

often intercalated layers of slate, quarried for roofing purposes. The thickness of the slabs is from three to six inches.

[We have given our correspondent's communication the place of honour, because if it be worth anything at all, it is worthy of the utmost prominence. We add, however, a word of caution, for we cannot append our own testimony to Mr. Taylor's opinion. On receiving the communication, we immediately wrote to Mr. Taylor for the specimens, which he has obligingly sent us, but, unfortunately, we are no wiser than before. The impressions, or whatever they may be, to our eyes, look more like portions of gigantic Lingulæ, or some fibrous shell, than like footprints. If however they occur alternately on each side of a direct line, as stated by Mr. Taylor, that fact is very singular. We would willingly have devoted a plate to them had there been any utility in so doing, but although our artistic powers are tolerably good, as our readers know, we have much doubt whether we could render them either pictorially or sufficiently intelligibly to be of any practical value. Mr. Salter, to whom we sent an outline of one impression, says they are not organic at all, and adds that we cannot possibly say whether the beds be Cambrian until they have been properly surveyed. We differ from him as to their organic origin. We consider there is little doubt about that; but *what* they are we are disposed to think it passes the wit of man to say.—ED. GEOL.]

PAST LIFE IN SOUTH AMERICA.

BY CHARLES CARTER BLAKE, ESQ.,

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The minds of the British public, accustomed to review the complex phenomena of geology and palæontology in the Old, are apt to neglect the equally interesting evidences afforded to them of past life in the New World. American palæontology is distinguished not because the mighty hemisphere, now the seat of political convulsions, has not passed through analogous phases of life-stages to those presented by the elder continent, nor because the extinct fauna of America is less interesting than that of Europe, Asia, or Australia, nor that the most eminent men in both worlds have omitted to call attention to the stupendous monuments of bygone existence in the pampas of La Plata or on the shores of Patagonia, but because the public mind has not yet sufficiently realized the idea that during the period whilst Europe and Asia underwent the manifold and changing influences of geological time, like conditions were passed through in America.

A tradition exists in the minds of all the earliest aboriginal nations of America, on the banks of the Missouri, at Manta, at Punta St. Elena in Ecuador, at Suacha in New Granada, at Tarija on the eastern slopes of the Andes, and at Tagua-tagua in the south of Chile, that a vast nation of colossal human beings existed before the present inhabitants. These giants, the credulous and imaginative mind of the native supposed, were destroyed by the deities, like the old race of Titans by the Olympian gods, or the Hrimthursar—the

frost-giants of ice and snow—by the supporters of Odin and the Æsir in the Norse mythology. It is instructive to trace these unhistorical narratives back to their physical origin; it is suggestive to find that such origin is rational, and does not rest upon any purely mythical base. Such a colossal race of beings did exist in the old times; they were, however, the gigantic mastodons, etc., which man drove before him and exterminated. When M. Albert Koch, in the year 1842, brought the so-called "*Missourium*" skeleton to England, which afterwards was demonstrated to be identical with the *Mastodon Ohioticus*, and now forms a conspicuous object in the British Museum, amongst many other dubious anecdotes recounted by him, was one, that with the bones of *Mastodon* had been found an arrowhead, proving apparently the existence of mankind in America contemporaneous with this great elephantine animal. This marvellous "Yankee cram" was ridiculed by English geologists in 1842 as quite preposterous. Now, however, in 1862, we look at the subject with more cautious and less sceptical eyes. We know that both in France and England, mankind either lived so far ago as the period when the hair-clad elephants and rhinoceroses existed in Normandy and Gascony, or (which is nearly the same thing) the elephants and rhinoceroses lived down to the period when human life, in a state of barbarism, existed in Europe. It is not more preposterous to believe that man, at one time, hunted elephants in the Confederate States than to believe that he hunted rhinoceroses in Normandy, and was himself the prey of hyænas in Devonshire. At all the places where a tradition like this exists in America, evidence of the existence of a fossil *Mastodon* has been found.

In Brazil, proof has been afforded us of the existence of a tradition amongst the Indians of a large ape, termed by them Cayporé, which is the analogue of the gorilla and chimpanzees of Africa. As no man-like ape of any sort exists in South America at the present time, two theories may be suggested to account for this popular belief. The negro slaves may have carried their faith in the existence of a huge ape from Sierra Leone and the Gaboon to Brazil, in the same manner as we recognize still amongst the half-Christianized slaves of America the traces of the Obeah-worship of their African forefathers. But the answer to this assumption is, that the tradition in question does not exist in the negro, but in the Indian mind. None of the Indians, however, have actually seen a Cayporé, or rather none of those Indians who profess to have seen them have undergone satisfactorily the ordeal of interrogation by such painstaking observers as Dr. Lund.

A signification is afforded us of the meaning of this tradition when we learn that a colossal ape, approaching in size the human stature, once existed in Brazil, and that it was probably contemporaneous with the early human races. The *Protopithecus Brasiliensis* was four feet high, surpassing far the dimensions of any existing American monkey; it nevertheless was a true platyrrhine, like all the simian forms of the New World. Found in the later Pliocene,

the possibility of its being contemporaneous with early man is rendered more probable when we reflect that on the borders of Lake Lagoa Santa, and at Minas Geraes, human remains have been found, coupled with those of forty-four extinct animals, amongst which was another large fossil ape, *Callithrix primævus*.

The extinct elephants and horses of America afford an interesting source of contemplation to the reflective palæontologist. Existing elephants, as is well known, are but of three species, those of Africa, India, and Sumatra. Professor Owen has, however, pointed out that our knowledge has been expanded by fossil evidences, and that during the Pliocene period, elephants existed in Africa, India, Europe, China, and Australia. Thus far there was little to surprise the practical observer, who was accustomed to find a wider distribution of animal life in the later Tertiary times than in the present day. But when we learn that two species of elephant (*Elephas primigenius* and *Texianus*) and one species of *Mastodon* co-existed with each other, in warm, temperate, and cold latitudes in North America, and that two other so-called species of elephantine animal (*Mastodon Andium* and *M. Humboldtii*) browsed on the trees of South America, prior to the upheaval of the vast Andian chain of mountains, astonishment almost verges into incredulity. "Well," it may be said, "since we have thus evidence of American elephants, why may we not have evidence of American rhinoceroses?" We have such proof of an animal closely allied to the rhinoceros and palæothere, discovered by Mr. Darwin in Patagonia, and which at the same time bears some points of analogy, but not of affinity, with the llamas. This animal, the *Macrauchenia*, has also been found on the eastern slopes of the Andes at Tarija, and in the very heart of the Aymará country at Corocoro. Imagination can scarcely conceive the period when this bulky brute, with its long stiff neck, elevated straight upright, as in the guanaco, contested the pastures of Patagonia and Bolivia with the llamas and horses around it. Some reader will say, "I understood that horses were first introduced on the American continent by the followers of Columbus, and that when the aboriginal Americans first viewed the mounted Spaniards, they regarded them as centaur-like monsters, or almost as divinities." The horse, however, of various species, had existed in the New World for countless centuries prior to the advent of the Spanish conquerors: whether its extinction dated previous to the human era is yet undemonstrated; tradition even of its existence had passed away long before the Columbian epoch. Various species of these early American horses are known to us; one from the Confederate States* of North America; another from Bolivia; a third from Chile; and a fourth from Patagonia. The last species (*Equus curvidens*), the best known, because the first discovered, indicates a

* An argument for the scientific recognition of the Confederate States might be founded upon the fact that their flora and fauna differ essentially from those of their more northern antagonists in the less fertile country north of the Ohio. The term "fauna of the United States" conveys no idea to the scientific mind. The term, to use Dr. Latham's expression, "means so much as to mean nothing."

species differing only from the European horse in the greater curvature of the molar teeth. These horses no doubt existed in herds, like the quaggas of South Africa, or like the wild asses of Central Asia. The same influences which promote the numerical increase of horses in South America at the present day, would have tended to promote a similar increase of the equine race in South America during the Pliocene period. The horse was first introduced in A.D. 1537, at Buenos Ayres; forty-three years afterwards, in A.D. 1580, they were found at the Straits of Magellan. The cause why the horse, once numerous in America, became extinct centuries before the time of Columbus, at present baffles speculation. More significant is the fact, that we find in the Old World a three-toed fossil horse (*Hipparion*) which by its annectant affinities to the earlier odd-toed herbivores, has been supposed to be absolutely the ancestor of the present *Equus caballus*. In the New World, however, no such form exists. Whence, then, on a derivative hypothesis, the horses of America?

Two tapirs are found, the one in the North, the other in South America; a dubious tapirine form has also been found at St. Louis, in Missouri, associated with fossils "of unquestionable Secondary date!" Pomel has erected this very suspicious type into a new genus, termed by him *Menodus*. It is not surprising that we should find tapirine forms in South America, when we reflect that the existing tapir, or d'anta, is found over the whole Brazilian and Argentine Confederation, and from Guatemala to Patagonia. In the Panamá and Chiriquí countries, the woolly tapir of the Andes, or Pinchaqué,* also exists, a species far more nearly allied to the extinct races than the other American or than the Sumatran tapir. In the Andes of South America, above the line of 6000 feet, the existing tapir is not found.

When Castelnau was at Tarija, surrounded by fossil remains of mastodons, horses, macrauchenes, scelidotheres, llamas, and other mammalia, he was struck with the state of "fat, contented ignorance" in which the good Franciscan monks had arrived in geological knowledge. The remains which he saw were all, according to them, proofs of the existence of a gigantic race of men who existed prior to the deluge. Padre Osorio, a Jesuit of Paraguay, had declared, in 1638, that he had seen with his own eyes, in the Gran Chaco, a race of men of the highest physical and mental cultivation so tall that the Jesuit with his upraised arms could scarcely touch their heads. Peradventure, these races belonged to the same stock with those Indians of California, immortalized by Padre Fray Pedro Simon, who had ears so large that they served for canopies, and under each of them five or six men could find ample shelter; or they might be allied to those of a neighbouring province, who, when in need of repose, used to go to sleep beneath the waters of a lake on the banks of which they lived. Even the giants whom Osorio imagined, how-

* Last summer, specimens of this species, which is hitherto unrepresented in our National Museum, were to be sold in the streets of Panamá for a dime = 6d. English.

ever, were far too small to have produced the mastodon bones of Tarija. When this argument was pressed on the monks, they replied, "that the bones had swelled since they were buried in the earth." Castelnau naïvely remarks, that a like proof might demonstrate that the mastodon bones of Tarija might have belonged to dwarfs. This singular superstition is by no means confined to the monks. Don Francisco Antonio Casello gravely tells his readers, that "the soil of the town of Tarija possesses the virtue of making bones grow beyond measure. If a body of ordinary size is buried, and is disinterred after the lapse of some time, we find the bones excessively swollen." The English reader who scoffs at this ridiculous theory of the Tarijans may, however, recollect that, in the year 1862, there are still a few writers in England who speak of "an unknown mysterious force" which has kept the species of animals distinct from each other throughout all time. We are not yet so far removed from the trammels of an adherence to unproven and undemonstrable assumptions in science to entitle us to ridicule the hypotheses which our less-gifted friends in Bolivia may suggest to the world.

The genus *Antilope* at present is chiefly confined to the Old World. Forty-seven species are found in the Old World, and one, or perhaps a second, in North America. In Brazil, during the Pliocene period, a species (*Antilope maquinensis*) has been discovered by Lund, besides two individuals of the extinct genus *Leptotherium*, allied to *Cervus*. The latitude of Brazil was as well qualified to support antelopes as that of Africa or India, although, since the Pliocene period, their place has been taken by the numerous species of small stags, the Guazútis and Brocket deer of Brazil, Colombia, and Mexico.

The European dog, like the horse, was introduced into America by the followers of Columbus. Prior, however, to this time, there existed in Mexico a small lapdog, termed Alco by the Peruvians, and a mute silky-haired breed employed by the natives of Santo Domingo in the chase. These last were termed Goschis, or Gasque, which word seems, according to Hamilton Smith, to be corrupted from Guarachay, and indicates that these animals were imported by the Caribs from Tierra Firme. Besides these, various species of true wolves, prairie wolves, aguára wolves, aguára dogs, and aguára foxes, being fourteen species in all, are described by Colonel Smith. In Santo Domingo, and on the Pampas of South America, feral dogs are found, the offspring of the European races. The origin of the dogs of Nootka Sound, of the Mackenzie River, and of the Esquimaux, is yet undemonstrated. In Brazil, during the Pliocene period, three species of dog existed.

Mr. Waterhouse has pointed out that the existing mice of the New World all belong to a different genus (*Hesperomys*) to those of the Old. Many species of fossil mice of the same natural group as the other American mice are found in Brazil, where their bones whiten the floor of the caves and fissures where they have been dropped by the owls, who then, as now, preyed upon the diminutive

rodents and insectivores. The portions of the skeleton found fossil are exactly those parts which the owl cannot digest, and which she casts out of her mouth as innutritive or indigestible. A coypú of superior size to the existing species is found in the Pliocene strata of Brazil. Many species of small pacas, agútis, and capybáras then existed allied to those which now infest the banks of the tributaries of the Amazon and Essequibo.

Blood-sucking bats then, as now, found a source of aliment in the warm-blooded mammalia. Cats, the size of the jaguar, subsisted on the numerous herbivorous animals. One of them deserves especial mention. The existing cheetah (*Cynailurus jubatus*) is confined to the Old World, where alone this "hunting-leopard," with non-retractile claws, preys upon the antelopes and deer. It is a surprising fact that a very small species of this hunting-leopard (*Cynailurus minutus*) existed during the Pliocene period in Brazil, with the gigantic *Machairodus*, or sabre-toothed tiger, and the Buenos Ayres bear. This *Machairodus*, the most carnassial of all the predatory animals known to zoologists, existed in the cave breccias of Devonshire, in the Sewálik (tertiary) strata of India, in the mountains of Auvergue and Darmstadt, and in the Patagonian and Brazilian bone caves.

In Chile the progress of geology is small. The erudite and painstaking M. Claudio Gay, who was appointed by the Chileno Government to report on the physical productions of their republic, actually, when describing the Plesiosaurian bones from Concepcion,* spoke of them as being contemporaneous with the Mastodons of Taguatagua, and like them, destroyed by the diluvial catastrophe. These *Plesiosauri* existed at Concepcion during the Jurassic period, and their remains singularly resemble those of some of the same genus from the chalk in England. The same observations may apply to the Ammonites, of which characteristic species are found in the "Oxfordian" and "Liassic" strata of Peru and Chile.

Thus far we have recounted some of the leading features of South American Palæontology. The exigencies of space, however, necessitate a brief glance only at the remains of the hosts of *Toxodontia* and smooth-brained *Bruta* which peopled the forests of Paraguay, the Pampas, and Patagonia. The labours of Mr. Charles Darwin, one of the few philosophical travellers who have ever visited South America, have made the forms of the Megatherium, the Mylodon, and the Glyptodon familiar to us; and the idea of South American Palæontology naturally recalls to the mind of the reader the bulky forms of these huge beasts. The armadillos and sloths of Brazil now form the puny representatives of these bygone creations. The *Mylodon*, which, poised on its hinder limbs, and supported by its powerful tail, tripod-like, with long-continued rapid and energetic vibrations, tore down the most gigantic trees; the *Glyptodon*, whose circular mailed cuirass suggested the idea to its first discoverers, that they had found a buried hog-head in the sand; the *Toxodon*, with its strange interblending of characters, allied to the rhinoceros and the manatee, yet resembling

* Geologist, vol. v. p. 110.

strongly a magnified guinea-pig, all these past forms are enshrined in our Museums, or by their restorations ornament our Crystal Palace. The object of the present paper is not again to describe those animals which the acumen and critical skill of Professor Owen, or the sagacity and hardy research of Mr. Darwin, have unveiled to us. South American Palæontology may well be proud that such labourers as these exist to illustrate its phases, or to demonstrate its signification. Whilst, however, since the publication of the works of these *Dii majores* of science, "evidence has been creeping in" indicative of the existence of new and interesting forms of extinct life in South America, a rapid glance at some of which has been the object of the preceding paper.

The following list is founded on that of Gervais ('Zoologie et Paléontologie Françaises'), but is only intended to offer a sketch of the principal South American Mammalia. Many of the species entered in this list, will doubtless sink to the rank of mere synonyms; whilst under one name, often many natural species will be comprised. In the meanwhile, it will be found useful as indicating the imperfect state of our present knowledge, which is caused by the fact that large districts of South America are yet unexplored by the palæontologist or the fossil collector. The malevolent influences, which retard the progress of physical science in countries colonized by Spaniards or their descendants, have been well described by the late Mr. Buckle, in the second volume of his 'History of Civilization.'

LIST OF FOSSIL MAMMALIA OF SOUTH AMERICA.*

Cebus macrognathus.	E. Americanus (of Chile, a different species from that of North America, to which the same name has been given).
Callithrix primevus.	E. curvidens.
Protopithecus antiquus = Brasiliensis, <i>Lund.</i>	Mastodon Andium, <i>Cuv.</i> } ? same spec.
Jacchus grandis.	M. Humboldtii, <i>Cuv.</i> } C. C. B.
Ursus Bonariensis, <i>Gerv.</i>	Toxodon platensis, <i>Owen.</i>
Canis protalopex.	T. angustidens.
C. incertus.	Nesodon imbricatus, <i>Owen.</i>
C. troglodytes, <i>Lund.</i>	O. orinus, <i>Owen.</i>
Machairodus neogæus, <i>Owen, Lund sp.</i>	N. Sullivani, <i>Owen.</i>
Felis protopanther.	Phyllostoma, <i>v. sp.</i>
Felis exilis.	Dysopes Temminckii.
Cynailurus minutus.	Mus, <i>v. sp.</i>
Antilope Maquinensis.	Ctenomys antiquus, <i>v. priscus.</i>
Leptotherium majus, <i>Lund.</i>	C. Bonariensis.
L. minus, <i>Lund.</i>	Phyllomys Brasiliensis.
Cervus.	Nelomys antricola.
Auchenia (2 <i>sp.</i>), <i>Lund.</i>	Lonchophorus fossilis, <i>Lund.</i>
Dicotyles (<i>pl. sp.</i>).	Loncheres elegans.
Tapirus suinus.	Aulaeodon Temminckii?
Macrauchenia Patagonica, <i>Owen: ? M.</i>	Myopotamus antiquus, <i>Lund.</i>
Boliviensis, <i>Huxley.</i>	Synætheres magna.
Equus neogæus.	

* Adapted from Gervais, 'Zoologie et Paléontologie Françaises,' 2nd edition, 4to. Paris, 1859.

- Synætheres dubia.
 Lagostomus Brasiliensis.
 Dasyprocta capreolus.
 Cœlogenyx laticeps.
 C. major.
 Kerodon antiquum.
 K. bilobidens.
 Cavia robusta.
 C. gracilis.
 Hydrochærus sulcidens.
 Megamys Patagonensis, D'Orbigny (genus
 of which the classification is yet doubt-
 ful).
 Megatherium Cuvieri, *Desm.*
 Mylodon robustus, *Owen.*
 M. Darwini, *Owen.*
 M. Harlani, *Owen.*
 Megalonyx Kaupii: ? Gnathopsis Oweni,
Leidy.
 M. Maquinensis.
 Scelidotherium leptocepalum, *Owen.*
 S. Cuvieri, *Owen.*
 S. Bucklandi, *Owen.*
 S. minutum: ? S. Brongiarti, *Lund.*
- Cœlodon Maquinense, *Lund.*
 Sphænodon minutus, *Lund. sp.*
 Glyptodon clavipes, *Owen.*
 G. reticulatus, *Owen.*
 G. tuberculatus = Schistopleurum typus,
 S. gemmatum and tuberculatum, *Nodot.*
 G. ornatus, *Owen.*
 G. clavicaudatus, *Owen.*
 Hoplophorus euphractus.
 H. selloi, *Lund.*
 H. minor.
 Pachytherium magnum, *Lund.*
 Chlamydotherium Humboldtii, *Lund.*
 Chlamydotherium s. Ocnotherium gigas,
Lund.
 Dasypus maximus.
 D. antiquus.
 D. punctatus.
 Euryodon latidens, *Lund.*
 Heterodon diversidens, *Lund.*
 Glossotherium, *Owen* = Mylodon?
 ? Abathmodon fossilis, *Lund.*
 ? Speothos pacivorus, *Lund.*

A VISIT TO RECVLVER, IN KENT.

BY GEORGE D. GIBB, M.D., M.A., F.G.S.

Those who are familiar with Sir Charles Lyell's 'Principles of Geology' will remember the illustrations given, in the twentieth chapter of his able and most philosophical book, of the action of the sea on various parts of the coasts of Britain. The changes that have taken place in some parts, even within the historical period, have been very considerable, and perhaps none more so than on the eastern and south-eastern coasts of England, where the encroachments of the sea seem to have been of the most destructive character. From the western coast of the Isle of Sheppey, extending eastwards to Herne Bay, Reculver, and Thanet, the destructive action of both the sea and the other elements has been witnessed by many in our own time; and every year tells its history of a change in some part of this line of coast.

I had long contemplated a visit to Reculver, and in the month of June last the opportunity of seeing this part of the coast was afforded me. No place is more accessible from London than Herne Bay; the visitor has the opportunity of running down either by steamer from London Bridge, or by the London, Chatham, and Dover Railway from either the London Bridge or Victoria stations. If time is an object, the latter is preferable, and it was the route I chose, which enabled me to see and learn all that I desired in a single day.