrum-equinum
clivosus
Capensis
Nycteris Thebaica
albiventer
Rhinopoma microphyllum
Taphozous nudiventris
perforatus
Dysopes Cestonii
Geoffroyi
Midas
Vespertilio auritus
marginatus
leucomelas
Ruppellii
Nycticejus leucogaster
Erinaceus Pruneri
brachydactylus
Erinaceus platyotis
Lybicus
diadematus
Sorex Hedenborgi
crassicaudus
Indicus
fulvaster
sericeus
Ratelus Capensis
Rhabdogale mutelina
multivittata
Mustela subpalmata
boccamela
Viverra civetta
genetta
Herpestes ichneumon
sanguineus
zebra
Canis variegatus
famelicus
zerda
pallidus
anthus
Niloticus
pictus
Hyæna striata
crocuta
Felis leo
leopardus
Felis guttata
caracal
chaus
Lybica
maniculata
Sciurus multicolor
leuco-umbrinus
melanurus
Dipus Ægyptica
hirtipes
arundinis
4-dactylus
Mus decumanus
Alexandrinus
rattus
musculus
orientalis
gentilis
albipes
macrolepis
Isomys variegatus
testicularis
cahirinus
Ascomys dimidiatus
Meriones robustus
pyramidum
(murinus)
pygargus
Meriones longicaudus
Burtoni
Rhombomys robustus
melanurus
Psammomys obesus
Hystrix cristatus
Lepus Ægyptius
Habessinicus
Isabellinus
Orycteropus Æthiopicus
Manis Temminckii
Elephas Africanus
Hippopotamus amphibius
Hyrax Syriacus
Camelopardalis giraffa
Antilope dorcas
Antilope dama
Sœmmeringii
leptoceros
defassa
montana
lunata
beisa
Antilope ensicornis
addax
bedea
tragelaphus

SENAAR.

From List by Dr. HEDENBORG in "Isis," 1839, p. 5.

Camelopardalis giraffa
Antilope Sommeringii
dorcas
dama
leucoryx
Simia viridis
Æthiops
Simia sphinx
Viverra zibetha
Canis variegatus
zerda
Niloticus
anthus
Erinaceus Senaariensis
Lepus isabellinus
Sciurus albovittatus
Hyæna striata
Orycteropus Capensis
Manis sp.
Psammomys avellania *Heden.*
Molossus midas *Heden.*
Sorex sericea *Heden.*
Mus gentilis
Mus testicularis
lineato-affinis
Indicus
Rhinolophus sp.
Nycteris sp.

ABYSSINIA.

Chief authority, RÜPPELL, "Reise in Abyssinia," 1838, &c.

Cercopithecus griseovirdis
Colobus guereza
Cynocephalus gelada
hamadryas
babuin
anubis
Pteropus Schoensis
labiatus
Rhinolophus fumigatus
Dysopes pumilus
Vespertilio auritus
pipistrellus
hesperida
Sorex Indicus
Rhabdogale mustelina
Lutra sp.
Viverra Abyssinica
genetta
Herpestes gracilis
mutgigella
zebra
sanguineus
Canis Simensis
mesomelas
Niloticus
pictus
Hyæna crocuta
Felis leo
leopardus
guttata
carracal
chaus
Sciurus multicolor
Gambianus
leuco-umbrinus
rutilus
Rhizomys splendens
Heterocephalus macrocephalus
glaber
Mus albipes
Abyssinicus
leucosternum
Dembiensis
Rhombomys lacernatus
Equus zebra
Elephas Africanus
Rhinoceros cucullatus
Phacochærus Æliani
Syriacus
Habessinicus
Antilope Sœmmeringii
defassa
montana
bahor
oreotragus
decula
redunca
madoqua
Hemperichiana
strepsiceros
beisa
Capra Waeli

EAST AFRICA.

From List by Capt. SPEKE, in "Proc. Zool. Soc.," 1864.

Cercopithecus sp.
Scotophilus sp.
Megaderma frons
Felis chaus
leo
serval
Herpestes badius
Otocyon Lalandii
Hyæna crocuta
Sciurus ornatus
Georychus pallidus
Golunda pulchella
Euryotis sp.
Aulacodus Swindernianus
Æpyceros melampus
Calotragus sp.
Scopophorus montanus
Nesotragus moschatus
Heleotragus reduncus
Kobus ellipsiprymnus
Kobus Singsing
sp. ?
leucotis
Ægoceros leucopheus
niger
Catoblepas gorgon
Boselaphus ?
Tragelaphus Spekii
sylvaticus
Oreas Livingstonii
Strepsiceros kudu
Bos caffer
Camelopardalis giraffa
Phacochærus Æliani
Hippopotamus amphibius
Rhinoceros bicornis
simus
Elephas Africanus

ZAMBESIA.

From List by Dr. KIRKE, in "Proc. Zool. Soc." 1864.

Cercopithecus erythrarchus
pygerythrus
Cynocephalus babouin
Galago crassicaudatus
maholi
Epomophorus crypturus
Phyllorhina gracilis
caffra
Rhinolophus lobatus
Nycteris fuliginosa
Vespertilio nanus
Nycticejus nidicola
Crocidura canescens
Macroscelides intufi
Petrodromus tetradactylus
Mellivora Capensis
Rhabdogale mustelina
Lutra inunguis
Viverra civetta
genetta
Herpestes fasciatus
ornatus
paludinosus
Otocyon Lalandii
Hyæna crocuta
Felis leo
pardus
jubata
serval
caligata
Sciurus mutabilis
flavivittis
cepapi
Aulacodus swinderianus
Mus Alexandrinus
(Pelomys) fallax
Hystrix Africæ-Australis
Lepus saxatilis
Manis Temminckii
Orycteropus Capensis
Equus zebra
Burchellii
Elephas Africanus
Rhinoceros Africanus
Hippopotamus amphibius
Phacochærus Africanus
Potamochærus Africanus
Hyrax arboreus
sp. ?
Camelopardalis giraffa
Æpyceros melampus
Cephalophus ocularis
Nesotragus Livingstonianus
Oreotragus saltator
Heleotragus arundinaceus
Vardonii
lechè
ellipsiprymnus
Ægoceros niger
Tragelaphus sylvaticus
Spekii
Strepsiceros kudu
Oreas canna
Livingstonii
Boselaphus Lichtensteinii
Catoblepas gorgon
Bos caffer

MOSAMBIQUE.

From PETERS' "Naturwissenschaftliche Reise nach. Mosamb." 1855.

Cercopithecus erythrarchus *Peters*
ochraceus *Peters*
flavidus *Peters*
pygerythrus
samango
Cynocephalus Babouin
Otolicnus crassicaudatus
Senegalensis
Microcebus myoxinus *Peters*
Lemur catta
niger
nigrifrons
Anjuanensis
Pteropus Edwardsii
Cynonycteris collaris
Epomophorus crypturus *Pet.*
Phyllorhina vittata *Peters*
gracilis *Peters*
Caffra
Rhinolophus lobatus *Peters*
Nycteris fuliginosa *Peters*
villosa *Peters*
Emballonura afra *Peters*
Taphozous leucopterus *Temm.*
Dysopes limbatus
brachypterus
dubius
Vespertilio macuanus *Peters*
nanus *Peters*
Nycticejus planirostris *Peters*
viridis *Peters*
Chrysochloris obtusirostris *Peters*
Crocidura hirta *Peters*
sacralis *Peters*
canescens *Peters*
annellata *Peters*
Macroscelides fuscus *Peters*
intufi
Petrodromus tetradactylus *Peters.*
Rhyncocyon Cirnei *Peters*
Mellivora Capensis
Rhabdogale mustelina
Lutra inunguis
Viverra civetta
rasse
genetta
Herpestes undulatus *Peters*
fasciatus
ornatus
badius
paludinosus
leucurus
Bdeogale crassicauda *Peters*
puisa *Peters*
Canis adustus
Hyæna crocuta
Felis leo
pardus
Felis serval
caligata
Sciurus flavivittis *Peters*
mutabilis *Peters*
palliatus *Peters*
Cepapi
Myoxus murinus
Aulacodes Swinderianus *Pet.*
Pedetes (Heliophobius) argenteo-cinereus *Peters*
Meriones leucogaster *Peters*
tenuis
Mus microdon *Peters*
arboreus *Peters*
minimus *Peters*
Alexandrinus
dorsalis
Pelomys fallax *Peters*
Acomys spinosissimus *Peters*
Steatomys edulis *Peters*
Krebsii *Peters*
Saccostomus lapidarius *Peters*
fuscus *Peters*
Cricetomys Gambianus
Hystrix Africæ Australis
Lepus saxatilis
Capensis
Manis Temminckii
Orycteropus?
Equus zebra
Elephas Africanus
Rhinoceros Africanus
simus
Hippopotamus amphibius
Phacochærus Africanus
Hyrax arboreus
Antilope (Tragelaphus) sylvatica *Sparrm.*
Cephalophus pygmæa *Licht.*
altifrons *Peters*
Campbell *Gray*
ocularis *Peters*
(Calotragus) melanotis *Forst.*
tragulus *Forst.*
hastata *Peters*
(Nesotragus) moschata v. *Duben.*
(Redunca) Isabellina *Afz.*
(Kobus) ellipsiprymna *Ogil.*
(Hippotragus) nigra *Harris*
(Strepsiceros) strepsiceros *Pall.*
(Æpyceros) melampus *Licht.*
(Bubalis) Lichtensteinii *Pet.*
(Damalis) oreas *Pall.*
(Catoblepas) Gorgon *Smith*
(Oreotragus) oreotragus *Forst.*
Bos caffer
Halicote cetacea
Physeter macrocephalus

AFRICA. SOUTHERN DISTRICTS.

From list of species collected by SIR A. SMITH. See "Illustrations of Zoology of South Africa," 1849.

Galago Maholi
Herpestes badius
(Cynictis) Ogilbyi
lepturus
Hippopotamus amphibius
Rhinoceros Keitloa
bicornis
simus
Aegoceros equina
Boselaphus oreas
Bubalus caama
lunatus
Catoblepas taurina
Cephalophus Natalensis
Damalis (strepsiceros) Capensis
Kobus ellipsiprymnus
Manis Temminckii
Chrysochloris villosa
Macroscelides typicus
rupestris
intufi
brachyrhynchus
Edwardsii
Erinaceus frontalis
Pteropus Leachii
Dysopes Natalensis
Miniopterus dasythrix
Scotophilus Dinganii
senex
varius
Capensis
flavescens
Vespertilio lanosus
minutus
Graphiurus Capensis
Sciurus Mariquensis
Cepapi
Petromys typicus
Otomys albicaudatus
Euryotis irroratus
unisculcatus
Brantsii
Dendromys typicus
melanotis
Gerbillus auricularis
afer
montanus
tenuis
Mus pumilio
dorsalis
Lehocla
Natalensis
colonus

CAPE OF GOOD HOPE.

Chief authority J. Smuts, "Dissertatio Zoologica Enumerationum Mammalium Capensium," 1832.

Cercopithecus pygerythræus
Papio porcarius
Pteropus Hottentottus
Leachii
Rhinolophus clivosus
Nycteris Thebaica
Capensis
Vespertilio Capensis
tricolor
epichrysis
platycephalus
Erinaceus Capensis
Sorex Capensis
varius
Macroscelides typus
rupestris
Chrysochloris capensis
rufa
Gulo Capensis
Mustela Zorilla
Lutra inunguis
Canis pictus
megalotis
mesomelas
Viverra tigrina
felina
Herpestes griseus
penicillatus
Herpestes paludinosus
Rhyzæna Capensis
Proteles Lalandii
Hyæna maculata
fusca
Felis Leo
jubata
leopardus
serval
caracal
caligata
Phoca pusilla
Graphiurus Capensis
Sciurus setosus
Myoxus murinus
Mus decumanus
rattus?
pumilio
colonus
dolichurus
Dendromys mesomelas
Meriones Schlegelii
Ctenodactylus Massonii
Otomys irroratus
unisulcatus
Pedetes caffer
Bathyergus maritimus
Capensis
Bathyergus cæcutiens
holosericus
Hystrix cristata
Lepus Capensis
saxatilis
arenarius
Orycteropus Capensis
Manis Temminckii
Elephas Africanus
Hippopotamus amphibius
Sus larvatus
Phacochærus Æthiopicus
Rhinoceros Africanus
simus
Hyrax Capensis
arboreus
Equus Zebra
Quagga
Burchellii
Camelopardalis giraffa
Antilope leucophæa
equina
barbata
oryx
euchore
pygarga
melampus
Antilope eleotragus
isabellina
capreolus
scoparia
oreotragus
tragulus
rufescens?
melanotis
pediotragus
mergens
pygmæa
perpusilla
sylvatica
Damalis Caama
lunata
oreas
canna?
strepsiceros
Catoblepas gnu
taurina
Bos caffer
Balæna mysticetus
sulcatus
Physeter macrocephalus
Delphinus Capensis
Heavisidii

DAMARA LAND.

Bats. From List by Tomes in "Proc. Zool. Soc.," 1861, 32.

Kerivoula argentata *Tomes*
Nycticejus planirostris *Peters*
Scotophilus minutus *Temm.*
rusticus *Tomes*
variegatus *Tomes*
Miniopteris Schreibersii *Kuhl*
dasythrix *Smith*

MADAGASCAR.

Indris albus
brevicaudatus
Propithecus diadema
lunatus
Varecia leucomystax
nigra
rubra
varia
Lemur catta
Prosimia albifrons
albimana
Anjuanensis
Prosimia collaris
coronata
melanocephala
Mongoz

MADAGASCAR, *continued* :—

Prosimia nigrifrons
rufifrons
xanthomystax
Microrhynchus laniger
Hapalemur griseus
olivaceus
Cheirogaleus Milii
Smithii
typicus
Lepilemur furcifer
Lepilemur murinus
mustelinus
myoxinus
Galago Madagascariensis
minor
Cheiromys Madagascariensis
Viverra fossa
Galidia concolor
olivacea
elegans
Paradoxurus stigmaticus
Cryptoprocta ferox
Galidictis vittata
striata
Herpestes Bennettii sp.
vansire
Eupleures Goudotii
Crocidura Madagascariensis
Centetes ecaudatus
semispinosus
Ericulus nigrescens
setosus
Echinogale Telfairi
spinosus
Pteropus Edwardsii
rubricollis
vulgaris
Rhinolophus Commersonii
Taphozous Mauritianus
Nycticejus Borbonicus

MAURITIUS.

Macacus cynomolgus (introduced ?) Mus decumanus (introduced) Lepus nigricollis (introduced ?) Pteropus Edwardsii

BOURBON.

Mus rattus * Mus decumanus Pteropus Edwardsii Nycticejus Borbonicus

* Introduced by the Buccaneers in 1548, and no difference upon it yet observable. See M. Coquerel in "Rev. et Mag. de Zoologie," 1859, p. 468.

ANGOLA.

From lists of species noticed by Mr. Monteiro, "Proc. Zool. Soc." 1860, p. 245, by Dr. Welwitch; Do. 1865, p. 400, and Dr. Barboza du Bocage, Do. 1865, p. 401.

Cercopithecus samango
melanogenys
Colobus Anglensis
Felis neglecta
servalina
Cynailurus guttata
Nandinia binotata
Genetta Abyssinica
sp.
Canis adustus
Mustela albinucha
Zorilla Africana
Bdeagale nigripes
Crocidura æquatorialis
Bayonia velox
Epomophorus Gambianus
Phyllorhina gigas
Mus rattus
Meriones Schlegelii
Pedetes caffer
Hyrax arboreus
Manis tricuspis

CAMAROON MOUNTAINS.

From List by Capt. Burton, "Zool. Proc.," 1862, 180.

Crocidura morio *Gray*
Mus maura *Gray*
Sciurus Isabella *Gray*
Euryotis irrorata *Gray*
Anomalurus Beecroftii *Fraser*
Troglodytes vellerosus ? *Gray*

WEST AFRICA, South of Sahara, and North of Gaboon.

Chief authority, Schmarda, "Geograph. Verbreit. d. Thiere," 1853.

Troglodytes Gorilla
niger
vellerosus ?
Cercopithecus Sabæus
cynosuros
nictitans
pogonius
Campbelli
Martini
Diana
roloway
leucampyx
erythrotis
cephus
Burnettii
mona
ruber
Æthiops
fuliginosus
Innuus talapoin
Colobus polycomas
leucomeros
satanas
fuliginosus
Pennantii
olivaceus
mormon
leucophæus
ursinus
Cynocephalus papio
Galago Senegalensis *Geoff.*
Demidoffii
Galago murinus
Alleni
Arctocebus Calabaricus
Pterodictus potto
Pteropus stramineus
Geoffroyi
Gambianus
macrocephalus
epomophorus
Hypsignathus monstrosus
Medagerma frons
gigas
tridens
Landeri
Nycteris Thebaica
hispida
Taphozous Senegalensis
leucopterus
Vespertilio Poensis
Nycticejus nigrita
Sorex (Crocidura) Poensis
crassicaudus
morio
Rhabdogale mustelina
Lutra Poensis
Aonyx Calabarica
Viverra civetta
genetta
Poensis
(Richardsonii)
Herpestes fasciatus
Gambianus
Herpestes melanurus
Crossarchus obscurus
Canis anthus
Hyæna crocuta
Felis leo
leopardus
guttata
Senegalensis
rutila
caracal
Sciurus Gambianus
Poensis
Stangeri
rufobrachium
leucogenys
pyrrhopus
erythropus
simplex
præstigiator
minutus
Congicus
Derbianus
Anomalurus Fraseri
Beecroftii
Derbianus
Aulacodus Swinderianus
Mus Allenii
maurus
Cricetomys Gambianus
Meriones pygargus
Hystrix cristata
Africana
Lepus sp.
Orycteropus Senegalensis
Manis longicaudata
tricuspis
Elephas Africanus
Rhinoceros sp. indet.
Hippopotamus amphibius
Chæropsis Liberiensis
Phacochærus Aeliani
Hyomoschus aquaticus
Camelopardus giraffa
Antilope dama var. nanguer
adenota
forfax
redunca
unctuosa
Koba
longiceps
scripta
doria
strepsiceros
sylvicultrix
Ogilbyi
quadriscopa
grimmia
Frederici
spinigera
bubalis
gazella
Moschus aquaticus
Bos brachyceros

CANARY ISLES.

Chief authority, Webb and Berthelot's "Isles Canaries," 1835.

Vespertilio barbastellus
pipistrellus
Canis familiaris
Felis domesticus
Phoca vitulina
Mus sp.*

And the following all introduced.

Lepus cuniculus
Sus scrofa
Equus caballus
Equus asinus
Ovis aries
Capra hircus
Bos taurus
Camelus dromedarius
Capra sp.
Delphinus sp.
Balæna sp.

The ancient historians speak of a wild species of Goat in the Islands called "Guanil."

* "It appears that there were rats, at least in some of the islands of the group, at the time of the arrival of the conquerors, for, according to Juan de Barros, cited by Vieva, the inhabitants of Gomera ate them. . . . . We have neglected to ascertain if these rats were of the common species."—Webb and Berthelot, "Isles Canaries," vol. ii. part ii. p. 9.

NORTH AMERICA.

From RICHARDSON'S "Fauna Boreale Americana," 1829.

Vespertilio pruinosus
subulatus
Sorex palustris
Forsteri
parvus
Scalops Canadensis
Condylura longicaudata
macroura
Ursus Americanus
arctos
ferox
maritimus
Procyon lotor
Meles Labradoria
Gulo luscus
Mustela vulgaris
erminea
vison
martes
Canadensis
Mephitis Americana
Lutra Canadensis
Enhydra marina
Canis lupus occidentalis
var. griseus
albus
nubilus
Canis lupus ater
Canis latrans
familiaris
var. borealis
lagopus
Canadensis
Novæ Caledoniæ
Vulpes lagopus
var. fuliginosa
fulvus
var. decussata
argentea
Virginianus
vulgaris
cinereoargenteus
Felis Canadensis
rufa
fasciata
Castor Canadensis
Fiber zibethicus
Arvicola riparius
xanthognathus
Pennsylvanicus
Noveboracensis
borealis
(Georychus) helvolus
Arvicola trimucronatus
Hudsonius
Grœnlandicus
Neotoma Drummondii
Mus rattus
decumanus
musculus
leucopus
Meriones Labradorius
Arctomys empetra
pruinosus
brachyurus
monax
Spermophilus Ludovicianus
Parryi
guttatus
Richardsonii
Franklinii
Beecheyi
Douglasii
lateralis
Hoodii
Sciurus (Tamias) Lysteri
4-vittatus
Hudsonius
niger
Pteromys sacrinus
Geomys Douglasii
umbrinus
bursarius
talpoides
Diplostoma bulbivorum
Aplodontia leporina
Hystrix pilosus
Lepus Americanus
glacialis
Virginianus
Lagomys princeps
Equus caballus
Cervus alces
tarandus
var. arctica
sylvestris
strongyloceros
macrotis
var. Columbiana
leucurus
Antilope furcifer
Capra Americana
Ovis montana
Ovibos moschatus
Bos Americanus

NORTH AMERICA.

NORTH-EASTERN DISTRICT OF NORTH AMERICA, BETWEEN BARREN GROUNDS AND NORTHERN SHORES OF LAKE SUPERIOR, BORDERED TO THE EASTWARD BY A NARROW STRIP OF LIMESTONE.

From RICHARDSON'S "Fauna Boreale Americana," 1829.

Vespertiliones, 2 or 3 sp.
Sorex palustris
Forsteri
Scalops sp.
Ursus Americanus
maritimus. Does not go further from seashore than 100 miles.
Meles Labradoria
Gulo luscus
Mustela vulgaris
erminea
vison
martes
Canadensis
Mephitis Americana var. Hudsonica
Lutra Canadensis
Canis lupus
Vulpes lagopus
Vulpes fulvus
var. decussata
argentata
Felis Canadensis
Castor Canadensis
Fiber zibethicus
Arvicola xanthognathus
Pennsylvanicus
(Georychus) Hudsonius
Mus leucopus
Meriones Labradorius
Arctomys empetra
Sciurus (Tamias) Lysteri
Hudsonius
Pteromys sabrinus
Lepus Americanus
Cervus alces
tarandus var. sylvestris

NORTH AMERICA. Barren Grounds, viz.:

The North-East corner of North America, bounded to the West by the Coppermine River, Great Slave, Athabasca, Wollaston, and Deer Lakes, to the South by the Churchill or Mississippi River, and to the North and East by the Sea.

From Sir J. Richardson's "Fauna Boreale Americana," 1829.

Ursus Arctos? Americanus	Canis lupus	Arvicola borealis	Arctomys (Spermophilus) sp.
maritimus	vulpes lagopus	(Georychus) tri-mucronatus	Parryi
Gulo luscus	fuliginosus	Hudsonius	Lepus glacialis
Mustela (Putorius) erminea	Fiber zibethicus	Grœnlandicus	Cervus tarandus
vison	Arvicola xanthognathus		Ovibos moschatus
Lutra Canadensis	Pennsylvanicus		

NORTH AMERICA. Mackenzie River District.

From List by Bernard R. Ross in "Nat. Hist. Rev." 1861, p. 271.

Sorex Forsteri?	Genus abundant to Arctic Coast.	Sciurus Hudsonius	To within Arctic Circle.
palustris?		Pteromys alpinus	Mountain ranges Liard River.
Lynx Canadensis	Ranges to Arctic Coast in summer.	Tamias 4-vittatus	From 33° 30′ to 67° N.L.
		Arctomys monax	To 62° N.L.
Canis griseo-albus	To Arctic Coast.	pruinosus	To Arctic Circle.
Vulpes fulvus		Kennicottii	Northernmost ranges of Rocky Mountains.
var. decussatus, argentatus	,,	Castor Canadensis	To within Arctic Circle.
lagopus, var. fuliginosus	,,	Jaculus Hudsonius	To Youcon River.
Mustela Americana		Hesperomys myoides	To Arctic Sea.
Pennantii	To 62° N.L.	Arvicola riparia	,,
Putorius pusillus	To Great Slave Lake.	Richardsonii	To 62° N.L.
Cicognii	To 62° N.L.	xanthognathus	To Arctic Sea.
Richardsonii	To Lapierres House.	Fiber zibethicus	,,
Noveboracensis	To 62° N.L.	Erithizon dorsatus	To within Arctic Circle.
longicauda	,,	epixanthus	To Liard River.
vison	To Arctic Coast.	Lepus Americanus	To within Arctic Circle.
nigrescens (young of P. vison)	To 62° N.L.	glacialis	To Arctic Sea.
Gulo luscus	To Arctic Coast.	Lagomys princeps	Mountain ranges, Liard Riv.
Lutra Canadensis	,,	Alces Americanus	To within Arctic Circle.
Mephitis mephitica	Great Slave Lake.	Rangifer caribou	To Youcon River.
Ursus horribilis	Plains of Upper Missouri to Youcon River.	Grœnlandicus	Barren Grounds and Arctic Coasts.
Americanus var. cinnamomeus	To Arctic Circle and beyond.	Aplocerus montanus	To Arctic Sea.
arctos? (Barren Ground Bear)	Barren Grounds and Arctic Coasts.	Ovis montana	To within Arctic Circle.
maritimus	Arctic Coasts.	Ovibos moschatus	Barren Grounds and Arctic Coasts, not rare.
		Bos Americanus	To Little Buffalo River, Great Slave Lake.
		Vespertilio subulatus	To Salt River.

NORTH AMERICA. United States.

From Professor Baird's "Report on the General Zoology of the United States," 1857.

Neosorex navigator
Sorex Trowbridgii
vagrans
Suckleyi
pachyurus
Forsteri
Richardsonii
platyrhinus
Cooperi
Haydeni
personatus
Hoyi
Thompsoni
Blarina talpoides
brevicauda
Carolinensis
angusticeps
cinerea
exilipes
Berlandieri
Scalops aquaticus
argentatus
Townsendii
Breweri
Condylura cristata
Urotrichus Gibbsii
Felis concolor
onca
pardalis
eyra
yaguarundi
Lynx rufus
rufus var. maculatus
fasciatus
Canadensis
Canis occidentalis
Do. var. griseo alba
var. nubila
var. Mexicana
latrans
Vulpes fulvus
var. decussata
argentata
macrourus
velox
Virginianus
littoralis
Bassaris astuta
Mustela Pennantii
Americana
Putorius pusillus
Cicognanii
Richardsonii
Noveboracensis
Putorius longicauda
Kaneii
frenatus
xanthogenys
vison
nigrescens
Gula luscus
Lutra Canadensis
Californica
Enhydra marina
Mephitis mesoleuca
varians
occidentalis
mephitica
bicolor
Taxidea Americana
Berlandieri
Procyon lotor
Hernandezii
Do. var. Mexicana
Ursus horribilis
Americanus
Americanus
var. cinnamoneus
Didelphys Virginiana
Californica
Sciurus vulpinus
cinereus
Ludovicianus
limitis
Carolinensis
Do. var. Mexicana?
fossor
castanonotus
Aberti
Hudsonius
Fremontii
Richardsonii
Douglassii
Pteromys volucella
Hudsonius
alpinus
Oregonensis
Tamias striatus
quadrivittatus
dorsalis
Townsendii
Spermophilus Beecheyi
Douglassii
grammurus
Couchii
lateralis
Harrisii
Franklini
Spermophilus tereticauda
tridecem-lineatus
Mexicanus
spilosoma
Parryi
Richardsonii
Townsendii
Cynomys Ludovicianus
Gunnisonii
Arctomys monax
flaviventer
Aplodontia leporina
Castor Canadensis
Castoroides Ohioensis
Geomys bursarius
breviceps
pinetis
Clarkii
castanops
Thomomys bulbivorus
laticeps
borealis
var. Douglassii
rufescens
umbrinus
fulvus
Dipodomys Ordii
Phillipii
agilis
Perognathus penicillatus
fasciatus
hispidus
monticola
flavus
parvus
Jaculus Hudsonius
Mus decumanus
rattus
tectorum
musculus
Reithrodon humilis
montanus
megalotis
longicauda
Hesperomys leucopus
texanus
Gambelii
austerus
Nuttalli
gossypinus
cognatus
Boylii
myoides
Hesperomys Sonoriensis
Michiganensis
Californicus
eremicus
leucogaster
palustris
Neotoma Floridana
Mexicana
micropus
fuscipes
occidentalis
cinerea
magister
Sigmodon hispidus
Berlandieri
Arvicola Gapperi
riparia
Breweri
rufidorsum
Townsendii
montana
longirostris
edax
Californica
occidentalis
modesta
Oregoni
austera
cinnamonea
Haydenii
pinetorum
Myodes Cooperi
torquatus
Obensis
Fiber zibethicus
Erethizon dorsatus
epixanthus
Lepus glacialis
Americanus
Washingtonii
campestris
callotis
Californicus
sylvaticus
artemisia
Bachmani
Audubonii
Trowbridgii
aquaticus
palustris
Lagomys princeps
Dasypus novem-cinctus

UNITED STATES, *continued*:—

Dicotyles torquatus
Alce Americanus
Rangifer Caribou
Grœnlandicus
Cervus Canadensis
Virginianus
leucurus
Mexicanus
macrotis
Columbianus
Antilocapra Americana
Aplocerus montanus
Ovis montana
Ovibos moschatus
Bos Americanus

Species not seen or identified.

Sorex palustris
fimbripes
parvus
Harlani
Scalops latimanus
Canis occidentalis
Do. var. atra
rufus
Putorius nigripes
Mephitis mesomelas
Procyon psora
Sciurus Colliæi
mustelinus
nigrescens
lanigerus
leporinus
ferruginiventris
Spermophilus macrourus
Arctomys pruinosus
Lewisii
Thomomys talpoides
Dipodomys Wagneri
Heermannii
Reithrodon Carolinensis
Hesperomys campestris
Arvicola albo-rufescens
borealis
Dekayi
Drummondii
hirsutus
nasuta
oneida
Richardsonii
rubricatus
Texiana
xanthognathus
Lepus Texiana
Nuttalii

NORTH AMERICA, Rocky Mountain district.

From Richardson's "Fauna Boreale Americana," 1829.

Vespertilio subulatus
Sorex palustris
Ursus Americanus
ferox
Gulo luscus
Mustela erminea
vison
martes
Canadensis
Mephitis Americana
Lutra Canadensis
Canis lupus
Vulpes fulvus
Felis Canadensis
Castor Canadensis
Fiber zibethicus
Arvicola riparius
xanthognathus
Novoboracensis
(Georychus) helvolus
Neotoma Drummondi
Mus leucopus
Arctomys empetra
pruinosus
Spermophilus Parryi var. erythrogluteia
phæognathus
guttatus
lateralis
Sciurus 4-vittatus
Hudsonius
Pteromys sabrinus var. alpina
Hystrix pilosus
Lepus Americanus
glacialis
Lagomys princeps
Cervus alces
tarandus
macrotis
Capra Americana
Ovis montana
Bos Americanus

NORTH AMERICA.

Country between Ridge of Rocky Mountains and the Pacific, from North California to the Northern extremity of the Continent.

From Richardson's "Zoology of Capt. Beecher's Voyage," 1839.

Vespertilio. Kotzebue found two small Bats with short ears in Norfolk Sound. Lat. $56\frac{30}{4}°$ N.
Sorex parvus
Scalops Canadensis
Condylura macroura
Ursus Americanus
arctos Americanus
ferox
maritimus
Procyon lotor
Meles Labradoria
Gulo luscus
Mustela (Putoria) vulgaris
(Putoria) erminea
vison
martes
Canadensis
Mephitis Americana
Lutra Canadensis
Enhydra marina
Canis lupus
var. fusca
Canis latrans
ochropus
familiaris
Vulpes lagopus var. fuliginosa
fulvus
vulgaris
cinereo-argentatus
Felis concolor
onca
rufa
fasciata
Phoca vitulina
Phoca Grœnlandica
barbata
jubata
ursina
fasciata
Trichechus rosmarus. Bhering's Straits and the Icy Sea to the northward, seen by Cook as far north as Bristol Bay, Lat. 58° 42′. Unknown to the Esquimaux of the Coppermine and Mackenzie Rivers.

NORTH AMERICA, *continued*:—

Didelphys Virginiana
Castor Canadensis
Fiber zibethicus
Arvicola rubricatus
Neotoma Drummondii
Mus leucopus
Arctomys caligata *Eschsch.*
brachyurus
Spermophilus Parryi
guttatus
Beecheyi
Douglasii
lateralis
Sciurus Hudsonius
Colliæi *Rich.*
Geomys Douglasii
Diplostoma bulbivorum
Aplodontia leporina
Hystrix pilosus
Lepus Americanus
glacialis
Virginianus
Equus caballus
Cervus alces
Cervus tarandus
strongylocerus
macrotis
leucurus
Antilope furcifer
Capra Americanus
Ovis montana

NORTH AMERICA.

PRAIRIE MAMMALS FROM MANEETOBAW, OR MANEEWOOPOO AND WINEPEGOOS LAKES TO FOOT OF ROCKY MOUNTAINS, NORTHWARDS.

From RICHARDSON'S "Fauna Boreale Americana," 1829.

Ursus ferox
Canis latrans
Vulpes cinereo-argentata
Spermophilus Ludovicianus
Arctomys Richardsonii
Franklinii
Hoodii
Geomys talpoides
Diplostoma bulbivorum
Lepus Virginianus
Equus caballus
Cervus alces
Cervus strongyloceros
macrotis
leucurus
Antilope furcifer
Bos Americanus

CALIFORNIA.

Chief authority, Dr. NEWBERRY in Report in "Pacif. R. R. Explor," 1857.

Macrotus Californicus
Antrozous pallidus
Sorex vagrans
Suckleyi
Scalops(Scapanus)Townsendii
Felis concolor
Lynx rufus
fasciatus
Canis occidentalis var. griseo-alba
latrans
Vulpes macrourus
velox
(Urocyon) Virginianus
littoralis
Bassaris astuta
Mustela Americana
Mustela Pennantii
Putorius xanthogenys
vison
Lutra Californica
Enhydra marina
Mephitis occidentalis
bicolor
Taxidea Americana
Procyon Hernandezii
Ursus horribilis
Otaria sp.
Phoca sp.
Didelphys Californica
Sciurus fossor
Douglasii
Tamias Townsendii
quadrivittatus
Spermophilus Douglasii
Beecheyi
lateralis
Aplodontia leporina
Castor Canadensis
Thomomys borealis
bulbivorus
laticeps
do. var. Douglassii
rufescens
Perognathus monticola
parvus
Jaculus Hudsonius
Mus decumanus
musculus
Hesperomys Gambelii
Arvicola Townsendii
Arvicola longirostris
montana
Fiber zebethicus
Erethizon epixanthus
Lepus campestris
Californicus
artemisia
Audubonii
Trowbridgii
Alce Americanus
Cervus Canadensis
leucurus
macrotis
Columbianus
Antilocapra Americana
Ovis montana
Bos Americanus

MEXICO.

From various sources—Baird, Berlandier, Saussure, &c.

Hapale rufiventer
Macrotus Californicus
Desmodus murinus
Glossophaga Mexicana
Antrozous pallidus
Blarina Berlandieri
exilipes
Felis concolor
onca
pardalis
Eyra
yagarundi
tigrina
Lepus rufus
Do. var. maculata
Canis occidentalis
Do. var. Mexicana
Do. rufa
latrans
Vulpes Virginianus
Bassaris astuta
Putorius frenatus
Mephitis mesoleuca
varians
bicolor
Taxidea Berlandieri
Cercoleptes caudivolvulus
Procyon Hernandezii
Do. var. Mexicana
Ursus horribilis
Do. var. horriacea
cinnamoneus
Gulo barbarus
Didelphys Virginiana
Californica
Sciurus limitis
Ludovicianus
Carolinensis
castanonotus
Tamias dorsalis
Spermophilus grammurus
Couchii
tereticauda
Mexicanus
spilosoma
Cynomys Ludovicianus
Castor Canadensis
Geomys Clarkii
Thomomys umbrinus
fulvus
Dipodomys Ordii
agilis
Philippii
Perognathus penicillatus
hispidus
flavus
Mus tectorum
Reithrodon megalotis
Hesperomys Texanus
Sonoriensis
Hesperomys eremicus
Neotoma Mexicana
micropus
Sigmodon Berlandieri
Fiber zibethicus
Cercolabes Lubmanni
Lepus callotis
Californicus
sylvaticus
artemisia
Bachmanni
Bradypus tridactylus
Dasypus novemcinctus
Dicotyles torquatus
Cervus Virginianus
Mexicanus
macrotis
Antilocapra Americana
Ovis montana
Bos Americanus *

* "No skins, but plenty of skulls."

ANTILLES.

From "Notes sur les Mammifères des Antilles," in "Ann. d. Sc. Natur." 2 ser. viii. 60.

Brachyphylla cavernarum
Glossophaga Redmanii
Phyllostoma perspicillatum
Jamaiceus
falcatum
Macrotus Waterhousii
Chilonycteris MacLeayii
fuliginosa
Chilonycteris cinnamomea
quadridens
Phyllodia Parnellii
Dysopes tropidorhynchus
macrotis
obscurus
Pternotus Davyi
Vespertilio Dutertreus
Vespertilio splendidus
lepidus
Maugei
barbatus
Nycticejus Blossevillei
Didelphis Virginiana
Solenodon paradoxus
Lutra insularis
Procyon lotor
Cercoleptis caudivolvulus
Capromys Furnieri
prehensilis
ædium
Dasyprocta aguti
Heteromys anomalus
Mus pilorides

JAMAICA.

From List of Species collected by Mr. Osborne. Tomes, "Proc. Zool. Soc." 1861, p. 66.

Mus rattus
tectorum
Capromys brachyurus
Arctibeus perspicillatus
brachyotum
Monophyllus Redmanni
Macrotus Waterhousii
Phyllonycteris Poeyi
Natalus stramineus
Mormoops Blainvillii
Chilonycteris quadridens
McLeayi
fuliginosa
Chilonycteris Osburni
Noctilio Americanus
Molossus fumarius
Nyctinomus nasutus

GUATEMALA.

From List of Species collected by Mr. Salvin. Tomes, "Proc. Zool. Soc." 1861, p. 278.

Desmodus rufus
Glossophaga Leachii
Sturnira n. sp.
Scotophilus ursinus
(Carolinensis *Geoff.*)
Sorex micrurus
Lutra Chilensis
Felis mitis
yagouarondi
Cercoleptes caudivolvulus
Nasua fusca
Mustela frenata
Mephitis mesoleuca
Vulpes cinereo-argentatus
Dicotyles torquatus
Dasyprocta aguti
Azaræ
Tamandua tetradactyla
Lepus palustris
Cercolabes Novæ Hispaniæ
Cœlogenys paca
Sciurus Ludovicianus
Carolinensis
sp.
sp.
Pteromys volucella
Sigmodon Berlandieri
Mus musculus
Neotoma ferruginea
Hesperomys leucopus ?
sp.
Myoxomys Salvinii
Reithrodon longicauda
Mexicana
Dasypus minutus
Didelphys Californica
Quica

HONDURAS, BELIZE, AND GUATEMALA.

From Mr. Thomas Moore's List of Species, collected by Mr. Leyland, in "Proc. Zool. Soc." 1859, p. 50.

Cyclothurus didactylus
Sciurus Boothiæ
mollipilosus
Galera barbara
Lutra sp.
Leopardus onca
pardalis
Vulpes Azaræ ?
Felis concolor
Dicotyles torquatus
Tapirus Americanus
Cervus (Cariacus ?)
Cervus (Coassus) sp.
Lepus sp.
Dasypus peba

PANAMA.

From Dr. Sclater's List of Species collected by Mr. Bridges in the province of Chiriqui, Panama, in "Proc. Zool. Soc." 1856, p. 139.

Saimarus sciurea *Linn.*
Sciurus æstuans
sp ?
Cyclothurus didactylus
Cholæpus didactylus

ECUADOR.

Chiefly from Mr. Tomes' List of Species collected by Mr. Fraser, "Proc. Zool. Soc." 1858 and 1860.

Arctibeus perspicillatus
pusillus
lilium
Floresii
Vespertilio alberceus
Chiloensis
velatus
Noctilio leporinus
Scotophilus furinalis
Emballonura canina
Molossus obscurus
ater
Glossophaga ecaudata
Phyllostoma hastatum
nigrum
Desmodus rufus
Diphylla ecaudata. Rio Napo.
Saccopteryx lepturus
Felis sp. (between tigrina and macroura)
Tapirus Americanus
Dicotyles torquatus
albirostris
Tamandua tetradactyla
Sciurus æstuans
Hesperomys arvicoloides
Hesperomys caliginosus
maculipes
elegans
cephalotes
latimanus
squamipes
bicolor
minutus
aureus
Renggeri
albigularis
longicaudatus
Mus rattus
Didelphys pusilla
Waterhousei
Echimys semispinosus
Cayennensis
Dasyprocta fuliginosa
caudata
Cœlogenys fulva
Azaræ
cancrivora
ornata
Lepus Brasiliensis

BRASIL.

From BURMEISTER's "Systemat. uebersicht der Thiere Brasiliens." 1854.

Mycetes fuscus
ursinus
Cebus fatuellus
robustus
Callithrix personata
nigrifrons
Hapale penicillata
rosalia
chrysopyga
aurita *Geoff.*
chrysomelas
phyllostoma
brevicaudum
hastatum
spectrum
superciliatum
perspicillatum
brachyotum
bilabiatum
lineatum
lilium
Phyllostoma excisum
Glossophaga ecaudata
amplexicaudata
Desmodus fuscus
Noctilio leporinus
Emballonura canina
saxatilis
calcarata
Diclidurus albus
Dysopes perotis
auritus
holosericeus
Dysopes velox
fumarius
Temminckii
Chilonycteris rubiginosa
gymnonotus
personata
Vespertilio derasus
nigricans
leucogaster
velatus
Felis onca
mitis
macrura (elegans *Wied.*)
concolor
Eyra
yagaroundi
Canis jubatus
Azaræ (Brasiliensis, melanostomas, aguarachai, melampus)
vetulus
Icticyon venaticus
Galictis barbara
vittata
Mephitis suffocans
Lutra Brasiliensis
Procyon cancrivorus
Nasua socialis
solitaria
Didelphis cancrivora
aurita
albiventris
palmata
Didelphis myosurus
Quica
cinerea
incana
murina
agilis
pusilla
tristriata
brachyura
velutina
Sciurus æstuans
Mus decumanus
leucogaster
tectorum
musculus
Hesperomys vulpinus
robustus
squamipes
physodes
anguya
leucogaster
laticeps
pyrrorhinus
eliurus
orobius
expulsus
lasiurus
lasiotis
auritus
arvicoloides
nigrita
rufus
Dactylomys amblyonyx
Dactylomys cuniculatus
cristatus
armatus
Echinomys myosurus
Notomys antricola
Mesomys spinosus
Carterodon sulcidens
Ctenomys Brasiliensis
Cercolabes prehensilis
villosus
Cœlogenys paca
Dasyprocta Azaræ
aguti
Hydrochærus capybara
Cavia aperea
fulgida
leucopyga
Spixii
flavidens
rupestris
Lepus Brasiliensis
Myrmecophaga jubata
tetradactyla
Cervus paludosus
campestris
rufus
simplicicornis
nanus
Dicotyles labiatus
torquatus
Tapirus suillus
Manatus australis

AMAZON AND RIO NEGRO.

Chiefly from WALLACE's "Travels in Brasil." 1853.

Mycetes seniculus. North bank of AMAZON
caraya
Beelzebub
Lagothrix Humboldtii
Ateles paniscus. North bank of AMAZON and east of RIO NEGRO
Cebus apella
gracilis
Callithrix sciureus
torquatus
personatus. South bank of UPPER AMAZON
Nyctipithecus felinus
Pithecia irrorata. South bank of UPPER AMAZON
Pithecia sp. North bank ditto
Brachyurus satanas. GUIANA, east bank of RIO NEGRO
oakary
rubicundus
sp. South side of UPPER AMAZON
Iacchus bicolor. North of AMAZON and RIO NEGRO
tamarin
nov. sp.
Arctopithecus flaccidus
Phyllostoma hastatum
nov. sp.
Tapirus Americanus
Coassus nemorivagus
rufus
Mazama campestris
Dicotyles torquatus
labiatus
Bradypus torquatus
Myrmecophaga jubata
tetradactylus
Cyclothurus didactylus
Priodonta gigas
Tatusia septemcinctus
Didelphys (several species)
Hydrochœrus capybara
Cœlogenis paca
Dasyprocta nigricans
punctata
agouti ?
Cercolabes prehensilis
Echimys sp.
Cercoleptes caudivolvulus
Nasua olivacea
Lutra Brasiliensis
Galera barbara
Vulpes sp.
Felis concolor
onca
pictus
griseus
Rodentia. (Many small Rats, Squirrels, &c.)
Manatus Australis
Platanista Amazonica
sp.

PERU.

(From TSCHUDI, "Fauna Peruana," 1844.)

Ateles marginatus
ater
paniscus
pentadactylus
Lagothrix Humboldtii
canus
Mycetes stramineus
rufimanus
flavicaudatus
robustus
capucinus
albifrons
Chrysothrix sciureus
Callithrix personatus
amictus
Nyctipithecus trivigatus
Pithecia satanas
Midas rufimanus
chrysomelas
labiatus
Phyllostoma elongatum
hastatum
innominatum
pusillum
erythromus
oporophilum
Glossophaga amplexicaudata
Peruana
anistrophora
Vespertilio innoxius
velatus
Vespertilio unicolor
affinis
Molossus naso
velox
fumarius
anonymus
ferox
myosurus
Ursus ornatus
frugilegus
Nasua socialis
montana
Cercoleptes caudivolvulus
Galictis barbara
Mustela agilis
Mephitis mapurito
furcata
Amazonica
Lutra Chilensis
montana
Canis familiaris
carabaicus
nigæ
Azaræ
Felis concolor
onza
macrura
celidogaster
pardalis
yaguarundi
domestica
Otaria jubata
Ulloæ
Didelphys Azaræ
myosurus
opossum
murina
ornata
noctivaga
impavida
Sciurus variabilis
stramineus
æstuans
tricolor
Eriomys chinchilla
Lagidium Peruvianum
pallipes
Octodon Cummingii
Echinomys leptosoma
Mus decumanus
musculus
Acodon Boliviense
Drymomys parvulus
Hesperomys Darwinii
destructor
melanostoma
leucodactylus
Myopotamus Coypi
Sphingurus bicolor
Dasyprocta aguti
variegata
Cœlogenys fulvus
Hydrochærus capybara
Cavia cobaya
Cutleri
Lepus Brasiliensis
Bradypus infuscatus
torquatus
Dasypus 9-cinctus
tatuay
Myrmecophaga tamandua
didactyla
Equus caballus
asinus
Tapirus Americanus
villosus
Sus scrofa
Dicotyles torquatus
labiatus
Auchenia lama
huanaco
paco
vicuna
Bos taurus
Capra hircus
Ovis aries
Cervus rufus
nemorivagus
antisiensis
Cetacea various species

PROPORTIONS OF DIFFERENT FAMILIES IN PERU. From TSCHUDI, op. cit.

	Coast Region.	Sierra Region.		Puna Region.	Cordill Region.	Wald Region.		All Regions.
		West.	East.			Ceja Region.	Eigenth Region	
Quadrumana	..	..	..	..	..	2	20	..
Cheiroptera	4	3	3	3	..	1	16	3
Rapacia	10	5	6	6	4	7	10	12
Marsupialia	3	3	3	..	..	3	6	3
Rodentia	..	..	..	..	..	..	..	..
Sciurina	1	..	..	..	..	1	3	..
Chinchillina	1	1	1	2	2	..	..	..
Psammorychina	..	1	1	..	..	..	1	..
Murina	4	1	1	1	1	1	5	1
Castorina	..	..	..	..	..	..	1	..
Hystracina	..	..	..	..	..	..	1	..
Subungulata	1	..	..	..	1	3	..	..
Duplicidentata	..	..	..	..	..	..	1	..
Bruta	1	..	..	..	..	2	7	..
Pachydermata	..	..	..	..	..	1	3	..
Ruminantia Tylopoda	..	..	..	4	4	..	..	..
Cervina	1	2	2	2	2	2	1	..

CHILI.

From Claudio Gay's "Historia Fisica et Politica de Chili," 1847, and from "United States' Astronomical Expedition," 1855.

Stenoderma Chilensis
Desmodus D'Orbignyi
Dysopes nasutus
Molossus nasutus
Nycticejus varius
macrotis
Vespertilio velatus
Chiloensis
Lutra Chilensis
Hindobria
montana
Mephitis Chilensis
furcata
Patagonica
molinæ
Galictis vittata
Canis familiaris
fulvipes
Magellanicus
Azaræ
Felis catus
concolor
pajeros
Felis guigna
colocolo
Ursus ornatus
Otaria porcina
jubata
flavescens
molossina
Guerini
ursina
Stenorhynchus leptonyx
Macrorhinus proboscideus
Didelphis elegans
Cavia australis
aperea
Chinchilla laniger
Lagotis viscacha
Lagidium pallipes
Cuvieri
cruciger
Abrocoma Bennettii
Cuvierii
Octodon Cummingii
Degus
Octodon Bridgesii
pallidus
Schizodon fuscus
Psammoryctes noctivagus
Poephagomys ater
Spalacopus Pœppigii
Ctenomys Magellanicus
Myopotamus coypus
Oxymicterus scalops
megalonyx
Mus decumanus
musculus
Hesperomys Magellanicus
longipilis
Renggeri
brachyotis
rupestris
xanthorhinus
Darwinii
lutescens
longicaudatus
Reithrodon chinchilloides
Lepus cuniculus
Dasypus minutus
Mastodon Andium
Sus scrofa (introduced)
Equus caballus (introduced)
Americanus
asinus (introduced)
Auchenia llama
guanaco
Vicuna
Cervus pudu
humilis
Chilensis
Capra ægragus (domesticated.) (Parent of all varieties of Goat fid. *Gay*, mistaken for hircus.)
Ovis aries (introduced)
Bos taurus (introduced)
Delphinus lunatus
albimanus
Physeter macrocephalus
Balæna antarctica

PARAGUAY.

From Rengger's "Saügethiere von Paraguay," 1830.

Mycetes caraya
Cebus Azaræ
Nyctipithecus trivirgatus
Phyllostoma superciliatum
lineatum
infundibiliforme
lilium
Glossophaga villosa
Vespertilio villosissimus
nigricans
Molossus laticaudatus
cæcus
crassicaudatus
castaneus
Noctilio dorsatus
ruber
Nasua socialis
solitaria
Procyon cancrivorus
Gulo barbarus
vittatus
Lutra Paranensis
Canis jubatus
Brasiliensis
familiaris
Felis onca
concolor
pardalis
macrura
Yaguarundi
Eyra
catus domesticus
Didelphis Azaræ
lanigera
crassicaudata
Mus Anguya
rufus
callosus
longitarsus
Echimys spinosus
longicaudatus
Myopotamus Bonariensis
Sphiggurus spinosus
Lepus Brasiliensis
Cælogenys Paca
Chloromys acuti
Hydrochærus capybara
Cavia aperca
Dasypus sexcinctus
gymnurus
novemcinctus
hybridus
Dasypus giganteus
Myrmecophaga jubata
tetradactyla
Tapirus Americanus
Dicotyles labiatus
torquatus
Sus scrofa
Equus caballus
asinus
Cervus paludosus
campestris
rufus
simplicicornis
Bos taurus
Capra ægagrus
Ovis aries

LA PLATA.

From BURMEISTER's "Reise durch die La Plata Staaten," 1861.

Mycetes caraya *
Cebus fatuellus *
Callithrix personata *
Hapale pencillata
Dysopes multispinosus
naso
Plecotus velatus
Vespertilio Isidori
Nycticejus Bonariensis
Felis onca
concolor
Geoffroyi
payeros
Canis jubatus
Canis entrerianus
Magellanicus. Valleys of the CORDILLERA
Azaræ. Eastern district.
gracilis *Burm.* PAMPAS, near MENDOZA
Galictis vittata
barbara
Mephitis Patagonica
Lutra Paranensis
Nasua solitaria ?
Didelphis Azaræ
elegans
Reithrodon typicus
Hesperomys
Several species.
Myopotamus coypus
Ctenomys Brasiliensis
Lagostomus trichodactylus
Lagidium Cuvieri
Dolichotis Patachonica
Cavia leucopyga
Anœma leucoblephara *Burm.*
Hydrochœrus capybara
Myrmecophaga jubata +
Dasypus (Priodontes) gigas
(Xenurus) 12-cinctus
hispidus
Dasypus (Euphractus) 6-cinctus
(Tolypeutes) tricinctus
(Praopus) longicaudus
Chlamydophorus truncatus ‡
retusus
Bos taurus (introduced)
Ovis aries (introduced)
Capra hircus (introduced)
Cervus sp.
Dicotyles torquatus
Tapirus suillus

* Brasilian species said by MARTIN DE MOUSSY, "Description Géographique et Statistique de la Confédération Argentine," Paris, 1860, to occur in the wooded districts on the URUGUAY, PARANA, and PARAGUAY, in the north-eastern districts of the Argentine Confederation, but not met with by BURMEISTER.

† Said to occur in northern wooded districts, but not found by BURMEISTER.

‡ Entirely confined to neighbourhood of MENDOZA.

MENDOZA.

EAST FOOT OF THE CORDILLERA.

No Quadrumana. (None in the States of LA PLATA, except in the north-east of ENTRE RIOS, where *Cebus fatuellus*, and in PARAGUAY *Mycetes barbatus* occur, but not living together.)
Dysopes sp.
Vespertilio sp.*
Canis gracilis
Felis concolor
Chlamydophorus truncatus
retusus

* No Phyllostomata have been met with.

V. Table of Geographical Distribution of the *Lagothricinæ*.

From Dr. Slack's Monograph, "Proc. Acad. Nat. Sciences." Philad. Nov. 1862.

	Bolivia.	Paraguay.	South Brazil.	North Brasil.	Peru.	Equador.	New Granada.	Venezuela.	Guiana.
Sapajou paniscus	..	..	..	*	..	..	..	..	*
ater	..	..	..	..	..	..	..	*	*
pentadactylus	..	..	..	..	*	..	..	..	..
Geoffroyi	*	..	*	..	..	..	..	..	..
Belzebuth	..	..	..	*	..	*	..	*	*
marginatus	..	..	*	..	*	..	..	..	..
hybridus	..	..	..	*	*	..	..	..	..
Brachyteles arachnoides	..	..	*	..	..	..	..	..	..
Lagothrix Humboldtii	*	..	..	..	*	*	..	*	*
Aluatta senicula	..	..	..	*	..	*	*	*	..
ursina	..	..	..	*	..	..	*	..	..
niger	*	*	*	..	..	..	..	..	..
Beelzebul	..	..	*	..	..	..	..	..	..
palliata	..	..	..	..	..	..	*	..	..
	3	1	5	5	4	3	3	4	4

VI. Families or Characteristic Forms of Living non-marine Mammals peculiar to special Districts, viz.

1. Families or Characteristic Forms present both in Africa south of the Sahara and the Indian region, and found nowhere else.

Note.—For the most part, large and important families embracing many genera and many species.

All the Catarrhine Monkeys, and especially the Anthropoid Apes and the Baboons
Lemurs
Viverridæ*
Paradoxurus
Herpestes†
Crossarchus
Hyena‡
Ratel
Antilopes,§ and especially the Anoa in the Philippine Isles
Tragulidæ
Rhinoceros‖
Elephant‖
Sirenia
Manis
Crocidura¶
Rhizomys

* With the exception of two stragglers in the Mediterranean district and one in Mexico.
† With the exception of one or two stragglers in the Europeo-Asiatic region.
‡ Probably not properly reckoned peculiar, having been an inhabitant of Europe in very recent geological times.
§ With the exception of two or three stragglers in the Europeo-Asiatic region.
‖ Perhaps these ought not to be reckoned here, as they have in recent geological times been inhabitants of Europe and Asia.
¶ With the exception of three stragglers out of thirty-four in the Mediterranean district.

2. Families or Characteristic Forms present in Africa south of the Sahara, and not in the Indian region;—and in the Indian region, and not in the African.

Note.—Almost all individual genera, often single species.

I. In Africa and not in India.

Cheiromys*
Rhabdogale and Zorilla
Horses†
Hippopotamus
Chrysochloris
Potamogale
Macroscelides‡
Rhynchocyon
Centetidæ (Madagascar)
Echimyina (two stragglers of South American type)
Hyrax§
Pectinatoridæ
Graphiurus and Anomalurus
Xerus
Bathyerges
And the following genera of Mice:—
Cricetomys-Saccostomus
Steatomys and Dendromys
Mystromys and Otomys
Pedetes

* Probably should be reckoned among and transferred to the Lemurs in the preceding list.
† Those found in India belong to the trans-Himmalayan part of Asia, being north of the southern slope of that range.
‡ With the exception of one in North Africa.
§ Also found in Arabia.

II. In India and not in Africa.

Galeopithecus ?*
Sun Bear
Weasels
Deer
Camel
Tapir
Tupaias
Platacanthomys
Rhinosciurus
Pteromys

* It depends upon its affinities whether this form should be reckoned here or not.

3. Families or Characteristic Forms present in Europe or Asia north of the Himmalayahs; and found neither in Africa south of the Sahara, nor in the Indian region.

Note.—All individual genera or single species.

Badger	Elk	Marmot
Glutton	Rein-deer	Spermophile
Bear (typical)	Bison type of Oxen	Tamias
Sheep	Talpa	Beaver
Goat*	Crossopus, Amphisorex, and Diplomedon	Voles
Chamois †	Glis, Muscardinus, and Eliomys	Spalax, Siphneus, and Ellobius

* With the exception of an Indian straggler.

† With the exception of a detached species (*Haplocerus Sumatrensis*) on the mountains of Sumatra.

4. Families or Characteristic Forms found in Europe, and not in Asia, or vice versâ.

I. In Europe and not in Asia.

None, except perhaps Myogale, but it is found in Russia, close to Asia, as well as the Pyrenees, and it therefore, in all probability, also occurs in Asia.

II. In Asia and not in Europe.

None.

5. Families or Characteristic Forms found both in the Northern half of North America and the Europeo-Asiatic region, and nowhere else.

Note.—All individual genera or single species.

Fox	Urotrichus
Badger	Polar Hare
Glutton	Lemming
White Bear	Spermophile
Elk	Marmot
Reindeer	Tamias
Chamois (Antilocapra)	Lagomys
Bison type of Oxen (Urus and Bison)	Dipodinæ

6. Families or Characteristic Forms peculiar to the New World, and found in both South and North America.

Note.—Almost all large and important families, embracing many genera and many species.

Platyrrhine Monkeys	Racoons	Sigmodontes
Galictis	Peccaries	Hesperomys
Skunks	Armadillos	Reithrodon
Coatis	Hystricidæ *	Opossums

* A species of porcupine (Erethizon rufescens *Gray*) has been lately obtained in Columbia, which Dr. Gray considers an *Erethizon*, an opinion in which I do not concur.

7. Families or Characteristic New World Forms found in South America, and not in North America; and in North America and not in South.

Note.—All single genera.

I. In North, and not in South America.

Condylura	Scalops	Blarina
Cynomys	Erethizon ?	

II. In South, and not in North America.

Note.—All, with one exception, families or genera, consisting of a considerable number of species.

Sloths *	Solenodon †	Cavies, Chinchillas, Octodons, Agoutis
Ant-eaters	Phyllostoma ‡	Echimyina §

* One found in Costa Rica may be said to have passed the boundary of S. America.
† In Cuba.
‡ Also found in Central America and West Indies.
§ Two found in Africa.

VII. Letter from Wm. Gifford Palgrave, Esq.,

AUTHOR OF "JOURNEY IN CENTRAL AND EASTERN ARABIA," ETC.

This letter was received too late to allow the information contained in it to be embodied in the preceding pages, but is printed here by permission of his brother. It will be seen that the results which he suggests from experience and personal observation very nearly correspond with those at which I had arrived by reasoning from the less extended premises which we already possessed.

"*Cairo*, 14 *May*, 1866.

"Dear Sir,

"Your letter of the 2nd April reached Egypt at a time when I was absent hence up the Nile, and was only delivered to me on my return a few days ago. This circumstance must apologize for my not having sooner replied to your varied queries.

"Some of these I must indeed, owing to the limitation of my own knowledge, leave without a satisfactory answer; others are fortunately more within my range.

"The limits of the monkey-tribe run, to the best of my knowledge, *south* of Nejed; at least, I neither saw nor

heard of them in that region. But in 'Oman I saw a few of a small grey species, with brown faces and long tails, resembling a kind not uncommon in the Soodan. The natives of 'Oman, like those of the Nile-valley, call them 'nisnas.'

"I met with one, and only one, porcupine, but do not precisely remember where; I think it was in the neighbourhood of Sotar.

"Squirrels in plenty, whether in Nejed or in 'Oman; but no flying-squirrels, nor did I hear of any such.

"Nor did I hear or see anything of the Hyrax.

"Buffaloes are common enough in Hasa; I have seen them, but less frequently, on the 'Oman coast. In Nejed there are, I believe, none; though hunch-backed cattle, like the Indian breed (called sometimes Bhaminee), occur there.

"The aspect of the 'Omanees has been by me described at some length in my work on Central and Eastern Arabia. Slender, lithe, brown, rather delicate-featured, without the strongly aquiline nose and narrow eyes of the northern Arab, but also without any Negro thickness of the lips; they, I mean the 'Omanees of pure race, no less than, in my opinion, the whole Kahtanee stock, of which they are perhaps the most authentic representatives, belong to the African Abyssinian family, and migrated at an early period into Arabia from the West, across the Straits of Bab-el-Mandeb. This Abyssinian family has nothing, in a specific sense, common with the Negro: it belongs to another class, of which the Berbers of Soodan are a further example.

"It is true that in the shading of races, always running to some degree into each other, especially when of the same or neighbouring localities, the Kahtanee, 'Omanee, or Abyssinian, three closely connected varieties of common origin, offer, some more, some less, certain points of resemblance with the generality of other African families, and hence, though furthest removed, even with the Negro. This is the case not only in physical points, as the eye, the too-slender calf, the uniform darkness of skin and hair, &c., but also in the type of institutions, superstitions, and the like. Still, while asserting my conviction of the *African* origin of the South-Arabian colony, and of the 'Omanees in particular, I should not be disposed to admit the imputation of Negro affinity.

"Now to your question, how far Arabia was formerly part of the South-African district. That it was so once in pre-historic and perhaps even pre-human times, before the waters of the Red Sea broke their way into the great valley which they now fill, is hardly to me a matter of doubt. Geological and mining investigations, conducted sufficiently far at least on either side of the Red Sea to ground a conviction on the subject, confirm, I am told, this belief. My own observation of the superficies of the soil, its qualities, the forms of the mountains and valleys, the character of the rivers, or rather torrents, the vegetation also, would lead me to class Arabia with Africa much more than with Asia.

"At what point on the eastern shores of the Red Sea such relationship ceases I cannot say. But *within* Arabia itself I should place the limit at Djebel Toweyk, an African mountain, while Djebel Shomer and what lies about it to north, east, and west, appear to me rather a continuation of Syria—Asia in short. Thus I should incline to give Nejed (the Kaseem included), along with Hasa and 'Oman to the east and south-east, and the westerly coast from Meda in Salih and Kheybar, besides Yemen, its Zehamah and Hadramowt, with the entire tract of Desert between its limits, over to Africa; regarding the Desert itself, in a certain measure, as a continuation of the Great Saharah of Africa, from which indeed it is only separated by the two long parallel undulations or valleys, that of the Nile and that of the Red Sea.

"The general slope of the Desert is from north to south and from east to west. But the mountain-chain that girds it seawards is of so varying an elevation, though on the whole uniform in character, that it would require more geological knowledge than I possess to determine what may have been its original relations to the plateau it rims. Its greatest elevation is in the mountains of 'Oman, and the gulf opposite is very deep. Perhaps the general rise, if it took place, may have been from north to east.

"I have never visited the interior of Beloochistan, but from what little I have seen of its coasts and inhabitants, I should not incline to think that they ever belonged to Africa; nor the Persian coast of the Persian Gulf either: its character being totally different from that of the Arabian side.

"Hoping that these remarks, however scanty, may prove of some use to you for the object you desire,

"I remain, Dear Sir,

"Yours very obediently,

"W. GIFFORD PALGRAVE.

"*To A. Murray, Esq.*,

"67 *Bedford Gardens, Kensington.*"

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