THE REGIONS OF VEGETATION

R. B. HINDS Esq.

Harry Soane, 1882.

11 Greenland 2 species & genus

36 Species of European genera in Mexico, Scotland — like other alpine regions, no peculiar Family & few genera (like Labrador & Arctic regions

48 Mountains of Brazil visited Gardner, Glaziou (Miers)

54 Abbeokuta & Fernando Po near Gaboon — 62

62 Vaccinium & Fragaria on Sandwich Is.

63 — 47 species in Low Arct, belonging to 40 genera & 27 families (small list, few individuals & temperate but new species)

94 Relations of Algerian & Cape & of Ford H. Borneo, Mexico, California

2912

EXTRACT FROM THE PUBLICATION

OF

CAPTAIN SIR EDWARD BELCHER, R.N.

ENTITLED

NARRATIVE

OF

A VOYAGE ROUND THE WORLD,

PERFORMED IN

HER MAJESTY'S SHIP SULPHUR,

DURING THE YEARS 1836—42.

LONDON:

PRINTED BY G. J. PALMER, SAVOY STREET, STRAND.

Charles Darwin Esq 5-9-64

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from the Author

THE REGIONS OF VEGETATION;

BEING

AN ANALYSIS OF THE DISTRIBUTION OF VEGETABLE FORMS OVER THE SURFACE OF THE GLOBE

IN CONNEXION WITH

CLIMATE AND PHYSICAL AGENTS.

BY

RICHARD BRINSLEY HINDS, Esq.

SURGEON, R. N.

LONDON:

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1843.

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ADVERTISEMENT.

Her Majesty's ship Sulphur was the school in which I more particularly studied geographic botany. Preconceived views, and results drawn from the perusal of the writings of scientific travellers, were here practically tested. Her extensive voyage, and rapid transition from one portion of land to another, afforded rich and most favourable sources of comparison. With a bias towards the subject, it was an occupation of delight to develope the principles of the study, and to apply them to a result. Climate is the basis on which the earliest data must be founded, and with the liberal use of instruments, observations on temperature and humidity were in time collected. These, with observations on the physical condition of the surface, furnish us with many of the circumstances which govern the distribution of the flora of the world. What I have accomplished under these heads. has been collected together, and forms the subject of a lengthened paper, which, through the liberality of the proprietors of the Annals of Natural History, has been already published. Naturally following the consideration of physical agents, were the subjects of original distribution, amount, relative proportion to space, and similar details; but which I have not yet ventured to make public.

The result of these investigations was the developement of regions of vegetation, and which had their origin and stability in previously established views. At the same time, I do not insist that these are natural, but that taken in their entireness, they present, in situations, circumstances of remarkable individuality. In the meantime they will be found eminently useful in studying the features of vegetation, and more particularly in leading the subject to the naturalization of plants—the great end and aim of geographic botany.

My views respecting these regions have been more fully dwelt on in Sir W. J. Hooker's Journal of Botany for June 1842, and our space here does not permit me to enter on these at a greater length. It is enough to add that these regions are the result of observations matured during the voyage, and that with fourteen of them I have been practically acquainted.

R. B. H.

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THE

REGIONS OF VEGETATION.

I.—THE GREENLAND REGION.

Extent.—An important portion of the northern hemisphere is occupied by a vegetation entirely without trees, and covering a dreary, bleak, inhospitable surface, hardly capable, even in the most favoured spots, of any cultivation. Greenland composes much of this, and the region further comprises that part of America to the north of a line commencing at Hudson's Bay in 60° N. lat., thence stretching to 68° at the Mackenzie river, and continued to Behring's Straits; with that part of Siberia to the north of 65°, and Iceland, Spitzbergen, and Melville island. The natural course of this line is with the forest, obeying its sinuosities and sweeps, and will be found to enclose a region of some peculiarities. The northern limit of course only ceases with the vegetation.

Physical Characters.—The surface is usually extremely rocky and rugged, destitute of soil, and maintaining its flora in sheltered valleys and ravines. It is now a re-

ceived fact, that all those plants mutually existing in the northern parts of Europe and America are found in this region; hence it seems to have been a region of transmission, and to have been eminently active in supplying the northern parts of these two portions of the globe with many plants in common.

CLIMATE.—There are but two seasons, summer and winter, which succeed each other with surprising rapidity. The latter is severe and protracted, and occupies a large portion of the year; summer suddenly follows on its decline, and from the now protracted presence of the sun much heat is accumulated. The activity of the vegetation would appear to be in proportion to the duration and completeness of its dormant condition, and is very characteristic. In Greenland, the range of the thermometer during the year is from 84° to—48°, or 132 degrees.

FLORA.—Shrubs compose the larger vegetation; they are not the large bushy plants known as such in temperate and warm climates, but are of dwarf stature, and appear to be struggling against the elements to attain that state which nature has destined them to assume; thus some of them are only a few inches high; still they are numerous, and have sometimes showy flowers with brilliant colours. Leguminosæ, umbelliferæ, caryophylleæ, and cruciferæ, have a smaller share in the vegetation than might be expected; bnt ranunculaceæ, saxifrageæ, and ericaceæ, hold a more important station, and the proportion of gramineæ has greatly increased. It is, however, among cellulares that the greatest change is manifest, particularly in musci.

Greenland has a flora of 403 species, of which 172 are phenogamous, and 231 cryptogamous. These are distributed among 137 genera and 45 natural families. On analysis, the phenogamous species are found to be in proportion

to the genus as 2 to 1, the cryptogamus as 4·5 to 1; taking the whole flora, the value of the genus is 2·9, of the natural family 3; of the phenogamous genus 2, of the cryptogamous 4·5; of the phenogamous family 2·3, of the crytogamous 7·3. The genera have few species compared with Iceland; saxifraga, draba, ranunculus stellaria, cerastium, epilobium, pedicularis, eriophorum, juncus, carex, and salix, being the only phenogamous genera with more than three species. There are no trees; pyrus aucuparia reaches 61° as a small shrub, and about a dozen species are peculiar.

Iceland, situated between 63° and 68° N. lat., has 652 species. Of these 359 are phenogamous, and 293 cryptogamous. Umbelliferæ constitute 109th part, leguminosæ 81st, cruciferæ 40th, compositæ 33rd, and gramineæ 15th. The most numerous phenogamous genera are salix, saxifraga, ranunculus, gentiana, veronica, potamogeton, plantago, epilobium, rumex, polygonum, geranium, hieraceum, gnaphalium, orchis, carex, juncus, agrostis, aira, poa, festuca.

Melville island, in 75° N. lat., has 116 species distributed between 22 families; or of phenogamous plants 67, and of cryptogamous 49. A few of the species are not found elsewhere, and it may have a genus of its own, at present an unsettled point.

Relations.—The most interesting are with the three upper regions of alpine vegetation, where many of its characteristic features reappear.

II.—THE NORTH-WEST AMERICA REGION.

Extent.—The rocky mountains and Pacific Ocean on the east and west, and 68° N. lat., and the Columbia river to the north and south, enclose this region.

PHYSICAL CHARACTERS.—The surface is irregular, consisting entirely of mountain and valley, without the least pretensions to plain; the former composed chiefly of primitive rocks, among which granite is abundant, quartz is sometimes seen, and rarely, I believe, limestone. The soil is often rich, from the great accumulation and rapid decomposition of vegetable remains.

CLIMATE.—Being freely exposed to winds from the ocean, and westerly winds prevailing, the climate is considerably modified. Compared with Europe, it is far cooler for the latitude, and with the opposite coast without those extremes so common there. It is, however, much more moist than either, and the rainy days are very frequent. In 56° N. lat., the mean temperature has been ascertained to be 45°5, and the range of the year from 2°3 to 81°9. Only thirty-seven really clear and fine days were experienced, on forty-six snow fell, and on the rest more or less rain. This was at Sitka, or New Archangel. At the Columbia river in 46° N. lat., being the southern limit, and with an interval from the above of ten degrees, the mean-temperature is 54°, the annual range from 18° to 92°, number of rainy days 157, the quantity of rain 53·6 inches, and snow is rarely seen.

FLORA.—Though the inequalities of the surface are great, soil is abundant, and the investing vegetation vigorous. The constant moisture favours premature decay, and thus the trees are early undermined, and falling from their ranks in the forest, cover the ground in vast numbers. It is not easy to conceive how thickly the surface is crowded with these, unless by recalling something like the vast accumulations of the coal measures. Within the tropics I have never seen anything equal to the scene of devastation the northern part of this region presents; trunks of trees, of great length and clear of branches,

are seen on all sides strewed in tiers, and covered with a dense agamic vegetation. It would often seem that they were unable to attain a good old age, as, always exposed to moisture from the repeated rains, they have yielded to its influence immediately that period of life arrived when the activity of vegetation diminishes. Here everything is moist, the soil is completely saturated, mosses and lichens are in their liveliest vigour, and much of the surface is swampy.

Tracing the regions from Prince William's Sound in 6° north latitude to the east, and then to the south, the whole will be found to be covered with one vast forest. It extends to the north as far as the boundary line, and to the south, through several degrees of latitude, to the Columbia river, where a sudden change occurs, and which is a very decided line of demarkation between this and the California region. Returning for a moment to Prince William's Sound, a tongue of land stretches from it to Oonalaska and the other islands of the Aleutian chain, over which there is no forest, and the only approach to trees is a few stunted spruces in the sheltered valleys. But the vegetation is very luxuriant, and towards the close of summer the roses, willows, and lupins form a dense mass not easy to penetrate. At this time, on the sides of the lower mountains, sustaining towards their summits irregular patches of snow, there is a richness and quiet beauty about the flora particularly attractive, for many of the flowers are showy, and their colours clear and brilliant. Here especially are mimulus luteus, geranium eriostemon, lupinus nootkatensis, making the surface quite blue with its flowers, epilobium latifolium, polemonium humile, and some ferns and grasses, many of the latter of which are in common with Europe. Elsewhere the forest, though dense, consists of but few

species; abies has three, which, with cupressus thyoides, constitute all the larger trees, whilst some smaller are contributed by cratægus, salix, cerasus, betula, and to the south diospyros.

The undergrowth of shrubs is so extremely luxuriant, that it appears a chief characteristic, and, regardless of the shade of the forest, flourishes in great vigour. These shrubs are chiefly the species of vaccinium, menziesia, rubus, and ribes, which, though numerous in species, have a multitude of individuals. Towards the south, lonicera involucrata, mahonia glumacea, symphoria racemosa, gaultheria shallon are superadded, and particularly aspidium munitum, a handsome fern, very social, and covering portions of the surface to the exclusion of others. Another peculiarity is, that though some of the genera appear through several degrees of latitude, they are continued by new species; thus ribes, rubus, rosa, and lupinus, are seen everywhere in the region, yet each species had but a small range, and is immediately succeeded by another.

Relations.—Two plants are common which are eminently distinguished for their large foliage, and as members of families of a warmer climate; panax horridum, a fine shrub with large showy leaves, upwards of a foot in length, has a range of growth from 45° to 61° north latitude; and dracontium camtschaticum, with a very different habit, spreading its broad leaves over the surface, on the under side of which is usually a small hairy helix, abounds in moist situations from 61° north latitude to the Columbia River, or 46°19′. Mimulus guttatus has a wide habitat, extending from 59° 30′ north latitude to 37° in California. The herbaceous plants are of families common to these latitudes, though both cruciferæ and umbelliferæ are scarce, and the genera are

similar to the European with few exceptions. The southern part mixes but feebly with the California region, and the features are preserved singularly intact even to the banks of the Columbia. Here quercus commences with many others, abies ceases suddenly, and pinus partly supplies its place, nor disappearing from the elevated lands till it arrives in the vicinity of Panama. A collection of plants from its northern part contained about one half common with the north of Europe, and a similar number with Siberia.

III.—THE CANADA REGION.

Extent.—To the west the Rocky Mountains, and to the east the Atlantic Ocean; in the south a line commencing on the coast in 44° north latitude, thence to the margin of Lake Erie and to the Mississippi, then taking a north, and afterwards a north-west direction by the north branch of the Saskatchawan river to the Rocky Mountains. Its northern outline is irregular, being determined by the forest; towards Hudson's Bay it crosses the country in 60° north latitude; but attains a higher latitude to the west, till it reaches 68°, near the Mackenzie River.

Physical Characters.—Much of this surface is covered with forest. There are no important mountain chains, though smaller ranges separate several large plains. These have generally a fruitful alluvial soil, but wild rocky districts are not uncommon, too dreary and inhospitable to support a vigorous vegetation. The primary mountains of the Iroquois region pass its southern boundary, and separate some plains in the vicinity of the lakes and the St. Lawrence, the luxuriant fertility of which,

according to Murray, is almost unsurpassed, and whose characteristics are limestone rocks, waters highly charged with calcareous matter, and copious deposits of gypsum and marl. Nova Scotia, New Brunswick, and the islands, form an important portion of the region. Here granite, clay-stone, sandstone, and limestone, constitute the basis on which the soil reposes. In Prince Edward's Island the soil is fertile, and though occasional masses of granite occur, scarcely a stone or pebble is to be seen; sandstone is the basis of the island, and clay abounds. In Newfoundland the surface is more rocky, secondary formations prevail, with coal and various sandstones. Of Labrador little more is known than that it is covered with a vast forest, and is unusually inclement for the latitude.

Climate.—This varies considerably, but is everywhere severe for the latitude. Like the United States the extremes of temperature are intense, and with the anomaly that the seasons of Lower Canada run into greater extremes than Upper Canada, or that the range is greater near the sea than inland. Summer and winter succeed each other so rapidly, that spring and autumn are not distinguishable. About the close of October, sharp frosts commence, heavy falls of sleet and snow occur in November, and this state of the weather prevails till the middle or end of December, when it rapidly yields to a clear sky and a frosty atmosphere, which continue till nearly the end of March. A rapid change now takes place; a fervid sun bursts forth, which melting the snows and unlocking the frozen streams, vegetation appears with magic haste, and every spot is beautiful and green with verdure. From May to September inclusive, a warm and oppressive summer prevails.

Flora.—Unlike the neighbouring Iroquois region, the

forest offers little variety in its trees, these being chiefly spruces, as abies alba, a. nigra, a. canadensis, with occasionally thuja occidentalis, pinus resinosa, and larix microcarpa. Mixed with these are several trees with deciduous leaves, but they do not extend quite so far north, nor so completely enter into the composition of the forest; quercus ambigua, betula papyracea, b. lenta, b. excelsa, populus balsamifera, p. tremuloides, p. grandidentata; and with limits something more southern, acer saccharinum, a. rubrum, fagus ferruginea, ulmus americana. A close compact forest is unfavourable to the humbler vegetation, and thus there is no great variety; and in the present instance is more particularly characterised by shrubs of cerasus, sambucus, viburnum, salix, rhodora, sedum, kalmia, ribes, rubus, rosa, and amelanchier.

Relations.—Among the herbaceous plants are many peculiar species, but almost always of genera widely diffused over other parts of the continent or of Europe. About half-a-dozen genera only seem peculiar. Wherever, during a portion of the year, the climate possesses considerable warmth, there will generally be found representatives of forms belonging more abundantly to warmer latitudes; here, accordingly, are met with two species of panax, two of aralia, and dracæna borealis.

IV.—THE IROQUOIS REGION.

Extent.—I have attempted, in the name of this region, to connect the memory of the brave Indians with the magnificent forests they once claimed as their own. The word was applied collectively to several tribes of North Americans, well known in their day as the Six Nations,

and closely concerned in the early political transactions of this country. They were the admiration of their co-temporaries, but nothing now remains of them, unless sufficient of their history to adorn a tale. Perhaps a few solitary descendants may be traced out, far from the land of their fathers, but no more. The forests themselves are disappearing under the thrift and industry of their greatest enemy, the white man; the trees that once sheltered the Indian lodge are falling beneath the axe of the regenerator; and the trackless forest, so often traversed by the skilful hunter and dauntless warrior, is now covered with corn-fields, canals, and rail-roads.

The boundary of this region commences on the coast of the Atlantic in 44° north latitude, and proceeds, just skirting the southern margin of Lake Erie, onward to the Mississippi. It now continues along the edge of the forest on its western shore, approaching it more closely at its mouth than in its northern course; and afterwards crossing Florida in 27° north latitude, with the Gulf of Mexico and the Atlantic Ocean, it incloses an irregular parallelogram of about 690,000 square miles.

Physical Characters.—This surface is unequally divided by the Alleghany mountains, which slope towards the Atlantic and the Mississippi. The latter has also a gradual and regular ascent from the Gulf of Mexico to the lakes of Canada, of 1,200 feet. Both of these plains abound in a fruitful soil wherever the forest has been removed, but superior fertility and excellence belongs to that between the mountains and the Mississippi. The mountain system, though attaining no great elevation, has a length of 1,200 miles, and occupies a belt of about one hundred, of which two-thirds are estimated to consist of valleys. It traverses the region obliquely from north-

east to south-west, and has an average height of between 2,000 to 3,000 feet, the highest summits never exceeding the latter. There are elsewhere some loftier elevations, Mount Washington being 6,428 feet, and the Black Mountain in Carolina 6,476 feet. The Alleghanies are divided into four distinct ridges, and are chiefly composed of primary stratified rocks. This stratification is very generally prevalent, and one of its effects is visible in the numerous cascades, falls, and rapids of the rivers. Gneiss, granite, sienite, and hornblende are frequent in the northern parts, and are equally the basis of the plains as of the mountains. Towards the south the granitic rocks in a great measure disappear, and are supplanted by an extensive limestone formation. Much of the surface of the plain between the mountains and the Atlantic is covered by sand, which in many instances is far more productive than might be imagined, from, it is supposed, a submersion to which it was formerly exposed. There are likewise extensive patches of marsh or moist meadow land, and nearer the sea occasionally inundated districts.

Climate.—With so wide an extent of latitude, there will be much difference in the climate. Generally it may be called a climate of extremes, particularly in the northern part, where this feature is experienced in greatest force. The vicissitudes are great, and accomplished with much rapidity; the extreme of heat and cold even in a single day is immense, and it has been known to be 41°; 28° is mentioned as common. After the hottest days, the nights may be piercingly cold. An American writer has summed up a detail of his climate by observing, that in spring it has the moisture of Britain, in summer the fervid heats of Africa, in June the bland warmth of Italy, in winter the snows of Norway and

the ice of Holland, the tempestuous winds of the West Indies, and in all seasons the variable weather of Great Britain. Such a combination is not likely to be favourable to the human race, but under it the vegetation is undoubtedly varied and luxuriant. Plants love a warm atmosphere, especially if combined with brilliancy of the sun's rays; and a succeeding cold season, instead of proving hurtful, seems rather to prepare them to expand in the coming summer with unusual vigour.

Flora.—A vast impervious forest once covered the whole eastern part of North America. Towards the north it commenced around the shores of Hudson's Bay, reaching as far as 60°; and stretched towards the south in one broad mass, bounded on one side by the Atlantic Ocean, and on the other by the Mississippi, the father of rivers. It did not quite confine itself to the east side, but crossing the river, continued down its west bank in a belt of fifty or a hundred miles broad. The only interruptions throughout its extent were occasioned by two inroads of prairie, mentioned under that region. To the south it received no check till it arrived on the margins of the Mexican Sea. A portion of this forest comprises the present region. Beyond the northern boundary of the latter the forest consists of but few species, but to its south a new state of things prevails; for many new and extensive genera now contribute their species, and bestow an unrivalled variety. One hundred and fifty distinct kinds of trees are known, of which eighty attain an height upwards of sixty feet. Of these the most peculiar to the region are the various carya, nyssa, liriodendron, taxodium, robinia, and gymnocladus. A small part only of this forest has been removed; but where this has happened a material change has been produced in the vegetation. Its original herbaceous plants, which re-

quired shelter and protection, have disappeared from the clearings, and were replaced by strangers. But if the forest again resumes possession of the soil the old inhabitants return, to the exclusion of the intruders. The numerous species furnishing these trees are, with few exceptions, peculiar, and, including those just mentioned, belong to the following genera, many of them having several species:—Quercus, ulmus, pinus, juglans, diospyros, cupressus, acer, negundo, laurus, celtis, gleditschia, virgilia, magnolia, tilia, maclura, œsculus, pavia, corylus, fraxinus, ostrya, juniperus, morus, rhus, rosa, euonymus, rhamnus, hamiltonia, hydrangea, prinos, clethra, kalmia, cratœgus, comptonia, myrica, sorbus, halesia, berberis, olea, philadelphus, malus, cerasus, gordonia; but many of the latter are only shrubs.

Among herbaceous plants the most characteristic are, in *Labiatæ*, collinsonia, salvia, gardoquia, calamintha, hyptis, ceranthera, macbridea, monarda, cunila, scutellaria, hyssopus; *Scrophularineæ*, seymeria, gerardia, macranthera, herpestis, gratiola, pentstemon, orobanche, antirrhinum, mimulus; *Euphorbiaceæ*, croton, euphorbia, phyllanthus, jatropha, tragia; *Ranunculaceæ*, clematis, thalictrum, delphinium, ranunculus; *Compositæ*,—these are extremely numerous and varied; aster and solidago on which Schouw has erected a region, but they are assembled with so many others that it is giving them an undue importance; liatris, a characteristic group, helianthemum, coreopsis, rudbeckia, eupatorium, prenanthes, apogon, krigia, borkhausia, stokesia, vernonia, cacalia, hymenopappus, erigeron, arnica, verbesina, chaptalia, galardia, baldwinia, elephantopus, senecio, lactuca, cnicus, hieraceum; *Leguminosæ*, desmodium, lespedeza, indigofera, stylosanthes, baptisia, astragalus, tephrosia, lupinus, two species with simple leaves; trifolium is not

common; *Stellatæ*, houstonia, galium, rubia; *Polemoniaceæ*, phlox, polemonium; *Papaveraceæ*, sanguinaria, meconopsis; *Apocyneæ*, amsonia, anantherix, polyotus, asclepias, stylandra, apocynum; *Umbelliferæ*, eryngium, hydrocotyle, leptocaulis, daucus, tiedmannia; *Cruciferæ* are scarce, but hesperis prevails; *Thymeleæ* has only one representative; among *Orchidaceæ* are habenaria, corallorhiza, orchis, triphora, malaxis, cypripedium, cranachis, bletia, spiranthes, epidendrum; and of other endogenæ iris, phalangium, yucca, agave, canna, tradescantia, commelina, amaryllis, crinum, pancratium. To complete this sketch must be added, podophyllum, diclytra, claytonia, erythronium, mikania, smilax, vitis, polygala, hypericum, lobelia, ænothera, silene, arum, nymphæa, nuphar, vallisneria, villarsia, sagittaria, zizania, sarracenia, dionæa, drosera, oxalis, solanum, rhexia, several species, jussiæa, mitreola, spilegia, gentiana and sabbatia, various beautiful kinds, eriogonum, pleea-like dionæa with a limited habitat, warea, tiaridium, and numerous ferns.

A strong tendency exists in the southern portions to display tropical characters, as is evident from some of the endogenæ already mentioned, and is farther confined by tillandsia, bromelia, epiphytic orchidaceæ, chamærops palmetto, and other palms; sapindus, passiflora, turnera, bignonia, croton, and pontederia.

The monomic* families are very few, and are confined to podophyllaceæ, sarraceniaceæ, and limnanthaceæ; of genera 332 are monomic in North America, which is certainly a large number to have so limited a range. There are two which are singularly absent, erica and ficus; for the latter might be expected in the south, since it is so plentiful in the low lands of Mexico. The forest trees are so numerous, that was it our opinion that vege-

* Confined to one region.

tation was diffused from centres, we should almost consider this as that whence the temperate regions of the world had been supplied. Leguminosæ bear among them a great proportion for the latitude Others are remarkable for the size and brilliancy of their flowers; occasionally for their glossy leaves; and the autumnal tints of an American forest have long charmed the imaginative observer. Gramineæ are feebly represented, and to some extent their place is supplied by junceæ and cyperaceæ, which love the marshy lands.

The range of growth of some of the trees has been carefully observed. Quercus virens, the live oak, is found along the shores of the Atlantic and the Gulf of Mexico to the Sabine river, but not more than twenty miles from the sea, and ceases at 37° N. latitude. Quercus prinus, the chesnut oak, abounds in the Atlantic states south of 41°; q. stellata, the post oak, in Maryland, Virginia, and the upper parts of Georgia and the Carolinas, preferring a dry gravelly soil; q. montana, the rock chesnut oak, valuable in ship-building, grows in stony soils on the Hudson, Lake Champlain, and in the Alleghanies of Pennsylvania and Virginia. Juglans nigra is common in a deep and fertile soil south of 43°. Acer saccharinum, the sugar maple, ranges chiefly from 43° to 46°, but is common in some parts of Pennsylvania and Genessee. Besides sugar, it yields potash abundantly, good charcoal, and a valuable wood. A. nigrum, the black sugar maple, is found farther south, and chiefly abounds in the vicinity of the rivers of the west. It yields sugar freely, but is less generally useful than the former. Betula papyracea, the canoe birch, is a northern tree, not descending beyond 43°. B. lenta occurs from 40° to 48°, and farther south on the summits of the Alleghanies. B. nigra, on the banks of the rivers, from 41° to Georgia. Laurus

caroliniensis, the red bay, in swamps to the south of 37°. Diospyros virginiana is common in the United States south of 41°. Asimina triloba, the papaw, but not to be confounded with carica papaya, ceases at 40°. Populus angulata grows only to the south of 39°. Chamærops palmetto stretches along the coast of the Atlantic to 35°. This palm grows to forty or fifty feet high, and has some useful qualities. The wood is in request for wharfs and other submersed buildings, as it is not attacked by worms; it also will not splinter when struck by cannon-balls. Cornus florida only grows south of 43°. Nyssa villosa, the sour gum, south of 41°. N. biflora, the black gum, to 43°, and always in moist situations. Fraxinus acuminata abounds to the north of 41°, and its wood is so valuable for strength and elasticity, that it is exported. Ulmus americana thrives best from 42° to 46°, but is found generally. Its wood is inferior to the European. Pinus resinosa, the red pine, is not seen south of 43°. P. palustris, a valuable tree for its wood, its copious resin, and as occupying a very arid soil, commences at Norfolk, in 37°, and stretches along the coast for 600 miles, and with a breadth of 100. P. tæda, the loblolly pine, exclusively to the south of 38°. P. strobus chiefly between 43° and 47°; and the tallest kinds are used for the masts of vessels. Abies canadensis, the hemlock spruce, has the same range as the last. A. nigra, chiefly from 44° to 53°. Its wood is preferred for spars, and spruce beer is made from its branches. A. alba has a similar range. Thuja occidentalis, lignum vitæ, or white cedar, grows with the spruces. Taxodium distichum, the bald cypress, is peculiar to swamps south of 38°. Juniperus virginiana, the red cedar, prevails south of 44° in dry exposed situations.*

* For much of these details I am indebted to the interesting sketch of the

Relations.—This region is so rich in variety that very extensive relations might be expected, but though these are certainly numerous, the peculiarity of its flora is very striking. With Europe it might be supposed to have many species in common; yet of 2,891 phanerogamic, only 385 re-appear there. The proportionate scarcity of umbelliferæ, cruciferæ, and trifolium, is somewhat remarkable; and in examining the vegetation we cannot fail to be impressed how closely the productions of cold and hot regions are brought together, and consequently how much the intermediate temperate portion is compressed. This appears to be the reason why the groups just mentioned are so little seen. With the China region there are some interesting points of resemblance, through hydrangea, cocculus, and others; with South Africa in amaryllideæ, India in scitamineæ; and with the Patagonia and California regions through berberis, and many other genera with the latter. Clusia rosea is met with in Carolina, and several cinchonaceæ prevail through the region to the vicinity of the lakes.

V.—THE CALIFORNIA REGION.

Extent.—After crossing the Columbia river from the north, an entirely altered vegetation commences. The dense compact forests of abies cease suddenly, and are supplanted by an open country, spotted by occasional clump of oaks, and the river lines fringed by platanus, fraxinus, juglans, and salix. The outline of the region may

botany of the United States, as in the American edition of Murray's Encyclopædia of Geography.

be traced up the Columbia river to the Rocky Mountains, which it meets in about 50° N. latitude, and is continued along them to the south, till approaching the commencing waters of the Colorado, it runs along its course to the gulf of California. The remaining portion is circumscribed by the Pacific Ocean.

Physical Characters.—In its northern part the surface is regular, and there are some well-watered fine alluvial plains, without a rock or stone. Occasionally ranges of low mountains traverse it, chiefly of porphyry, basalt, and jasper, which are not of sufficient elevation to affect materially the vegetation, but support some groves of pinus lambertiana and abies religiosa; pinus rigida prefers the plains. The broad plains which separate them are often overflowed in the winter, which with their deep rich soil renders them very fertile. To the south, the scenery is wild and rugged, nearly altogether mountainous, the ranges running from north to south. Not a tree is to be seen, but there is a moderate sprinkling of a more lowly and interesting vegetation. The prevailing rocks here are serpentine, gneiss, basalt, and greenstone. There is no soil nor fertilizing streams, water being very scarce.

Climate.—To the north the climate is even and temperate; the winters are mild and of short duration, and snow appears on the loftier hills; and the summers have an agreeable warmth, with the atmosphere clear and transparent. In the autumn the dews are excessively heavy. The summers of the southern portion are warmer, the temperature being generally from 60° to 74°. The rains are soon over, but during their continuance deluge the country. The atmosphere is particularly clear, and it would also appear dry, as when signs of the

wet season were gathering in the heavens, the dew-point was 62°, the shade 72°; and at the same time the sun's rays were 115°.

Flora.—The finest part of this region is to the north, where an open country prevails, varied by patches of trees of noble growth. Of the oaks, two species are deciduous, and two evergreen. The latter are confined to the neighbourhood of the sea coast between 38° and 34° N. latitude. The other trees are not numerous, and are chiefly comprised under platanus, acer, pavia, juglans, cornus, laurus regia, and the aromatic tetranthera californica. It is among these forest trees that the chief relations with the Iroquois region is established, and it is one of affinity. The undergrowth consists of several species of rubus, ribes, lupinus, rhus, vaccinium, arbutus, and lonicera; and such is the variety of some of these, that a new species may be met with almost every hundred miles. Vitis, scarcely expected, grows abundantly on the margins of some of the rivers. Shrubby compositæ prevail throughout, but are in the greatest intensity towards the centre of the region; and in the more arid parts cacteæ and euphorbiaceæ are particularly numerous, with a few leguminosæ. Cacteæ are not seen further north than 34°; here also is the limit of ricinus communis, of course introduced, as is phœnix dactylifera, a few large trees of which may be seen about San Diego, but only yielding a sour fruit.

As characteristic peculiarities of the region may be mentioned, its great aridity, general scarcity of trees, superior prevalence of cacteæ, compositæ, and euphorbiaceæ, great number of plants with lactescent juices, and with fragrant foliage, the frequent developement of the flowers and leaves at different periods, and the general small range of its species. The negative features consist

in the scarcity of ferns, mosses, and fungi, none of which exist in the southern part, except perhaps the latter during the rains. Lichens, with sickly aspects, occasionally cling to the trees or rocks.

Relations.—California, though less known, has an equally fine climate with the south of Europe, Chili, the Cape of Good Hope, or New South Wales; and with these parts of the world has a general resemblance in its vegetation. In establishing a comparison between the western and eastern parts of the American continent, a superiority must be assigned in the forest trees to the east, and in the herbaceous vegetation to the west.

VI. THE PRAIRIE REGION.

Extent.—This is a peculiar tract enclosed by the vast forests of North America. It extends from within a hundred miles of the west bank of the Mississippi to the Rocky Mountains, stretching to 54° N. latitude, and again only bounded on the south by the wooded country of the Texas and the Mexican Sea. The outline is tolerably regular, except that two processes cross the above river; one penetrating the states of Illinois, Indiana, and Ohio; and the other farther south, stretching into Alabama.

Physical Characters.—The prairie is far from being a continuous extensive plain, and in this respect must yield to the Pampas. It consists rather of an assemblage of plains, often with slightly undulating surfaces, and frequently covered with a fruitful soil; their level being occasionally broken by projecting masses of rocks or ranges of low hills. The subjacent structure is composed of red or grey saliferous sandstone, chiefly the

former, with beds of clay. Chloride of sodium abounds with other salts, and are found largely in the vicinity of the Rocky Mountains, and in the northern part of the region. Gypsum likewise occurs, and gravel, sand, or boulders occasionally prevail.

Climate.—The long droughts to which the prairie is liable have been supposed to preclude the existence of shrubs or trees, and to be favourable to the more fugacious grasses. Heavy rains sometimes fall, and during their continuance rivers spring up, and gliding over the country, nourish a lively vegetation. In the dry season these soon shrink to small streams, disconnected chains of ponds or marshes, or entirely disappear.

Flora.—This extensive portion of country supports a by no means insignificant flora. Gramineæ is the most important group, and is represented by numerous festuca, bromus, stipa, aristida, poa, agrostis, crypsis, kæleria, hordeum, eriocoma, and others. Grasses flourish more particularly in the northern part, yielding gradually towards the south to various herbaceous compositæ, some cucurbitaceæ, vites, scrophularineæ, solaneæ, boragineæ, and euphorbiaceæ. The peculiarities of the region are derived chiefly from the absence of trees, the great preponderance of gramineæ and of compositæ through the genera rudbeckia, helianthus, silphium, coreopsis, and other allied groups, and in the scarcity of bulbous plants in a situation, where, from a comparison with the Cape of Good Hope and other places, they might be supposed to exist. Cacteæ appear farther north in the prairie than in the California region, and are often accompanied in both by a yucca.

However interesting the Rocky Mountains may prove to the geologist, they have no flora sufficient to give them any individuality as a region. They are as destitute of

arborescent vegetation as the prairie, and the interesting herbaceous plants found among them are only a portion of this flora. If their latitude generally is considered, they will be found incapable of possessing any important alpine vegetation, and even around their bases the snow will lie long and perseveringly on the ground.

Relations.—Towards the south this region becomes gradually blended with the California and Chihuahua regions: an analogy with the pampas is established through the numerous gramineæ; and with the northern regions by numerous cruciferæ and umbelliferæ, but those of the prairie are nearly all peculiar. The more interesting relation exists with the Steppes of Tartary, with which it has many points in common. The chief relation is that of affinity, the same genera being represented in both by different species; among these are artemisia, astragalus, thermopsis, sophora, glycyrrhiza, fritillaria, and diotis; and rheum is replaced by the analogous genus eriogonum.

VII.—THE CHIHUAHUA REGION.

Extent.—This name is pronounced Chi-wah-wah, and though the designation may appear somewhat novel, on the spot it is in extensive use; but almost equally little is known of the inhabitants, productions, and flora. On account of the barrenness of information respecting the latter, we can hardly more than indicate this region. Though an important portion of Mexico, it differs from it in many respects, and it is necessary to draw a strong line of demarcation, since the very name of Mexico is apt to convey to the mind of the botanist an association of characters certainly not pertaining to this part of the

republic. On the north it has the Prairie Region, sweeping round it even to the shores of the Gulf of Mexico, and meeting the Central America Region, thus completely separating it from the Atlantic. To the south, it ceases about the limit of the tropic, and on the west it has the Gulf of California, and the Rio Colorado.

Physical Characters.—Bold and mountainous.

Climate.—Cold for the latitude, and apparently liable to vicissitudes.

Flora.—A thin forest occasionally covers part of the surface; at other times the vegetation is lowly, and there are broad spots entirely without any. The general character is rugged and austere, the land rising rapidly to a moderate elevation. Hence the climate is cool for the latitude, and the productions those of ten or fifteen degrees farther north. Steep precipices, and narrow passes abound, with the customary attendants of stern mountain scenery. Between the various ranges are fertile plains well adapted to agriculture, and the valleys are often very productive. Nitre and common salt are sometimes mixed copiously with the soil, depriving it of fertility. Compositæ are numerous; some are shrubby, but the tribe coreopsideæ more particularly prevails. Cacteæ are common; a few amaryllideæ, some showy and interesting spieces of labiatæ, and perhaps also of scrophularineæ and boragineæ.

Relations.—Unknown.

VIII.—THE CENTRAL AMERICA REGION.

Extent.—The southern portion of the republic of Mexico, the whole of the Federal States of Central America, and a portion of New Granada; it thus extends

from the north tropic to the Gulf of St. Michael in the Bay of Panama, but sends a tongue to meet the Prairie Region, on the Mexican Sea. In elevation it attains 4,500 feet, or the commencement of the cultivation of wheat; and the lowland cultivation ceases about this, which is inconsiderable for the latitude. Humboldt's warm region ceases at 600 metres, or 1,968 feet, but this is no limit to either the introduced or natural productions.

Physical Characters. — That part comprising the Mexican States, and the Upper States of Central America, rises rapidly from the shores of both seas to the elevated and peculiar table-lands of this part of America. Near both shores the soil is productive, if not abundant, but on leaving them the surface is usually rugged, and broken by huge masses of granite, porphyry, serpentine, or bazalt. This part of the region is composed almost entirely of these primary rocks, very few of secondary formation being known to exist. More to the south, and near the Isthmus of Panama, the country is far more even, the continuity of the Andes being completely broken, and in the vicinity of the lakes of Leon and Nicaragua is so even that no perceptible inequality can be noticed on traversing it, and the greatest difference is nowhere more than a few yards. Here the soil is rich and abundant, very productive, and capable of yielding many successive crops.

Climate.—The seasons are tropical, the rains commencing from April to June, according to the latitude, and lasting five months. During the rest of the year a hot sun and clear sky prevail.

Flora.—This region belongs to that variety of tropical vegetation where leguminosæ, &c., prevail, and hence we infer a certain aridity of soil and atmosphere. In this respect it yields greatly to the Oronoco Region, and

though Schouw combines them in his anomalous region of Cacteæ and Piperaceæ, I venture to separate them, after some practical acquaintance with both. Everywhere a forest exists, but it is usually a thin open forest: the trees are not distinguished either for stature or bulk, and there is a scarcity of undergrowth. In this latter respect there is a very remarkable difference between it and the North-West America Region. Nor is the variety of the forest trees great; hæmatoxylon campechianum is common; swietenia mahagoni and cedrela odorata are gregarious in the neighbourhood of the lakes, and very numerous as individuals. Mimoseæ are particularly abundant on the summits and sides of the hills, where there is any exposure, and the larger kinds convey a particularly airy and picturesque effect. Bauhinia, hymenæa, and schrankia, have several species. Ficus is also numerous, and from the manner of growth is highly distinctive; one species has a strange partiality for encasing the trunk of the chamærops palmetto, of which instances are numerous. Tropical endogenæ are not frequent, a few scitamineæ, musaceæ, and commelineæ appearing only in the wet season; passiflora, piper, melastoma, and ferns, are not common; cacteæ are spread over the region, but are not in such vigorous existence as elsewhere. Agave americana, salvia, hyptis, asclepias, viscum, loranthus, mikania, cordia, geraschanthus, heliotropium, tournefortia, quassia, datura, and solanum, are most frequent in the vegetation. Palmæ are almost comprised in chamærops palmetto, bactris minor, cocos nucifera, a licuala, and a phœnix.

Relations.—The extensive existence of ficus is a source of resemblance with the Indian forest. Cacteæ are very generally diffused, though never in any intensity, and through them a general character is maintained

with all America, subject to a warm or even temperate climate. It yields to the West India Region in the number, variety, and luxuriance of its vegetation, but its closest connexion is here; also to the South American tropical regions; and, considering its situation, is far from being rich or productive. Within it, it must be remembered, is an alpine region, and the celebrity the flora has enjoyed is shared between them. On the west coast, in 19° N. latitude, I saw a solitary tree of metrosideros glomulifera, which conveys an interesting relation with New Holland.

IX. THE MEXICO ALPINE REGION.

Extent.—The Mexican mountains, above 4,500 feet, between 12° and 22° north latitude. This height is the lower boundary of the cultivation of wheat, and on the elevated plains it thrives admirably, when fed by regular irrigation. Since latitude within the tropics has such a trifling influence on climate, the difference in the alpine range of growth of vegetation on the mountains of Mexico and the Ecuador is surprising. In the latter, Quercus is not seen lower than 5,800 feet, but in Mexico it commences suddenly at 2,700 feet.

Physical Characters.— The distribution of the Mexican highlands is remarkable. Instead of rising gradually to a lofty sierra or ridge, as in the Andes of South America, the ascent suddenly ceases in a broad expanded tableland with an elevation from 4,000 to 8,000 feet. On this are placed many active volcanos, and it is likewise diversified by ridges of low hills and numerous lakes, whence mountain streams take their origin.

Climate.—The mean heat is perhaps lower than might be expected, and in the less elevated situations thin ice is

common in the winter. At times the power of the sun's rays is very great.

FLORA.—The character of the vegetation varies; much is covered by a thin forest of trees, stunted, and crooked in their growth, and struggling among rugged volcanic rocks; and also by large fertile plains, sustaining a varied and abundant flora, through which run clear streams, fringed with trees of very European aspect, and many lively plants. Still there are places extremely barren, and where exposure and the absence of water have excluded all vegetation. There is, however, no want of fertility, and the variety in the climate is favourable to a multitude of fruits and vegetables. The tropical productions of the plains soon cease, and leave the region in the possession of trees, shrubs, and herbaceous plants, whose analogies are with temperate and even cold climates. Quercus has nearly twenty species, which grow through a great variety of elevation, and cease only at about 10,000 feet; one authority says 10,400, and another 9,843 feet. This genus is widely distributed through the continent; to the north we find it with deciduous leaves, on the east coast in 45°, and on the west in 47°; it soon becomes an evergreen, and ascending the mountain sides, does not cease till it has crossed the equator. Recalling that many of its species are found on the Himma-leh mountains, in Java, and other Indian islands, its partiality for low latitudes is very decided. Wheat ceases to be cultivated at the same elevation, and previously rye and barley are mixed with it. Pinus occidentalis is frequent, ranging between 6,100 and 13,000 feet, and as far south as 12° north latitude. There is another species, I believe as yet undescribed, with long cones and longer leaves. It is found around Tepic in the northern part of the region, com-

mencing at 3,500 feet. Other trees and shrubs are supplied by abies hirtella, cupressus thurifera, c. sabinoides, taxodium distichum, taxus montana, alnus mexicana, salix several species, amygdalus microphylla, cheirostemon platanoides, mespilus pubescens, and several species of arbutus, arctostaphylos, vaccinium, rosa, and ribes.

Relations.—With temperate Europe and America it has many genera in common, as senecio, cnicus, draba, ranunculus, anemone, arenaria, stachys, pedicularis, myosotis, polemonium, galium, cornus, and caprifolium; but a firmer connexion with the latter is established through lupinus, ageratum, and chelone; yet nearly every species is peculiar. The more peculiar genera are 'mirabilis, maurandya, leucophyllum, hoitzia, georgina or dahlia, zinnia, sckhuria, ximenesia, lopezia, vauquelinia, choisya, and cheirostemon.' It possesses, in common with other alpine regions, the negative character of having no peculiar natural family, and comparatively few genera; its individuality depends on species. Through quercus and pinus, and some of the herbaceous genera, it is connected more closely with the Himma-leh than with the Andes region.

X.—THE WEST INDIA REGION.

Extent.—The West India Islands, the Bahamas, and the extremity of Florida, south of 27° north latitude, compose this region, which, with the exception of the latter, is the same as Schouw's. It possesses all the vigour and luxuriance of an island climate within the tropics, where moisture is ever ready in the atmosphere to feed vegetation; and the elevation of the surface, which in Cuba

attains nearly 9,000 feet, is also sufficient to produce a variety in the productions. The whole is situated between 10° and 27° north latitude.

Physical Characters.— These islands vary much in their character and geological formation. They admit of a twofold division; the volcanic rising to elevated summits, covered with forest, abundantly supplied with streams of water, and very fertile, as St. Vincent, St. Lucie, Martinique, Dominica, and Guadaloupe; the others, principally composed of limestone, are low, less watered, by no means so productive, and sometimes even sterile, such as Barbadoes, Tobago, Antigua, and Barbuda. Cuba, the most extensive island, is chiefly covered with forest, and has a superficies of 54,000 square miles. A chain of mountains traverses it from east to west, which rises into several peaks, and sends many streams to the plains below. The mountain chain is composed of granite, syenite, gneiss, and mica slate, and the lower lands of secondary formations, and they are eminently fertile and productive. Jamaica has a superficies of 4,256 square miles, and the Blue Mountains, whose greatest elevation is 7,278 feet, make an agreeablo variety in the climate, and a healthy retreat for the invalid. These are chiefly composed of transition rocks, with, nearer the coast, red sandstone, marl, and limestone reposing on them. Some parts are alluvial, and generally well watered and fruitful. St. Domingo has an area of 28,000 square miles, and the central mountain peaks are lofty, La Serrania attaining 9,000 feet, and La Sella, 7,000 feet. Their flanks support noble forests, and are traced by numerous fertilizing streams. Puerto Rico contains 240 square miles, and is equally fertile with the rest. Its highest part is about 4,000 feet, and it has several fertile valleys and plains. The Bahamas comprise a

numerous group, composed of sandstone; and though the soil is generally dry and rocky, they yield some good timber.

Climate.—The temperature is usually equable, but must be called warm; the range is therefore inconsiderable, and the mean at different places will vary from 73° to 81°. It is only on the accession of a north wind, that much deviation occurs, and then even ice is stated to be produced, but those islands most to windward are the greatest sufferers.

Flora.— Originally nearly the whole of this region was covered with forest; a few exceptions might only be found where tropical grasses occupied the surface. Now cultivation has removed an important portion, but extensive woods still exist. Swietenia mahagoni abounds in several islands, as does also guaicum officinale, with various species of myrtus, uvaria, laurus, and melastoma. The sameness these might otherwise produce is broken by several palmæ, and especially by the arborescent ferns, whose peculiar beauty is highly characteristic of the scenery. Ferns are generally very abundant, and assume a tropical variety of stature and habit. The most prevalent and characteristic are asplenium arboreum, cyathæa arborea, c. speciosa, c. muricata, with numerous species of polypodium, pteris, aspidium, gymnogramma, acrostichum, and adiantum. A multitude of twining plants festoon the vegetation, lashing it into an impervious mass, belonging to convolvuluceæ, passifloreæ, some leguminosæ, assisted by interesting kinds of paullinia and aristolochia. Orchidaceæ are very abundant, particularly the extensive genus epidendrum, and species of oncidium, bletia, catasetum, and spiranthes are also numerous.

The claims of Florida south of 27° north latitude to

be considered a part of this region, are established through tillandsia, sapindus, indigofera, chrysobalanus, rhexia, croton, jatropha, and several others.

Relations.—The position of this region between the large continents of America insures an intimate relation with them, modified by its insular situation. This is, however, stronger with South than North America, perhaps arising from the moister atmosphere common to both, for there are no other circumstances which are not equally shared by the Central America region. With the South American regions it is strongly related by similar genera of palmæ, passifloreæ, orchidaceæ, plumbagineæ, cordiaceæ, and arborescent and herbaceous ferns. With the central America region the connexion is through ficus, a few orchidaceæ, asplenium arboreum, swietenia mahagoni, pinus occidentalis, and some others, particularly those of the sandy shores, as hippomane mancinella. There is a singular absence of quercus in the higher lands, considering how very numerous the species are in the Mexico alpine region within the same latitude. It has all the luxuriance of other insular regions within the tropics, and is unsurpassed by them in the variety of its ferns and orchidaceæ, as none others have a similar number for a given space. In the latter, the Pacific islands are much poorer, perhaps from the absence of the dense forest they appear to love. Wydleria portoriccensis and lepidium virginicum, two cruciferous plants, are found on the island, indicated by the specific name of the former.

XI.—THE ORONOCO REGION

EXTENT.—That vast portion of South America, stretching from the Cordillera of the Andes to the Atlantic, and from the Carribean Sea to the Rio Plata, presents several divisions characterised by certain physical features. From the elevated lands of the interior of the continent three sets of rivers take their origin, and after traversing huge basins, are at length emptied into the ocean in three directions, to the north, the east, and the south. The vegetable productions of the divisions have also their peculiarities, which are sufficiently distinct to authorise a separation; and assuming a designation from the principal river of each, we have the Oronoco Region, the Amazon Region, and the Paraguay Region, the boundaries of which are conveniently traced along the ridges of those secondary mountains, at the bases of which their tributaries have their origin.

The Oronoco Region occupies the northern part of South America, and a line running along the sierra of Araray, and traversing the continent to the Bay of Guayaquil, forms its southern limit; whilst to the north it ceases at the Gulf of St. Michael, and is elsewhere inclosed by the Atlantic and Pacific Oceans.

PHYSICAL CHARACTERS.—Some lesser ranges of mountains traverse the region, with their sides broken into steep and confined valleys. From their bases extend vast plains or llanos, covered either with forest or luxuriant grasses. These extensive llanos are represented in Brazil by the campos, and around Buenos Ayres by the pampas, but are here in their greatest richness. The rivers often inundate their banks, fertilizing a soil already extremely rich, and for a time

converting large districts into savannah. A very sandy soil prevails in some places, as in the neighbourhood of Cumana, supporting chiefly multitudes of gigantic cacteæ. Humboldt has observed that the vegetation here appeared more luxuriant wherever the limestone was covered by quartzy sandstone, the latter appearing favourable to the retention of moisture.

Climate.—Situated so near the equator, the climate is a warm one. Caraccas has an annual mean of from 70° to 72°, which, however, is far too low for the region, perhaps as much as 8°. The range is stated to be from 51° to 85°, being considerable for the latitude. The humidity of the atmosphere varies according to the soil and vegetation. On the Pacific, in the Bay of Choco, rain falls ten months in the year, but in the more arid parts rain is far from frequent or abundant. The climate of Guiana has been supposed to be favourable to the growth of certain spices, as cloves and nutmegs, which, from some idiosyncracy, are still produced of the best quality only in the Moluccas.

Flora.—Much of the region is covered with forest, particularly in the vicinity of the oceans, between which and the interior a broad belt intervenes. In many instances the trees are remarkable for the beauty of their wood, the fragrance of their secretions, and the rich and valuable resins they exude. In Guiana trees of this character are very numerous, and belong chiefly to Laurineæ. Throughout are spread a vast number of representatives of the tropical arborescent families. Gramineæ abound in the llanos, chiefly of kellingia, cenchrus, and paspalum, intermixed with species of mimosa, turnera, and malvaceæ. On some of the rivers a grass, cynerium saccharoides, attains a height of thirty-two feet. Where the climate is humid, piperaceæ, passifloreæ, and me-

lastomaceæ, are very numerous, overshadowed by the singular clusia and the lofty and fecund bignonia. Filices are numerous as individuals, but, together with orchidaceæ, do not abound in species. Some palmæ are peculiar, and of interest.

Relations.—With the neighbouring regions there are naturally some strong affinities. Rhopala, a proteaceous genus, occurs; and also a species of punica.

XII.—THE ANDES REGION.

Extent.—As ur alpine regions always commence at the line which separates the cultivation of the lowlands from that of the mountains, the lower boundary will be at 6,500 feet, and includes all above this to the confines of the vegetable world at 18,000 feet. It stretches to the northward along the magnificent mountain chains of New Granada, and to the south through Peru and Bolivia, where the line of lowland cultivation will descend a little. Its exact extent to the south has not been acertained.

Physical Characters.—Among the stupendous scenery of the Andes and the steep and scarped precipices and mountain sides, vegetation would appear unlikely to flourish; yet these often afford a shelter, and also assist to collect a soil in the valleys and plains. Hence, from the barrenness of a bare surface of primitive rocks, to the luxuriance of fertile and warm valleys, there is every variety of productiveness. In the plains between parallel ranges the soil is often deep and rich, and is equally suited to agriculture or the rearing of herds of cattle. Mountain torrents descend in fury through deep chasms,

or sometimes assuming, for a while, tranquillity, wander in peaceful and fertilizing streams through the plains.

Climate.—The atmosphere of alpine regions is liable to violent disturbance from storms, which are both rapid in their approach and disappearance, and often leave behind much devastation among the trees of the forest. The temperature of any given spot is very equable, and ranges, for the whole region, from 65° to several degrees below the freezing point. Rain falls throughout the year in frequent showers, with little regard to the seasons, and the amount is no where great. To the decreased pressure, greater brilliancy of the sun's rays, and diminished suspended moisture, some of the peculiarities may be referred.

Flora.—The least elevated portion is occupied by a magnificent forest, and valuable as containing numerous species of cinchona, which yield a medicine highly prized throughout the world, except in the neighbourhood of its production. Some tropical families ascend tenaciously to these elevations, as piperaceæ, melastomaceæ, cacteæ, and passifloreæ, the latter assuming the novel habit of arborescence; and the numerous synanthereæ are particularly characteristic. Ficus, oreocallis, clusia, persea, and ocotea, are mingled with podocarpus, quercus, ilex, and salix. Above the forest is a large district of bushes with much variety in the species; drymis and wintera from the south, meet ribes, rubus, and viburnum from the north, and are associated with various species of thibaudia, alnus, andromeda, fuchsia, vaccinium, calceolaria, culcitium, duranta, barnardesia, escallonia, berberis, and befaria. The flora is agreeably diversified by some hæmanthus, alstrœmeria, sisyrinchium, and other liliaceous plants. The grasses, which, in both a botanical and economical point of view, are so important, occupy a broad space between 13,000

and 14,500 feet, and are contributed chiefly by jurava, stipa, agrostis, panicum, avena, and dactylis. Succeeding to the grasses are many herbaceous plants, and lastly the lichens, crowning, as it were, the flora of the region. Even this very slight sketch would be incomplete without mentioning some of the groups which flourish on the higher elevations and give an aspect of variety. A few of these are herbaceous compositæ, lowly umbelliferæ, saxifrageæ, cruciferæ, valerianeæ, and caryophylleæ; with species of gentiana, rumex, plantago, arum, oxalis, dorstenia, swertia, and lobelia. The plants attaining the greatest elevation are two lichens, umbilicaria pustulata and verrucaria geographica.

Relations.—Between all alpine regions there will be numerous analogies, but few points of identity, and also a certain similarity with regions of the lowlands in a proportionate latitude. With the Mexico alpine region are several sources of resemblance through ericaceæ, synantereæ, cruciferæ, quercus, salix, and cheirostemon platanoides. It however is deficient in the important genera of pinus, abies, and rosa. The flora is so rich and varied, that relations may easily be traced with most regions under a temperate climate.

XIII. THE AMAZON REGION.

Extent.—This extensive region occupies a chief part of the empire of Brazil, and comprises the richest and finest portion of South America. It consists of a magnificent basin intersected by a multitude of rivers, many of which are of considerable size. The original streams of the largest of these, the Amazon, have their rise in the Andes, and gradually uniting their waters, traverse the region to the Atlantic ocean. Its boundaries are the

ridges of the mountain chains, which may be regarded as the margins of the basin, and cannot be traced with accuracy. From east to west it extends from the Atlantic to the Cordilleras, on the north it has a sinuous outline on the summits of the Sierra de Araray and the Parimé chain to the bay of Guayaquil; and on the south between the provinces of Minas Geraes and San Paulo, bending to the head waters of the Paraguay onward to the Andes in Bolivia.

Physical Characters.—From the Andes, plains of almost boundless extent gradually incline towards the Atlantic. Several ranges of low mountains intersect them, but their comparative importance is trifling, and their elevation rarely exceeds 4,000, never 6,000 feet; which is insufficient to produce any material change in the vegetation, though permitting some plants to adopt a selection. Balbi regards these plains as table lands, with an elevation from 1,030 to 1,660 feet. Granite and syenite form the bases of both the mountain chains and the lowlands, on which repose gneiss, mica slate, chlorite slate, quartz rock, and limestone. On these again are sandstone and slate clay, with alluvial deposits. True volcanic rocks have no existence. The soil varies; in the forest it is either a rich dark vegetable mould, or a fruitful deep red loam, and both are astonishingly productive under cultivation. In the more open country sand enters largely into the soil, and when opposed to a moist as well as warm atmosphere, displays a varied vegetation. The soil in the neighbourhood of the rivers has, from their periodical inundations, attained the greatest fertility, and gives birth to an excess of luxuriance.

Climate.—The equator traverses the region, but the climate partakes of that unsteady character with regard to humidity which is so frequent, and at the same time so

productive of variety. Para will give us the state of the climate on the plains nearest the river. The atmosphere is hot and sultry, and the range of temperature throughout the year very small; the mean is 84°, and the annual fall of rain from 80 to 100 inches. More to the south, the year is regularly distributed into the wet and dry seasons. At Rio Janeiro the rains occur from September to March, the temperature high, and often with much electrical disturbance of the atmosphere. In the interior of the country rain is less abundant, and in some places scarce. The seasons are the reverse of those in the neighbouring Oronoco regions.

Flora.—In this region the American tropical families are in excess, and have the greatest number of representatives. The vegetation has a twofold character, comprising the forest, which extends in a broad belt along the coast from north to south, and the Sertam country, a contraction of dezertam, where grasses and shrubs prevail, and occasionally a few trees in sheltered valleys or ravines.

The forest is composed of an endless number of trees, of which to mention some would be placing others too much in the background. These trees attain a great height, with straight clear stems, their foliage uniting in a canopy above, and leaving all beneath in perfect shade and quiet. This great longitudinal developement is not favourable to a protracted existence, as age and climate soon attack the trees, and their places are left vacant for others. Of the natural families which abound in greatest intensity, and are also conspicuous for their interest, are, palmæ, assuming much variety of habit, cinchonaceæ, melastomaceæ, piperaceæ, myrtaceæ, marcgraaviaceæ, gesnerieæ, sapindaceæ, vochyaceæ, guttiferæ, malpighiaceæ, hippocrateaceæ, and bromeliaceæ. Epiphytic plants festoon the trees in multitudes, but here orchi-

daceæ are not frequent, and their place is supplied by species of bromelia, tillandsia, the strange pothos, and many ferns. The twining plants are freely supplied by passifloreæ, leguminosæ, convolvulaceæ, aristolochiæ, asclepiadeæ, and mikania.

The Sertam country has its own vegetable charms, and though much occupied by grasses with a dull grey hairy surface, has large spaces covered with bushwood, and sometimes even trees. Many of these are attractive, and chiefly belong to cinchonaceæ, compositæ, apocyneæ, malpighiaceæ, and euphorbiaceæ. A few of the more numerous genera are declieuxia, rhexia, banisteria, gaudichaudia, croton, wedelia, kleinia, and sauvagesia. The trees are described by Von Martius as attaining only fifteen or twenty feet in height, and growing as a light open grove. The chief are derived from laplacia, gomphia, marcgraafia, vochysia, qualia, solanum, byrsonima, erythroxylon, panax, and rhexia; and amaryllideæ are frequent.

Some peculiarities may be noticed on the sides and summits of the different mountain chains. On Itacolumi, or the Child of Stone, a mountain near Villa Rica, attaining 5,710, Von Martius saw the curious arborescent lilies of barbacennia bicolor, b. tricolor, b. tomentosa, b. luzulæfolia, b. ensifolia, vellosia abietina, and v. taxifolia. Other characterizing genera are galium, morinda, declieuxia, oxypetalum, ditassa, lisianthus, exagum, phyllanthus, lavradia, gloxinia, gesneria, vitis, and ternstroemia. Growing on the ironstone floetz formation, and supposed to be distinctive of it, were, laurus erythropus, bauhinia ferruginosa, abatia tomentosa, brysonima nitidissima, banisteria versicolor, vanillosma firmum, lisianthus pulcherrimus, phyllanthus robustus, and mikania glauca. The swampy ground is distinguished by species

of hydrocotyle, drosera, andromeda, gaultheria, utricularia, sauvagesia, and eriocaulon.

Relations.—Among the alpine plants, if so they can be called, are many intimately connected with the vegetation of the temperate regions of Europe and North America, as panax, clethra, vitis, galium, and gaultheria. Ambrosia artemesiæfolia, a strand plant of the Iroquois Region, occurs on the shores of Paraiba. Walsh saw patches of the European fern, aspidium filix mas, and also bushes of Rubus occidentalis. The same traveller mentions avena sterilis attaining a height of ten feet. For some time the existence of canna indica was supposed to confer an interesting point of identity with India, but it is now known to be a frequent plant within the tropics.

XIV.—THE PARAGUAY REGION.

Extent.—It embraces the space of country traversed by the Paraguay River and its tributary streams; its outline will thus extend from the coast between the Brazilian provinces of San Paulo and Minas Garaes, and, arching to the north, terminate on the limits of the Pampas Region, and again on the south along the course of the Rio Plata, and the hitherto unascertained margin of the same region.

Physical Characters.—A portion of this country is not so completely a plain as would appear from the maps, as towards the Andes several spurs are sent off which spread into the interior. San Paulo is sufficiently elevated to affect considerably its productions, and the difference between it and Minas Geraes has struck several travellers. Generally the soil is rich and fertile,

but there are large spaces covered with scarcely anything but sand, and yielding a poor bushy vegetation.

Climate.—That of San Paulo corresponds to the whole region; the mean temperature of the year is 73°, and the range is small. Hoar frost is sometimes seen, but snow is unknown. The rains occur at two periods, the autumnal being the heaviest.

Flora.—The tropical features, which the Amazon Region possesses in such intensity, have greatly diminished; palmæ are few; ferns continue very numerous, but with a habit more suited to a drier climate. Baccharis and other compositæ cover the sandy districts, and cacteæ are frequent. Umbelliferæ, though far from numerous, have a greater preponderance than in neighbouring regions. The forest is open, and composed of fine trees; arborescent ferns still continue, and where they assemble in groves exclude all other vegetation, a peculiarity possessed by them when growing gregariously. In a collection of plants made in the warmer portion of the region, compositæ were a 12th, leguminosæ a 15th, cinchonaceæ and orchideæ a 20th, melastomaceæ a 29th, labiatæ and solaneæ a 40th.

Tristan da Cunha, situated in 37° S. lat., is known to possess 113 indigenous plants, among which are several umbelliferæ, which induces us to regard the island as a fragment of this region.

Relations.—These are perhaps feeble with distant regions, whilst they are not strong with those in the vicinity. Araucaria brasiliensis is frequent in the forest, a representative of an Australian genus, though having a nearly allied species in Chili.

XV.—THE CHILI AND PERU REGION.

Extent.—A peculiar and well-defined region, but still far from productive. It includes a narrow strip between the Cordilleras and the Pacific Ocean from Cape Blanco in 4° S. lat. to the oblique line stretching from 36° S. lat. on the coast of Chili to Port St. Antonio on the opposite side. Both limits are well marked; at the northern the forest of the adjacent region commences suddenly, and at the southern, around Conception, rapidly appear those numerous genera, which establish so strong a relation between the Patagonia Region and the temperate latitudes of the northern hemisphere. Some doubts may arise whether the Andes of its southern part should not be included, and I am disposed to think they ought, but at present it is impossible to trace the exact relations. The two islands of Juan Fernandez also belong here.

Physical Characters.—The flank of the Cordilleras regarding the Pacific is composed chiefly of porphyritic rocks, but the somewhat inclined plane which slopes towards the ocean is formed by deposits of clay, both tertiary and recent, very frequently inclosing shells, and resting on a substratum of brown sandstone. The surface may be divided into the valleys and the intervening ridges; the former containing some soil, and a supply of water near which is assembled the entire vegetation, whilst the spaces between are usually quite bare, or only support some straggling brushwood. The soil in the exposed places contains a large proportion of salt, both of nitrate of potash and chloride of sodium, which lies in a thin stratum one or two inches beneath the surface, and can be easily removed in solid thin cakes. This

admixture renders the soil very puffy, and after being moistened by the heavy dews it forms a thin brittle crust. It also deprives it of the customary cohesion, and wherever the soil has collected, as on the sides of the hills and valleys, the foot readily sinks six or eight inches.

Climate.—Though much is within the tropics, it has few corresponding features. The temperature of the intertropical part is warm during the dry season, but is unusually cold and chilly at the opposite period; it has thus a great range. Rain is a novelty almost throughout, and instead there are dense falling mists, called garuas, from May to August, which render the weather particularly unpleasant. In the northern part these cease with great suddenness, for in the Bay of Guayaquil the rains are very heavy, and at Tumbez, within half a degree, a shower is not seen for years together. To the south the two are gradually shaded off into each other, and at Valparaiso the rainy season is short and less regular, whilst at times there is something like the garuas. The absence of regular rain has been attributed to the south wind, which blows with much constancy; and it has been observed that during the season of mists a light breeze from the opposite quarter is not unfrequent. At Valparaiso the temperature is more in accordance with its geographical position; it is situated in 33° S. lat., and during June and July, the two most unfavourable months, the range was from 46° to 64°, the dews extremely heavy, but rain fell latterly.

Flora.—Nothing that can be called forest exists, a few trees only being scattered sparingly about, and though much is within the tropic, corresponding characters are not strong. Cocos chilensis has a few individuals scattered about the valleys in the neighbourhood of Val-

paraiso, and the potato may be seen here growing wild on some of the hills; a species of bambusa is not uncommon, and a salix is frequent in the valleys. The chief tree is cordia decandra, but many spots are not deficient in cultivated fruit trees. The plants recalling tropical features are azara serrata, krameria cistoidea, coriaria ruscifolia, cassia sp., mimosa cavenia, loasa acerifolia, amirola glandulosa, and croton lanceolatus. Cereus, opuntia, euphorbia, lobelia, calceolaria, and oxalis, are common. About Valparaiso are low thickets of shrubby compositæ; and amaryllideæ and irideæ are numerous. On waste ground near Lima tropæolum majus abounds, with sida, datura, cestrum, alternanthera, œnothera, asclepias, and calceolaria. In a few favoured valleys the ground is quite yellow with the multitudes of flowers of pancratium amencaes, whose expanding flowers are the signal for the commencement of the revels bearing its name.

Relations.—The most interesting will be with the California Region, with which there is much similarity in climate, and some in productions through ageratum, mimulus, castilleja, rhus, ribes, berberis, and laurus. The prevalence of bulbous plants in Chili confers some resemblance with the South Africa Region.

XVI.—THE PAMPAS REGION.

Extent.—That portion of South America between the Andes and the mouth of the Rio Plata is composed entirely of this peculiar district. To the north it extends to the neighbourhood of the towns of the interior, and approaches the river Paraguay; its exact outline is here imperfectly known. To the south it terminates in an

oblique line, extending from the Port of San Antonio to 36° S. latitude on the west coast.

Physical Characters.—A vast plain stretches on all sides, very slightly raised above the level of the sea, and only diversified in a few places by low hills. Some unimportant rivers have their origin, and are often again lost in the soil. Reddish marl is mentioned as occurring, but is not perhaps general. To the south the soil is impregnated with saline matter.

Climate.—The seasons are temperate, and their alternations produce a rapid change in the vegetation.

Flora.—The remarks of Sir Francis Head on the features are appropriate. "The great plain of Pampas of the Cordillera is about 900 miles broad, and the part which I have visited, though in the same latitude, is divided into regions of different climate and produce. On leaving Buenos Ayres, the first of these regions is covered, for 180 miles with clover and thistles; the second, which extends for 430 miles, produces long grass; and the third region, which reaches the base of the Cordillera, is a grove of low trees and shrubs. The second and third of these regions have nearly the same appearance throughout the year; for the trees and shrubs are evergreens; and the immense plain of grass only changes its colour from green to brown; but the first region varies with the four seasons of the year, in a most extraordinary manner. In winter, the leaves of the thistles are large and luxuriant, and the whole appearance of the country has the rough appearance of a turnip field. The clover, at this season, is extremely rich and strong; and the sight of the wild cattle, grazing at full liberty in such pasture, is beautiful. In spring, the clover has vanished, the foliage of the thistle has extended across the ground, and the country still looks as if covered with a rough crop of turnips. In

less than a month the change is most extraordinary; the whole region becomes luxuriant with enormous thistles, which have suddenly shot up to a height of ten or eleven feet, and are in full bloom. * * * The summer is not over before the scene undergoes another change; the thistles suddenly lose their sap and verdure; their heads droop, the leaves shrink and fade, the stems become black and dead, and they remain rattling with the breeze one against another, until the violence of the pampero or hurricane levels them with the ground, where they rapidly decompose and disappear; the clover rushes up, and the scene is again verdant." Ranunculaceæ, caryophylleæ, and cruciferæ, make their appearance, and the low bushes are most probably chiefly compositæ. Species of lathyrus, polygala, anemone, oxalis, lobelia, galium, plantago, and teucrium, are also frequent.

Relations.—There is a strong connexion with some of the European Regions through numerous genera, and some slight alliance with the South Africa Region. It is curious that an exotic thistle, cynara cardunculus, should have taken such entire possession of a large district, as to have obliterated nearly the whole of the spontaneous vegetation. Its luxuriance is so great, that the question arises, whether plants can ever find a situation more favourable to their existence than that in which nature has placed them? The excessive developement also of psidium pomiferum, at Tahiti, would seem to require an affirmative. In general character there is some similarity with the Prairie Region, but the minuter features are different, and the latter is less fertile.

XVII.—THE PATAGONIA REGION.

EXTENT.—In the vicinity of Conception, a change takes place in the character of the vegetation, and in the climate; trees commence, and heavy rains are exchanged for the peculiar climate of Chili and Peru. An imaginary line, commencing on the west coast, in 36° S. latitude, and extending obliquely to Port San Antonio, on the opposite side, separates the southern extremity of the continent, and with the adjacent islands constitutes the region.

PHYSICAL CHARACTERS.—The Andes have now lost their stupendous size, and are continued as an inferior mountain range, of an average elevation of 3,000 feet, rarely or never attaining 6,000 feet, and their appearance is wild, bleak, and desolate. Primitive rocks abound, and granite greatly prevails; towards the Straits of Magellan are various hornblendes and slates, and the latter appear favourable to vegetation, for fagus antarctica attains on it a great size, whilst a reddish sandstone is barren.

CLIMATE.—Moist and unfriendly for the latitude; the number of rainy days is very great, and a thoroughly fine one is rather a novelty. Though the temperature is not in extremes, still the summer months are chilly. For the month of May, in the vicinity of Cape Horn, the mean temperature was 40°, the range from 30 to 48°, and very equable through the day and night; the fall of rain eight inches; dew-point 2° or 3° below the atmosphere, the greatest being 7° or 8°; hail frequent, with the temperature from 42° to 48°. About Conception the climate is more agreeable, the temperature warmer, and the rain falls at regular seasons.

Flora.—Irregular groups of wood cover the surface, wherever the climate is moderate, and there is a mitigation of its general austerity. The chief trees are assembled about Conception, and somewhat to the south is the principal station of auraucaria imbricata. Among these are fagus obliqua, laurus lingui, laurelia aromatica, drymis chilensis, quadria heterophylla. At Tierra del Fuego and Staten Land, fagus antarctica, an evergreen species, is frequent, and, assisted by others of a similar habit, gives a peculiar character to the scenery. Forster, the companion of Cook, has described with some quaintness the general features. "In the cavities and crevices of the huge piles of rocks, forming Tierra del Fuego and Staten Land, so very like each other, where a little moisture is preserved by its situation, and where, from the continued friction of the loose pieces of rocks, washed and hurried down the steep sides of the rocky masses, a few minute particles form a kind of sand; there, in the stagnant water, gradually spring up a few algaceous plants from seeds carried thither on the feet, plumage, and bills of birds; these plants form at the end of each season a few atoms of mould which yearly increases; the birds, the sea, or the wind carries from a neighbouring isle, the seeds of some of the mossy plants to this little mould, and they vegetate in it during the proper seasons. Though these plants are not absolute mosses, they are, however, nearly related to them in their habit. We reckon among them the ixia pumila, a new plant which we call donatia, a small melanthium, a minute oxalis and calendula, another little dioicous plant, called by us phyllachne, together with the mniarum. These plants, or the greater part of them, have a peculiar growth, particularly adapted to these regions, and fit for forming soil and mould on barren rocks. In proportion as they grow

up, they spread into various stems and branches, which lie as closely together as possible; they spread new seeds, and at last a large spot is covered; the lowermost fibres, roots, stalks, and leaves, gradually decay and push forth on the top new verdant leaves; the decaying lower parts form a kind of peat or turf, which gradually changes into mould and soil. The close texture of these plants hinders the moisture below from evaporating, and thus furnishes nutriment to the vegetation above, and clothes at last whole hills and isles with a constant verdure. Among the pumilous plants some of a greater stature begin to thrive, without in the least prejudicing the growth of these creators of mould and soil. Among these plants we reckon a small arbutus, a diminutive myrtle, a little dandelion, a small creeping crassula, the common pinguicula alpina, a yellow variety of viola palustris, statice armeria or sea-pink, a kind of burnet, the ranunculus lapponicus, the holcus odoratus, the common celery, (apium australe,) with the arabis heterophylla. Soon after we observed, in places which are still covered with the above-mentioned, a new rush, (juncus triglumis,) a fine amellus, a most beautiful scarlet chelone, (C. ruelloides,) and lastly even shrubby plants, viz. a scarlet-flowered shrubby plant of a new genus, which we called embothrium coccineum, two new kinds of berberry, (berberis ilicifolia, b. mitior,) an arbutus with cuspidate leaves, (A. mucronata,) and lastly the tree bearing the winter's bark, (drymis winteri,) which, however, in these rocky barren parts of Tierra del Fuego never exceeds the size of a tolerable shrub; whereas in Success Bay, on a gentle sloping ground, in a rich and deep soil, it grows to the size of the largest timber." Many of Forster's new names have now become as fa-

miliar as household words to the botanist. Mosses and lichens abound here, but ferns are scarce.

The flora of the *Falkland Islands* is scanty, being composed chiefly of a few compositæ, gramineæ, lichens, and musci. Bolax glebaria is found here, and veronica decussata as a shrub six feet high, but not fit for firewood, the deficiency of which is met by peat, which, Weddel says, is abundant.

The *South Shetlands* have only some straggling grass and a lichen.

Relations.—The relations are stronger with the temperate regions of the northern hemisphere than with those in its vicinity. With the former it has a number of genera in common, as, omitting those already mentioned, betula, ribes, rubus, andromeda, vaccinium, auricula, cardamine, draba, lepidium, stellaria, hydrocotyle, anemone, drosera, galium, tussilago, salix, carex, cyperus, and usnea. With adjoining regions, fuchsia, myrtus, drymis, baccharis, escallonia, calceolaria, and chelone. With the South Africa Region, notwithstanding a considerable difference in the climate, gladiolus, ixia, wistenia, galaxia, and crassula. And with New Holland, araucaria, embothrium, ourisia, and mniarum. Its own peculiarities are due to the novelty of nearly the whole of the species, and to the genera gaimardia, astelia, callixene, philesia, drapetes, bæa, pernettia, oligosporus, nassavia, bolax, azorella, donatia, acæna, hamadryas, and the curious misodendrum. A relation of identity with European regions is established through pinguicula alpina, viola palustris, statice armeria, dactylis glomerata, and several mosses and lichens.

XVIII.—THE POLYNESIA REGION.

Extent.—The various groups of islands composing this region have no great superficies, but possess many features of peculiarity and interest. The region by no means includes all the group of the Pacific Ocean, but only those which are more particularly designated as Polynesia. It comprises the Sandwich Islands, the Society Islands, the Marquesas Islands, the Gambier Islands, the Harvey Islands, the low coral islands of the Dangerous or Pomoutou group, and the Radack and Ralick chains, with a few solitary detached, but unimportant islands.

Physical Characters.—There are perhaps few spots where such an assemblage of agreeable external circumstances is met with, and where the visitor is assailed by so many favourable impressions. The climate is warm without being oppressive, the scenery partakes of all that variety nature can so well assume, where mountain, valley, and plain exist, and have each their charms; and where the vegetation is varied and agreeable, without being in excess. The islands may be regarded as so many mountains of basalt and lava, split by numerous valleys, and with their bases often dilated into plains, stretching with various inclinations to the cliffs or coral reefs of the shores. The valleys are usually very steep, and contain the chief and richest soil, for the mountains often display precipices with the smoothness and regularity of artificial walls. Elsewhere are numerous projecting masses of rocks, rendering certain parts entirely unfit for cultivation. Among the denser vegetation the soil is black from the mixture of organic matter, but on the plains it is frequently of a deep-red colour, and may be used as a coarse paint. This owes much of its exist-

ence to the decomposition of the lava rock, and is very productive when supplied with abundance of water. The coral islands must be excepted from the above, as they have a low flat circular surface, with small patches of vegetable mould.

Climate.—Within the influence of the trade-winds, and ever fanned by their breezes, the temperature of the region is not high for the latitude. It is something greater at the Society Islands to the south of the equator, than at the Sandwich Islands to the north. At Honolulu, Sandwich Islands, Mr. Rooke's Observations for 1838, give the mean temperature as 77° 3, fall of rain 21·1 inches, fine days 285, rainy 37, variable 43. Similar observations at the Society Islands are wanting. The quantity of rain in different places varies greatly; and in the interior, near the highest land, the amount will be three or four times more than the above; and places to windward will have less than others to leeward. From some observations, I am disposed to fix 193 feet of ascent as equal to one degree of the thermometer. The seasons at the two sides of the equator will be at different periods, and rains occur a little after the summer solstice. At the Marquesas I found some relative temperatures to be, under the shade of vegetation 86° 5, the soil 80°, the sun's rays partially obscured, 103°.

Flora.—The vegetation is not rich but interesting; indeed it may be called a poor flora. Forest cannot be said to exist; and the trees crowd up the valleys and less perpendicular ascents, with more the character of groves. Irregular patches of these diversify the aspect of the country, the intervals being filled with smaller vegetation. Dracæna terminalis spreads over the valleys; and the troublesome grass, centrotheca lappacea, covers every dry spot on the ridges and sides of the hills, and even of

the plains. The trees are not large but numerous, and want the great height attained in the genuine forest. The vegetation is otherwise peculiar, from its small and inconspicuous flowers, being deficient in size and richness of colour, the absence of fragrant properties to a great extent, and the leaves being mostly small, undivided, and of a dull shade of colour.

I have thought that there were proofs here of plants degenerating towards the margins of the extent of their indigenous existence. Artocarpus incisa, broussonetia papyrifera, and aleurites triloba, grow nearly everywhere spontaneously. At the Society Islands they thrive vigorously, as large trees; but on advancing eastward they gradually diminish in size and vigour till, in the Gambier group, they are hardly of any use to the natives; and in Easter Island, where the two latter are found, they are low and useless bushes. The same circumstance may be noticed with the shells, cardium cardissa, terebra maculata, conus betulinus, purpura persica, and perhaps others.

The Sandwich Islands have a superficies of 6,600 square miles. The prevailing families are, filices, very numerous; a large proportion of compositæ, cinchonaceæ, leguminosæ, malvaceæ, cyrtandraceæ, labiatæ, urticeæ, euphorbiaceæ, piperaceæ, and gramineæ. The vegetation is more closely distinguished by several araliaceæ, goodenoviæ, lobeliaceæ, amarantaceæ, and pandaneæ; whilst the presence of cruciferæ, saxifrageæ, and umbelliferæ, invests it with further peculiarities. Till recently no palm beyond the cocoa-nut was supposed to exist, but a species of chamærops has been discovered. Orchidaceæ have no existence. The peculiar genera are few, kadua, charpentiera, dubautia, and a few others. In Hawaii, Mouna Roa reaches 15,980 feet, and Mouna Koa 13,500 feet, and

have a vegetation with alpine features. Vaccinium, rubus, and fragaria are found here; and when the flora shall be better known, a small alpine region will most probably become necessary.

The Society Islands. These islands have a much smaller superficies, and a flora of only 500 species. They contain nearly the whole of the different species of the region south of the equator; and there are very few not found at Tahiti, the largest of the group. The prevailing families of the Sandwich Islands exist equally here, the chief peculiarities depending on the presence of several cruciferæ, on the comparative abundance of cinchonaceæ, euphoribaceæ, and urticeæ, the scarcity of leguminosæ, and through celtis discolor in possessing ulmaceæ.

The Marquesas yield nothing in natural beauty to the other islands, and have a flora hitherto very sparingly examined, but apparently identical with that of the Society Islands, though even less abundant. The self-introduced plants which fringe the shores are different from those of the same class at the Sandwich Islands, and evidently come from that part of the coast of America nearest at hand. Some species monopolize a large surface. Hibiscus tiliaceus runs far into the valleys, to the exclusion of everything else; desmodium purpureum occupies the waste ground near the sea; and centrotheca lappacea spreads higher upon the hills. The bread-fruit and cocoa-nut compose large groves.

The Harvey Islands have a vegetation identical with the Society Islands. Raratonga has the reputation of being the most picturesque island of the Pacific. It is very productive; and the paramount object of the residents at present is to exclude the guava-bush, which at Tahiti has spread so widely, obliterated the grass, and much other of the vegetation.

The Gambier Islands are volcanic islands set in coral reefs. The flora is the same as at the Society Islands. Metrosideros obovata has hitherto only been met with here.

The Pomoutou Islands. These irregular coral islands are upwards of fifty in number. Their surface is composed of ragged fragments of dead coral, with a little vegetable mould in places; and sometimes water is found a few inches beneath the surface. The flora is extremely limited, and, it must be inferred, in no respect original; yet there are one or two plants at present not known to exist elsewhere. A collection of plants made by myself, with a few additions from other sources, gives a total amount of 47 species, which are referable to 40 genera, and 27 families. Lepidium piscidium disregards the heat, and appears wherever there is a little soil, and the parasitic cassythis filiformis mats together the bushes.

The Radack and Ralick Chains, though closely resembling the latter, are more productive, and cultivation is practised. Chamisso mentions 52 species, many of which are indigenous at the Sandwich Islands and Guahon. He also observes that the southern islands have a richer soil and older vegetation.

Relations.—The existence of this region, as a whole, is very clearly defined; the connexions with the nearest regions not being very intimate. Its relations are spread far and wide. In the Sandwich Islands there are affinities with New Holland through metrosideros, myoporum, exocarpus, cyathodes, and an aphyllous acacia; with Europe are several jungermannia, and musci in common; besides, with North America and Asia, several identical species. In the Society Islands the affinities are strongest with New Holland through metrosideros, myoporum, casuarina, and dodonæa; but they have no representative

of epacrideæ, as at the Sandwich Islands. From these latter they are further distinguished by the presence of ficus and several orchidaceæ. With South America and Asia there are some relations, but they are not striking. Rhizophora has no existence.

XIX. THE PAPUA OR NEW GUINEA REGION.

Extent.—Several large and important islands, of which New Guinea is by far the most extensive, lying between the equator and 23° south latitude. Commencing at the western extremity, the region includes the Moluccas, Papua or New Guinea, the former designation being the most in use in the surrounding seas, the Admiralty Islands, New Britain, and New Ireland, the Solomon Islands, New Hebrides, New Caledonia, the Feejee Islands, Tonga archipelago, and Navigator's Islands.

Physical Characters.—The scenery is bold and rugged, particularly about the Solomon group, and many of the islands are nothing but mountains. The forest, which abounds everywhere, rests on rocky declivities, with very little soil. In Papua and the Feejee Islands, there are extensive level surfaces of rich soil, apparently the deposit of rivers. There are several active volcanos, and much of the structure is in every probability volcanic. Conglomerate, limestone, and stratified sandstone occur in Papua. The islands of the Tonga group are curious flat tables of limestone, forty feet and upwards above the level of the sea, and with deep water close to their wall-like cliffs. The elevation of the mountains of Papua is undoubtedly not so great as has been supposed, and along the whole extent of its northern

shore none are visible which at all approach the limit of perpetual snows.

Climate.—Heat and moisture prevail, and render the climate a warm, and from the productions, it is likely, a peculiar one. An anomaly exists in the distribution of the seasons. It is customary for the south-east monsoon to bring the dry season to the space over which it blows from May to October inclusive. The north-west monsoon prevails for the remaining months of the year and accompanies the rains. The reverse happens over the extent of this region, for though the monsoons are not so powerfully felt at its eastern extremity, the climate is everywhere the same. In the south-east monsoon the rains are heavy and frequent, and the deposition must be very considerable.

Flora.—Approaching this region from the eastward, the character of the flora as distinct from the Polynesian is very evident; palmæ become more numerous through chamærops, caryota, and areca; pandanus has many species; leguminosæ, though more abundant than in the Polynesia Region, and compositæ are not frequent, a proof of the usually moist state of the atmosphere; cycas first appears at New Ireland, and rhizophora in the rivers of the Feejees. However, it is a flora, with the exception of the Moluccas, almost unknown.

Papua or New Guinea.—Forest covers everywhere this large and fine, but unhealthy, island, and presents a variety which perhaps makes it the most prolific of vegetable forms in the world. The vegetation is extremely varied, and the species appear to have a limited range. Here, as elsewhere, it is chiefly on the margins of the forest, that flowers and herbaceous plants are seen. The colours are generally little attractive, and white greatly prevails. This is partly compensated by

the frequent fragrance of the flowers, and sometimes even of the foliage. Leguminosæ, solaneæ, and umbelliferæ, are uncommon. Trees of achras and myristica are numerous in the forest, and there are several species of each. The nutmegs are without the aroma found in myristica moschata. This genus extends as far to the east as the Feejee Islands. Ferns of every variety of habit are most numerous, and orchidaceæ abound.

The Moluccas have a less compact forest, as open spaces of bushes often occur, but a great variety in its trees. They are remarkable, as the native country of the clove and nutmeg of commerce, and of other aromatic productions.

Relations. — When the southern shores of New Guinea are better known, there will most probably be discovered many sources of resemblance with New Holland. At present the most prominent are, casuarina, common throughout the region, melaleuca and eucalyptus in the Moluccas, and acacia laurifolia, an aphyllous species, in the eastern groups. A passiflora is common in the Feejee and Navigators' Islands. Agathis appears in the Moluccas, as well as in New Zealand, and the resin is largely used, under the name of dammar, to give light.

XX.—THE AUSTRALIA TROPIC REGION.

Extent.—The space between the northern shores of New Holland and the limit of the tropic in 23°28′ south latitude. The genuine characters of this region are lost, even within this limit, towards the west coast, where at Point Leveque in 123° east longitude, it meets the west Australian region.

Physical Characters.—Little is known respecting it, the coast only having received a partial examination. The shores are generally low and sandy, often barren, but sometimes clothed with a rich and luxuriant vegetation.

Climate.—Tropical in temperature, but deficient in the usual amount of suspended moisture.

Flora.—The thin forest of New Holland prevails, but partakes more of the usual tropical characters, and in some places is so dense and vigorous as to be almost impenetrable. In the vicinity of Van Diemen's Gulf species of eucalyptus, corypha, pandanus, acacia, and croton, form a thick vegetation. The shores are closely beset by rhizophora, brugiera, and carallia, all genera of rhizophoreæ. Palmæ are not numerous, and are represented by corypha, seaforthia, livingstonia, and calamus. Leguminosæ, as might be expected in such a climate, are very abundant; also euphorbiaceæ through croton and phyllanthus; and coniferæ are present in podocarpus, callitris, and araucaria. A. excelsa is not here a large tree, but occasionally covers much space. Cinchonaceæ do not abound, and such as exist have Indian relations. Bignoniaceæ have a few species. Cryptogamic plants, epiphytic orchidaceæ, and others with similar habits, and depending less on their roots for food than on the atmosphere, are all infrequent. Loranthus, embracing as it does genuine parisites, is frequent on all the coasts of New Holland.

Those plants so entirely characteristic of this continent, and which are developed so profusely in the metropolis of their existence, are still spread among the vegetation, but in reduced numbers. Proteaceæ are nearly limited to grevillea, hakea, and persoonia; the Australian myrtaceæ are few; diosmeæ has only eriostemon and phe-

balium; eucalyptus has few species and individuals, and diminished vigour; casuarina is gradually disappearing.

Relations.—Mr. Allan Cunningham has had the best opportunities of examining the vegetation. In an expedition directed to this part of the coast he collected 1500 species of phenogamous plants, of which 520 had been previously described. In a comparison between the east and north-west coasts in the parallel of 15°, and with an intervening space of 1,800 miles, he found only forty-eight species in common. He also gives a list of fifty-two Indian and South American plants, which are indigenous to Australia. (King's voyages, Appendix.) Umbelliferæ have a few species, and there are some close relations with the flora of New Guinea and the Malay Islands. Among others, myristica is not uncommon on the northern and north-western coast.

XXI.—THE NEW SOUTH WALES REGION.

Extent.—The British colony of New South Wales occupies a large portion of the east coast of New Holland. Our region is, however, more rigorously defined, and will comprise the east portion of the continent south of the tropic, and ceases to the west and south somewhere in the neighbourhood of the mouth of the Morumbridgee.

Physical Characters. — The whole continent has been divided into two parts, the region of terraces, and the region of plains, separated by the 148th meridian. Captain Sturt observes, that of the ridges which divide the latter, each presents a different rock formation, and also that he has noticed that the botanical and geological features are intimately connected. The Blue Mountains

attain no considerable elevation, scarcely exceeding 3,000 feet, and form a wild and sterile barrier between two portions of the country. The soil varies, much is extremely arid, and some is productive on slight cultivation. It is probably a variety which will soon wear out, and large tracts are required for grazing purposes. The kind of trees growing are regarded as a good indication of the quality of the soil; the native apple (Angophora lanceolata) selecting a good soil, and the spotted gum and stringy bark a bad. Rhagodia, salsola, and similar plants, are met with in places, and indicate a saline soil. After the wet season, ephemeral rivers traverse the country, and lose themselves either in sandy plains or chains of marshy ponds. At other seasons much of the surface is indifferently watered.

Climate.—There is a great disposition to excess both in temperature and in dryness. The range of the thermometer is sometimes very great and sudden, being in the summer months from 36° to 106°, the mean 70°; and in the winter months from 27° to 98°, the mean 66.° At Sidney the number of rainy days is 107. There is evidently a strong adaptation of the vegetation to the climate and other physical agents.

Flora.—It has been observed by many, that in the Australian vegetation there is a sombre dulness which entirely excludes any of those lively and agreeable impressions it elsewhere so frequently creates. The forest, where it abounds, is not close and compact, but so open as to offer no obstruction to the passenger, and intervals are frequently occupied by dry stunted bushes, or straggling grass. Mr. P. Cunningham remarks that the trees are nearly all evergreens, with fewer branches, and comparatively fewer leaves than European trees. Many shed their bark, and whilst the new has the appearance of a dead

tree pealed, the old bark is hanging in loose shreds and flakes, giving the whole much the character of an assemblage of dead trees. Dr. R. Brown attributes the monotonous aspect and want of lustre in the vegetation to the equal existence of the cutaneous glands, or stomata, on both surfaces of the leaf. Nor when vegetation has ceased does the decay of the decomposing parts impart the usual fertility, for Captain Sturt conceives that the decaying leaves and timber, instead of adding richness to the soil, actually preclude minor vegetation, and that plants seem to shun the spot where a tree has fallen and gone to decay. In a climate so arid, the seasons will assert a powerful influence over the vegetation, and as soon as the beneficial effects of the rains are felt, there is much gaiety and liveliness in the numerous curious and handsome flowers; but on their disappearance the vegetation soon becomes parched and uninteresting. The wood of the trees possesses to an important extent the property of incombustibility, which is supposed to be due to the presence of aluminous earth.

The botanist must take a closer inspection, and here finds a novelty and pleasure the more general observer is deprived of. The various species of eucalyptus, nearly a hundred in number, compose the chief bulk of the forest; it has been estimated at four-fifths. They are frequently trees of enormous dimensions, except within the tropics, where they are also fewer. Exocarpus cupressiformis is the commonest tree of New Holland, without the tropics. Casuarina has many species, which have the local name of oaks. Leguminosæ are very abundant, the decandrous papilionaceous kinds prevail, as pultenæa, gompholobium, and dillwynia; and the aphyllous species of acacia are almost peculiar. Compositæ are liberally represented by the tribe corymbiferæ, but very sparingly by the two

others. Orchidaceæ are very numerous as species, but not as individuals, always growing sparingly, and sometimes are extremely rare; those which are epiphytic cease at 34° S. latitude, and are more abundant in this region than the tropical. Palmæ extend to the same limit. Proteaceæ, myrtaceæ, and epacrideæ, abound in great numbers in peculiar genera, and intermingled with diosmeæ, goodenoviæ, myoporineæ, stylideæ, restiaceæ, tremandreæ, polygaleæ, and dilleniaceæ, impress very distinctive peculiarities. Cryptogamic plants are not so abundant as usual, owing to the dryness of the climate, the absence of large trees in many situations, and the deciduous bark. A tree-fern, dicksonia antarctica, extends through the region, even into Van Diemen's Land.

Relations.—It is not a little singular, that identical species of European plants appear here in greater numbers than in South Africa, or other intervening regions. Dr. Brown's experience renders his observations valuable. "In comparing very generally the flora of the principal parallel, (between 33° and 35° S. latitude) of Terra Australis, with that of South Africa, we find several natural families characteristic of the Australian vegetation, as proteaceæ, diosmeæ, restiaceæ, polygaleæ, and also butteneriaceæ, if hermannia and mahernia be considered as part of this order, existing, and in nearly equal abundance, at the Cape of Good Hope; others are replaced by analogous families, as epacrideæ by ericeæ; and some tribes, which form a considerable part of the Australian peculiarities, as dilleniaceæ, the leafless acaciæ, and eucalyptus, are entirely wanting in South Africa. On the other hand, several of the characteristic South African orders and extensive genera are nearly or entirely wanting in New Holland; thus, irideæ, mesembryanthemum, pelargonium, and oxalis, so abundant at the Cape of Good Hope, occur very sparingly in New Holland,

where the South African genera aloe, stapelia, cliffortia, penæa, and brunia, do not at all exist. Very few species are common to both countries, and of these, the only one which is at the same time peculiar to the southern hemisphere is osmunda barbara."*

XXII.—THE WEST AUSTRALIA REGION.

Extent.—The tropical features of New Holland are not fully developed on the north-west coast, which makes it necessary to extend the limits of this region in this direction. It will thus occupy the western portion of the continent from 123° E. long., and become mingled with the New South Wales Region on the south coast in the neighbourhood of the Morrumbidgee, the interior of the continent being unknown.

Physical Characters.—It is a feature in New Holland that the shores are invested by a broad belt of sandy soil, which gives them a very unprepossessing aspect to the stranger, and most of all to the settler. This is succeeded by grassy and thinly-wooded plains. Such is particularly the character of this region. At a little distance from the coast is a parallel, but irregular and broken, range of hills; and others detached are spread over the country. Basaltic rocks are not unfrequent, but that kind of sandstone known as ironstone, chiefly prevails, and forms the basis of the plains. Limestone is also not unusual. This surface generally is indifferently supplied with streams.

Climate.—Similar to that of New South Wales, but not so liable to extremes of temperature or to long droughts. At Perth the average temperature in Fe-

* Flinder's Voyages, Appendix, Vol. ii., p. 588.

bruary, at four P.M. was 84°, in August 63°, and at ten A M. respectively, 81° and 60°. The mean of these hours throughout the year are 72° 1 and 69° 5. January, February, and March, are the months of greatest heat and aridity.

FLORA.—The plants of this coast are almost entirely distinct from those of the east coast, but with King George's Sound they are strikingly identical. This peculiarity, however, is chiefly confined to species. The most charactertstic plants are species of casuarina, callitris, zamia, exocarpus, xanthorrhœa, and kingia australis, and nutysia floribunda. Eucalyptus has few species, and angophora is not known. (*Brown in Journal Geographical Society.*) The northern limit of xanthorrhœa is at 28° S. lat. The vegetable productions, then, of this region are sufficiently peculiar, for whilst it fully retains Australian features, its closer forms are its own.

RELATIONS.—South African ferns are more abundant than in any other portion of the continent, and this is conspicuous even in its proteaceæ. An European plant, arenaria marina, is met with.

XXIII.—THE VAN DIEMEN'S LAND REGION.

EXTENT.—The island so called, situated between 40° 42′ and 43° 43′ S. lat., and having an area of 17,192 square miles.

PHYSICAL CHARACTERS.—Van Diemen's Land has fewer of those extremes so frequent in the neighbouring continent. The surface is occupied by fertile plains, occasionally swelling into hill and dale, and sometimes raised into ranges of inconsiderable elevation. Ben Lomond, to the

north-west, attains 4,200 feet, and Mount Wellington, near Hobart Town in the south, about 3,700 feet. In the vicinity of the rivers are large plains with good soil, and covered only with an herbaceous vegetation. The whole island is available, and rarely unfit for cultivation.

Climate.—With our European notions of climate, this would be considered cold for the latitude. The seasons are more regular, and the distribution of heat and moisture more equable, than in New South Wales. The smaller range of temperature is attributable to its insular position, and the humidity to the prevalence of southerly winds.

Flora.—There is a freshness and variety about the vegetation denied to New Holland. Though possessing many of its distinctive groups, the species are to a great extent limited; its epacrideæ, proteaceæ, and myoporineæ have even peculiar genera. Eucalyptus, though with fewer species, attains here its greatest developement. Among its trees are podocarpus asplenifolius, dacrydium taxifolium, exocarpus cupressiformis, carpodontos lucida, atherosperma moschata, zieria arborescens, tasmannia australis, t. fragrans, with species of gaultheria, pomaderris, and fagus. Cryptogamic plants are numerous, and some are identical with the European. Dicksonia antarctica, an arborescent fern, is met with.

Relations.—The connexions of the vegetation are widely extended. With the more temperate parts of Europe there are many genera in common, as stellaria, linum, viola, clematis, anemone, ranunculus, veronica, drosera, geranium, polygonum, cardamine, and nasturtium. With the South Africa region more particularly, by pelargonium, elichrysum, and oxalis; with North America, by gaultheria and aster; and with the Malaisia region, by podocarpus.

XXIV.—THE NEW ZEALAND REGION.

Extent.—Two islands situated between 34° and 48° S. lat., and with an area of 62,160 square miles. The northern is the smaller, but possesses the greatest capabilities, and is called Eaheinomauwe. The southern is known as T'avai Poenammoo.

Physical Characters.—A lofty range of mountains, from 12,000 to 14,000 feet high, traverses both islands, their upper portions covered with eternal snows, and their lower clothed with noble forests, the trees of which are equally distinguished for their tall and stately growth, as for their great girth. The soil of the plains is plentiful in places, and yields a good return under cultivation.

Climate.—Temperate, but liable to fluctuations.

Flora.—Tropical vegetation still lingers in palms, arborescent ferns, and epiphytic orchidaceæ; the latter cease at 45° S. lat. Areca sapida reaches 34° S. lat. There is a curious mixture of its own peculiar forms with others common to both near and distant regions, as is evident in the genera dracæna, forstera, myoporum, melaleuca, avicennia, weinmannia, tetragonia, dicera, pimelea, epacris, phormium, knightia, plagianthus, cyathea, angiopteris, gleichenia, fuchsia, andromeda, oxalis, and mesembryanthemum. Palms, tree-ferns, and epiphytic orchidaceæ all occur farther south than in New Holland. The kawrie, yielding valuable masts and spars, is the dammara australis or agathis australis.

Relations.—The most interesting are with the Patagonia Region through fuchsia, mniarum, drymis, acæna, sisymbrium, and lepidium; and with the South Africa Region through gnaphalium, tetragonia, and oxalis.

There are also some other interesting affinities with South America. Agathis loranthifolia, a near ally of the kawrie, abounds in the Moluccas.

XXV.—THE SOUTH AFRICA REGION.

Extent.—Southern Africa beyond the tropic; Cape L'Agulhas, the extreme point, is in 34° 55′ S. L.

Physical Characters.—"The surface of this region is striking and peculiar, presenting three successive mountain ranges, running parallel to the coast and to each other. The first, called Lange Kloof, is between 20 and 60 miles from the ocean, the breadth of the intermediate plain being greatest in the west. The second chain, called the Zwaarte Berg, or Black Mountain, rises at an interval nearly similar behind the first, is considerably higher and more rugged, and consists often of double or triple ranges. Behind, at the distance of 80 or 100 miles, rises the Nieuweldts Gebirgte, the loftiest range in Southern Africa. The summits, to a great extent, are covered with snow; from which circumstance the eastern and most elevated part is called the Sneuwberg, or Snowy Mountains, whose highest pinnacles are not supposed to fall short of 10,000 feet. The plain nearest the sea is fertile, well watered, richly clothed with grass and trees, and enjoys a mild and agreeable climate. The plains between the successive ranges are elevated, and contain a large proportion of the species of arid desert called karroo. The southern plain in particular is almost entirely composed of the great karroo, 300 miles in length and nearly 100 in breadth, covered with a hard and impenetrable soil, almost unfit for any vegetation. Along the foot of the Sneuwberg, however,

there is a considerable tract, finely watered, and affording very rich pasturage. Beyond the mountains, the territory is for some space black and sterile; but it gradually improves till it opens into the extensive pastoral plain occupied by the Boshuanas. So far as this has been explored to the northward, it becomes always more fertile, though to the west there has been observed a desert of very great aridity. The eastern coast also consists chiefly of a fine pastoral plain, occupied by the various Caffre tribes, and broken by some chains of mountains, the direction of which has been very imperfectly explored."—(*Murray's Geography.*) The most fertile soil is found in the neighbourhood of the coasts, along the base of the Snowy Mountains, and in the vicinity of the rivers. Several rivers and streams traverse the country, becoming during the rains much swollen, and shrinking in the long and painful droughts to a small size, or to chains of muddy pools. Sandstone and granite greatly prevail in the mountain ranges, on which often repose clay-slate and greywache. "As far as is at present known, the whole of the table-land of Africa to the north of the Orange River is composed of limestone in horizontal strata, clay-slate, sandstone, and quartz rock, granite, greenstone, serpentine, and potstone." —(*Jameson in Murray's Geography.*) In some places the soil is very salt.

Climate.—Over such a diversified surface there will be much variety in the climate. The mean temperature and range are different in situations in the neighbourhood of each other, and the eastern coasts are colder than the western. Mr. Colebrook's observations give the mean of Cape Town 67° 3, and the extremes 96° and 45°, or fifty-one degrees. The mean of the coldest month is 57°, of the hottest 79°, least summer heat 77°, and the solar radiation is very considerable. Inland both the mean and

range are lower; at Stellenbosch the mean of one year's observations was 66° 3, range from 87° to 50°; at Zwartland the mean 66° 5, range from 85° to 54°. The year is divided into the cold or rainy season, which lasts from May to October, and the warm or dry season, from November to April. From the same we have some facts on the hygroscopic condition of the atmosphere obtained near False Bay from December to March. At sunrise the ordinary dryness was 6° or 7°, the extreme from 12° to 3°. The maximum at noon was 26°, the greatest range within the day 35°, mean dryness of the morning 7°, of the noon 14°, and further minimum dryness scarcely a fourth of the atmospheric capacity for moisture.

Flora.—This portion of Africa presents a good specimen of a particular variety of vegetation, where there is an intimate relation between the flora and external influencing circumstances, and a close adaptation of the organs of plants to the duties required of them. In many respects this is highly conspicuous; the leaves are often very small or minutely divided, and clothed with hairs, or tomentose, or lanuginose investments; many species are provided with fleshy succulent leaves, which do not part readily with their juices, and serve as so many magazines of nourishment, whilst the very numerous bulbous plants are eminently adapted to a climate which, for a long season, is extremely arid; at this time the bulbs retain their vitality without requiring any nourishment, and are ready to assume activity on the appearance of the rains. The want of moisture, equally with low temperature, as seen in northern regions, would seem productive of a low, stunted, bushy vegetation, and is also characterised by the frequency of spinous organs, the disagreeable effects of which are expressed in the quaint name of wait-a-bit, given to acacia detinéns. The colours of the flowers are usually rich and

brilliant, the brightness of the solar rays, assisted by a clear atmosphere, having developed them in the most perfect manner. Pink, yellow, and white flowers greatly prevail, with a rare mixture of those tamer colours seen in a luxuriant vegetation under a moist atmosphere. Though the flowers are not conspicuous for their fragrance, this is frequent in the foliage; we observe this in various pelargonium cultivated with us, and on the spot in species of diosma, compositæ, and the numerous stapelia, if the carrion odour of the latter can be so called.

The mention of a beautiful provision of nature must not be omitted, particularly as it involves a departure from a general rule. The capsules of several species of mesembryanthemum refuse to open except when moistened by the rains, lest, opening in a dry season, they should shed their seeds on an unprepared soil.

The very numerous species which constitute the flora of South Africa belong, to a considerable extent, to genera which are peculiar; and even when it shares its natural families with other regions, its genera are rarely extended to them; as in proteaceæ, leguminosæ, irideæ, compositæ, rosaceæ, and cruciferæ. It is only in particular situations that forest exists, giving shelter to numerous savage buffaloes. The largest trees are ilex crocea, curtisia faginea, cunonia capensis, taxus elongata, laurus teterrima, olea capensis, tarchonanthus camphoratus, t. arboreus, brabejum stellatum, acacia vera, ekebergia capensis, and various proteaceæ, gardenia, and royena. We will glance hastily over the prevailing families and their more peculiar genera. *Proteaceæ* abounds in protea, serrularia, leucospermum, lorocephalus, spatalla, mimetes, and nivenia; *Leguminosæ* has liparia, lebeckia, aspalathus, borbonia, lessertia, psoralia, podalyria, and schotia; *Ericaceæ*, the very numerous and interesting group of erica, and the far

smaller genus blæria; *Diosmeæ* prevail extensively in diosma, agathosma, adenandra, and baryosma; *Asclepiadeæ*, the numerous and strange stapelia, with huernia and gomphocarpus; *Crassulaceæ*, a family with some kindred habits, is represented in crassula, rochea, leptas, and cotyledon; *Ficoideæ*, by the various mesembryanthemum, with tetragonia and hymenogyne; *Polygaleæ*, in polygala, muraltia, and mundia; *Compositæ* prevail extensively, and many are characterized by that peculiar texture of the flower belonging to everlastings. Most of the following genera are peculiar: chrysocoma, arctotis, othonna, osteospermum, tarchonanthus, sphnegyne, erichrysum, cacalia, pteronia, berckleya, and gazania; *Orchidaceæ* cannot be supposed to be abundant; disa and satyrium find convenient localities on the Table Mountain, and some of them are scarce; *Irideæ* abound in ixia, gladiolus, tritonia, watsonia, hesperantha, sparaxis, babiana, and trichonema; *Amaryllideæ* equally so in hæmanthus, strumaria, brunsvigia, nerine, cyrtanthus, and gethyllis. There are yet several important genera requiring notice: euphorbia has a group of species which simulate the habit of cacteæ, and supply their place; aloe has a great variety of species, and others are frequent, in oxalis, phyllica, restio, struthiola, cliffortia, roella, hypoxis, eucomis, massonia, lachenalia, and streletzia. Heliophila, a cruciferous genus, is monomic. Lobelia, cestrum, lyceum, chironia, and others prevail. Two families also claim to be regarded as monomic,—bruniaceæ and penæaceæ. Climbing plants are uncommon, as are also cryptogamic. Some ferns are found on the sides of the Table Mountain, the particular flora of which has other evidences of a moister atmosphere. The mass of the vegetation is to a great extent confined to the colony, and several of its more peculiar groups, ericaceæ, proteaceæ, diosmeæ, and restiaceæ, do not appear on the arid karroo,

which is occupied by gregarious species of lyceum, acacia, euphorbia, and mesembryanthemum. Some have a very limited range, and the species of stapelia abound more particularly on the arid sands of the west coast.

Relations.—The various relations of a region so complete as that of South Africa must be extremely interesting; and it seems probable that so rich a vegetation, with a liberal hand, gives more representatives to other regions than it receives from them. Passing over a more extensive view of its relations, we will confine our notice to groups having their chief existence elsewhere. A few of the genera of Europe, North America, and Siberia, have species here; the presence also of salix, bryonia, and viola, recalls a different latitude and climate. In common with the north-eastern portion of Africa, it has acacia vera, cucumis colocynthis, and a zizyphus; and has an affinity with New Holland in metrosideros angustifolia. Several introduced plants are becoming diffused, as solanum nigrum, sonchus oleraceus, and polygonum persicaria.

XXVI.—THE MOZAMBIQUE REGION.

Extent.—That portion of the east coast of Africa between 10° N. lat. and the south tropic in 23° 28′ has been so little visited, that nothing is known of its vegetation, except that it is clothed with rich forests, and has a climate in all respects tropical.

Physical Characters.—Spacious plains abound near the coast, traversed by considerable rivers, and liable to partial submersion.

Climate.—Tropical, moist, and frequently unhealthy, but well suited to the growth of the nutmeg, cinnamon,

and similar productions of a tropical climate in its excess.

Flora.—Further than that it abounds in luxuriant forest, and supplies us with Columba-root and a few other articles of commerce, little is known concerning it, and the native rulers are too jealous of foreigners to permit any examination of the interior of the country.

Relations.—It differs so entirely from the regions to the north and south, that the propriety of its separation from them seems undoubted.

XXVII.—THE MADAGASCAR REGION.

Extent.—The large and fruitful island of Madagascar, situated between 12° and 26° S. lat., and the far smaller islands of Bourbon, Mauritius, and the Séchelles.

Physical Characters.—In Madagascar, extensive fertile plains extend from the shores towards a lofty range of mountains in the interior. The soil is represented as rich and highly productive, and extensive marshy districts are occupied as rice-fields.

Climate.—Tropical, moist, and in some parts of Madagascar extremely fatal to human beings.

Flora.—Just enough of the productions of Madagascar are known to assure us they are peculiar, and to stimulate research. The vegetation is luxuriant, and varied with the usual aspect of the tropics. The natural family of chlenaceæ is confined to it; areanthes and other orchidaceæ abound. Tanghinia veneniflua, yielding a most energetic poison, and hydrogeton fenestralis, remarkable for the structure of its leaves, are both natives. Several species of the small family of homalineæ are found in the islands, and also the myrtaceous genus jossinia.

The *Mauritius* has rather an extensive and tolerably well-known flora, and with a fair proportion of peculiar species. Danais and chasalia are confined to it.

Bourbon closely resembles the Mauritius.

The *Séchelles* are chiefly remarkable for a double-fruited variety of cocos nucifera, which is produced on three of the islands.

Relations.—From its position, Madagascar would seem to belong to Africa, but such observations as have been instituted on its flora and that of the neighbouring coast, point out decidedly stronger affinities with India. Edwardsia is common both to New Zealand and the Mauritius.

XXVIII.—THE WEST AFRICA REGION.

Extent.—A considerable tract of country, inhabited by many populous nations, situated between the Great Sahara or central desert of Africa and the Atlantic Ocean, and Cape Blanco, in 20° 55, N. lat., and 23° 28, S. lat., or the south tropic.

Physical Characters.—In the neighbourhood of the coast the surface is composed chiefly of level plains, broken occasionally by ranges of low hills, and with chains of lofty mountains in the background, of primitive formation. Much of the soil is alluvial, and surprisingly productive; and the banks of the numerous rivers are low, and during a part of the year extensively overflowed by the rising of the waters. At the mouth of some of the rivers are large salt-water marshes, covered by mangrove and other congenial plants. But salt, so abundant in other parts of Africa, is here in the interior so scarce as to be greatly prized.

CLIMATE.—Tropical, and generally moist; but in the vicinity of the desert partaking of its aridity.

FLORA.—Over this extensive surface there is little variety in the vegetation; the same forms are continually repeated, and there is a scarcity of some of those elsewhere so abundant in the tropics. Palmæ have few species; elais guineensis, phœnix spinosa, raphia vinifera, and the cocoa-nut, are the chief. Musaceæ, scitamineæ, piperaceæ, are scarce. Yet there is a denseness and luxuriance in the vegetation hardly surpassed in any other part of the world. The forest is extensive and magnificent, the trees attaining a large size; and on the banks of the rivers which have been navigated some have been seen of enormous dimensions. Cinchonaceæ, leguminosæ, and malvaceæ abound; ficus, cassia, acacia, and euphorbia have many species. Some of the more conspicuous belong to bombax, adansonia, sterculia, cadaba, parkia, hoflandia, melhania, pentadesma, cratæva, capparis, grewia, pterocarpus, psychotria, bignonia, avicennia, anona, and pandanus candelabrum.

The Cape de Verd Islands have, perhaps, a less varied and vigorous vegetation than the coast.

St. Helena, situated in 16° S. lat., has the character of a very poor flora, but of which the members are nearly altogether peculiar. Of 61 species, two or three only have been noticed elsewhere. Ferns, grasses, compositæ, and the cocoa-nut and date-palm, are met with, but the climate is ungenial, and the sugar-cane scarcely thrives. The peak of Diana is elevated 2,692 feet.

Ascension Island is situated in 7° S. lat. The Green Mountain attains 2,818 feet. Some of the caves are verdant with ferns. Grasses are in proportion numerous, and portulacca oleracea, euphorbia origanoides, asclepias curassavica, convolvulus arenarius, and carex pedunculata, overrun the plains.

RELATIONS.—Between the tropical portions of Asia, Africa, and America, many of the natural families are shared in common; thus we see combretaceæ, meliaceæ, ochnaceæ, sapindaceæ, terebintaceæ, anonaceæ, sapoteæ, and potaliaceæ, all essentially tropical groups, freely represented in each. Frequently the genera are in common, but beyond this the relations are feeble. Still some extensive families are only sparingly represented, as passifloreæ, melastomaceæ, myrtaceæ, and loranthaceæ. It is probable that when the vegetation of the base and flanks of the Cameroon Mountains shall be known, they will require a separate consideration. Their supposed elevation is 13,000 feet.

XXIX.—THE CANARY ISLANDS REGION.

EXTENT.—These islands are in the same parallel at the Great Sahara, being situated off that part of the African coast where that desert meets the ocean, and are thus situated, in a geographical position, between the Barbary Region and the West Africa Region. In addition to the islands more properly known as the Canaries, the region includes the fertile island of Madeira, with the almost desert Porto Santo and the Dezertos, and the Azores.

PHYSICAL CHARACTERS.—The islands of these groups may be regarded as so many mountains rising above the ocean to considerable elevations. Teneriffe attains 12,176 feet, and the highest part of Madeira, 6,233 feet. Their plains and valleys abound in a fertile soil, the productiveness of which is further insured by its volcanic origin, insular position, copious supply of moisture, and warm atmosphere. In some parts lava prevails so completely as to exclude vege-

tation, and those islands with an aspect towards the coast of Africa are materially affected by its arid breezes.

CLIMATE.—The temperature is warm and even, but some parts are subject to considerable depression from sudden gusts, which sweep the cold air from the summits. The mean of Funchal, Madeira, is 65°, number of rainy days 73, and fall of rain 31 inches. At Santa Cruz, Teneriffe, the mean is 71°. The temperature given for the alpine regions of vegetation are calculated; those used by Spix and Von Martius are assumed from the calculations of Howard; we therefore pass them over till we possess strictly observed data.

FLORA.—This must be regarded as an alpine region, and the different portions of its flora have been described by Humboldt, Von Buck, Von Martius, and Kuhl. There is, however, some discrepancy between their statements; for not only are the alpine regions of Teneriffe made to differ from those of Madeira, but also from the rest of the Canaries. In attempting to reduce them to mutual consistency we shall follow out the views we have previously expressed on this subject.*

Teneriffe has been ably examined by Humboldt, and his regions are nearly natural.

1. *The Region of Lowland Cultivation* extends to 1,800 feet. It is distinguished by the presence of a few tropical forms; dracæna draco, phœnix dactylifera, chamærops humilis, musa paradisaica, m. sapientum, arborescent euphorbias, and some species of mesembryanthemum from Africa, meet species of cactus from America.

2. *The Region of the Woods* extends to 7,200 feet. These woods are lofty and extensive, and comprise laurus indica, l. fœtens, l. nobilis, rhamnus glandulosa, erica

* London Journal of Botany for March, 1842.

arborea, erica texo, quercus canariensis. Ferns are numerous. A convenient subdivision may be established, since the pines occupy only the upper part of this region for the breadth of 25,000 feet; thus constituting—1, the sub-region of laurels to 5,400 feet; 2, the sub-region of pines to 7,200 feet.

3. *The Region of Shrubs.*—Spartium nubigenum abounds, and not much else, for the surface is chiefly volcanic ashes.

4. *The Region of Grasses.*—Scrophularia glabrata, viola cheiranthifolia, and the cruciferous plants, cheiranthus longifolius, c. frutescens, c. scoparius, erysimum bicorne, crambe strigosa, c. lævigata, are met with.

5. *The Region of Cryptogamic Plants.*—It contains only urceolaria and other lichens.

Madeira, as the name implies, was formerly covered with woods, but the early cultivation of the sugar-cane, and subsequently of the vine, and still more recently the adoption of grazing, has produced a total change in the original features of the vegetation.

1. *The Region of Lowland Cultivation* extends to 2,000 feet. The agave, plantain, date, pomegranate, and fig all thrive well. Of sixty species found here, 36 are common to the north of Europe, 17 to southern Europe and northern Africa, and 7 peculiar to the Canary Region. Among them is scarcely a genus with more than one species.

2. *The Region of Woods* extends to 3,000 feet. The trees are not numerous; castanea vesca, pinus canariensis, laurus fætens, l. indica, clethra arborea. In thirty-two species, eight only are European, the remainder being peculiar. Here, therefore, the flora is more characteristic, and introduced plants have not attained this elevation.

3. *The Region of Shrubs* extends to the loftiest part of the island. Spartium scoparium, cytisus divaricatus, erica

scoparia, and vaccinium padifolium, abound. Grasses, belonging to cynosurus, aira, and agrostis, begin to appear on the higher stations.

In Madeira succulent plants are frequent; the trees have coriaceous leaves, and the northern families of amentaceæ, saxifrageæ, and caryophylleæ, are uncommon, as are the tropical families of euphorbiaceæ and malvaceæ. Of compositæ, the tribe of corymbiferæ is scarce, but cichoraceæ abundant.

The Azores are situated something to the north of the other islands. Like them they are volcanic, with bold scenery, scarped rocks, deep ravines, and a general elevation of the surface from 2,000 to 5,000 feet. The indigenous flora is scanty, but the climate is good, and highly suited to the growth of tropical and such other fruits as have been introduced. From their supposed comparatively recent origin, the early history and subsequent diffusion of vegetation might be satisfactorily studied here.

Relations.—In such a region a considerable change must have been produced by the extinction of native plants, and the introduction of others. Its affinities are more copious with Europe than south Africa. The species of cactus are regarded as instances of migration from America, and dracæna draco is supposed to have come originally from India. Of 62 plants collected at Teneriffe in Kotzebue's first voyage, 30 were peculiar to our region, 30 common with Europe, and 2 with Africa. Von Buch mentions 533 species as belonging to the Canaries, of which he considers 162 as introduced.

XXX.—THE BARBARY REGION.

Extent.—The northern part of Africa, embracing the states of Morocco, Algiers, Tunis, and Tripoli, is separated by the Great Sahara from the rest of the continent, and to the west is beaten by the waves of the Atlantic, whilst to the east it extends nearly to the delta of the Nile. The Atlas range of mountains forms an important portion of this region; and, when better known, will most probably contain its greatest peculiarities. There are also some other mountains of considerable elevation.

Physical Characters.—With much dry and barren land, there are also extensive districts of great fertility. The soil is generally sandy, but productive when supplied freely with moisture; and the neighbourhood of the Atlas mountains is indicated as possessing much that is rich and fertile. From the elevated lands numerous streams descend to the plains; those towards the north finding an outlet in the Mediterranean Sea, whilst those falling to the south are chiefly lost in the thirsty sands of the desert. The highest ascertained part of the Atlas range is 11,400 feet, is in the vicinity of Morocco, and clothed with perpetual snow. Salt marshes and lakes, and saline soils, are all of frequent occurrence.

Climate.—The heat is great, but not so oppressive as in Egypt or Arabia, in the same latitude. At Algiers the mean of the year is 70°, of the summer 80°2, and of the winter 61°4. Vegetation is in its greatest vigiour in autumn, after the rains. It is then that a crowd of herbaceous plants hasten to spread abroad their beauty, retiring rapidly as the moisture disappears; leaving a bushy vegetation to struggle with the parching atmosphere of the dry months.

Flora.—Only a partial examination has been made, and our chief acquaintance with the vegetation is due to M. Defontaines. It is owing to this that a very powerful connexion has been traced with the vegetable productions on the northern shores of the Mediterranean. When our knowledge of the interior is more complete, a greater proportion of peculiar forms will undoubtedly be discovered; at least such is a fair inference from what is observed elsewhere. Upwards of 2,000 species are known, and it has been remarked that, though a great number are peculiar, they belong to genera shared with Europe. In 344 woody kinds, about a hundred are peculiar. Those groups of plants which prefer a dry warm atmosphere, such as leguminosæ, malvaceæ, labiatæ, solaneæ, caryophylleæ, and certain compositæ, prevail. Among characterising genera may be mentioned rhus, zizyphus, vitex, viburnum, diospyros, pistacia, celtis, tamarix, juniperus, thuja, olea, adonis, verbascum, smilax, cercis, cistus, nerium, and agave. Pinus halepensis grows in large forests, and other species are frequent; a large surface is occupied by phœnix dactylifera. On the Atlas range are many quercus, and fagus, alnus, salix, with many herbaceous genera common to Europe.

Relations.—We separate this from the Nile region, on account of its alpine vegetation; and from the European regions, though undoubtedly some affinities are great, since the same combination of alpine and lowland vegetation does not occur in any of them. The alpine features more closely coincide with the Pyrenees, whilst those of the plains recall Italy and the south-east of Europe.

XXXI.—THE NILE REGION.

Extent.—The whole portion of country traversed by the Nile and its tributary branches. Towards its source the elevation of the surface compensates for the lower latitude, producing a milder climate and corresponding vegetation. It thus embraces a broad belt of country between the Red Sea and the Great Sahara, by which its isolation from other botanical regions is rendered nearly complete.

Physical Characters.—There is much diversity in the surface. The valley of Lower Egypt presents an uniform plain, almost without a hill, and subject to the periodical inundations of the Nile. Gradually a chain of bare and rugged mountains converge towards the river, leaving the intervening valley with only the breadth of a few miles. Upper Egypt assumes a bolder character; the banks of the Nile become rocky, and the inundations far less general. In Nubia, for this reason, the river is sometimes unapproachable, and a laboured irrigation is practised. Abyssinia is traversed by piles of mountain masses of extreme barrenness, and with intervening valleys, whose rich and productive soil is some compensation for their sterility. There is here a general elevation of the surface, and some of the mountains attain a great height. Egypt has been justly considered a granary with almost an unfailing supply; a productiveness which is dependent more on the overflowings of the Nile, than on any inherent richness of its somewhat sandy soil.

Climate.—Few regions would, perhaps, supply us with more interesting sources of the adaptation of the vegetation to the climate, if we were furnished with the necessary information. The temperature is warm; that of Lower Egypt particularly so, the mean summer heat of Cairo

being 92°. Rain is scarce; the dews, however, are heavy. Rain is more frequent about the Delta, and in the vicinity of the coast, than elsewhere. Thunder and lightning are even more uncommon than rain. The seasons are not very strongly marked, and run imperceptibly and rapidly into each other. Summer commences in June, and lasts till September. Autumn succeeds. The cold season begins in December, and lasts two months; and in February spring makes its appearance. Harvest succeeds in seven or eight weeks to the sowing; and the trees lose their leaves in the cold seasons, and are rapidly replaced by new. The inundations of the Nile, to which Egypt owes its vast fertility, are due to the autumnal rains of Abyssinia. Their effects are visible in the first week of July, when the river begins to swell; and, continuing to increase, has reached half its augmentation in August, and its greatest in the latter days of September. For two weeks it continues stationary, till on the 10th of November it has fallen one-half, and afterwards continues to decrease till the 16th of May, when it has reached its lowest.

Flora.—For three months the vegetation of Egypt is bathed in the overflowing waters of the Nile. As these subside a rapid vegetation ensues, the period of fructification is hastened and has passed away, and during the remainder of the year a parching aridity prevails. The superior luxuriance belonging to the former would be greatly misplaced in the latter; and, regarding the character of the vegetation, that particular variety has been dispensed to it which is congenial to the dry seasons, and will survive the inundation. It is not be expected that the flora will be numerous; and the aspect of the country is uniform and tame, being only relieved by some accidental trees of mimosa, zizyphus, phœnix dactylifera, and cucifera thebaica. Abyssinia is more fruitful, and contains many

spots of rich variety, and patches of fine forest. In accordance with these views, succulent plants are common; the leaves are those suited to a dry atmosphere, and spinous organs are much developed. It has been deemed singular that fungi should be entirely wanting in a soil for a certain period saturated with moisture, and apparently suited to their ephemeral existence. In some barren spots, beyond the reach of the inundation, certain plants have established themselves, and drag on a starved and stunted existence. The valley of Lower Egypt is not likely to present a very perfect specimen of an indigenous flora, having been under the closest cultivation for many ages; and it is probable that its alluvial soil has been the gradual deposit of the Nile, and that it has received its vegetation from Abyssinia and elsewhere. We shall, therefore, direct our attention chiefly to the former.

Some insight into the flora of Abyssinia has been obtained, particularly by Salt and Caillaud, who made collections. Many of its species are found to be peculiar, and to bear a larger proportion to the entire vegetation. Leguminosæ are very abundant through acacia, cassia, mimosa, pterolobium, erythrina, alhagi, desmanthus, and bauhinia. Other conspicuous genera are euphorbia, avicennia, juniperus, tamarix, zygophyllum, fagonia, polymnia, œrua, brucea, balsamodendron, cordia, and pistacia. Coffea arabica is indigenous, and fresnella fontanesii forms thick groves on some of the hills. Gramineæ are numerous, and several kinds of holcus, sorghum, poa, and andropogon, are cultivated. In those frequent situations, where neutral salts are mixed with the soil, are salsola, salicornia, traganum, and calligonum. The bed of the Nile is often closely set with sedges and flags. Papyrus antiquorum is equally found here and in the lakes of Abyssinia. Nelumbium speciosum has disappeared; yet still

the rivers of India and China are enlivened by its fine red flowers. The white-flowered nymphæa lotus abounds; and n. cærulea is sometimes seen. Arum colocasia is cultivated for food.

The vast sea of land of the Great Sahara is an effectual barrier to the extension of the flora of this region, in the direction over which it prevails. It consists of a low flat plain, with the surface covered with white and grey quartz, and becoming more shingly towards the east, or in the direction of the prevailing wind. It is towards its eastern part that the oases chiefly exist, affording a grateful resting-place to the traveller, occupied by a rather numerous population, and having a lively vegetation. The dreariness of the surrounding waste is here replaced by groves of date-palm. Acacia vera and other species shade the gushing streams, and tufts of grasses vary the surface.

Relations.—Many of the plants frequent on the shores of the Mediterranean appear in Lower Egypt; and some of those of Arabia cross the Red Sea to Nubia and Abyssinia. The most interesting relation, however, is with the South Africa Region through several species of mesembryanthemum, pelargonium abyssinicum, protea abyssinica, hagenia abyssinica, brunia ciliata, albuca abyssinica, and geissorhiza abyssinica. Adansonia digitata of the west coast re-appears, and the trunk is applied to entombing the dead. A tropical character is displayed in some of the genera enumerated, and in musa ensete. Rosa abyssinica occurs in the valleys of that country.

XXXII. THE ASIA MINOR REGION.

Extent.—Let us suppose ourselves stationed at the head of the Persian Gulf, and then project lines to the

west and north in the direction of the latitude and longitude. These, with the Caspian Sea, the range of Caucasus, the Black Sea, and the Mediterranean, will enclose an interesting portion of country, watered by the Euphrates and other considerable rivers, and comprising Syria, Palestine, the rich provinces of Turkey in Asia, Bagdad, and a portion of Persia.

Physical Characters.—The aspect and general features are variable. In some places it would be difficult to exceed the dreary barrenness and unproductive nature of the surface, resisting with complete success any invasion from vegetation. There are, however, others, and they are numerous, where the verdure and fertility are of the most agreeable kind. In Asia Minor, between the ranges of hills, are often beautiful and extensive plains in full cultivation, and dotted by the villages of the inhabitants; the groups of cypress and the singular burying-grounds pointing out those of the Turks, whilst cultivation and its attendants indicate those of the more thrifty Albanians. These plains are always well watered by streams originating in the surrounding mountains, and their benefits are greatly extended by irrigation, which from the aridity of the soil seems indispensable.

Climate.—This is generally regarded as warm, but some parts, as Bagdad, are distinguished for their great heat, and the northern winds produce a rapid and important depression of temperature. The summer months are generally warm and very dry, and the atmosphere is serene and transparent. Rain is even scarce in some places.

Flora.—The vegetation of Asia Minor is eminently adapted to delight the traveller. He is not buried in a vast dark forest, where the view is most circumscribed, and without objects to engage attention. Forest trees are grouped together in the valleys and mountain sides, whilst

occasional open spaces are in the undisturbed possession of piles of rocks, or more profitably occupied in agriculture. Sometimes a waving line of brighter green points out the course of a river or mountain stream. The foliage is generally distinguished for its evergreen character, the dark sombre shade of its colour, and the leathery consistence of the leaves. The trees most prominent are quercus infectoria, platanus orientalis, pistacia terebinthus, p. lentiscus, and other species of these genera, pinus halepensis, abies orientalis, cupressus sempervirens, juniperus sabina, ceratonia siliqua, juglans regia, liquidambar imberbe, and others of acer, celtis, fraxinus, and celsia. Among the smaller vegetation, labiatæ are numerous, and have their chief station here. The nearly allied family scrophularineæ is also freely represented, and cucurbitaceæ and asphodeleæ are conspicuous for their numbers. In some parts are extensive tracts producing a great multitude of individuals of tamarix, acacia, glycirrhiza, and hedysarum alhagi. And in others of even a less favourable character are met with chenopodium, ruta, rumex, artemisia, centaurea, amarantus, cucumis, lyceum, solanum, mesembryanthemum, and asclepias syriaca; which last, though a pretty plant, has an extensive range, and is every where a weed. The vegetation of Mount Caucasus is particularly rich and fascinating, but it has a very European character.

Relations.—I regard this region as separable from the Danube Region, with which it has much in common, in the different aspects of the vegetation, and in the partial cessation, sometimes nearly complete, of several genera as populus, spiræa, cratægus, campanula, rhamnus, viola, &c., and of the group of umbelliferæ. With the China Region it has many interesting relations, and prunus armenaica, which is represented as covering the sides of Caucasus, is again seen in China; and with North America there are

several through æsculus, juglans, and liquidambar. Ulmus campestris is supposed to have been introduced to Palestine by the Crusaders.

XXXIII.—THE ARABIA REGION.

Extent.—The Arabian peninsula, and separated from the adjoining region by a line extending due west from the head of the Persian Gulf to the Mediterranean sea.

Physical Characters.—Arabia is little else than an extensive desert clothed with straggling thorny shrubs, and having some spots of redeeming fertility. Rocky cheerless mountains traverse it, occasionally sheltering within them small fertile valleys, called Wadis. About Yemen, the country is superior, and vegetation has some luxuriance, and is remarkable for its fragrant qualities.

Climate.—An excessive clearness and transparency prevail in the atmosphere from the scarcity of moisture. The skies are almost always cloudless; from June to September showers occasionally fall, but chiefly about Yemen or Arabia Felix. Hot winds, coming from Africa, sometimes sweep its western shores.

Flora.—Arabia, famed for its spices, derives its reputation more probably from being a country of transit, than as their source. Still it has contributed its share, and even the general character of the shrubs is aromatic. Moving eastward, we meet in this region several new forms, reminding us strongly of Asiatic vegetation. Where forest exists, numerous species of ficus enter largely into it, mingled with sterculia platinifolia, tomex glabra, grewia, populifera, balsamodendron gileadense, b. opobalsamum, b. kataf, b. kafal, mærua uniflora, m. racemosa, cynan-

chum arboreum, celastrus edulis, c. parviflora, keura odorifera, and pandanus odoratissimus. Little woods of arborescent euphorbia occur. Cryptogamic plants, gramineæ, and cyperaceæ, are all scarce. Some of the bulbous plants of South Africa make their appearance, cucurbitaceæ are not uncommon, and succulent plants are also frequent. Coffea arabica is regarded as not indigenous, and the testimony of the Arabians themselves refers its origin to Abyssinia. Acacia arabica is native, and some active medicines are produced, as senna, aloes, myrrh, and olibanum.

Socotra is a mountainous island, consisting of granite, of indifferent fertility, nearly bare of trees, and distinguished for its aloes, dates, and dragon's blood.

Relations.—Its tropical forms are chiefly from India, but the most interesting affinities are with the South Africa Region through aloe, stapelia, mesembryanthemum, and hæmanthus. Several species are shared in common with the Nile Region.

XXXIV—THE TARTARY REGION.

Extent.—A broad irregular space, of peculiar aspect and fluctuating fertility, occupies the centre of Asia between the Altai and Himma-leh chains of mountains, including the states of Tartary, Thibet, and portions of Persia and Cabul.

Physical Characters.—Situated as it is between stupendous mountain chains, the greater part of the surface presents a considerable, but varying elevation, and is further diversified by being traversed by others of inferior grandeur. Aridity chiefly prevails, much of the soil being very sandy; large portions are sometimes so salt as not to yield the slightest vegetation, and the wind is said to

drive it on the bushes and cover them as with a hoar frost. Partial fertility is imparted by the streams, and more particularly by the rivulets occasioned by the rains.

Climate. — Extremes characterize the seasons; the summers are burning and arid, and the winters severe and nipping.

Flora.—Wherever there is shelter and some moisture, trees from the Asia Minor Region are met with, as pistacia lentiscus, p. terebinthus, pinus pinea, morus nigra, olea europea, and some oaks. Species of artemisia spread in crowds, impregnating the atmosphere with their peculiar aroma, and giving a bluish green tint to the steppes. Other characteristic species are spartium junceum, s. spinosum, statice tartarica, calligonum polygonoides, and others of selinum, centaurea, tamarix, salvia, verberis, ruta, lyceum, solanum, capparis, asclepias, astragalus, hedysarum, spiræa, rumex, and lithospermum. The fruits are those of warm temperate latitudes, and millet, barley, sorghum, amarantus, and paspalum are cultivated.

Relations.—The flora is poor, and so indifferently known, that this portion of its history remains in obscurity. The proportion of spinous plants is unusually great.

XXXV.—THE SIBERIA REGION.

Extent. — A continuous barrier, enclosing the vast steppes of Siberia, is formed by the Ural and Altai mountains, which forms its western and southern borders, and terminates at the sea of Okotsk in 55° north latitude. The steppes of Ischin, a portion of Tartary, is thus inclosed, and the region is limited to the north by the extent of the growth of trees somewhere about 65° north latitude.

The whole of the Altai range is comprehended, and constitutes an important portion.

Physical Characters.—The surface within the mountain ranges presents an extensive level plain, traversed by numerous large rivers with a general course to the Arctic Ocean, and therefore with an inclination towards the north. The aspect and nature of the surface varies; towards the north it is dreary and usually frozen; more to the south there are extensive districts of rich dark soil, and in the vicinity of the rivers are fine alluvial tracts. Small lakes and marshy patches abound, with their peculiar vegetation, and saline substances are occasionally largely mixed with the soil. The highest parts of the Altai range do not attain any considerable height.

Climate.—Siberia is not so bleak and inhospitable as has been generally represented, though, compared with similar parallels in Europe, or even in Amerca, it must still be called inclement. Over much the soil is frozen even to June, but where the inhabitants can be drawn from the chase of the fur animals to the less exciting pursuits of agriculture, large and profitable crops of the northern cerealia are produced. The variety and beauty, with the occasional richness of the vegetation, is an unquestionable proof that the climate is not always severe.

Flora.—The clothing of vegetation which invests the surface, varies in different situations. In some are thick forests, in others extensive marshes; large tracts are sometimes covered with saline plants, or lastly, a luxuriant and pleasing vegetation prevails. The forest chiefly follows the direction of the rivers, and the pine prevails. Among the herbaceous vegetation, perennials are by far the most abundant, and though numerous species are identical with European, a great many are peculiar, and some still new to science. Nowhere, perhaps, do herbaceous

plants so truly luxuriate as in these latitudes, where they are in unrestricted possession of the rich soil. Their short existence through the summer months is compensated by a vigorous growth and obtrusive beauty. The predominating families are ranunculaceæ, cruciferæ, umbelliferæ, leguminosæ, saxifrageæ, and caryophylleæ. As the seasons advance, labiatæ, scrophularineæ, and boragineæ, contribute important members; whilst liliaceæ and irideæ are conspicuous among the spring vegetation. The individuality of the flora depends almost entirely on species, for the genera are extremely similar to those of Europe, and though the features of the vegetation are different, a catalogue would appear to show a close resembance. A few may be mentioned as to some extent distinctive, and which have usually several species; astragalus, hedysarum, caragana, pedicularis, pœonia, zygophyllum, phlomis, ephedra, and robinia. Ceratocarpus arenaria and diotis ceratoides are represented as covering large tracts; whilst the saline plants belong chiefly to polycnemum, atriplex, chenopodium, frankenia, tamarix, nitraria, and salicornia.

Pallas and Ledebour are almost our only authorities for Siberian vegetation. The latter has examined somewhat closely the flora of the Altai Mountains between 47° and 54° north latitude, and 73° and 87° east longitude. The influence of aspect was found to be important in favour of the south; from various observations, the limit of perpetual snow seems as high as 7,350 feet; in some places corn grew at 4,400 feet, and here also was the limit of habitations. At 4,900 feet the vegetation most resembles that of Europe. The highest limit of trees is 7,200 feet; pinus cembra, with a south aspect, attains 7,200 feet, and with a north aspect, 5,800 feet. Betula alba reaches 5,850 feet, and pinus siberica and abies communis grow together to the height of 5,800 feet, where they both cease. Ledebour mentions two

peculiarities in the vegetation; the nearly total absence of hard-wooded trees, such as those furnished by quercus, fagus, acer, tilia, carpinus, aud fraxinus; and that many of the families which have numerons species are represented by few genera; thus, saussurea, serratula, and artemisia in compositæ, zygophyllum in rutaceæ, and astragalus, oxytropis, and phaca in leguminosæ monopolize the far greater part of the species in their respective families.

Relations.—When we reflect how much the continuity of the land has diffused the animal and vegetable productions of the northern part of Europe, Asia, and America, the Siberia Region must be allowed to have retained its entireness with great success. At the southern limits of the Altai range such a change occurs in the climate and physical characters as to be incompatible with a vegetation like that of Siberia. Towards Bering's Straits, though the interval is small, the difference between the two coasts is as marked as can be expected between neighbouring regions. Kamtschatka has received no important accessions from America, though the flora of the latter is represented in rhododendron, robinia, erigeron, claytonia, and trillium. This distinction is less evident on its west side, where the plants of Europe and Siberia intermingle. Through rheum and pœonia it claims an alliance with the more southern floral regions of Asia.

XXXVI.—THE JAPAN REGION.

Extent.—Balbi, in his Geographie, has indicated a Sinico-Japanese Region, but the lofty volcanic mountains, insular position, and rough climate of Japan, would seem to point to a peculiar vegetation, and one with predominating alpine features. The foundation of this region con-

sists of Niphon and Jesso, with the other islands known collectively as Japan. It also includes the long island of Saghalien, and a portion of the main of peculiar aspect and nearly covered with forest, situated between 55° north latitude and the river Hoang-ho in China. The peninsula of Correa is thus embraced, and the northern part of China, in which is situated the capital Peking, but a tract of country of great aridity and barrenness.

Physical Characters.—The aspect of the Japanese Islands is bold and rugged, and the mountains are elevated far above the line of perpetual snow. The connental portion, except to the south, is traversed by mountain chains.

Climate.—Severe for the latitude and prone to extremes. At Nangasaki, in 32° 45 north latitude, observations give the mean temperature as 68°, and the range in the year from upwards of a hundred degrees to below the freezing point.

Flora.—It is but indifferently known; the mass of the vegetation is temperate, but singularly mixed with tropical forms. Raphis flabelliformis and cycas revoluta mingle with species of acer, quercus, thuja, pinus, and juniperus. Thunberg collected near Naugasaki 755 phænogamous plants, which certainly bespeaks a flora rich in forms. Its bizarre character will be visible in pinus, abies, larix, tilia, salix, citrus, bumbusa, ficus, olea, mespilus, cydonia, prunus, salisburia, podocarpus, clerodendron, nerium, laurus, diospyros, paullinia, vitex, melia, broussonetia, camellia, illicium, and hydrangea. Like the China Region, the vegetation in connexion with the climate well deserves attentive study.

Relations.—In many respects they are close with China, and also abundant with Siberia through pinus cembra, the birch, the larch, and the willow, &c. The

affinities with the North American Regions are much stronger than happen in the China Region, through sambucus, æsculus, pavia, magnolia, vitis, bignonia, juglans, and rhododendron.

XXXVII.—THE CHINA REGION.

Extent.—A large portion of the east of Asia, comprising the vast empire of China, Correa, Japan, and the islands bordering the coast, presents a remarkable vegetation, influenced by some peculiarities of climate, and having many interesting relations with other and sometimes distant regions, from all which its isolation is complete. I regard it as conveniently divided into two regions; the China Region, and the Japan Region; the former entertaining copious relations with India, and the latter with Siberia. The China Region, the object of our present attention, does not embrace the whole of that empire, but that portion of it situated between the Hoang-ho, or great river, and the Gulf of Tonquin. Its western boundary is within a line stretching from the Gulf of Tonquin to the Himma-leh Mountains, and, continuing along the chain which separates Thibet from China, ceases at the Tartary Region. To the east it is bounded by the Pacific Ocean, but includes the islands of Formosa, Loo-Choo, and Hainan.

Physical Characters.—No country in the world presents such a forbidding aspect as China. The land on the southern shores is generally bold, and seems to be so swept by the periodical winds that vegetation will not thrive. A little fern and coarse grass alone resist them, with occasionally a few stunted bushes. In other places the shores are low, and flooded by the sea. Where, however, there are

sheltered valleys vegetation prospers, and is more distinguished for its variety than luxuriance.

The interior of the country, on the lowest estimate, supports a population of 230 to the square mile, the chief part of which has for ages been engaged in the great national pursuit of agriculture, and cannot have failed, in this long period, to have materially altered the face of the country, and to have driven the native flora to the mountains, and other places not favourable to cultivation. To this may also be attributed the scarcity of forest, but it must at the same time be remembered that this latitude elsewhere is not remarkable for this kind of vegetation. Particulars of the interior of China have been collected by the English and Dutch embassies, and in the writings of the Jesuit missionaries. The country is traversed by several mountain chains of no great elevation, pursuing various directions, and impressing a picturesque and even romantic aspect on much of the scenery. This is aided too by the scattered growth of trees, which are spread in open irregular clumps, and by the methodical and extreme cultivation of the plains. The prevailing mineral structures are granite, often traversed by veins of quartz or supporting blocks of it, coarse limestone, clay-slate, and sandstones. Bazaltic trap occurs in the island of Hong-kong. It was very generally observed that the rocks were in a state of rapid disintegration. The soil has an universal character throughout China, consisting of a loam of a red or ferruginous colour, sometimes clayey, and capable of being formed into bricks, which become blue after burning. The soil itself is sufficiently productive, and is diligently assisted by a persevering upturning and division of the lumps, the plentiful application of manure, and the most laboured irrigation. The mountains are rocky and barren, scattered with trees of quercus glauca or other species, laurus

camphora, or stillingia sebifera. The range separating the province of Canton is extensively wooded with pinus massoniana and p. lanceolata. Many bushes of melastoma, myrtus, rhus, camellia, eugenia, and chloranthus, abound in similar situations.

CLIMATE.—Meteorological observations have been conducted at Canton through a series of years, which give some satisfactory mean results. June, July, and August, are the summer months, as with us, and the heat is intense. In December, January, and February, the weather is equally bleak and cold. The mean temperature is 70° 4′, and the range from 29° to 94°, or sixty-five degrees. It is in all respects a climate of extremes, for both the annual and diurnal range is great, and its peculiarities will be placed in the strongest light by a comparison with that of Calcutta, San Blas in Mexico, or other places in a nearly similar latitude. The influence of the sun's rays in the cold season is greatest, according to my observations, at one P. M., when their radiating power is 43° above the shade. The hygrometric state of the atmosphere does not appear so much influenced by the seasons as usual. Rain falls in all the months, but by far the greatest quantity in the summer. The mean of sixteen years observations is 70·6 inches. The amount varies greatly in different years, and also in different months. Thus ninety inches have been known, and in 1840 there only fell sixty-one inches. The range of the hygrometer is probably below the average, for in the dry season I never obtained a greater depression than 6°, and even then the dews were very heavy.

FLORA.—The vegetation comprises great variety in species, and attractive kinds are more than usually abundant. It has been observed that, in relation to the space, forest is not frequent, but this is met by a great variety of low shrubby plants, the preponderance of which is character-

istic. Generally their foliage is evergreen, and with the customary rich deep green shades. Aromatic qualities also prevail among them. The flowers, though not of large size, are very frequently of rich deep colours, having a very showy appearance, and when they fade are succeeded by berries nearly as attractive from their varied colours as the flowers. The number of different kinds of berries yielded by the shrubs is really astonishing. One of the most striking features of the region is the mixed character of the vegetation, and it would perhaps be impossible to find it carried to a similar extent elsewhere. The violet is seen blooming under the shelter of the melastoma, the bamboo and the pine grow together on the hills, and the potato and sugar-cane are cultivated in the same field. A great number of natural families are represented, some of which are more prominent than others. Aurantiaceæ is particularly abundant; three species of orange are indigenous, and there are many varieties, and the fruit is always fine. The climate is undoubtedly eminently favourable to this group. Camellieæ is nearly limited here, and has several important species. Rhamneæ, connaraceæ, nepentheæ, leguminosæ, compositæ, myrtaceæ, sterculiaceæ, cinchonaceæ, and coniferæ, all deserve mention. There are some which appear unusually scarce, as tropical endogenæ, orchidaceæ, amygdaleæ, and the cryptogamic families generally, particularly fungi.

The arborescent vegetation is chiefly supplied by quercus, of which there are most probably many species. Pinus, also, with several species, one of which descends to 22° N. lat., thuja, cunninghamia, podocarpus, juniperus, acer, morus, sterculia, melia, ficus, magnolia, laurus, and bambusa. The shrubs are considerably more numerous: ilex, olea, rhododendron, rhus, rubus, azalea, rosa, spiræa, camellia, gardenia, canthium, itea, myrtus, eugenia, vibur-

num, photinia, raphiolepis, prinos, triphasia, murraya, glycosmis, pittosporum, melastoma, bauhinia, chloranthus, olea, jasminum, diospyros, and hibiscus. Among the plants of a more fugitive existence are malva tricuspidata, kalanchoe spathulata, clematis hedysarifolia, drosera loureirii, sida rhombifolia, indigofera hirsuta, crotalaria retusa, c. vachellii, abrus precatorius, mesembryanthemum cordifolium, torilis japonica, paratropia cantoniensis, with species of hypericum, polygonum, chenopodium, salvia, chrysanthemum, aster, gnaphalium, and grangea. Cyanus nelumbo and trapa bicornis are plentiful on the canals and quiet waters. Viscum ovalifolium is found in the neighbourhood of Canton; and another parasite, cassythis filiformis, festoons the shrubs with its sickly branchlets. The geographical range of the latter is extensive, stretching as it does from the Cape of Good Hope in 18°, E. long., to China, the Indian islands, and across the Pacific Ocean to 140°, W. long., or nearly two-thirds round the globe.

In a statistical view, the number of species in the flora appears to be small in proportion to the leading groups represented, as they stand in about the following numerical relations: families 5, genera 13, species 16, giving something more than three species to each family.

Some of the cultivated or more remarkable plants are worthy of notice, and the tea shrub is naturally the most prominent. The numerous varieties known in commerce are equally produceable from the two species, thea bohea and t. viridis, the difference depending on soil, culture, the age of the leaf, and the manufacture. It is a handsome shrub, with fragrant white (yellow, *Davis*) flowers, preferring the sides of the hills and a poor soil. Green tea is chiefly produced in Kiang-nan, between 29° and 31° N. lat.; black tea in Fohkien, between 27° and 28° N. lat. The favourite soil is a decomposed granite mixed with feltspar, and which

is used in the manufacture of the elegant porcelain in which the infusion is drank. One portion of the world, as the English and others, pronounce it tea; the other portion, as the Portuguese and Spaniards, cha. Both words are Chinese, but the former is the dialect of Amoy, and the latter of Canton. The range of the indigenous shrub is perhaps as far as 45° N. lat. The sugar-cane is cultivated to 30° N. lat.; but its productiveness is probably not great. The banana is abundant about Canton, but the fruit requires to be protected by a covering of the dry leaves—a practice I never observed elsewhere. It is far from attaining perfection, the saccharine qualities seeming to form after the fruit has been gathered, and when it is becoming almost rotten. Rice is most extensively cultivated throughout the empire, and is really the staff of life. The seeds of stillingia sebifera are surrounded by a substance resembling, and having the same use as, tallow. Ligustrum lucidum yields from its berries a wax. A branch of olea fragrans is the reward of literary attainments, Camellia oleifera and other species contain oil in their seeds, which is easily expressed, and is sold at Canton under the name of tea oil, for all common purposes. Æschynomene paludosa was for some time supposed to produce the rice paper of China; the proper plant, however, is still a desideratum. This plant is also a native of China, as well as India, where it is called shola, and has its uses. The fruits more particularly Chinese are the loquat, litchi, longan, flat peach, mandarin orange, red lime, and fingered shaddock.

Relations.—The entireness of its flora may be sought in the peculiarity of the vegetation when compared with the latitude, and in the sources of resemblance it has with distant regions, as with the Iroquois Region through magnolia, juglans, prinos, and ilex; with the California Region in general aspect and habit, and in the prevalence of rham-

neæ; and with several distant regions through pinus, quercus, acer, rhus, rhododendron, azalea, myrtus, lonicera, rubus, &c. Few of these plants connecting it elsewhere are shared with neighbouring regions, if we make some exception in favour of Japan: but of its more tropical species many occur equally in the various parts of India and the Malay islands. Through paliurus, diospyros, olea, and tamarix, we are reminded of Asia Minor. Species of euphorbia partially replace the cacteæ of the New World.

XXXVIII.—THE BIRMAH REGION.

Extent.—At present we separate this region rather because it has not the features of the neighbouring regions, than from any known peculiar characters of its own, since so little is known concerning it. It embraces a large portion of country extending south from the Himma-leh mountains, between the Ganges on one side, and the Gulf of Tonquin on the other, with the exception of the Malacca peninsula, which belongs to the Malaisia Region; including thus the kingdoms of Birmah, Siam, and Cochin China.

Physical Characters.—The interior is little known. The country would appear productive, and is watered by several large rivers.

Climate.—Tropical, but apparently without those extremes of temperature so frequent in the China Region.

Flora.—Botanists have hitherto made very slight inroads. Loureiro has given us a fragment of the vegetation of Cochin China. Aurantiaceæ seem to be nearly as frequent as in the China Region, and there are several of the most tropical plants in common, but a nearly complete absence of those of more temperate latitudes, which so abound

there. In Assam the tea plant has been found in abundance, and the leaves have been since manufactured and exported to England. Some of the species of Blume's Flora Javæ occur here, and perhaps also of other of the Malay islands.

RELATIONS.—Unknown.

XXXIX.—THE MALAISIA REGION.

EXTENT.—The numerous islands of the Indian Ocean, of which Sumatra, Java, Borneo, Celebes, the Phillipines, Flores, and Timor, are the most extensive. The Moluccas are not included, as they belong to the New Guinea Region; the peninsula of Malacca, however, forms an important part of this region.

PHYSICAL CHARACTERS.—Bold scenery and lofty mountains are especially characteristic of these islands, and extensive traces of volcanic action are in many places apparent. They are generally distinguished for their rich soil and fertility, the latter due to a moist atmosphere, frequent heavy rains, and the constant influence of a hot sun. Though some of the mountains are extremely lofty, they rarely attain the elevation of perpetual snows.

CLIMATE.—The equator traverses the region, and produces a difference in the distribution of the seasons in the islands somewhat removed from it. Those to the north have their wet seasons from May to September or October, being nearly the same as our summer. To the south, the rains commence in October and cease about April. At the equator, the distinction of these seasons is less decided, the different parts of the year being very similar. The range of temperature is very small in the year or during the day. The thermometer generally stands at 86° to 90°.

The rains are very heavy, and the air is usually laden with moisture.

FLORA.—With few exceptions, the whole of the islands are covered with forest, which is particularly exposed to that rapid growth and decay consequent on a humid and warm atmosphere. It is rich in species, and distinguished as the source of some of those remarkable for their aromatic or luscious qualities, and which might be easily diffused throughout the region. In many respects they are the same as those of the Indian regions, with such differences as depend on climate. Leguminosæ, malvaceæ, and some others, are therefore not proportionately numerous.

Java is a rich and fruitful island. Its forests are filled with cinchonaceæ, which abound here in astonishing numbers, and which would seem to be the spot of greatest intensity of the family. Hydrocereæ, having only a solitary species, is confined to the island. The curious rafflesia and the famous antiaris toxicaria are indigenous. On the elevated lands of the interior quercus and other genera of a temperate climate are encountered.

Sumatra and *Malacca*, like Java, are covered with forests, supporting or sheltering a luxuriant vegetation, among which orchidaceæ, ferns, and climbers, are very numerous; and the dead wood is often invested with lichens of gloomy colours.

Celebes has an estimated superficies of 70,000 square miles. The forest vegetation is thinner than elsewhere, and the surface often very rocky. The neighbouring island of *Borneo*, however, has the usual vast compact forest, in which the dryobalanops camphora is conspicuous, and where at present it is confined.

Timor is distinguished for its sandalwood forests, but santalum is probably diffused over all the islands.

The Phillipines, though nominally belonging for so long

a time to the Spaniards, are really in possession of the natives, and sealed against Europeans; they are, therefore, little known. Some of the tropical plants of the China Region are found here, and the seasons are directly the reverse of those in the southern islands. From these and some other reasons, they may, perhaps, deserve to be considered as a distinct region.

Relations.—In the circumstances of the climate, and in some of the more prominent productions, there is a clear resemblance with some parts of the Oronoco Region. In the superior prevalence of cinchonaceæ in both, this is particularly manifest. With the Indian Regions there is much in common, and tectona grandis and other trees abound in the forest of Java, though dipterocarpeæ belongs chiefly to the islands.

XL.—THE HINDOSTAN REGION.

Extent.—Vast research has been already devoted to the immense flora of intertropical Asia, but the results rather make us acquainted with detached portions, than convey a general view of the whole. Thus there are extensive districts hitherto unexamined, and of which we consequently know nothing. A difficulty, therefore, exists, amounting in some cases to an impossibility, of defining its regional vegetation. However, there are important points of difference between the portion known as Hindostan and that comprehending Birmah and Cochin-China, and for the present we will regard the Ganges as an arbitrary line of distinction. To the north are the Himma-leh Mountains, and to the west the region probably crosses the Indus to the Solyman range.

Physical Characters.—Great diversity of character is

visible over this extensive surface. In the neighbourhood of the rivers, particularly that of the Ganges, the surface is an extensive alluvial plain, where a hillock would be a a novelty. In other parts, a number of secondary mountain chains traverse the country, and give rise to many rivers and streams which carry fertility through their course. These elevations are often extremely bold and rocky, and are sufficiently great to affect the vegetation and climate. On the whole the soil is fruitful, and in some places eminently productive; in others there are occasional sandy or rocky districts.

Climate.—The seasons are tropical, with perhaps a greater range of temperature than is customary for the latitude. At Calcutta the mean heat is 79° 4, and the temperature sometimes falls to 63°; at Madras the mean is 84° 4, and at Bombay 81° 9. The quantity of rain has been estimated at Calcutta to be 81 inches annually, and at Bombay 82 inches. In the Nhilgerries, where the elevation influences the climate, the mean of the year at Serloo, elevated 3,500 feet, is 70°; at Jackanary, 5,000 feet, 60°; and at Ootacamund, 8,500 feet, 56° 6. At the latter, the average fall of rain is about 64 inches.

Flora.—The magnificent vegetation of this region presents all that is rich and beautiful, and such as can be expected within the tropics. The extensive forests contain a great variety of trees, often of surpassing magnitude; and frequently the number of individuals is very great, as in the saul forests which skirt the base of the Himma-leh Mountains, and sometimes in the assemblage of palms in situations suited to their growth. We have only room to state, that the mass of the vegetation is derived from the following natural families: araliaceæ, nelumboneæ, capparideæ, flacourtianeæ, anonaceæ, myristiceæ, dilleniaceæ, laurineæ, menispermeæ, sterculiaceæ and dombeyaceæ,

sections of sterculiaceæ, moringeæ, elæocarpeæ, salicariæ, myrtaceæ, combretaceæ, santalaceæ, olacineæ, leguminosæ, urticeæ, artocarpeæ, euphorbiaceæ, celastrineæ, rhamneæ, sapindaceæ, vites, meliaceæ, cedreleæ, aurantiaceæ, connaraceæ, amyrideæ, burseraceæ, anacardiaceæ, ochnaceæ, balsamineæ, bignoniaceæ, piperaceæ, cucurbitaceæ, cinchonaceæ, loranthaceæ, loganiaceæ, asclepiadeæ, myrsineæ, cyrtandraceæ, begoniaceæ, cycadeæ, commelineæ, scitamineæ, smilaceæ, pandaneæ, and aroideæ. — (*Greville.*) Many of these families, however, are more copiously represented elsewhere, and some are but rarely seen. The families strictly confined to India are few, as memecyleæ, alangieæ, aquilarineæ, stilagineæ, and some of these even may be disputed.

Ceylon is estimated to contain 24,660 square miles, and its highest point attains 8,280 feet. The climate varies much in temperature and fall of rain in different parts. At Colombo the annual range is from 76° to 87°, and the fall of rain from 75 to 80 inches. The vegetation is similar to the continental, and the elevation of surface is friendly to the existence of a somewhat altered vegetation, mixed with a few genera of temperate latitudes.

Relations.—There is so much similarity in the controlling influences within the tropics of the different continents, that we are not surprised to find them approaching each other in the general characters of their vegetation. This is not only visible in the more bulky tropical families, as combretaceæ, melastomaceæ, piperaceæ, cinchonaceæ, and celastrineæ; but in the inconsiderable groups of pedalineæ, olacineæ, ochnaceæ, samydeæ, hippocrateaceæ, and homalineæ. In some instances, where the relations are less intimate, a compensation seems attempted, as in the presence of cyrtandraceæ for the gesnereæ of intertropical America. Whilst America presents some affinities with

New Holland, they are rarer in Asia, a circumstance perhaps due to geographical position. Several genera are shared with the China Region, the most remarkable being nepenthes. Cyrtandra is numerously represented in the Sandwich Islands.

XLI.—THE HIMMA-LEH REGION.

Extent.—This is probably the most interesting alpine region in the world, as some allowances are necessary for the charm with which Humboldt has invested the Andes. The novelty of his researches ensured an early and lasting impression on the minds of scientific men, and the wide reputation which ensued has so overshadowed the subject elsewhere, that all other mountain chains have been reduced to almost a secondary importance. The names of a few Englishmen have recently become associated with the examination of the natural features and productions of the Himma-leh Mountains, and the obscurity in which they were long buried has been considerably removed. This gigantic mass of mountains traverses a great portion of Asia from east to west in a somewhat devious line between 25° 20′ and 31° N. lat., and 75° and 95° E. long. In accordance with our views of the extent of an alpine flora, this region commences at the spot where the lowland cultivation ceases, and which, in different aspects and situations, varies, to an important extent, between 3,200 and 4,400 feet. Above this are the four permanent belts of an alpine flora. Von Buch is disposed to think there is room for another region towards the limit of vegetation, but I do not deem it advisable to distinguish further in the alpine regions.

Physical Characters.—The Himma-leh Mountains

are not a solitary chain, but are composed of many heaped against each other, of varied outline and elevation, and containing within them numerous defiles, valleys, plains, and every other disposition of surface liable to occur, and materially influencing the climate and vegetable productions. In many of these situations is collected a rich soil and all the appliances of great fertility. Their geological structure presents numerous rocks; approaching the chain from the south, sandstone first appears, distinctly stratified and containing strata of lignite; to these succeed various kinds of slaty rocks, imbedding quartz, limestone, and hornblende; lastly, gneiss appears in vast quantities, traversed by veins of granite, and imbedding garnets, schorl, hyacinth, and native gold. Animal remains occur in considerable quantities in some places, consisting of marine shells, fish, and the bones of animals. The breadth of the region varies between 250 and 350 miles, but the extent of surface geographically furnishes no correct estimate of the real superficies. The snow-line fluctuates according to the circumstances of the locality, but may be generally stated at from 14,000 to 16,000 feet, and is always higher on the northern flanks. Among the loftiest peaks are Javaher, attaining 25,800 feet; Dhawalagiri, 28,500 feet; and Chumularee, 29,000 feet; but vegetation has ceased long before.

Climate.—Whilst the region possesses the evenness of temperature, brilliancy of atmosphere, and other attendants of alpine situations, the climate is greatly affected by aspect, and the mean heat, range, and distribution of moisture differ on its northern and southern flanks.

Flora.—Nature has enriched this magnificent range of mountains with a varied and abundant vegetation. It is singular, that some of the genera that do not usually produce trees, have species here which attain a considerable

bulk, as juniperus, salix, ligustrum, rubus, and rhododendron. Though the range of its alpine regions varies considerably with aspect, the very brief notice we must here take of them will be found generally correct.

1. *The Region of Lowland Cultivation* extends to 3,200 or 4,400 feet. This correctly does not belong to the Himmaleh Region, but to that embracing the plains of Hindostan. Tropical productions prevail, as scitamineæ, epiphytic orchidaceæ, numerous tropical forest trees, the sugar-cane, pine-apple, mango, banana, and bamboo.

2. *The Region of Woods* extends to 11,000 feet. The vegetation is dense and luxuriant; the more conspicuous genera are laurus, quercus, pinus, ilex, magnolia, gordonia, prunus, pyrus, fraxinus, michelia, podocarpus, morus, ulmus, berberis, and populus.

3. *The Region of Shrubs* extends to 12 or 13,000 feet. Many of the genera of the last region enter this, but when of arborescent habit they universally become stunted and dwarf; salix, vaccinium, betula, juniperus, taxus, cupressus, stunted species of quercus and pinus, viburnum, lonicera, rhododendron, rubus, ribes, rosa, and ulex. Among herbaceous plants are potentilla, fragaria, gentiana, viola, saxifraga, salvia, dracocephalum, plectranthus, ranunculus, polyanthus, primula, antennaria, ageratum, sida, and geranium.

4. *The Region of Grasses* extends to 14,600 feet. It abounds in natural pasture land.

5. *The Region of Cryptogamic Plants* extends to the line of perpetual snow. Lichens and mosses prevail of identical genera, and also to a great extent, species, with the high latitudes of Europe.

Relations.—As we increase the height above the plains, the affinities with the neighbouring regions become less distinct, and others are established with distant latitudes

and other mountain ranges. They soon become very intimate with the Alps and Pyrenees, and even with the Altai and Andes. Genera common to both are represented by similar species, and sometimes one tree or shrub seems to occupy the place of another; thus, abies dumosa replaces the pinus pumila of Europe. There are a few species identical with Europe, as hedera helix, rosa canina, r. spinosissima, and salix babylonica. (Levant.) American affinities are recognized in magnolia, juglans, careya, ageratum, photinia, and osmorhiza.

XLII.—THE SPAIN REGION.

Extent.—Spain and Portugal, with so much of the mountain chains and southern side of the Pyrenees as is devoted to the cultivation of the plains; and the islands of Minorca, Majorca, and Loiça.

Physical Characters.—The European peninsula is traversed in all directions by numerous mountain ranges, often of the most forbidding sterility. Nor are the features of the intervening plains frequently much improved by any important accession to the vegetation. The most promising verdure will usually be found collected in the valleys, or along the courses of rivers and streams, and in some of the most fertile lower plains. The different provinces present some variety in this respect.

Climate.—The summers are warm, and the winters mild. Some parts are generally dry and severe throughout the year; but the northern parts, with a milder climate, are liable to much rain and heavy weather.

Flora.—The vegetation everywhere is characterized by the evergreen oaks; the habit, mode of growth, and foliage of which are peculiar. These consist of several species,

some of which are at present imperfectly defined. Among them quercus suber is distinguished as composing large woods; and q. ilex and q. tanzin are abundant. Entire woods of these trees are frequent in Aragon, Catalonia, the Castilles, Estremadura, Andalusia, Valencia, and Murcia. Quercus valentina of Cavanailles is seen in the eastern part of Valencia and other parts of the south. Q. australis of Link, a fine species, is associated with q. suber near Gibraltar. Q. fastigiata is found on the flanks of the Pyrenees. Of the deciduous kinds q. rubur is very abundant in the northern provinces, not existing in the central. Sometimes q. pubescens accompanies it. Q. coccifera prefers the south, where it abounds extensively, and extends as far north as the centre of Spain. Q. ægilops is met with in the Sierra Morena.

Captain Cook, in his Sketches in Spain, regards the vegetation as conveniently distributed into three divisions. The *first* division comprehends Galicia, Asturias, the Basque provinces, Upper Navarre, and the maritime parts of Old Castile. It is distinguished for the humidity of the atmosphere, equable temperature, its pastures, verdure, and luxuriant vegetation. It produces little or no oil, wine of an inferior quality, but much valuable timber. Quercus robur, q. ilex, menziesia daboeci, pteris aquilina, ulex stricta, u. europea, are chiefly characteristic. The *second* division includes the Castiles, Estremadura, Aragon, part of Catalonia, and the upper portions of Valencia, Murcia, and Andalusia. The climate is remarkable for its dryness. In some parts the olive is abundant; and Aragon is famous for its large pine forests. Quercus ilex, q. tauzin, q. prasina, and numerous cistus and helianthemum prevail. The *third* division occupies the shores of the Mediterranean, the western coast of Andalusia, and the valley of the Guadelquivir, as far as Cordova. The sum-

mers are hot and dry, and the winters mild. Syngenesious plants are abundant, as are also cistineæ and irideæ; and the sugar-cane, cotton, rice, sweet potato, lemon, orange, fig, and pomegranate, may be all seen.

It will be instructive to trace the vegetation south from the Bay of Biscay to Madrid, then south-east to the Mediterranean. In Asturias we are surrounded by quercus robur, castanea vesca, corylus avellana. The range of mountains may now be crossed, some parts of which about Puerto de Pajares attain from 8,000 to 9,000 feet. On the mountain sides here are fagus sylvatica and quercus prasina. About Valladolid is pinus pinea. The upper ranges of the Guadarrama are clothed with pinus sylvestris, and beneath it, at a somewhat less elevation, is quercus tauzin. Here, too, according to Captain Cook, is the southern boundary of the ash. After passing Madrid, pinus halepensis is seen mingled with p. pinaster; the former grows exclusively on the shore of the Mediterranean, and its northern European limit is 40° 20′. N. lat. at Sacedon. On the Sierra de Cuenca pinus sylvestris occurs for the last time, having hitherto tenaciously clothed every mountain summit, and p. maritima, and p. halepensis conduct us to Valencia.

Reseda is frequent, though it does not embrace the favourite of our gardens, which is a native of Egypt. Narcissus and similar plants are abundant in the spring vegetation, and among a multitude of others there are a few genera particularly deserving of mention as conspicuous in the flora; helianthemum, cistus, erica, teucrium, lavandula, ulex, spartium, ononis, rosmarinus, cerinthe, anchusa, echium, passerina, nepeta, delphinium, &c.

Of several families which have for a long time been regarded as densely clustered about the shores of the Mediterranean, cistineæ is found in the greatest intensity in

the Spain Region; labiatæ in the Asia Minor Region; caryophylleæ in the Danube Region, but are nearly equally numerous in Asia Minor, proportionately few in Spain, and many species are indigenous to the north of Europe and Siberia. Borragineæ are perhaps most numerous in the Danube Region, though very abundant in Asia Minor; less so more to the westward, but increase in the Canary Islands. And oleaceæ are most prevalent in the Italy Region, though fraxinus has most of its species in North America.

The Balearic Islands have a few peculiar plants. To *Minorca* are ascribed buxus balearica, arum crinitum, caprifolium implexum, ligusticum balearicum, rubia angustifolia; and to *Majorca* rubia lucida.

Relations.—Several tropical plants have migrated to this region, and imparted distinct features, such as chamærops humilis, phœnix dactylifera, agave americana, opuntia vulgaris, and other cacteæ. Its most decided peculiarity, as an European region, is derived from the presence of many African species. Both these features are more strongly impressed in the south, and the scanty vegetation about Gibraltar is characterized by genista unifolia, spartium junceum, teucrium valentinum, phlomis fruticosa, chamærops humilis, and opuntia vulgaris. A collection of phænogamous plants made by Von Martius at Algesiras contained 143 species belonging to the south of Europe, 60 to temperate Europe, and 17 to Africa; and of the whole number 58 were indigenous to Great Britain. A very interesting relation with the South Africa Region is displayed through erica, which has here several distinct species; and indeed the prevalence of the genus in a portion of Europe is remarkable when we reflect what a broad barrier intervenes, how truly a cape genus it is, and how very sparingly it is diffused elsewhere, even

when the climate and circumstances seem favourable, the whole of the two Americas not offering a single species. More relations with the same region may be traced through passerina and others.

XLIII.—THE ITALY REGION.

Extent.—Italy, to the south of the Alps, that portion of France south of the Cevennes, and Sicily, Malta, Corsica, and Sardinia.

Physical Characters.—Those who have entered Italy from the north by way of the Alps, have been always impressed by the sudden change and interesting character of the vegetation. The north of Italy is eminently fruitful, and in the Milanese the soil, aided by irrigation, yields four crops of grass in the year. This is the country of the Parmesan cheese. Prolonged irrigation destroys the grass, and a rotation of crops is conducted. The sluices are shut, and the soil subjected to courses of hemp, leguminous plants, oats, wheat, and maize, for five years. After this, grasses accumulate, and are assisted by irrigation, usually for fifteen years. The territory about Genoa is rocky and unproductive, and much of the south is in the same condition, and some parts almost too unhealthy to cultivate. In Sicily, the lava fields are planted with cactus, which after thirty years become fitted for cultivation.

Climate.—Generally the seasons are warm and even, and the temperature rarely below 32°, but in some places, as at Naples, they are liable to extremes. At Rome the mean temperature is 59°5, of winter 45°8, of summer 75°2; at Toulon the mean is 62°, of winter 48°4, of summer 74°8, and at Hieres, in the neighbourhood, the orange ceases

to grow; at Palermo, in Sicily, the annual mean is 65°, and the range, in twenty years observations, from 105° to 34°, or seventy-one degrees; the number of rainy days is only 65, and the fall of rain 21·1 inches; the cotton plant, banana, and sugar-cane all repay cultivation. The amount of rain and rainy days varies somewhat; in Provence the number of rainy days is only 67, in Florence 103, fall of rain 31·6; in Rome, rainy days 117, fall of rain 39 inches, but at Tolluezzo in Fruili, and at Carfagnano in the Apennines, the amount is said to be respectively 82 and 92 inches. More rain falls to the west than to the east of the Apennines.

Flora.—As an European region, it is distinguished by the open character of its vegetation, the dry juiceless evergreen foliage, absence of real forest, and the mixture of tropical and sub-tropical forms. The olive, myrtle, fig, vine, and pomegranate, abound everywhere. Several of its grasses are peculiar, and some attain a large size, as arundo donax. In a climate like that of Italy, there will be a very considerable difference in the vegetation of the seasons, and the warm rains of spring are especially favourable to the presence of asphodeleæ and similar plants; ornithogalum, muscari, erythronium, ixia, bulbocodium, anemone, adonis, clematis, ranunculus, fedia, lotus, medicago, bellis, chrysanthemum, are now numerous; the more permanent vegetation is derived from certain species of quercus and pinus, acer, pseudo-platanus, diospyros lotus, paliurus australis, morus nigra, celtis australis, capparis spinosa, acanthus mollis, plumbago europea, erythrina corallodendron, smilax aspera, cassia italica, phyllyrea, hibiscus, erica, cistus, buxus, pistacia, ornus, numerous borragineæ, labiatæ, scrophularineæ, solaneæ, and malvaceæ.

Sicily has a flora extremely similar to Italy, and with

very few peculiarities. In the introduced plants there is a greater resemblance to the tropics.

Malta, from its situation, may be supposed to have more African plants than Sicily. Its total flora is about 200 species, nearly the whole of which it is likely have migrated here. Spix and Von Martius collected 150 kinds, of which 56 were common with Germany, 90 with the south of Europe, and only 4 with the neighbouring coast of Africa. It may have a few plants of its own, as fungus melitensis, yucca tenuifolia, and ricinus armatus.

Corsica offers a few peculiar plants, and the summits of the hills are covered with pinus laricio.

Sardinia has supplied us with common parsley, petro selinum sativum, but it is not limited to the island.

Relations.—In many respects this is a parallel region with the Spain Region, for tropical features show themselves in both, but in the latter are more mixed with African. Labiatæ, though numerous in both, are more abundant here. In the habit of the vegetation it corresponds in many respects with the Asia Minor, California, South Africa, and New South Wales Regions. The Cape of Good Hope genera of irideæ, gladiolus, moræa, trichonema, have each representatives here. Putoria calabrica, a cinchonaceous plant, is met with in the south.

XLIV.—THE DANUBE REGION.

Extent.—That portion of Europe to the South of the Carpathians, and between the Adriatic andBlack Seas, and consisting of Hungary, the Turkish provinces in Europe, and Greece, much of which is fertilized by the Danube and its tributaries. The southern extreme of Greece is in many respects very similar to Asia Minor.

Physical Characters.—No part of Europe is superior in the capabilities of the soil, yet none has been rendered so little available. From some of the productions it would appear more favourable than any other portion of this quarter of the world, for the growth of several of the plants of warm latitudes. The far greater part is still covered by forest, and there are vast marshes where rice is extensively cultivated.

Climate.—The summers are warm, and the winters not usually severe, but the temperature is liable to vicisitudes.

Flora.—The forest, which abounds over much of this region, is composed of a little variety in its trees; in Hungary, species of prunus enter largely into it, sometimes with multitudes of fraxinus rotundifolia; whole forests of cherries and apricots are seen in Wallachia, and the elevated lands sustain large numbers of firs, oaks, pines, and beeches; daphne cretica and spartium parviflorum characterize the shores of Gallipoli; the plum is everywhere cultivated in the greatest abundance, and is the source of a brandy called raky; rhus cotinus abounds in Sclavonia and the neighbouring provinces; and in the southern and south-eastern states are large groves of the olive.

Isatis tinctoria, or woad, exists in Hungary, and other species are indigenous; valeriana celtica, or spikenard, seems to prefer a certain elevation; daphne, nerium, clematis, capparis, arbutus, amygdalus, populus, acer, asparagus, orobanche, antirrhinum, astragalus, pyrus, cratægus, spiræa, gypsophila, thalictrum, helleborus, artemisia, chrysocoma, cnicus, carlina, kitaibelia, bubon, seseli, are all characteristic. Quercus racemosa is confined to the south, and the melon and the vine are largely cultivated in Hungary.

Relations.—In Spain the vegetation partakes of African features, and in this region of that of Central and

Western Asia. If it here wants the picturesque beauty of Italy, it is also without the dry sapless aspect of its trees; and the smiling circumscribed character of the vegetation is compensated by luxuriance and vigour. Those plants which like shelter, as certain ranunculaceæ and ferns, are more abundant, and for a similar reason cruciferæ are proportionately numerous. Mesembryanthemum has two or three species in Greece.

XLV.—THE ALPS REGION.

Extent.—The elevated sides of the mountain chains in the south of Europe, above the line of lowland cultivation, to their summits, or the limits of the vegetation. The principal are the Pyrenees, the different portions of the Alps, the Carpathians, the Apennines, and Mount Ætna.

Physical Characters.—It comprises an extent of rugged and bare mountains, but often sheltering within them rich moist valleys, and small verdant plains. Primitive rocks chiefly prevail, and sometimes with such steep scarped sides as to preclude the assemblage of soil and vegetation. In Mount Ætna, and in some parts of the Alps, there are large fields of lava, which, after a certain period, become clothed with plants.

Climate.—This will vary from temperate to frigid, according to the elevation; it is also liable to fluctuations, and to be disturbed by brisk winds and storms. The mean temperature of St. Gothard at 6,390 feet is 30° 4. On St. Bernard the fall of rain is 63 inches, which seems great for the latitude, since the mean of twenty places in the lower valleys of the Alps is 56· 5 inches. The mean temperature of Ætna, at the base, is 64°.

FLORA.—The vegetable productions of higher latitudes gradually appear as the elevation is increased. At first are seen thick forests of their trees, till by degrees they become dwarf and stunted, and are then succeeded by shrubs; after these come certain herbaceous plants, with a large proportion of grasses, large spaces covered with lichens, and lastly perpetual snows. The flowers of this region are often distinguished for the pureness and brilliancy of their colours. The characteristic plants are chiefly derived from gentiana, campanula, phyteuma, cherleria, androsace, primula, aretia, soldanella, ramonda, helleborus, aconitum, saxifraga, pœonia, cytisus, and rhododendron.

The Pyrenees are situated between 42° and 43° N. latitude, and some of the highest peaks attain from ten to twelve thousand feet. The lower portions of both the north and south sides are covered with forests. The oaks on the north side, as quercus robur, q. tauzin, q. pubescens, q. fastigiata, but no evergreen species, these being confined to the southern flanks, and the genus ceases at 3,280 feet. Pines now prevail, pinus sylvestris being found on both sides, at its upper limits being mixed with p. uncinata, which soon after appears alone and closes in the trees at 7,800 feet. Rhododendron ferrugineum now grows in the valleys in vast quantities, with some northern shrubs. Some herbaceous species of cold climates with lichens soon after close in the vegetation among the perpetual snows, which commence at 8,950 feet. Abies communis and larix europea, have no existence here. The evergreen oaks cease at the village of Andorra. Several of the alpine parts of the Spain Region belong here, as the Sierra Nevada in Granada, Sierra de Estrella in Portugal, Sierra de Cuenca, heights of the Guadarrama, and others.

The Alps stretch across the south of Europe between 44° and 48° N. latitude, and present many greatly elevated peaks and ranges; Mont Blanc, the loftiest, attaining 15,730 feet. Their physical history and flora are scarcely of inferior interest to the Himma-leh mountains, but are far too extensive to be detailed here. The lowland cultivation ceases at about 2,000 feet, and is succeeded by forests of oak, chesnut, and pines, to 3,900 feet. Betula alba, rhododendron, and stunted spruce, reach 7,800 feet, salix herbacea extending something higher. The line of perpetual congelation is about 8,760 feet.

The Carpathian Mountains are situated in the east of Europe, between 45° and 50° N. lat. There are also some lofty peaks within this range, detached from the general chain. Mount Lomnitz attains 8,436 feet, but the average height is something below this. The lowland cultivation ceases at 1,500 feet. The region of woods succeeds to 4,600 feet, the lower part being chiefly occupied by the oak, birch, and particularly the fir. Next is the region of shrubs, and here also are a few stunted trees of pinus mughus, extending to 5,600 feet. And to these succeed a number of low alpine plants to 6,500 feet, or the summits of the mountains. When the elevation is greater, the surface is occupied by lichens to 8,000 feet, constituting the region of cryptogamic plants.

Mount Ætna is situated in 37° 43° N. lat., and has an elevation of 11,360 feet. Observers differ as to the lines of vegetation. The lowland cultivation of the vine and maize ceases at from 2,200 to 3,300 feet. The orange, lemon, and lime attain 1,900 feet, date 1,600, gossypium herbaceum 1,000, morus nigra 2,500, fig 2,200. The plants characteristic of the lava beds are andropogon hirtus, a. distachyos, lagurus ovatus, rumex scutatus, valeriana rubra, plumbago europea, thymus nepeta, satureja greca,

ranunculus bullatus, capparis rupestris, scrophularia bicolor, heliotropium bocconi, mandragora autumnalis, senecio chrysanthemifolius, daphne gnidium, spartium infestum, solanum sodomæum, ricinus africanus, smilax aspera, euphorbia, linaria, &c. The region of woods extends to 6,500, the oak and chestnut ceasing at 4,350 feet, and pinus sylvestris at the limit of the region. The region of shrubs ceases at 8,125 feet, and contains bushes of juniperus, berberis, betula, and fagus. The region of grasses ceases at 9,750 feet, and of cryptogamic plants at 10,000 feet.

Relations.—Rhododendron, and some few others, carry our associations to the alpine regions of Asia and America, to lesser heights in China, and to some northern latitudes. Sempervivum abounds in species in the Canaries, yet on Ætna not a trace of it exists, but is replaced by sedum, which is equally numerous, but has no existence in the Canaries.

XLVI.—THE CENTRAL EUROPE REGION.

Extent.—That portion of the centre of Europe to the north of the southern chain of mountains is distinguished for a certain individuality in its vegetation, and the extensive cultivation of wheat. The southern limit is bounded by the Alps and the Carpathians to the Caspian Sea, and the Pyrenees and the Cevennes, thus excluding a portion of the south of France. To the north it includes Denmark, and a part of the south extremes of Sweden and Norway, and is separated from the Volga Region by a line commencing in the Baltic on the coast in 55° N. lat., and traversing the southern provinces of Russia to the sea of Azof. Its northern limit is in the vicinity of the

boundary of acer, pseudo-platanus, morus nigra, populus alba, p. nigra, pyrus malus, the vine and the chestnut; and the region generally may be regarded as that portion of Europe where wheat is most advantageously cultivated for food, to the north soon yielding to rye, and to the south to Indian corn and rice. Wheat is stated to be most profitably cultivated between 36° and 50° N. lat., and to cease entirely at 60° or 62°. The British islands complete the region.

Physical Characters.—According to Balbi, the surface of Europe presents several remarkable geographical features. Its centre consists of an extensive plain of considerable productiveness, and to the north in Russia it rises to a broad table-land of about 1,150 feet of elevation. Another important table-land occupies the centre of Spain, having an elevation of 2,300 feet, that of the Jura Alps attains from 1,750 to 3,850 feet, and another in Piedmont from 600 to 2,000 feet. But a far greater diversity is imparted by the several mountain chains of the Pyrenees, the Alps, the Carpathians, the Apennines, and the Dofrines, which considerably modify the climate and the character of the vegetation. Besides there are several valleys which serve to guide certain rivers to the ocean, and which are pre-eminent both for their beauty and fertility. Of these the most distinguished are the valleys of the Lower Danube, the Rhine, the Drave, and the Po. Formerly, by far the greater portion of the surface was covered with forest, much of which has been gradually removed by cultivation, but very extensive tracts in Russia and Poland are still in this state, and throughout Europe generally a good deal of forest still remains. On the whole, the soil is good and fruitful, but there are spots consisting of little else than rocks, or where the occasional invasion of the sea renders it unserviceable, or where bog, morass, or heath exists, to

the exclusion of cultivation, as in the countries south of the Baltic.

CLIMATE.—Malte-Brun and Balbi assign to Europe three well-defined climates; the Atlantic distinguished for its even temperature, and its moisture; the climate of the north-west of Europe being one of extremes of temperature: and the climate of the south, which, with its higher temperature, holds a middle station between the two others. Aware, however, that this division very imperfectly expressed all the important features, a further seven-fold one was proposed. Europe is so situated, between extensive seas on one side and a large mass of land and range of mountains on the other, that it cannot fail to be greatly governed by their influence over climate, and to offer some variety. Compared with other climates of a similar latitude, it will be found to be mild, less exposed to vicissitudes, and that vegetation attains a higher northern station. Between the west and east portions there are certain differences. The mean heat may be nearly the same through the same parallel, but the distribution in the seasons will be different. On the west side, the climate being equable, the range throughout the year is not great, and the mean of the summer and winter months will not be in excess; the atmosphere is also moister, and the number of rainy days greater. On the east side, however, the mean of these two seasons is prone to extremes, and to take respectively higher and lower stations. Whatever differences occur in the mean heat of the year will be in favour of the eastern portions. The result of this on vegetation is, that plants which prefer a climate free from extremes, and that move with the mean temperature, will take a higher northern station on the eastern side, as is visible in some of the plants of Norway and Sweden, the apple for instance; and those which revel in a hot summer, and are indifferent to

the extremes of winter, will be found occupying a limit gradually extending towards the north-east.

In the Central Europe Region, the circumstances of the climate are less strongly marked. The mean varies from 48° to 54°, and the usual annual range from 28° to 83°. The atmosphere is often much loaded with moisture, and the rainy days are nearly half the total to the year, though the quantity of rain which falls does not exceed from 22 to 30 inches. The mean hydrometric state of the atmosphere is four or six degrees below the mean temperature. In a climate so clouded, the power of the sun's rays over vegetation must be supposed to fall far short of their effects in lower and more brilliant latitudes.

Flora.—The indigenous productions are those of a temperate latitude. The climate holding a middle station, the plants of the south wander here, and those of the north do not find it ungenial; it has thus a large proportion of species for the extent of surface, and the more important groups of plants are freely represented. The region will therefore display, with a number of species, also a number of genera and families, the proportions of the latter to the former bring greater than usual. In the forest trees, however, the number of species as compared with other regions is singularly small, and genera extensively represented elsewhere have here often only solitary species. Nearly all have deciduous leaves, and though grasses have not an important numerical relation to the flora, they flourish in great luxuriance. These trees often manifest a partiality to particular soils, and in the forest, which clothes a larger portion of Poland, the oak, yew, ash, poplar, chestnut, and willow, are found on the clayey soil, whilst the pine and the fir occupy exclusively the sandy soil. Inconspicuous flowers prevail greatly, as might be expected where amentaceous and coniferous plants are so numerous, but in other

regions it is not unusual to have an intermixture of attractive flowers even in the trees, such as is not seen here. The details of the region may be sought for in ranunculaceæ, cruciferæ, caryophylleæ, geraniaceæ, saxifrageæ, leguminosæ, particularly the section vicieæ, rosaceæ, stellatæ, compositæ, borragineæ, ericaceæ, gentianeæ, labiatæ, scrophularineæ, polygoneæ, chenopodeæ, the families of amentaceæ, orchidaceæ, junceæ, cyperaceæ, gramineæ, and a large proportion of the cryptogamic families.

Umbelliferæ have a slight preponderance over other regions, as will be seen in their distribution. The total number of species is 1,009, but the duplicate habitats are here included. In the Central Europe Region there are represented 172 species; Danube Region, 161; Italy Region, 152; Asia Minor Region, 90; Spain Region, 82; Barbary Region, 69; South Africa Region, 63; Iroquois Region, 61; Volga Region, 53; Siberia Region, 50; Chili and Peru Region, 45; New South Wales Region, 29; Paraguay Region, 19; Patagonia Region, 10; other regions, 216. They are here found to exist in far greater numbers in the northern hemisphere, and particularly in Europe. In the latter they are most densely assembled in the central, southern, and south-eastern portions, whence we may infer their partiality for a warm temperate climate, for warm summers and extremes in the seasons rather than the reverse, and lastly, for an atmosphere tolerably supplied with moisture. A few species cling to Western Europe along the shores of the Atlantic, and are not found in the eastern countries. Some have a partiality for elevated stations in the Pyrenees, Alps, Andes, and Mexican highlands, and the Asia Minor Region derives its species in great part from Caucasus.

France is chiefly included in this region; it has an area of 200,925 square miles, and 5,966 species; or, in the proportion of one species to about 34 square miles.

The British Isles are estimated to contain 110,181 square miles, and their total vegetation, omitting algæ and fungi, is composed of 2,393 species, or one to every 46 square miles. These are distributed among 939 genera and 112 families. The value of the genus, or its average proportion of species, is 3·7; of the family, or its proportion of genera, is 5·7; of the exogenous genus, 2·8; of the same family, 4·7; of the endogenous genus, 2·8; of the same family, 6·7; of the cryptogamic genus, 8·5: of the same family, 13. The flora has little to distinguish it from the continent of Europe.

Ireland has 682 exogenæ, 211 endogenæ, and 41 ferns. Some plants are found there not indigenous to Great Britain, but generally occurring to the south of Europe; as, arbutus unedo, menziesia polifolia, papaver nudicaule, sedum palustre, arenaria ciliata, saxifraga umbrosa, pinguicula grandiflora, trichomanes brevisetum, hookeria lætevirens, and h. splanchnoides. The two last are quite peculiar.

Relations.—Besides the close relations to neighbouring regions, some interesting affinities exist with the distant Patagonia and Van Diemen's Land Regions. Compared with its American parallel, the Iroquois Region, it fails greatly in variety, and particularly in the forest trees.

XLVII. THE VOLGA REGION.

Extent.—Russia, to the west of the Ural Mountains, and to the north of a line commencing at the fifty-fifth degree of latitude on the Baltic, and extending to the Sea of Azof; with the whole of Norway and Sweden, with

the exception of a small portion of their southern extremes.

Physical Characters.—Russia consists chiefly of an extensive plain of inconsiderable elevation, and dotted with numerous lakes and marshes, and Norway and Sweden are intersected by lofty mountains.

Climate.—To the eastward the climate is one of extremes, the summers being hot and the winters long and severe. On some days the temperature is higher than is usual many degrees to the south. The western countries have a more even climate, but still a rigorous one.

Flora.—The extensive and often magnificent forest, which covers nearly the whole of this region, is composed chiefly of pinus sylvestris, mingled with abies picea, and a. communis; and pinus cembra is met with towards the Ural Mountains. Though the species of pine are fewer here than in the south, the trees are of far finer growth; a circumstance that occurs also with the eucalyptus in Van Diemen's Land, where, though there are fewer species, the trees grow much larger. Sheltered by the forest, a dense undergrowth flourishes, of species of vaccinium, andromeda, empetrum, rubus, salix, betula, and arctostaphylos. Coniferæ, amentaceæ, saxifrageæ, cruciferæ, and ranunculaceæ, are particularly prominent, and some members of umbelliferæ, caryophylleæ, and borragineæ, are mixed with the vegetation, but are rapidly disappearing. An English botanist visiting this region will find most of the northern plants of his own island, but will perhaps be more surprised to see what an altered character a vegetation of similar species assumes here; for he will find many plants very common, which were rare at home, and others before regarded as common weeds are here prized. Senecio jocobæa, so frequent a nuisance in our meadows, is in Norway an object of diligent search.

Several important plants have their northern limits in

this region. Quercus robur ceases at 61°, fraxinus excelsior 60°, fagus sylvatica 60°, prunus cerasus 57°—60°, tilia intermedia 63°, abies communis 67°, populus alba and p. nigra 56°, pinus sylvestris 70°; the ash, alder, aspen, and juniper, in Norway, reach the arctic circle, or 67°, but cease near the Urals at 60°.

Alpine vegetation can scarcely be supposed to exist in a region which possesses so many of its characters, and any attempts to give it prominence will be attended with very feeble results. In Lapland, between 66° and 68°, according to the statements of Wahlenberg, the *Region of Trees* attains 1,800 feet; the *Region of Shrubs* succeeds to 2,500 feet, and is closed in by lichens and perpetual snow at 3,300 feet. In Finmark, according to Von Buch, at 70°, pinus sylvestris grows to 730 feet; betula, larix, and vaccinium, to 3,100 feet; then cryptogamic vegetation and perpetual snow at 3,300 feet.

Relations.—The parallel regions in America are filled with forests of noble trees of abies instead of pinus, mixed with cupressus thyoides, and occasionally a pine, cratægus, or fraxinus; besides this there is much similarity in the vegetation.

XLVIII.—THE OCEAN REGION.

Extent.—The shores and shoal waters of the ocean through all latitudes, from high-water mark to a depth at present uncertain, but which most probably is inconsiderable.

Physical Characters.—The medium in which marine plants live may, in several ways, affect the functions of those which select it for their habitation. The influence of the atmosphere is nearly excluded; and light, even at

small depths, is greatly obstructed. The saline constituents must be regarded as essential to their well being, though I have seen a fucus and a potamogeton growing together in water of a very slight degree of saltness. In many cases they evidently display a selection as to their place of attachment, and usually prefer mud or soft rocks to harder substances. They appear particularly scarce in coral islands, perhaps because the coral animal feeds on them.

CLIMATE.—The seasons and temperature have a decided influence. In the summer months this flora is in great vigour, and when a season occurs eminently favourable to vegetation, it is proportionately affected. From their geographical distribution it may be inferred that these plants are sensible of small variations in the habitual temperature. Within the tropics those living in shoal waters are surrounded by a temperature varying from 74° to 86°. At greater depths the temperature gradually and evenly descends. A decrease, however, does not always happen. In 25° N. lat., when the air was 67° and the surface of the sea 69°, the temperature at 35 feet was 73°. The temperature at the surface will generally be found to fluctuate about the mean of the latitude, but is liable to be disturbed by currents, as is the case with the gulf stream, which so modifies and warms the climate of the Bermudas. In high latitudes the surface may be sometimes below the mean temperature, and an increase occur for certain depths, but this will rarely exceed 42° or 44°.

FLORA.—Notwithstanding the uniformity of the ocean, the facilities of diffusion, and simple organization of the vegetable beings which inhabit it, they will be found often remarkably circumscribed in their limits of growth. The same laws prevail as on the land, that there shall be everywhere variety, and that under similar circumstances in widely separated localities there shall be close relations.

Looking over, then, this extensive region, the different deep inlets, gulfs, and seas, will each be found to have their own peculiar kinds, and sometimes in such numbers as almost to justify their exaltation into separate regions. It is said that the species found in the Red Sea are almost entirely different from those of the coast of Syria, though separated by so small a portion of land. In our own island rhodomenia cristata and odonthalia dentata are confined to the northern shores; and fucus tuberculatus, laurencia tenuissima, rhodomenia jubata, rhodomela pinastroides, iridæa ensiformis, and others, to the southern.

The flora of this region is entirely derived from the natural family of algæ, but does not comprehend all its species, since many prefer fresh waters. Lamouroux has calculated that the total number of species may reach 5,000, or even 6,000. Fucus and laminaria exist in enormous beds in the high latitudes of both hemispheres. Several species of sargassum replace the former within the tropics, where they are often densely crowded on the surface, and generally in an active state of vegetation. Tamnophera, caulerpa, gelidium, amansia, and dictyoteæ are chiefly tropical. Codium tomentosum is found in nearly all seas throughout the world. Macrocystis belongs to the southern hemisphere from the equator to 45° S. lat, and durvillea and lessonia are likewise limited to this part of the world. Thaumasia ovalis, a remarkable plant, is found only at Ceylon. Cystoseira has several species on our own coasts, and others abound in the northern hemisphere, but a peculiar group is met with in New Holland, where, Greville remarks, it is as peculiar as the aphyllous acaciæ are on the land.

Relations.—Between the terrestrial and marine vegetation the link is perfect and complete. Of the latter, the mass unquestionably find the waters of the ocean essential

to their existence. Some, however, of closely allied organization prefer fresh or sweet waters; and there are a few which live indifferently in both. With lichens, hepaticæ, and fungi, they have much structural resemblance, and like them prefer cold climates, where they all flourish in greater numbers and luxuriance. Moisture also is necessary to the existence of them all, and the selection of certain lichens and fungi of old walls may be due to the saline substances to be found there, and which the marine plants receive from the ocean.

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The Sulphur was commissioned in September, 1835, by Captain Beechey, and accompanied by her consort, the Starling, Lieutenant-Commander Kellett, quitted England in the following December. He invalided at Valparaiso, and was succeeded by Acting Commander Kellett, who was again superseded by the author who took the command at Panama, in February, 1837, having crosssed the Isthmus of Darien for that purpose, and retained it till the conclusion of her protracted voyage. After some little delay in completing certain necessary operations, the Sulphur proceeded northerly, touching at Realejo and Libertad in Central America, and reached San Blas in June, whence she sailed for the Sandwich Islands, which she reached the following month.

Port-Etches, in King William's Sound, in 60° 30′ N., was their next destination. Point Riou and Port Mulgrave were chosen as base stations for determining the position of Mount St. Elias, and further settling the question of longitude between Cook and Vancouver. The ship then proceeded to Sitka, or New Archangel, in

[VOYAGE ROUND THE WORLD.]

Norfolk Sound, where the officers received very courteous treatment from Captain Koupreanoff, the Russian governor. She next visited Friendly Cove, in Nootka Sound, and thence sailed to San Francisco, when the examination of the River Sacramento, 156 miles from her anchorage, occupied them in open boats for thirty-one days. Thence she successively visited Monterey, San Blas, Acapulco, and Libertad, on her way to Realejo, where the author, for the recovery of his health, undertook a land-survey of the principal mountains over-looking his future ground in the Gulf of Papagayo, and fixed the principal features of the Lake of Managua to its first fall into that of Nicaragua at Tepfitapa. After surveying the Gulf of Papagayo and Port Culebra, the Sulphur quitted Central America, touched at, and fixed the Cocos, and reached Callao in June, 1838, for the purpose of refit, and the completion of stores and provisions. Having examined the coast between Cerro Azul and Callao (about sixty miles), she left Callao in August, calling at Paita and Guayaquil, and returned to Panama in the following October.

Here may be said to have ended her first cruize; but between October and March a survey was made of the Gulfs of Fonseca and Nicoya, Pueblo Nueva, and Baia Honda, after which the ship moved northerly, repeating her cruize of 1837. She was detained at the Columbia River till September; Bodega, the Russian position near San Francisco, was then surveyed, and subsequently San Francisco, Monterey, Santa Barbara, San Pedro, San Juan, San Diego, San Quentin, San Bartolome, the Gulf of Magdalena, and Cape San Lucas. The Sulphur then proceeded to San Blas and Mazatlan, where orders for a westerly return awaited her. Having shipped supplies for fourteen months from a transport which had been sent to meet her, she commenced her homeward voyage in January, 1840; the author landed on the islands of Socorro and Clarion, and secured their positions. She reached the Marquesas the same month, and after a short visit to Port Anna Maria, Nuhuhiva, moved on to Bow Island, where the operation was performed of boring for the volcanic foundation on which these coral islands are suspected to stand. She then visited Tahiti, Huaheine, Raratonga, Vavao (Tonga Group), Nukulau (Feejees), Tanna (New Hebrides), Port Carteret (New Ireland), Britannia Island, New Guinea, coasting that island to Arimoa and as far as Jobie, where she remained to rate and survey, then to Amsterdam, Pigeon Island (Dampier's Straits), Bouro, and Amboina, moving thence to Macassar, Great Solombo, and Pulo Kumpal, off the Borneo coast, and reached Sincapore in October of the same year.

Orders here awaited her to proceed instantly to China, where she was detained, and took an active part in the warlike operations against the Chinese, till nearly the close of the year 1841, when she sailed for England. After leaving Sincapore, touching at Malacca, Penang, Achen, (Sumatra,) Point de Galle (Ceylon), Seychelles, Madagascar, Cape of Good Hope, St. Helena, and Ascension, she at last returned to Spithead.

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