PHILIPS'
SCHOOL ATLAS
OF
PHYSICAL GEOGRAPHY

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OF

PHYSICAL GEOGRAPHY,

For the Use of Schools;

ILLUSTRATING

THE NATURAL FEATURES OF THE GLOBE,

THE GEOGRAPHICAL DISTRIBUTION OF NATURAL PHENOMENA,

AND THEIR

CONNEXION WITH THE INDUSTRIAL PURSUITS OF MANKIND.

EDITED BY

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ETC., ETC., ETC.

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DESCRIPTIVE NOTICE OF THE MAPS.

I.

THE WORLD, ILLUSTRATING THE DISTRIBUTION OF LAND AND WATER, &c.

This Map is designed to illustrate the prime elementary truths of Physical Geography, displaying them in a form which is obvious to the eye, as well as capable of ready appreciation by the reflective faculties of the learner.

Physical Geography is the *geography of the natural world.* The first essential in a study of the truths which it embodies is an adequate conception of the way in which Land and Water are distributed over the surface of the globe. The Land may be regarded under three aspects—1st, Position and comparative extent; 2d, Contour or shape; 3d, Superficial aspect, or form of relief. The first and second of these points of view are illustrated in the delineations afforded by the Map itself; in the case of the third, the appended Table (of high-land and low-land regions) serves as a supplement to the Map, and supplies such deficiencies as are inherent to it.

The Map of the World delineated on the plane of a meridian 20° west of Greenwich exhibits an Eastern and a Western Hemisphere, and shows admirably the respective grouping of the land-masses that constitute the Old and the New Worlds. The Old World is of the larger extent, and the more solid in shape. But this single illustration is not sufficient. The land and water must be viewed also under the conditions of a Northern and a Southern Hemisphere, as in the case of the smaller appended map, in the lower left-hand corner of the plate.

Further, the world must be regarded under the conditions of a division which brings the greatest possible amount of Land-surface within the limits of one hemisphere, and the greatest amount of Water-surface into the other half. This is accomplished by a line of division 90° distant on every side from London—or, in other words, by a projection made *on the plane of the horizon of London*, and coincident with what would be obtained on the artificial globe by elevating the north pole 51½° (the latitude of London) above the horizon.

The facts which this plate serves to illustrate, and the conclusions to which it points, are summed up in the second chapter of the "Class-Book of Physical Geography."*

II.

PHYSICAL MAP OF THE WORLD, SHOWING THE CHIEF NATURAL DIVISIONS OF THE LAND, AND THE OCEAN CURRENTS.

This plate carries the learner forward, in his study of the natural aspects of the globe, by a highly important stage. From the first conception of the general forms of Land and Water, he proceeds to examine more closely the aspects and properties of each. The Land exhibits not merely its high-land masses and its expanse of plain, but has besides its mountain-chains, its steppes, prairies, savannahs, pampas, and deserts. The Water has its currents, or ocean-streams. All of these are delineated on the present Map.

It is of the highest importance in physical geography to study thoroughly the direction of mountain-chains. These give their form and slope to the lower grounds, and determine the courses of the rivers. The strong black lines (which mark, in the present Map, the mountain-chains) show at a glance the predominant direction of east and west in the high-lands of the Old World, and, in a manner more strongly marked, that of north and south in the case of the New World. But there are exceptions to the rule, in the instance of each. The transverse chains determine, in many cases, the lateral limits of the great river-basins, as the greater chains do their slope and general area.

* "Class-Book of Physical Geography." By W. Hughes. (Published by G. Philip & Son, London and Liverpool.)

Again, the higher mountain-chains occupy the middle belt of the Old World, and culminate towards the eastern extremity of that belt. In the other half of the globe, they stretch along the western side of the continent. In other words, the elevated land-masses adjoin the Pacific and Indian Oceans much more nearly than they do the Atlantic and Arctic basins, and it is consequently towards the latter that the longer slopes of the land are turned. This truth is further illustrated in the upper line of Sections appended to the Map, in which are shown the comparative elevations of the land along lines drawn in the Old World from south to north, and in the New World from west to east.

The lower line of Section shows the proportion which the greatest known elevations of the land bear to the greatest ascertained depth of the sea. It serves, besides, to illustrate the truth, (too often disregarded by learners,) that the ocean constitutes only a superficial interruption to the continuity of the land. The mountain-slopes, which in one place sink beneath the waters of the sea, re-appear in the form of islands rising out of the deep waters. The greatest ascertained depths of the sea exceed the highest elevations of the land in nearly the same ratio that the water-surface bears to the land-surface of the entire globe.

Chapters IV.–VI., ("Class-Book of Physical Geography,") in the case of the Land, and Chapter VIII., in reference to the Ocean, supply a full development of the subjects which the present Map illustrates.

III.

MAP ILLUSTRATING THE GEOLOGICAL STRUCTURE OF THE EARTH, CHIEFLY ACCORDING TO AMI BOUÉ.

This map must be regarded as only an approximation towards a view of the arrangement displayed in the rocks which compose the Earth's crust. It is based principally upon the work of the distinguished French philosopher, Dr Ami Boué, with such additions as later researches have supplied in the case of various regions, as in parts of interior Africa, Australia, and elsewhere. It aims only at a broad generalisation, showing the extent to which the great families (as they may be termed) of rock formations are developed in the superior layers composing the crust of the globe.

The great division of rock-substances is into aqueous and igneous. The former are sedimentary deposits, and are for the most part stratified and fossiliferous: the latter are either plutonic or volcanic. The plutonic rocks have been formed through the agency of fire, under considerable pressure, and often at vast depths. The volcanic rocks are the produce, not merely of recent or modern volcanic action, but of analogous phenomena at various periods belonging to the earth's past geological records. Granite is the typical example of the plutonic formation: the various rocks coming under the general name of "trap," (as basalt, trachyte, &c.,) together with the produce of modern volcanic eruption, belong to the volcanic series.

The sedimentary rocks comprehend (in the descending order) the successive series of formations, from the recent deposits of sand or gravel to the rocks of hard and slaty texture which constitute the Silurian and Cambrian systems. These form, according to the classification adopted in the present day,* nine distinct series. In the present Map, the four upper members of the secondary formation (from the chalk to the lower new red sandstone inclusive) are grouped together, while the carboniferous strata are allied with the lower members of the secondary series.

To the two great classes of igneous and aqueous is added a third, known as metamorphic, from the fact of the rocks which it comprehends exhibiting an appearance of alteration from their original form, due probably to the combined influence of heat and pressure. The metamorphic rocks exhibit a stratified arrangement, but contain no traces of former life—*i. e.*, no fossils.

It is obvious, on comparison of the present Map with that by which it is immediately preceded, that the rocks of plutonic origin, together with the older members of the secondary series, coincide for the most part with the great mountain-ranges of either continent. Granite forms the basis of the Himalaya Mountains, the Alps, the Pyrenees, the Ural Mountains, and the Caucasus, though portions of either mountain-system are in some instances overlaid by sedimentary formations, which stretch outwards from its base. The mountains of the Scandinavian peninsula are throughout composed of granitic and crystalline rocks. In the New World, both the Rocky Mountains and the Andes have the same granitic bases; in the latter system, however, granite is only visible in the lower elevations, the higher mountain-masses being crowned by basalt and other rocks of volcanic origin.

Vast portions of the earth's surface—especially in the Old World—exhibit stratified rocks belonging to the tertiary period of geology. The middle zone of Europe, stretching from the shores of the German Ocean eastward, through Northern Germany and the region of the steppes, to the Caspian Sea; in Asia, the western division of the great Siberian plain, from the banks of the Yenesei river westward to the Ural region, the deserts of Turkestan, and the vast expanse of the Gobi, with the Persian and Syrian deserts; in Africa, the immense region of the Sahara, belong to this period. Similar regions in the western half of the globe, and in the Australian continent, are easily recognised on the Map. The student of speculative geology finds interest in seeking to delineate the relative contour of land and sea belonging to the various epochs of sedimentary deposit, when many of the higher mountain-chains of the present era must have presented the aspect of insular masses, rising out of the waters of a surrounding sea.

* See Table in "Class-Book of Physical Geography," Chap. iii., p. 24.

The older strata of the earth's crust, generally speaking, especially where the earlier sedimentary formations come into contact with rocks of crystalline texture, and with various plutonic masses, are the chief seat of metallic veins. Thus, gold is uniformly found in connexion with quartz, and, in the case of our own country, the palæozoic rocks of Cornwall and Devon are the chief seat of the deposit of tin, copper, and other metallic substances.

IV.

PHENOMENA OF VOLCANIC ACTION, SHOWING THE REACTION OF THE INTERIOR OF THE EARTH UPON ITS EXTERNAL SURFACE.

This Map forms an important sequent to that which immediately precedes it. It shows the geographical distribution of Earthquake-shocks, and the seats of modern volcanic fire. The appended plans of particular volcanic regions, on a larger scale, illustrate the phenomena of some of the more celebrated earthquakes and eruptions.

In this plate, as the wording of its title implies, the phenomena of earthquakes and volcanic eruptions are regarded as connected with the earth's central heat.* The high subterranean temperature of our globe—everywhere increasing with increase of depth—is of uniform distribution; but its manifestation on the earth's surface is limited (probably by chemical and mineral conditions) to particular regions. These regions, however, have a wide geographical area, as the Map shows. The vast circuit of the Pacific exhibits a belt of igneous disturbance, stretching almost continuously round its shores. The equatorial Andes, on one side of the great ocean, and the East Indian archipelagoes on the other, mark its limits in the direction of east and west, and these are divided by 180° of longitude—or half the circumference of the globe. Western Asia and the shores of the Mediterranean comprehend another great volcanic region, the outlying portions of which, to the westward, stretch far into the bed of the Atlantic, and rise at intervals, in the islands of the Canaries and the Azores, above its waters. The volcanic members of the Lesser Antilles, in the West Indies, are perhaps to be regarded as belonging to the same region. In a more northerly latitude, Iceland constitutes another and highly important seat of igneous disturbance. But the shading of the Map itself serves best to indicate such localities, and renders commentary almost superfluous.

A distinction is drawn by writers on geology between central and linear volcanoes. The former term is applied to those instances in which a crater of eruption forms the central point of a group of volcanic vents. The Sandwich (or Hawaiian) and Society Islands, the Marquesas group, the island of Ré-union, or Bourbon, and a few others indicated on the Map, are of this order. But by far the greater number of volcanic craters exhibit a linear arrangement, such as is strikingly exhibited in the volcanoes of the Andes, the volcanic cones which extend (in nearly a direct line) across the Mexican plateau, the islands of the Aleutian and Kurile chains, and, even yet more obviously, in the numerous volcanoes of Java—prolonged, as the enlarged plan of that region shows, through the entire length of the island.

The names and positions (the latter denoted by a small black dot) of all the more important volcanoes are given upon the Map, with as much completeness as the scale will admit of. The total number of volcanoes known to have been in activity within the historic period is about three hundred.

V.

MAP OF THE MOUNTAIN-CHAINS AND RIVER-SYSTEMS OF EUROPE.

This Map, and the four succeeding Maps of the series, supply additional details respecting the various reliefs of the land, with the extent and direction of the respective high and low grounds of either continent. The mountain-chains and hill-ranges of Europe are here traced with considerable approach to completeness, and the study of the Map, in combination with the Sections by which it is bordered, will be found of high value to the learner. Much care has been bestowed upon the preparation of the sectional diagrams, which show, at a glance, the comparative elevations of all the principal mountains. The prolonged lowland plain which extends through the middle belt of Europe, in the direction of east and west, from the German Ocean to the neighbourhood of the Ural Mountains, is well shown in the lower diagram.

An important purpose of the Map is brought out by its colouring, which shows the comparative area of drainage belonging to the various seas by which Europe is, for the most part, surrounded. The Mediterranean basin is limited in area by the mountain-chains, which, making close approach to its shores, preclude the development of prolonged river-courses; while the basins of the Black, Caspian, and Baltic Seas stretch far back into the distant interior of the continent.

This Map illustrates the fallacy, long prevalent, and even yet scarcely sufficiently discarded, which identified watersheds with mountain-chains. The great watershed of Europe—that which separates its northern and southern drainage—coincides, throughout the eastern half of the continent, with a low range of hills, which, in their greatest elevation, the Valdai plateau, hardly reach more than eleven hundred feet in height,

* "Class-Book of Physical Geography," Chap. xi., p. 161.

and which subside in some parts into an expanse of marsh. To the north of this watershed the rivers flow towards the Baltic Sea and the Arctic Ocean, while on its opposite side the streams are directed towards the Black and Caspian Seas. The watershed itself is crossed in several instances by canals, formed with little difficulty across its gentle undulations, and uniting the head-waters of rivers which have their outlets at opposite extremities of the continent.

VI.

THE MOUNTAIN-CHAINS AND RIVER-SYSTEMS OF ASIA.

Two prime characteristics of the physical geography of Asia are—the vast extent and altitude of its high-land masses, and the large area of its inland drainage. The Sections appended to the Map illustrate well the former of these features, especially that to the right. The vast plateau which spreads, in the very centre of the continent, between its prolonged mountain-ranges, reaches in the plains of Tibet an altitude rivalling the highest points of the Alps. The snow-covered peaks of the Himalaya, which form the southward buttress of this region, nearly double that elevation.

The Sections, especially that on the right of the Map, help to show the real nature of so-called mountain-chains, and indicate the place which they occupy in regard to the elevated lands of the globe. Mountain-chains are a portion merely of the earth's high-land masses, and have no existence excepting as such. The highest mountains on the earth's surface—the Himalaya—are only the southward face of the Tibetan plateau. They reach a height of 29,000 feet above the waters of the Bay of Bengal, but are less than half that altitude when regarded from the summit of the table-land, on their opposite face.* Again, it is not in the highest crest of the mountain-region, but in the broader mass of elevated land, behind the chain of snow-covered peaks, that the watershed between southern and central Asia is found. The head-waters of the Indus and its chief tributaries are found to the northward of the higher mountain crest, and their streams pass *through* deep openings or gorges which break up the whole region on its southward face. The Altai, again, is not a watershed—at least not in its highest crest. The affluents of the Obi, and the streams that join the basin of lake Baikal, have their sources to the southward of the mountains. So true is it that mountain-chains and watersheds are distinct features, and so great is the error of identifying the one with the other.

The inland drainage of Asia comprehends the vast region of the Gobi, the basin of lake Lop, the steppes of the Aral and Caspian lakes—the whole of them continuous. Adding to this extent that large portion of the Caspian basin which belongs to Europe, we find a continuous area of above two millions of square miles, within which the running waters nowhere reach the ocean. The most depressed portions of this vast region, the shores of the Caspian, are even below the general level of the waters of the globe.†

VII.

THE MOUNTAIN-CHAINS AND RIVER-SYSTEMS OF AFRICA.

It is only within recent years that our knowledge of African geography has been sufficiently extended and definite to supply materials for such a Map as this. Even now there is much that is doubtful—and there are many gaps for future explorers to fill.

The ascertained existence of extensive lake-basins in the southern half of the African continent, and the acquirement of a true conception of the physical configuration of that extensive region, are the most important results of recent African research. Instead of vast central high-lands, long supposed to fill up the interior of Africa to the south of the equator, that region has been shown by Livingstone to consist of moderately-elevated plains, with their longer slope directed to the eastward, and bordered towards the sea, on either side, by mountain-chains which rise above the average level of the interior. These border mountain-chains of the eastern and western coasts are not watersheds: the rivers derive their supply from the watered plains of the interior, and pass through openings in the higher grounds, on their way to the sea. The large lake of Tanganyika, lying six hundred miles distant from the eastern coast-line, has an elevation of only 1800 feet above the sea.

The river Nile still offers (as it has done for three thousand years) the great problem of African geography. Whence does that mysterious stream draw its most distant waters? We may regard the problem as on the eve of solution. The stream of the White Nile has been traced upwards to within three degrees of the equator. If the fresh-water lake of Nyanza, the southernmost extremity of which is about the same distance south of that line, be not the long-sought source of that river, there is at least high probability that it falls within its basin. The large expanse of the Bahr el-Ghazal, the affluents of which stretch south to within a short distance of the equator, is united to the channel of the White Nile. The basin of the Nile therefore stretches from the shores of the Mediterranean back into the far-distant interior of the

* See remarks on this subject in "Class-Book of Physical Geography," p. 37.
† *Ibid.*, p. 63.

continent, through thirty degrees of latitude, and the great river itself has a development which (including its windings) is probably little short of three thousand miles. Yet through fourteen hundred miles (from the junction of the Tecazze downwards) the Nile does not receive a single affluent—an instance which has no parallel in hydrography elsewhere.

The two great features of African geography are the river Nile and the Desert. Few things have exercised a greater influence upon the fortunes of mankind. In ancient times, civilisation grew into maturity within the valley of the Nile, and the movements of nations followed the waters of the great river, beside the banks of which the student of art still loves to wander. But the periodical overflow of its waters marks with precision the limit of Egyptian art and culture. Immediately adjacent is the desert—vast and dreary in its solitude—the home of nomade races, unchanging in their habits as the wilderness itself. In the desert, nothing changes,—neither external aspect nor social life.

VIII.

THE MOUNTAIN-CHAINS AND RIVER-SYSTEMS OF NORTH AMERICA.

The New World is the region of lowland plains and of vast river-basins. Its fresh-water lakes approach the character of seas in their magnitude. The basin of a single river—the Mississippi—is more than a third the size of Europe, and the united area of the lakes belonging to the St Lawrence valley exceeds that of the island of Great Britain.

The Rocky Mountains are the back-bone of the North American continent, and they divide, through great part of their prolonged extent (though not continuously, for in this, as in other instances, the water-shed is not throughout coincident with the mountain crest) its eastern and western waters. The country lying to the west of the Rocky Mountains is a singular region, towards the physical aspect of which the occurrences of recent years have directed an increasing share of regard. It includes the large tract of the Great Basin or plateau of Utah, a region which bears close analogy to the enclosed plateaus of Central Asia. The Great Salt Lake, within this area, has no outlet to the sea, though lying at an elevation of 4200 feet. Its waters are intensely salt and bitter, rivalling in such regards those of the Dead Sea.

All that portion of North America which is west of the Rocky Mountains exhibits regions of elevation —masses of high-land alternating with deep river-basins, such as those of the Sacramento and the Fraser. This belt of elevated land is prolonged southward in the plateaus of Mexico and Central America. The strictly continental mass of North America—the region of lowland plains, great lakes, and yet greater rivers —terminates to the south, along the line of the Mexican Gulf, nearly under the parallel of 30° latitude. The western region of high-land is throughout more or less volcanic, and becomes conspicuously so in its southward prolongation. The features of the Mexican plateau are brought out in the Section appended to the Map.

IX.

THE MOUNTAIN-CHAINS AND RIVER-SYSTEMS OF SOUTH AMERICA.

South America exhibits the same characteristic feature as the northern half of the New World—a broad belt of high-land along its western side. To the eastward of this elevated belt are vast lowland plains, stretching over the central regions of the interior. The slope of the whole continent is to the eastward, as the courses of the great rivers show. The Section along the upper portion of the Map illustrates this.

The Andes are the typical mountain-region of the New World, as the Himalaya are of the eastern half of the globe. The comparative heights of their principal summits are well illustrated in the Section given below the Map. Aconcagua, the loftiest of the Chilian Andes, is generally regarded as the culminating point of the entire system, but the mountain known as Lirima, within the Bolivian Andes (S. lat. 19° 47′) has been conjectured to reach a greater height.* The passes over the Andes rival those of the Himalaya in altitude, and the plateaus which are enclosed between the successive cordilleras nearly equal in height the table-lands of Asia, though inferior to them in superficial extent.

X.

MAP ILLUSTRATING THE CLIMATES OF DIFFERENT REGIONS, WITH THE PRINCIPAL HYDROGRAPHIC BASINS OF EITHER CONTINENT.

The subjects illustrated by this Map are discussed in Chapters VII., IX., and X., "Class-Book of Physical Geography." They include an extensive variety of topics, too comprehensive to be properly understood without careful and detailed study. Such merely technical explanation as is necessary to an understanding of the symbols used in the Map is supplied on the plate itself.

Valuable deductions, in reference to the climate of particular regions, and their resultant capabilities,

* See "Class-Book of Physical Geography," Chap. v.

may be obtained from study of the smaller appended Maps, which exhibit (on a scale necessarily small, but yet sufficient for the general purposes of the learner) the courses taken by lines of mean equal yearly temperature drawn round the globe, and of similar lines marking the respective temperature of the seasons of summer and winter. Such lines are known as isothermal—that is, of *equal heat.** It is at once obvious that none of these lines coincide in direction with parallels of latitude, nor does the direction of the mean summer and winter lines correspond, either the one with the other, or with that of the lines representing the distribution of mean *yearly* temperature. These differences, as elsewhere explained, result from the irregular conformation of land and sea, and their inequality of distribution over the surface of the globe.

The western shores of the Old World, within the limits of the temperate zone—that is, the countries of Western Europe, possess conditions of climate most favourable to man. They have a higher temperature, upon the average of the whole year, than other regions at correspondent distances from the equator; and at the same time they enjoy summers of moderate heat and winters of moderate cold. The opposite shores of the Atlantic exhibit the most contrasted conditions in these regards. The lines drawn on our plate illustrate these truths. Compare, for example, Labrador with Norway, upon each of the three appended Maps. There are 20° in difference of latitude between the extremities of the two countries; but the mean yearly isotherm of 32°, (the freezing point of Fahrenheit,) which crosses Labrador, passes also the North Cape of Europe. The line which marks a summer temperature of 50° takes almost the same course. The contrast between the two countries is greatest in the case of the winter season. The winter of Labrador (and even of Lower Canada) is actually colder than that of the North Cape, for the line of 14° temperature, which passes just to the south of the former, ranges far to the northward of the highest point of Scandinavia. Conditions of like contrast (and perhaps to nearly as great an extent) are exhibited in the case of the opposite shores of the Pacific Ocean, between the western coasts of North America on the one side, and the eastern extremity of Asia on the other. The student will realise many such points of difference for himself, by study of the Map, and in doing so will learn a lesson of high value in physical geography.

XI.

1. MAP OF THE WORLD, SHOWING CO-TIDAL LINES.

2. MAP SHOWING CURVES OF EQUAL MAGNETIC VARIATION, FOR 1858.

1. By a co-tidal line is meant a line connecting places which experience high water, at new and full moon, at the same hour. A series of such lines, drawn upon a chart of the World, illustrate the advance of the tidal wave, as it successively brings high water to different portions of coast.

Owing to conditions which are explained elsewhere,† the Southern Ocean is the region in which the great tidal wave, which passes entirely round the globe twice within every twenty-four hours, is generated, and whence, travelling onward, it reaches in succession the other oceans and seas. The conformation of land and sea, at their line of junction, the various depths of the ocean's bed, and other conditions, (many of them but obscurely known,) affect its rate of progress, and either retard or accelerate its course. Hence the difference between the intervals which separate the hour-lines, observable at a glance upon the chart. These intervals are greater in the open portions of the ocean, and smaller in the narrow seas: in the case of the former, where no obstacle impedes the advance of the tidal wave, it passes with comparative rapidity over large spaces of sea, and along extensive lines of coast. In the narrow channels and partially land-locked estuaries or bays, the same wave is retarded both by lateral obstacles and diminished depth, and places that are only at trifling distances apart yet experience considerable difference in the respective times of high and low water. The tidal wave thus passes from the coast of Tasmania to the neighbourhood of the Cape of Good Hope, and again from the latter to the shores of Portugal, in the same interval of time that it takes (in a further stage of its course) to get thence to the head of the English Channel. Again, as the Map shows, the tidal wave divides, as it meets the shores of Britain, into two great branches, one of which flows up the English Channel, while the other, passing round the western side of Ireland and the western and northern shores of Scotland, afterwards travels down the east coast of Britain, and, off the estuary of the Thames, meets the advancing portion of a *later* wave, which, travelling up the Channel, has reached the same point by a shorter route. In a part of the German Ocean, towards its eastern side, and under the same parallels as the coast of Jutland, there is no perceptible tide, owing to the way in which the opposing streams, coming from different directions, neutralise one another. Elsewhere, the height of the tidal wave is either increased or diminished, by analogous causes. This explains the extremely small tides which occur upon the northern portion of the Dutch shores and the adjoining coast of Jutland. There are numerous similar anomalies, which can only be explained by careful observation of the precise local conditions.

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2. The entire subject of terrestrial magnetism is a difficult, and in some respects an obscure one. The polarity of the magnet has been known to the Chinese, and probably to other Oriental nations, from early

* Lines of equal mean summer temperature are distinguished by the term *isotheral*, and those of mean winter temperature as *isochimenal*. See "Class-Book," p. 150.

† "Class-Book of Physical Geography," p. 105.

antiquity, but the use of the magnetic needle in navigation was not introduced into Europe earlier than the thirteenth century. Columbus, in the course of the memorable voyage which resulted in the discovery of the New World (1492) was perhaps the first to observe *the declination of the needle*, that is, its deflection from the true north. The amount of this deflection, at any particular time and place, is a subject of the highest importance as a problem of practical navigation.

The present chart (reduced from one officially published by the British Admiralty) shows two curved lines—one crossing the Eastern, the other the Western half of the globe—along which the magnetic needle exhibits no deflection from a due north and south direction. There is, besides, another similar line, of oval shape when projected on the Map, and encircling a portion of Eastern Asia. These are called Lines of No Variation.

The two principal Lines of No Variation shown on the chart are obviously but the opposite sides of one great circular line passing round the globe, and forming a Magnetic Meridian. There are two places on this line—one in the northern and the other in the southern hemisphere—towards which the extremities of the needle, in whatever part of the globe, are always directed. These are known as the Magnetic Poles. The place of the North Magnetic Pole (in about lat. 70°, and nearly under the meridian of 94° W., that is, adjoining the Arctic shores of America) is shown on our map. The South Magnetic Pole, the place of which does not fall within its limits, is in a nearly correspondent latitude of the southern hemisphere, under the meridian of 150° east (nearly due south from Tasmania.) The needle always points to these poles; hence the amount of deflection from the true meridian (which is a line joining the opposite extremities of the earth's axis) continually increases with every successive degree of departure from the place of the *magnetic* meridian, or line of no variation. Upon one side of either of the lines shown on the chart the deflection of the needle is to the westward, and upon the other side to the eastward, of the true north. In passing *round* the place of either magnetic pole, the needle would make a complete circle (its north or south point, as the case might be, remaining constantly directed towards its own pole), so that the direction of its extremities, with reference to the true north and south, would become actually reversed. That is (taking the northern magnetic pole as an example), the amount of deflection, or variation, would keep on increasing until it arrived at 180°, and when at that precise amount the North end of the needle would point due south, and the reverse.

The Lines of No Variation are not fixed. They oscillate to and fro over the earth's surface, and, with their movement, the amount of deflection or variation at any given place undergoes continual change. In 1660, one of the lines of No Variation passed through London, the needle in that year pointing, at London, due north. It then commenced a deflection to the west of north, the amount of this deflection increasing until it attained, in 1818, a maximum of 24·3°. Since that time, it has been slowly returning to the eastward. In 1858, (the date represented by the chart), the variation at London was nearly 22° west.

XII.

MAP ILLUSTRATING THE DISTRIBUTION OF VEGETABLE LIFE IN DIFFERENT REGIONS, AND AS AFFECTED BY CONDITIONS OF CLIMATE.

Each region of the earth is the seat of particular forms of vegetable life. In other words, every country (and even every district of any considerable extent) has its own particular *flora*. Thus, the Old World is the native region of rice and wheat, of the date-palm, the tea-plant, and the coffee-shrub, of cinnamon and nutmeg; the New World, of maize, cocoa, the cassava plant, of the potato, and of tobacco. But climate influences in a material degree the distribution of plants, and the zones of temperature which succeed one another from the equator towards either pole are marked by correspondent differences in the forms of vegetable life. Thus, palms and bananas flourish only within or near the tropics, while only herbaceous plants, mosses, and lichens, grow in the neighbourhood of the polar circle.

In the present Map, the surface of the earth is divided into zones of vegetable life, to each of which is given a name derived from that of some distinguishing characteristic in such regards. Thus, Palms and Bananas are succeeded, on either side, by a zone of Evergreen foliage; to that succeeds a belt of Deciduous vegetation, followed by a zone of trees belonging to the Coniferous order, and (yet further distant from the equator) by a zone of Mosses and Lichens. This division, adopted with the purpose of placing before the student a broad and summary generalisation, capable of being easily retained in the memory, might of course be expanded into one of greater minuteness, in which the number of such belts would be increased. Thus, either half of the earth is sometimes divided, for such purposes, into a Tropical, a Sub-tropical, a Warm Temperate, a Cold Temperate, a Sub-arctic, an Arctic, and a Polar zone, to each of which may of course be assigned its characteristic (and, in a certain measure distinctive) class of vegetable life. But the less minute division here adopted appears to have preferable advantages.

The Map is sufficiently explanatory in itself, and requires little comment. The divisions between the various zones, it will be observed, are not marked by parallels of latitude, but by lines of equal temperature—for the most part by *isotheres*, or lines of mean equal summer heat.* The learner will guard against

* The lines which divide the Zone of Palms and Bananas from those of Evergreen Foliage are *isotherms* (or lines of mean yearly heat), because within or near the tropics the distinctions of summer and winter are unknown. The dividing lines

the impression that lines so definite as those drawn on the Map have any place in nature. The typical forms of one region pass into the regions which adjoin it on either side, and are only gradually succeeded by other forms, with which they at first intermingle. Each zone, in reality, *overlaps* its adjoining zones, while the distinctive character of each is yet sufficiently marked. It is thus throughout the world of nature, which everywhere avoids abrupt transitions.

XIII.

1. THE GEOGRAPHICAL DISTRIBUTION AND CULTIVATION OF PLANTS, EMBRACING HUMBOLDT'S AND SCHOUW'S SYSTEMS.

2. THE GEOGRAPHICAL DISTRIBUTION AND CULTIVATION OF ALL THE IMPORTANT PLANTS USED AS FOOD FOR MAN.

The two Maps which are included on this plate form important supplements to the preceding Map. Such explanation as their use requires is furnished on the plates themselves. A botanical region, it will be observed, differs widely from a zone of vegetable life. Each genus of plants (perhaps each species), originally confined to a particular district, often of exceedingly limited extent, has by natural agencies become spread over a wider region—still, however, limited by well-marked conditions, dependent on soil and climate. Schouw divides the surface of the globe into twenty-six botanical regions, the names of which are derived from their characteristic forms of vegetable life. In popular language, one part of the world is the Region of Spices, another of Heaths, a third of Pines, a fourth of Eucalypti, and so on. Not a single heath is found in the New World, though plants of that family are numerously spread over a large area of the eastern hemisphere. A large area of the globe, indicated in the present Map as the Region of Wastes, Steppes, and Deserts, has a peculiar vegetation, limited to certain grasses, with thorny shrubs and other plants of such a description.

The agencies most effective in extending the limits of particular botanical regions are—winds, rivers, ocean-currents, and tides, with the movements of birds and animals in general, and above all, the migrations of man. These are treated of at some length in Chapter XIII. of the "Class-Book of Physical Geography." It is mainly by the last of these—the migrations of man from one region of the globe to another—that the principal food-plants have in the present day become distributed over the globe in the way shown in the lower of the two Maps now under notice.

XIV.

ILLUSTRATIONS OF THE PERPENDICULAR GROWTH OF PLANTS, IN THE TORRID, TEMPERATE, AND FRIGID ZONES.

The figures given on this plate are highly instructive, as well as interesting, and deserve careful study. They illustrate the way in which, in every zone, (and in every country) successive ascent above the sea-level affects the growth of plants. The student may advantageously compare the plate with what is said elsewhere on this subject.*

XV.

ZOOLOGICAL MAP, ILLUSTRATING THE GEOGRAPHICAL DISTRIBUTION OF MAMMALIA.

Notwithstanding their powers of locomotion, animals, equally with plants, are limited to particular regions, in so far at least as natural distribution is concerned. In other words, each region of the earth has its own proper *fauna*, as well as its *flora*. The present Map illustrates this truth, in so far as a few of the members of the important class *Mammalia* are concerned. Fuller illustration will be found in Chapter XIV. of the "Class-Book of Physical Geography," which the student will read with increased advantage by aid of this and the two succeeding plates.

A Map of the World showing simply the distribution of land and water forms a not unimportant commentary upon the diversities of animal life, as exhibited in the case of different regions. Geographical proximity has undoubtedly favoured the passage of various animals from one region to another; and in cases

between the other zones are *isotheres*, or lines of mean summer heat, because within temperate and higher latitudes it is the temperature of summer, rather than the average temperature of the year, which regulates capability of vegetable growth.

* "Class-Book of Physical Geography," Chapter x., p. 134–6, and Chapter xiii., p. 201.

where identity of species occurs in countries that are far removed from one another, the successive stages of transit can be often traced without difficulty. The lands that lie under the Arctic Circle are continuous, excepting in the case of Behring Strait, and the comparatively limited breadth of ocean dividing Scandinavia from Iceland, and that island from the shores of the New World. Even these partial interruptions to continuity of land are to some extent periodically bridged over by ice. This conformation explains the fact of identity of species in the case of so many of the animals native to high latitudes of either hemisphere. The southernmost extremities of either continent, which are separated by the widest intervals from one another, supply in their zoology the most striking instances of dissimilarity—not merely of species, but even of genera. We can readily understand, for example, why the white bear of the Arctic regions should range over the higher latitudes alike of Europe, Asia, and America. But the animal life of the further extremes of the South American and African continents has nothing in common. Still less has the zoology of Australia—an island-continent—any points of identity with that of other regions.

Extensive deserts, not less than large bodies of intervening water, constitute a barrier to the passage of animals, unassisted by human agency. The African wilderness limits to the northward the range of the elephant, the rhinoceros, the giraffe, the zebra, and other denizens of the plains of Southern Africa. A full exposition of such truths, however, would involve an amount of detail foreign to the purpose of a work like the present, which seeks to illustrate only the fundamental truths of a subject ranging over the whole field of natural zoology.

XVI.

ILLUSTRATIONS OF THE PERPENDICULAR DISTRIBUTION OF ANIMALS, IN THE TORRID, TEMPERATE, AND FRIGID ZONES.

This plate, like that similarly devoted to the growth of *plants* in regions of successive ascent above the sea, forms an instructive commentary on the Zoological Map of the World, and will be found full of combined instruction and interest to the student. The forms of nature are infinitely varied, in the animate and inanimate worlds alike, and more attractively so in the case of the former than in that of the latter. A few minutes only of thoughtful attention devoted to this plate, conjointly with those by which it is immediately preceded and followed, would surely suffice to relieve geography from the imputation of dryness, sometimes ignorantly made.

Quadrupeds attain their greatest elevation on the plateaus and mountain-slopes of Asia, where flocks and herds are pastured, on the sides of the Himalaya, at an elevation of 18,000 feet. The birds proper to mountain-regions attain in their flight a still greater altitude. The condor of the Andes—the largest of birds—has been seen winging its way through the air at the height of at least 24,000 feet, apparently without experiencing any difficulty from the rarity of the atmosphere at such elevations. Birds of prey occupy the most elevated positions—the falcon tribe being commonly met with at 15,000 feet above the sea: among quadrupeds, the bear has been met with at 16,000 feet, the puma at 11,000, and the royal tiger at 9500 feet. Reptiles are not usually found at any considerable elevation. The *axototl* of Mexico, an amphibious reptile of the batrachian kind, about eight or nine inches in length, (fig. 27, in the diagram to the left of the plate) is met with, however, at the height of 8500 feet.

XVII.

ZOOLOGICAL MAP, ILLUSTRATING THE GEOGRAPHICAL DISTRIBUTION OF BIRDS AND REPTILES.

More than six thousand species of birds are known to the naturalist, Europe and tropical America being richer in respect of them than any other regions. A very few only among the members of this numerous class of the animal kingdom are selected for illustration in the present Map, which yet, however, brings out some prominent and well-defined truths.

The influences of man on the geographical distribution of animal life, as it exists in the present day, have been equally great in the case of Birds as in that of the Mammalia. Our domestic poultry have been derived from other quarters of the globe, and the song-birds of Europe are now in course of introduction into the Australian woodlands. With Reptiles, on the contrary, the natural habitations remain in great measure unchanged. Many of these creatures, obnoxious to man, are little interfered with by him, except in those cases where the instincts of self-preservation, and the usages of civilised life, prompt their destruction. The range of particular species of the Reptile kingdom is, for the most part, comparatively limited. Reptiles reach their maximum size within the tropics, as the huge boa constrictor of the South American swamps, and the pythons of the East Indies and tropical Africa, instance. Their numerical development is greatest within the same regions. Towards higher latitudes, their numbers undergo rapid diminution, and they scarcely pass the line of the northern polar circle. The species of the Old and New Worlds are in every instance distinct, as again are those that are native to the Australian continent and adjacent islands.

XVIII.

MAP SHOWING THE DISTRIBUTION OF MANKIND, ACCORDING TO THE AMOUNT AND COMPARATIVE DENSITY OF POPULATION IN DIFFERENT LANDS.

The earth is inhabited by above eleven hundred millions of human beings. Some remarks upon their geographical distribution, with reference to the popular division according to race, are made elsewhere.* It is the chief object of this Map to show the comparative numerical population of various countries in the present day. A Tabular Summary of the result is appended to the Map, and forms an instructive theme of study, suggestive of many valuable reflections.

The preceding Maps of our series have sought to illustrate the capabilities of the various regions of the Earth, with reference to their natural advantages of position, soil, climate, and produce. But the present numerical distribution of mankind over the globe requires its explanation to be sought in history rather than in geography. Or we should perhaps say, it is necessary to study history and geography conjointly, in order to attain a full comprehension of it.

No portion of the American continent has, as yet, more than twenty inhabitants to the square mile—very few portions above half that number. Yet many of the regions that are now so scantily occupied by man are endowed with capabilities for the support of populations as dense as those which tenant the most civilised lands of the Old World. Again, the most populous among the settled provinces of Australia (the colony of Victoria) has a ratio of only five persons to the square mile. The island of Tasmania has only three, New South Wales only one, and New Zealand the same. The Cape Colony, with its almost boundless expanse of pasture, is at present as scantily occupied by man. Contrast such instances as these with the cases of India, China, Italy, France, England, the Netherlands, and the difference is indeed great.

Many extensive portions of the earth, owing either to unfavourable conditions of position, natural sterility, or analogous causes, must always remain thinly possessed by man. Siberia, the plains of Mongolia and Turkestan, the African and Arabian wildernesses, and the vast expanse of territory which adjoins the Arctic shores of the new world, are instances. The Sahara is parched by the scorching heat of a vertical sun, while Siberia and Arctic America suffer equally from extreme cold. Such countries as Norway and Sweden, or the greater part of European Russia, again, can never become populous, any more than the Highlands of Scotland or the rocky coasts and islands of Greece. But many parts of Western Asia exhibit instances of lands gone to decay, and tracts now comparatively desolate bear evidence of former population, wealth, and industry.

Only eight among the national divisions of the Earth have populations exceeding the ratio of two hundred to the square mile; three of the eight, it may be noted, are islands. Only three countries, Belgium, China, and England, have a ratio of more than three hundred inhabitants per square mile. The Eastern Continent includes the lands of past achievements: the Continents of the West and the South are the regions of promise for mankind in the future.

XIX.

MAP ILLUSTRATING THE NATURAL PRODUCTIONS OF DIFFERENT LANDS, AND THE PRINCIPAL ROUTES OF MARITIME COMMERCE.

It is the aim of Physical Geography to show the various capabilities of the Earth, *regarded as the abode of man*, to describe its natural features, productions, and various phenomena. It is full of *human* interest, for every part of its extensive range of subjects has a direct bearing upon the pursuits and condition of mankind. The present Map aims at illustrating in some degree the connexion which obtains between the natural world and the social condition of mankind. The productions of distant lands, and the commercial intercourse which is maintained between their respective populations, are among the most important facts of every-day life, as well as among the truths and corollaries of physical geography.

This Map may be advantageously compared with Nos. 2 and 10 of the series, for the sake of studying the lines of route across the ocean (which constitute one of its prominent features) in connexion with the direction of currents and periodical winds, as delineated in the two preceding plates. It is an elementary truth in commercial navigation, that the course of a vessel through the ocean has to be determined by other considerations than those of apparent distance on the chart. Again, the outward and homeward routes between the same points often necessitate the navigator's pursuit of widely different tracks. Why, for example, does the outward route from Britain to Canada and New England lie some degrees to the northward of the return route? The course of the Gulf Stream, delineated on plate 2, supplies the answer. Or why, in the outward route from England to the Cape of Good Hope, does the mariner cross the equator under a meridian lying so far to the westward, often making near approach to the South American coast, before he takes the eastwardly track which leads to his destined haven? The winds and currents of the Atlantic explain the seeming anomaly. The trade-wind of the northern hemisphere favours (and indeed

* "Class-Book of Physical Geography," Chap. xv.

compels) a considerable *westing* in the earlier half of his route, and, after crossing the line, it is necessary to stretch far to the south before the prevailing winds and currents which belong to the neighbourhood of the southern tropic favour a returning course towards the east.

The outward and homeward routes now generally taken by vessels engaged in the Australian trade have been determined by analogous considerations. Ships make the outward voyage to Melbourne or Sydney by way of the Cape of Good Hope, and return to Britain round Cape Horn, thus circumnavigating the globe, because in doing so they avail themselves of the prevailing currents—of the air and the ocean alike—which, in the temperate latitudes of the southern hemisphere, are directed eastward. It has been by careful attention to such conditions that, under guidance of the numerous observations brought together by Captain Maury, of the U. S. Navy, the passage between New York and San Francisco has been materially shortened in point of time.

The Tabular List of Seaports appended to the Map will be found useful, and also, it is believed, possessed of some interest. The facts which it brings together have not hitherto been presented in so compendious a form.

XX.

PHYSICAL MAP OF THE BRITISH ISLANDS.

This Map requires no commentary, and needs no explanation beyond that given on the plate itself. It is included in the present series for reasons which are sufficiently obvious. The geography of our own country requires to be studied in greater detail than is necessary in the case of other lands, and everything in the condition—social, industrial, and commercial—of the British nation is more or less directly dependent upon the physical aspect of the group of islands which are its home. The Map may be usefully compared with the brief description given in the "Class-Book of Modern Geography," under the head of "The British Islands," (page 31 *et seq.*)

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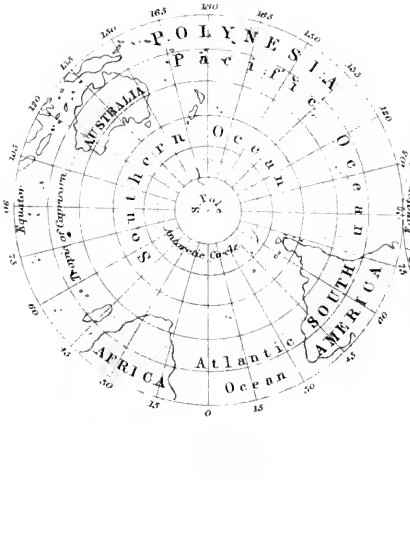

HIGHLANDS. OR

(New World)

Utah	*mean height*	5000 f.
Mexico		7000 .
Central America, Guatemala		3500 .
Quito	*Andes*	9000 .
Pasco	*do.*	11000 .
Titicaca	*do.*	13000.
El Despoblado	*do*	13000.
Interior Brazil		1500 .

(New World)

NORTH AMERICA

Mackenzie & Winnipeg basin	
Mississipi basin	*prairies*
Atlantic coast plain	

SOUTH AMERICA

Orinoco basin	*llanos*
Amazon basin	*selvas*
La Plata basin	*pampas*

E

Central S	
Bavaria	
Southern	

A

The Sahar	
Abyssiniz	
Southern	

LOWLA

E

Eastern p	
Hungary	
Wallachia	
Lombardy	
Languedo	
Bohemia	

A

Central Afr

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ATEAU REGIONS.

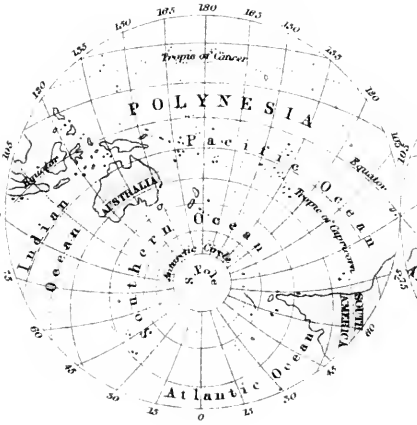
(Old World)

PE		ASIA	
	2000 f^t.	Tibet *mean height*	15,000 f^t.
	1600 .	Mongolia	3000 .
ay	1000 .	The Deccan	3000 .
		Afghanistan	6500 .
CA		Persia	3000 .
	1500 f^t.	Armenia	6000 .
	6000 .	Asia Minor	3000 .
or	3000 .	Arabia	3500 .

PLAINS

(Old World)

PE		ASIA	
Russia &c.		Euphrates basin	*Mesopotamia*
le Danube		Hindoostan	*Northern India*
ower Danube		North eastern China	
Italy		Siberia	
France		Turkestan	
e Elbe		Pegu	
CA		Siam	*Indo Chinese peninsula*
Niger & Chad		Tonquin	



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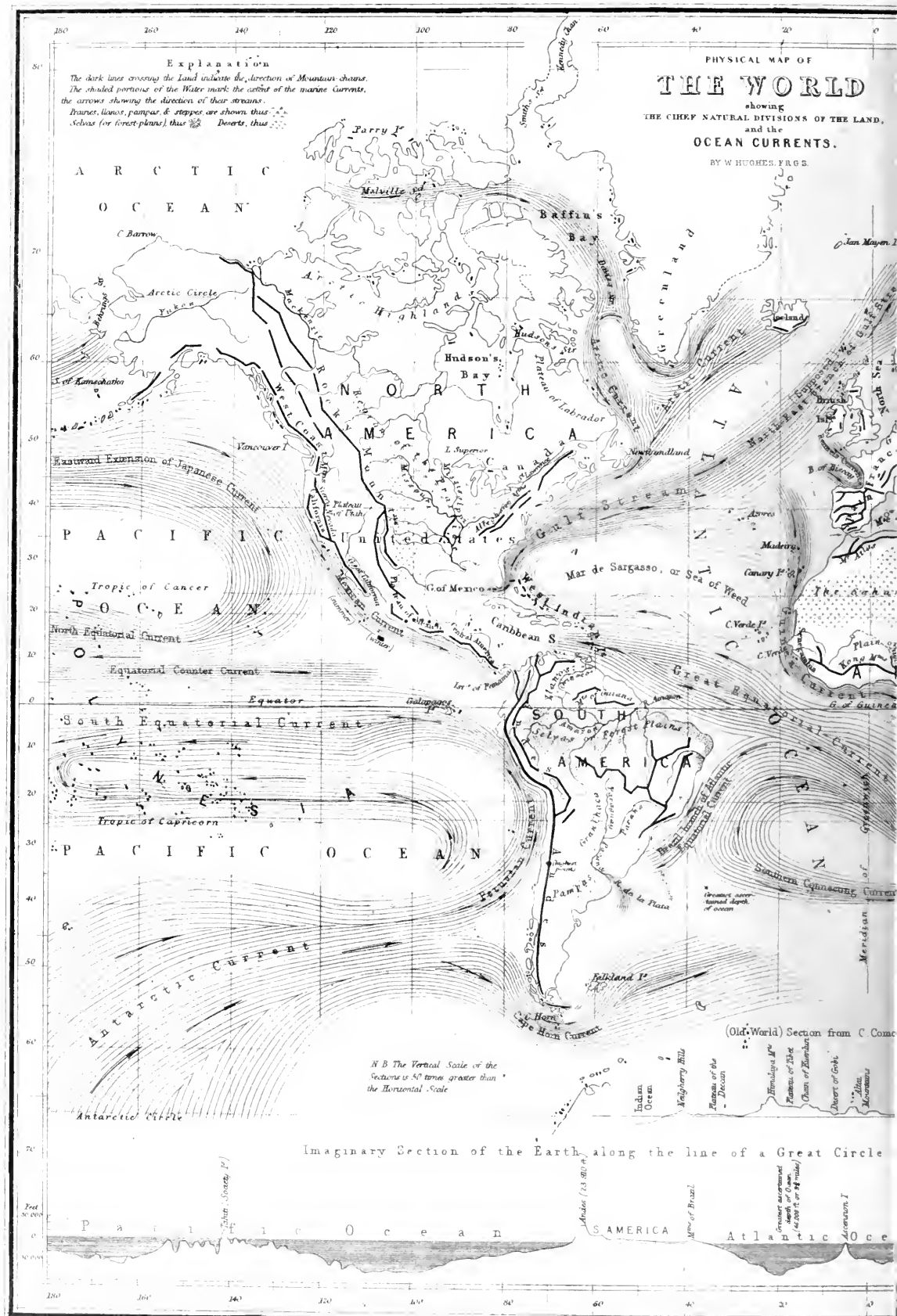

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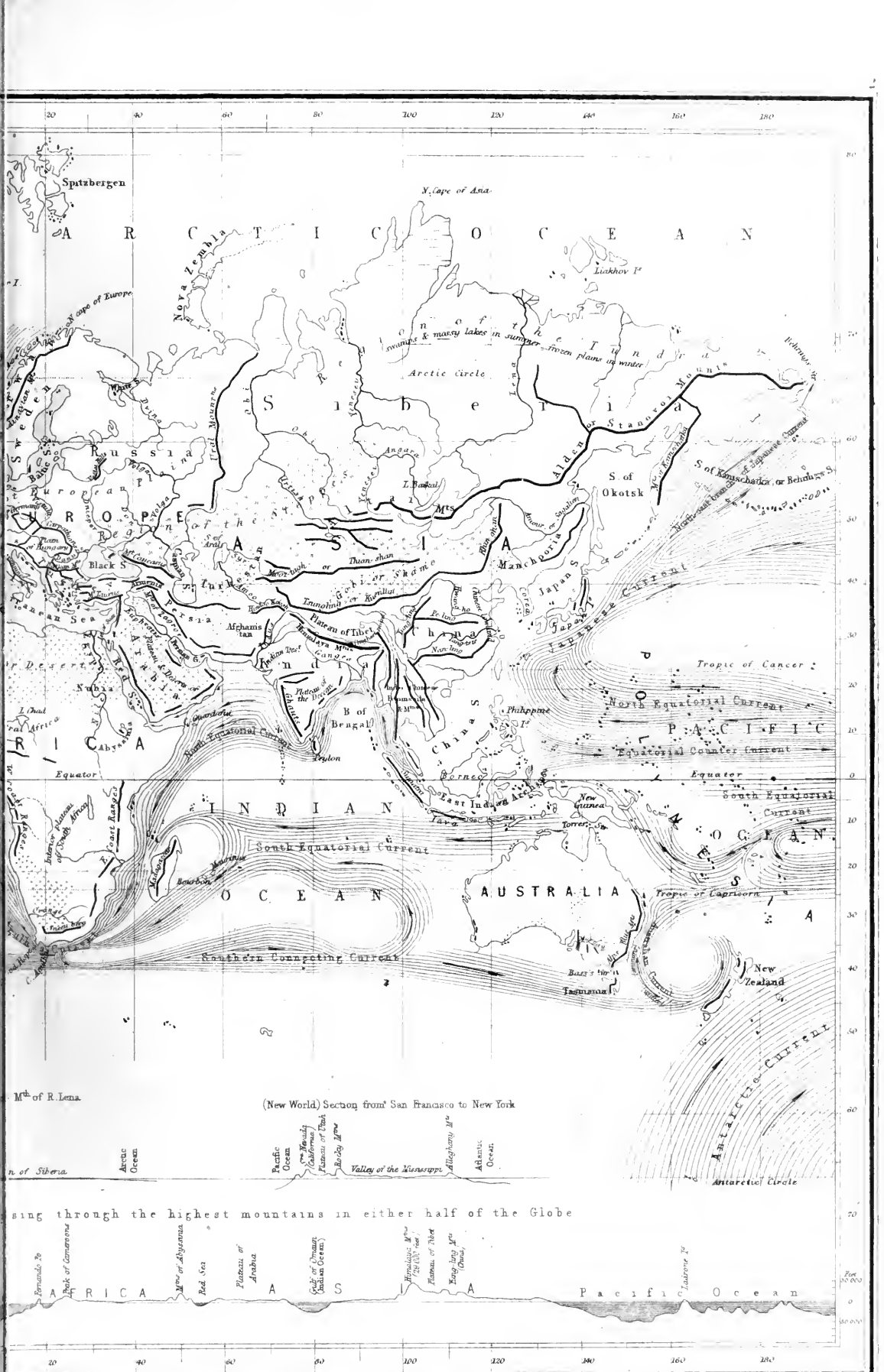

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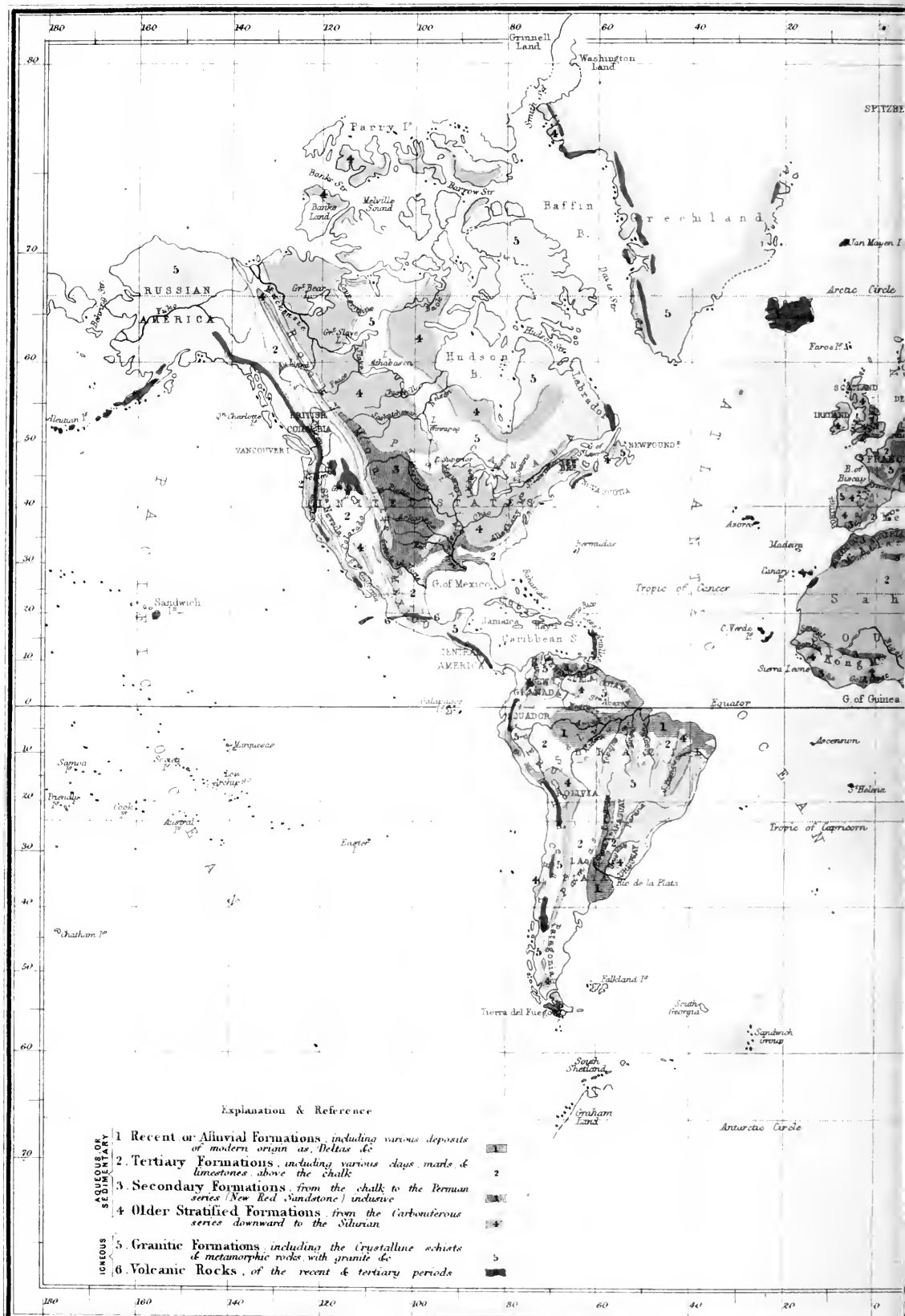
Explanation & Reference
AQUEOUS OR SEDIMENTARY
1 Recent or Alluvial Formations, including various deposits of modern origin as, Deltas &c
2. Tertiary Formations, including various clays, marls & limestones, above the chalk
3. Secondary Formations, from the chalk to the Permian series (New Red Sandstone) inclusive
4 Older Stratified Formations, from the Carboniferous series downward to the Silurian
IGNEOUS
5. Granitic Formations, including the Crystalline schists & metamorphic rocks with granite &c
6. Volcanic Rocks, of the recent & tertiary periods
Grinnell Land
Washington Land
Parry Is
Baffin B.
Grœnland
Melville Sound
Banks Land
RUSSIAN AMERICA
Hudson B.
Labrador
BRITISH COLUMBIA
VANCOUVER
NEWFOUNDL.
UNITED STATES
Bermudas
G. of Mexico
Caribbean S.
CENTRAL AMERICA
NEW GRANADA
ECUADOR
PERU
BOLIVIA
BRAZIL
Sandwich Is
Marquesas
Samoa
Low Archip.
Friendly Is
Cook Is
Austral Is
Eagle I.
Chatham Is
Falkland Is
Tierra del Fuego
South Georgia
Sandwich Group
South Shetland
Graham Land
Jan Mayen I
Faroe Is
SCOTLAND
IRELAND
Azores
Madeira
Canary Is
C. Verde Is
Sierra Leone
G. of Guinea
Equator
Ascension
St Helena
Tropic of Cancer
Tropic of Capricorn
Arctic Circle
Antarctic Circle
Rio de la Plata
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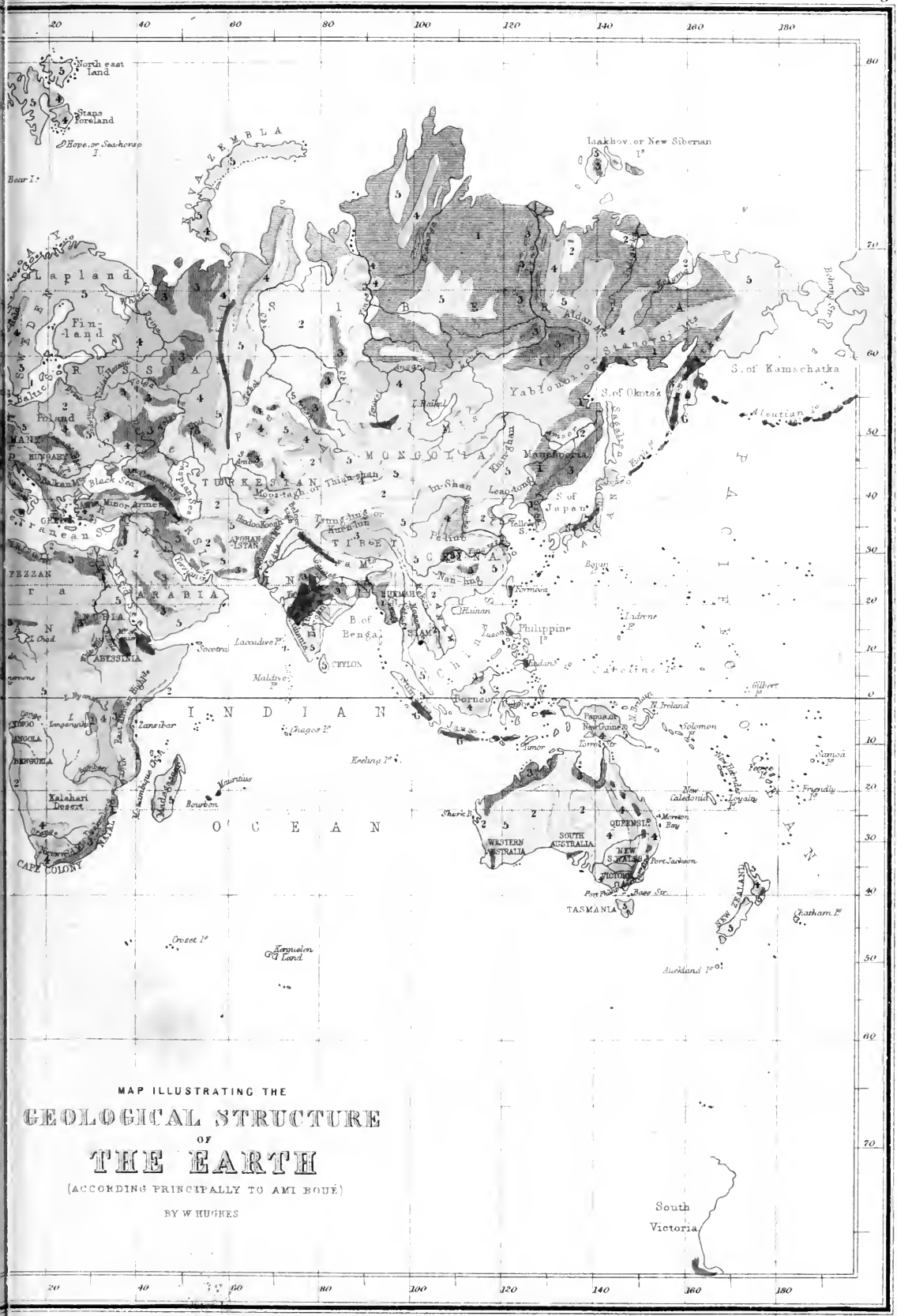

MAP ILLUSTRATING THE

GEOLOGICAL STRUCTURE OF THE EARTH

(ACCORDING PRINCIPALLY TO AMI BOUÉ)

BY W HUGHES

W. Hughes

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PHENOMENA of VOLCANIC ACTION,

shewing the REACTION of the INTERIOR of the

EARTH

upon its EXTERNAL SURFACE.

from von Buch, Hoffman, de Mayne, Lyell and Berghaus Atlas.

The Volcanic Series of this Region are nearly all Active, emitting either Smoke, Sulphureous Vapours, or Boiling Water.

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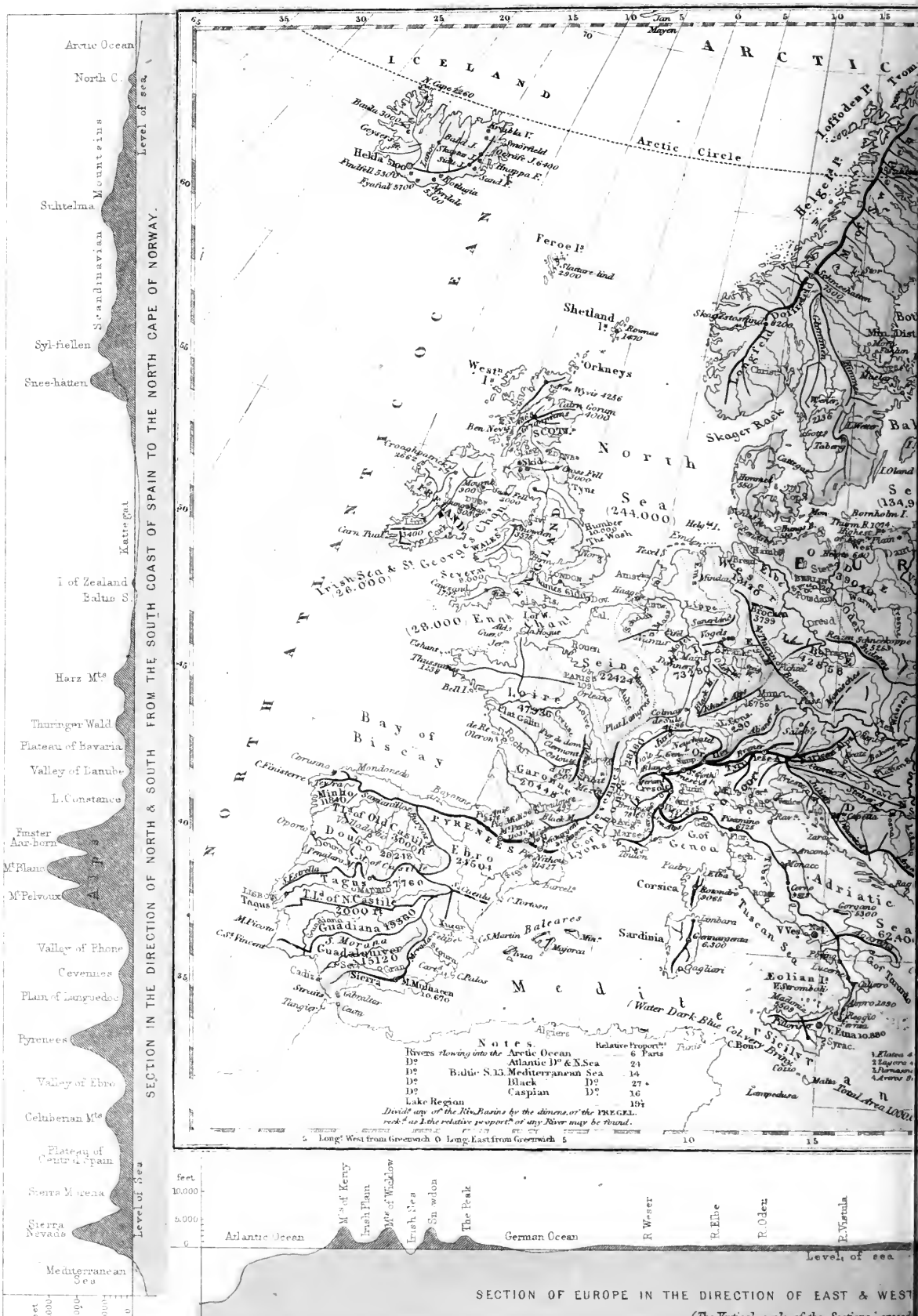

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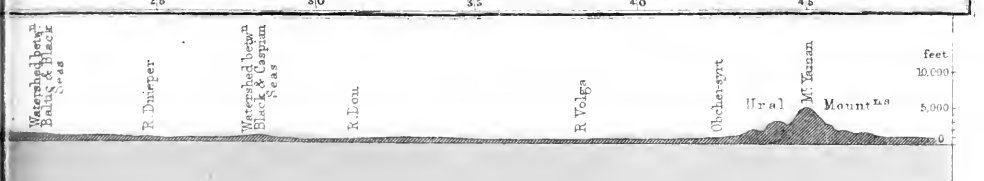
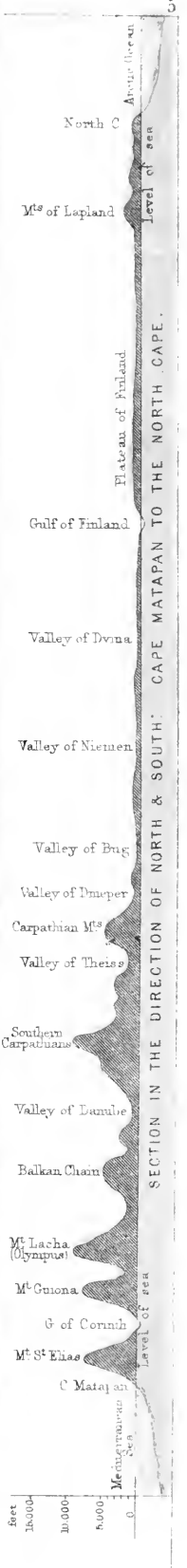
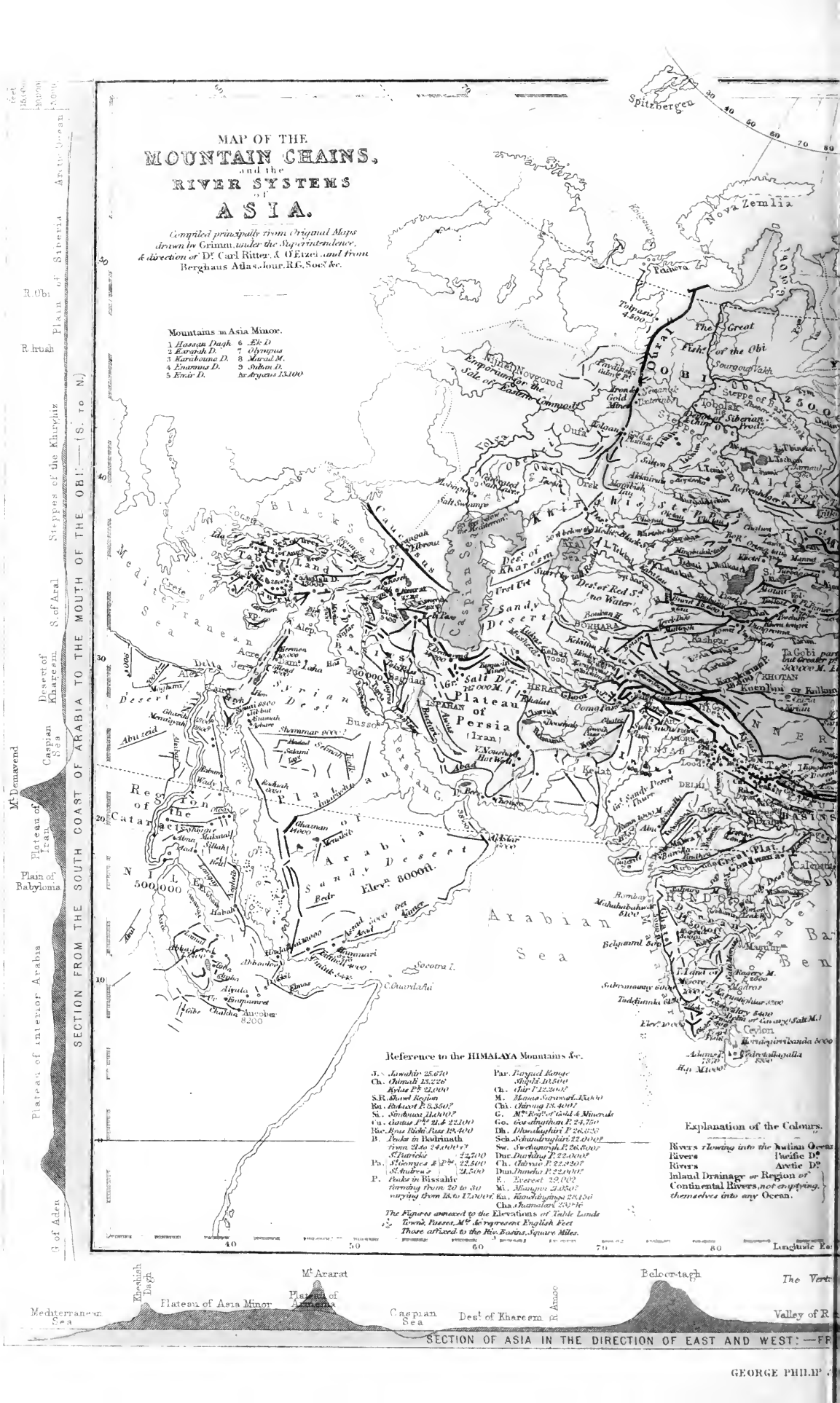


FROM THE WEST COAST OF IRELAND TO THE URAL MOUNTAINS.

Horizontal Scale in the ratio of about 70 to 1.)





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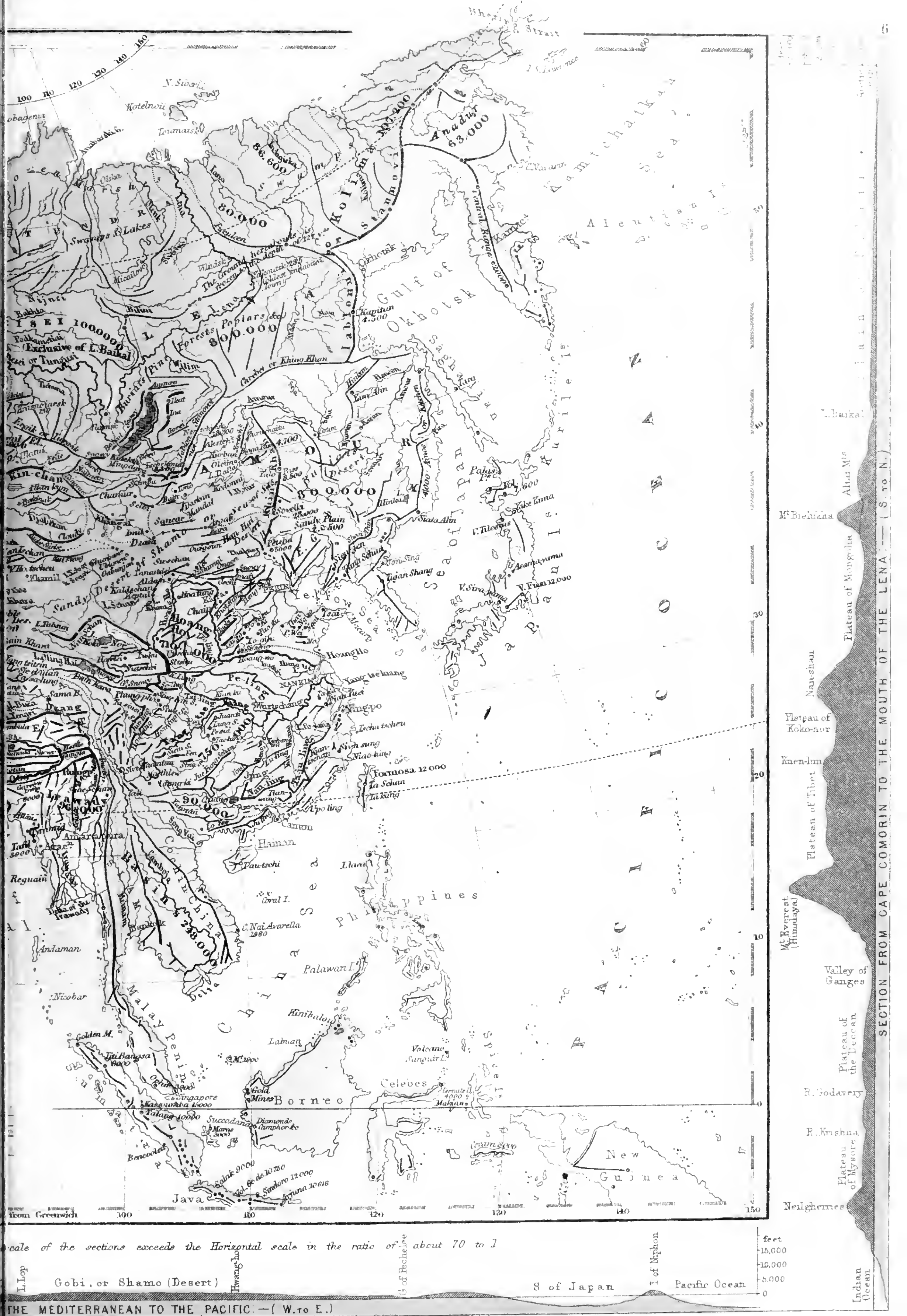

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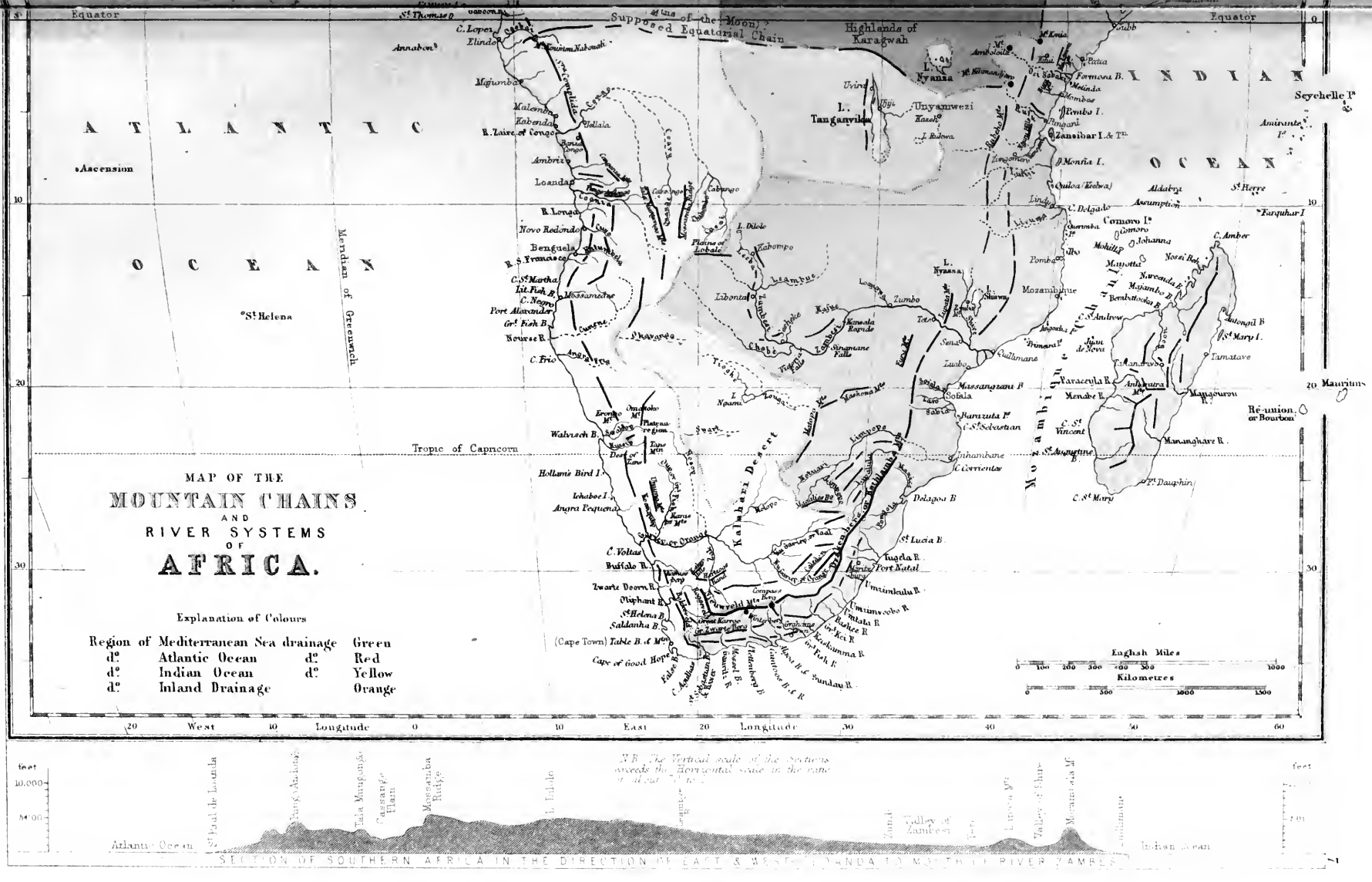
SECTION OF NORTHERN AFRICA IN THE DIRECTION OF EAST & WEST — CAPE VERDE TO THE GULF OF ADEN
feet
15,000
10,000
5,000
Atlantic Ocean
C. Verde
R. Senegal
R. Niger
Honhorn Mts
Mt Mendefy
L. Chad
White Nile
Blue Nile
Mts of Geesh
L. Dembea
Mts of Semien
L. Assal
G. of Aden
ATLANTIC
OCEAN
Portugal
Spain
Mediterranean Sea
Asia Minor
Greece
Sicily
Malta
Str. of Gibraltar
Tangier
Algiers
Oran
Tunis
Tripoli
Plateau of Barca
Plateau of the Hammada
Fezzan
Mourzook
Belad el-Jereed
Madeira
Porto Santo
Canary Is.
Grand Canary
C. Bojador
C. Blanco
Sahara or Desert
Timbuctoo
Walata
Wadan
Bilma
Agadez
L. Chad
Kong Range
Gold Coast
Ivory Coast
Sierra Leone
C. Verd
Bathurst
Senegal
Gambia
Bissagos Is.
Alexandria
Rosetta
Damietta
Delta
Cairo
Suez
Akaba
EGYPT
NUBIA
New Dongola
Old Dongola
Khartoom
El Obeid
Kobbe
Wara
ABYSSINIA
Red Sea
Mecca
Medina
Jiddah
Arabia
Tropic of Cancer
Persian G.
Mocha
Aden
Gulf of Aden
Socotra
C. Guardafui
Wady Nogal
Ras Awath
Ras Asooad
Shebeyli
Ganameh
Gondokoro
Bahr el-Abiad
Bahr el-Ghazal
Sobat
Hurrar
Ankobar
Mushahk I.
Fernando Po
Clarence Peak
Cameroon Mts
Abomey
Coomassie
Lagos
Abbeokuta
Kano
Yaoori
Boussa
Quorra or Niger
Jenneh
Sego
Hamda Allah
Tafilelt
Ain Salah
Ghadamis
Ghat
Aujilah
Sywah



N.B. The Vertical scale of the Sections exceeds the Horizontal scale in the ratio of about 1 to 1

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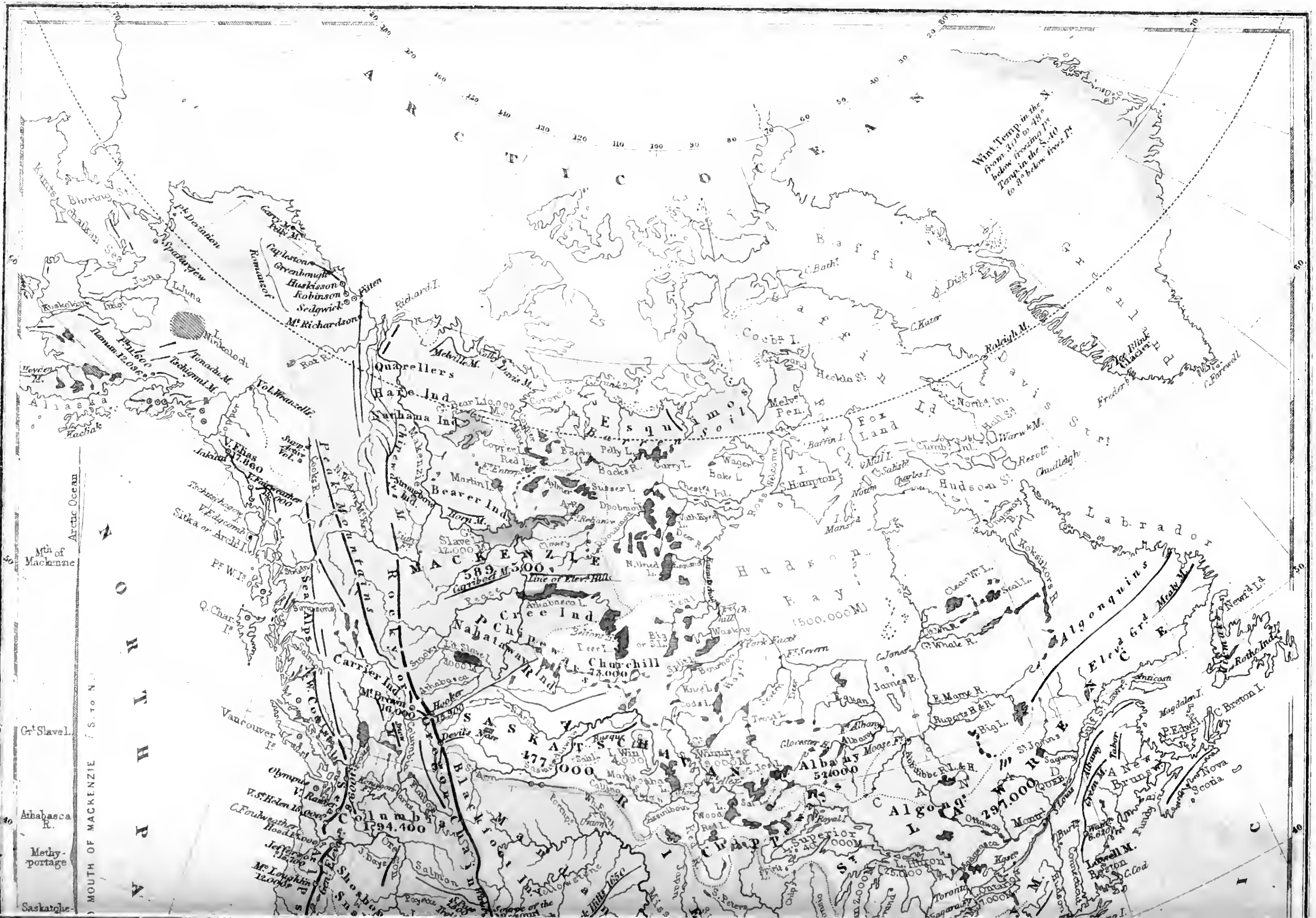
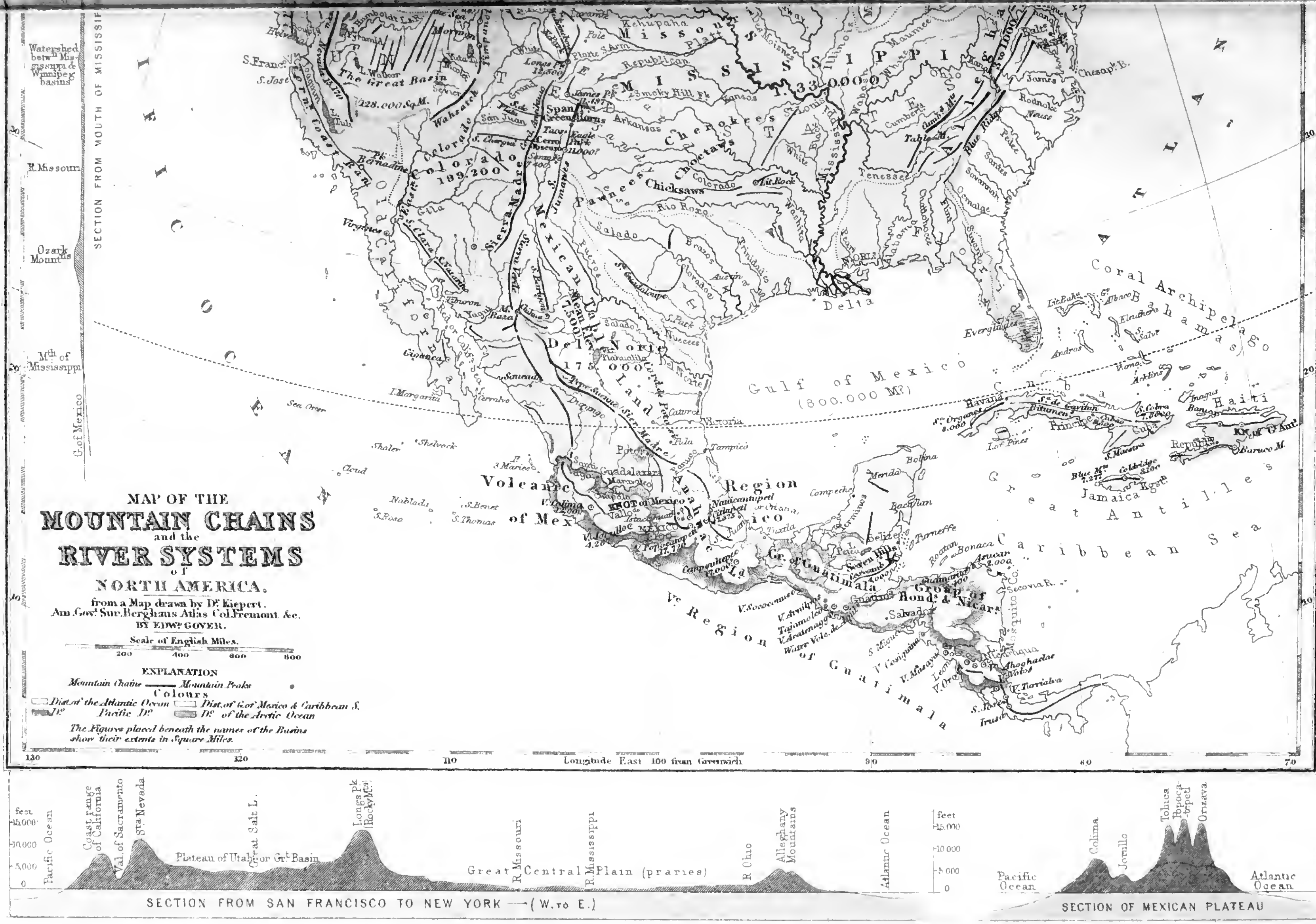
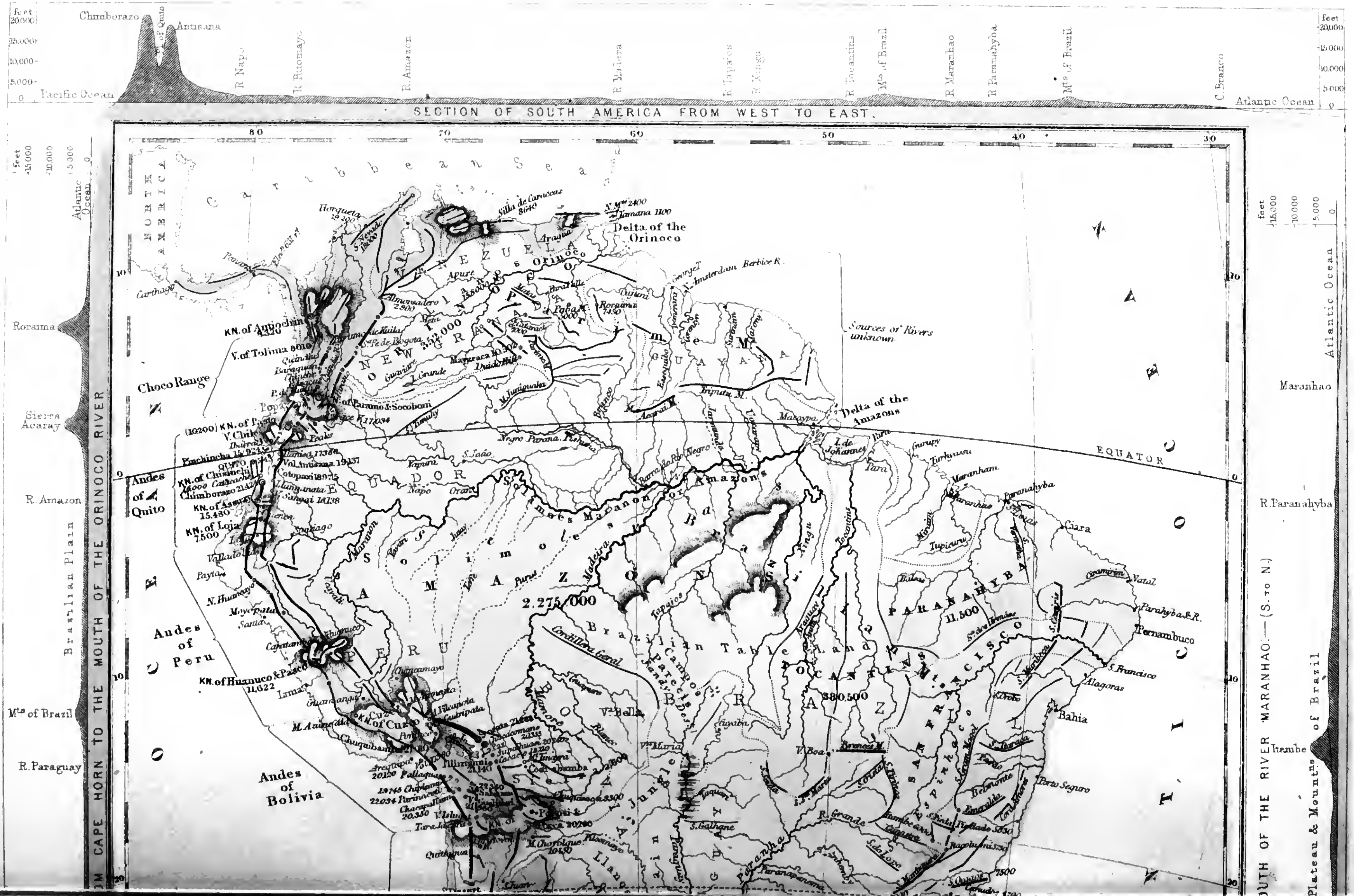
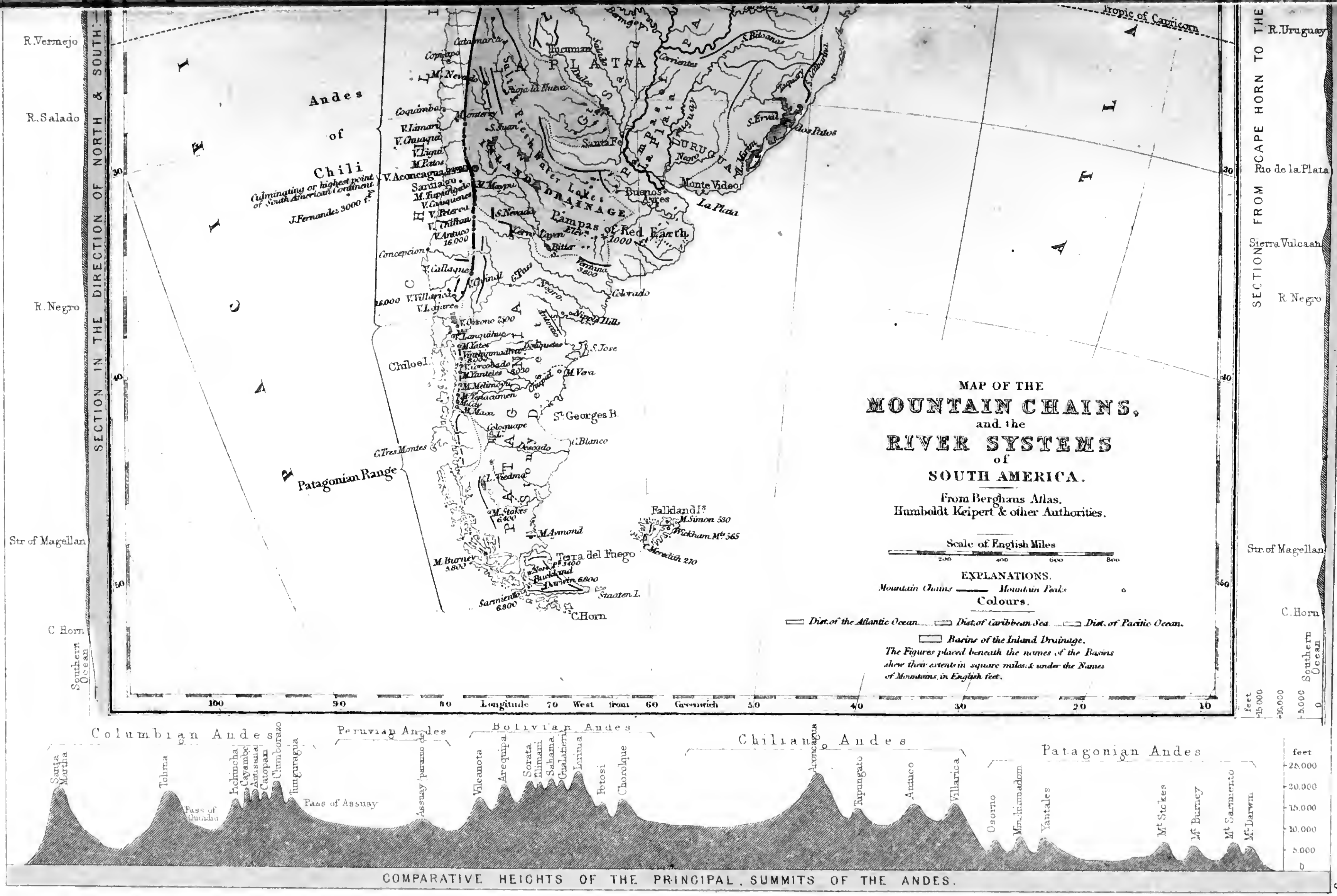

ARCTIC OCEAN
NORTH PA
Wint. Temp. in the N. from 31° to 48° below freezing pt. Temp. in the S. 10 to 8° below freez. pt.
Baffin Bay
Greenland
Davis Str.
Hudson St.
Hudson Bay (500.000 M.)
Labrador
Algonquins
Eleva. Grd.
MACKENZIE 589.500
Line of Elev. Hills
Cree Ind.
Chipewyans
Churchill
SASKATCHEWAN 477.000
Albany 52.000
Columbia 194.400
Peak Mountains
Rocky or Chippewyan Mts.
Quarellers
Hare Ind.
Beaver Ind.
Esquimos
Fox Land
Alaska
Mt. Richardson
V. Elias 17.860
V. Fairweather
Vancouver Is.
Sitka or Archd. I.
Q. Charlotte Is.
Arctic Ocean
Mth. of Mackenzie
Gt. Slave L.
Athabasca R.
Methy-portage
Saskatche-
MOUTH OF MACKENZIE (S. to N.)
Nova Scotia
C. Breton I.
Newfd. Ld.
Lake Superior
L. Huron
Ontario
Toronto
Boston
C. Cod

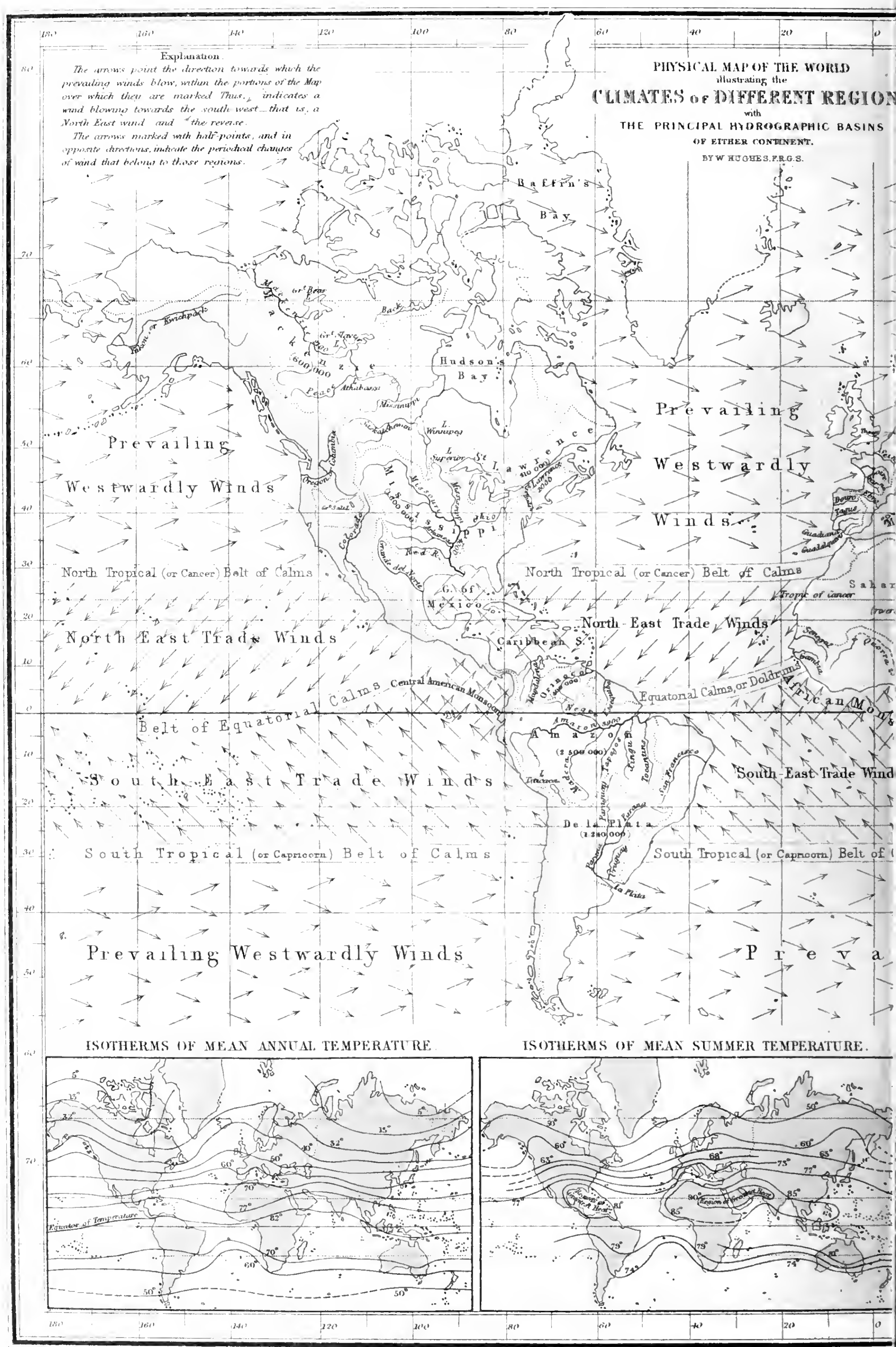


GEORGE PHILIP & SON, LONDON & LIVERPOOL.

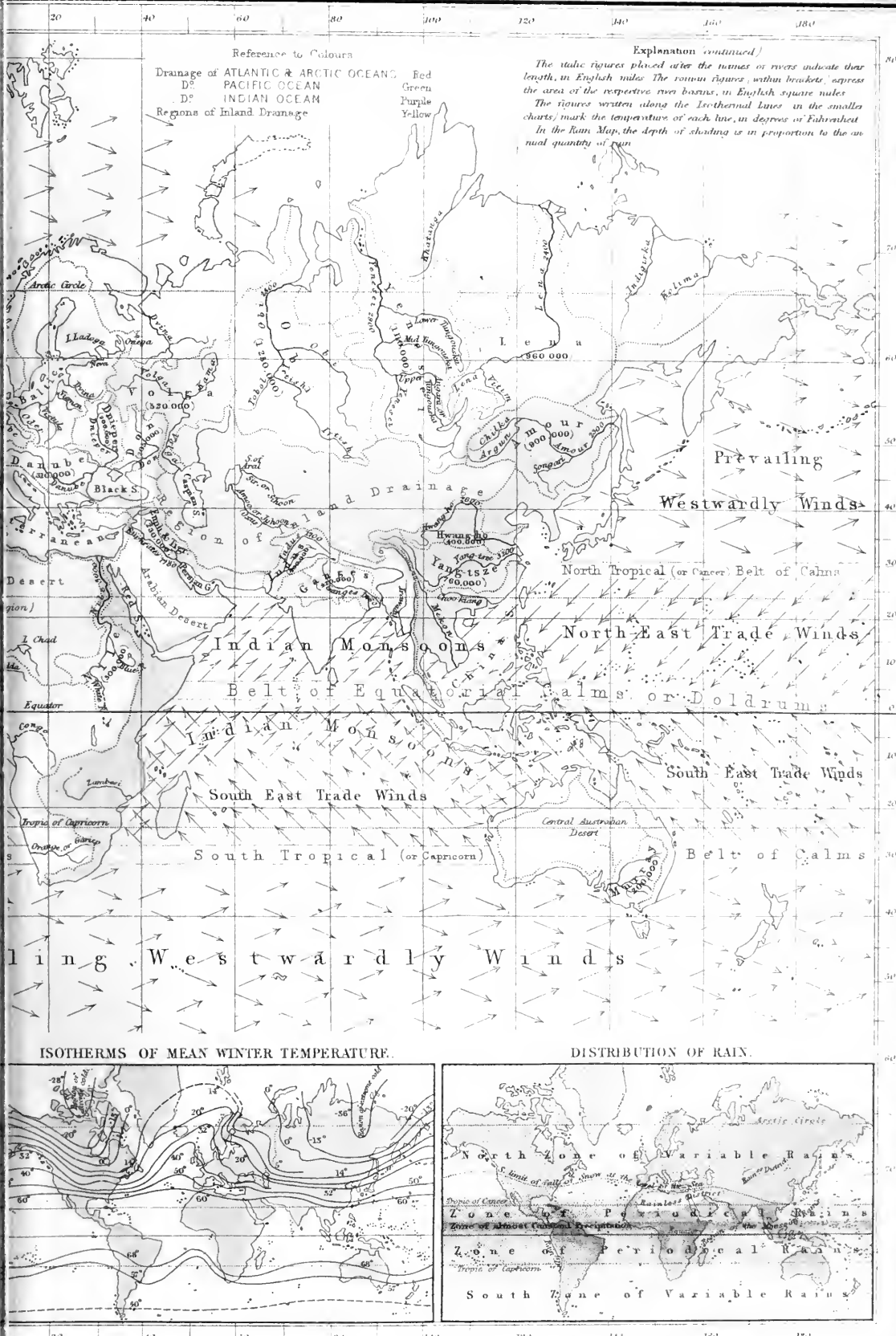

SECTION OF SOUTH AMERICA FROM WEST TO EAST.
Chimborazo
Antisana
Pacific Ocean
R. Napo
R. Putomayo
R. Amazon
R. Madera
R. Tapajos
R. Xingu
R. Tocantins
Mts of Brazil
R. Maranhao
R. Paranahyba
C. Branco
Atlantic Ocean
MOUTH OF THE ORINOCO RIVER
Roraima
Sierra Acaray
R. Amazon
Brazilian Plain
Mts of Brazil
R. Paraguay
MOUTH OF THE RIVER MARANHAO.—(S. to N.)
Maranhao
R. Paranahyba
Itembe
Plateau & Mountns of Brazil
Atlantic Ocean
NORTH AMERICA
Caribbean Sea
Delta of the Orinoco
Delta of the Amazons
Sources of Rivers unknown
EQUATOR
Choco Range
Andes of Quito
Andes of Peru
Andes of Bolivia
VENEZUELA
NEW GRANADA
GUAYANA
EQUADOR
PERU
BOLIVIA
Solimoes Maranon or Amazons
Brazilian Table Land
2.275.000
380.500
Campos Parecis
Ciara
Natal
Pernambuco
S. Francisco
Alagoas
Bahia
Porto Seguro
Lima
Cuzco
Chuquisaca
Potosi



GEORGE PHILIP & SON, LONDON & LIVERPOOL.



GEORGE PHILIP & SO

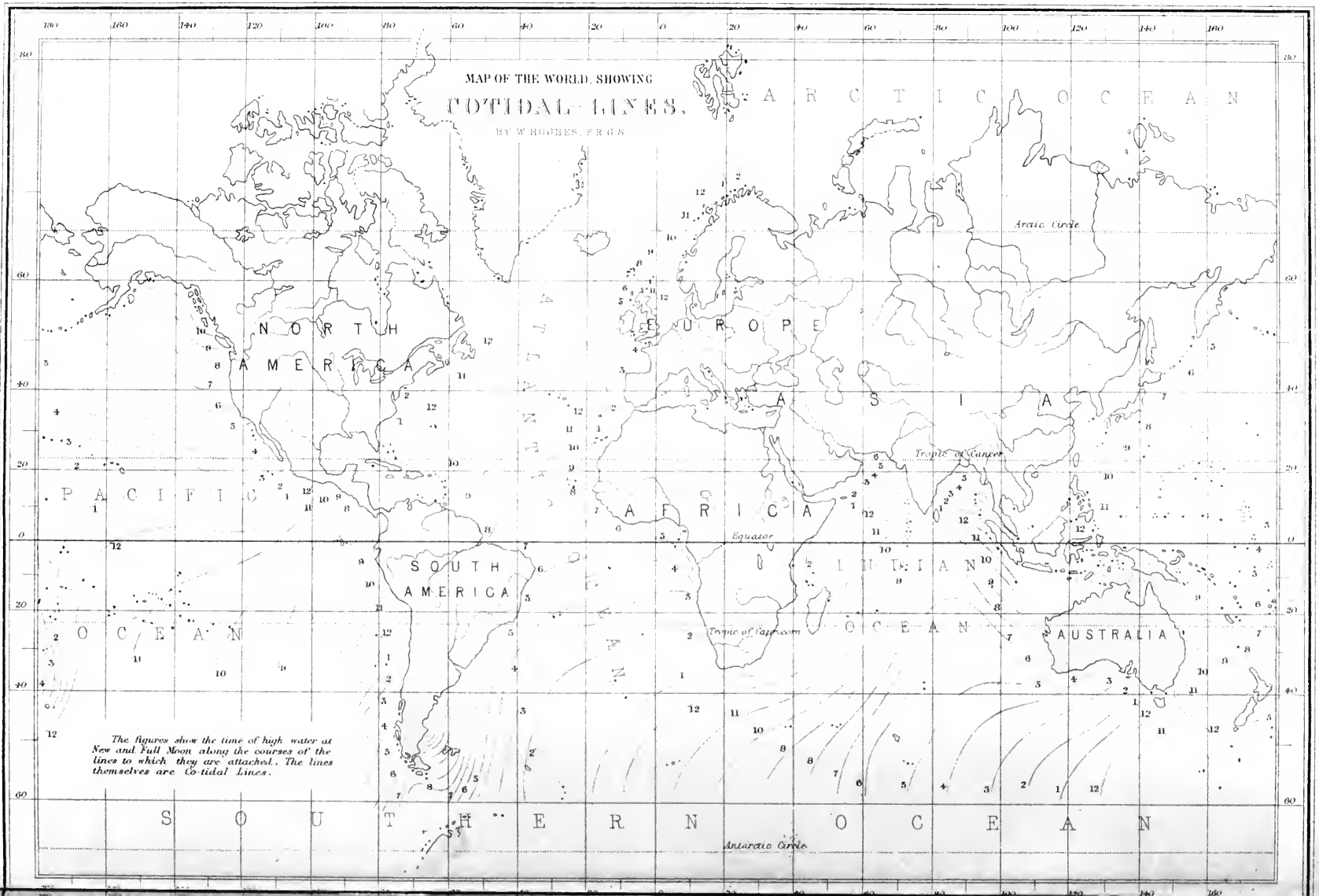


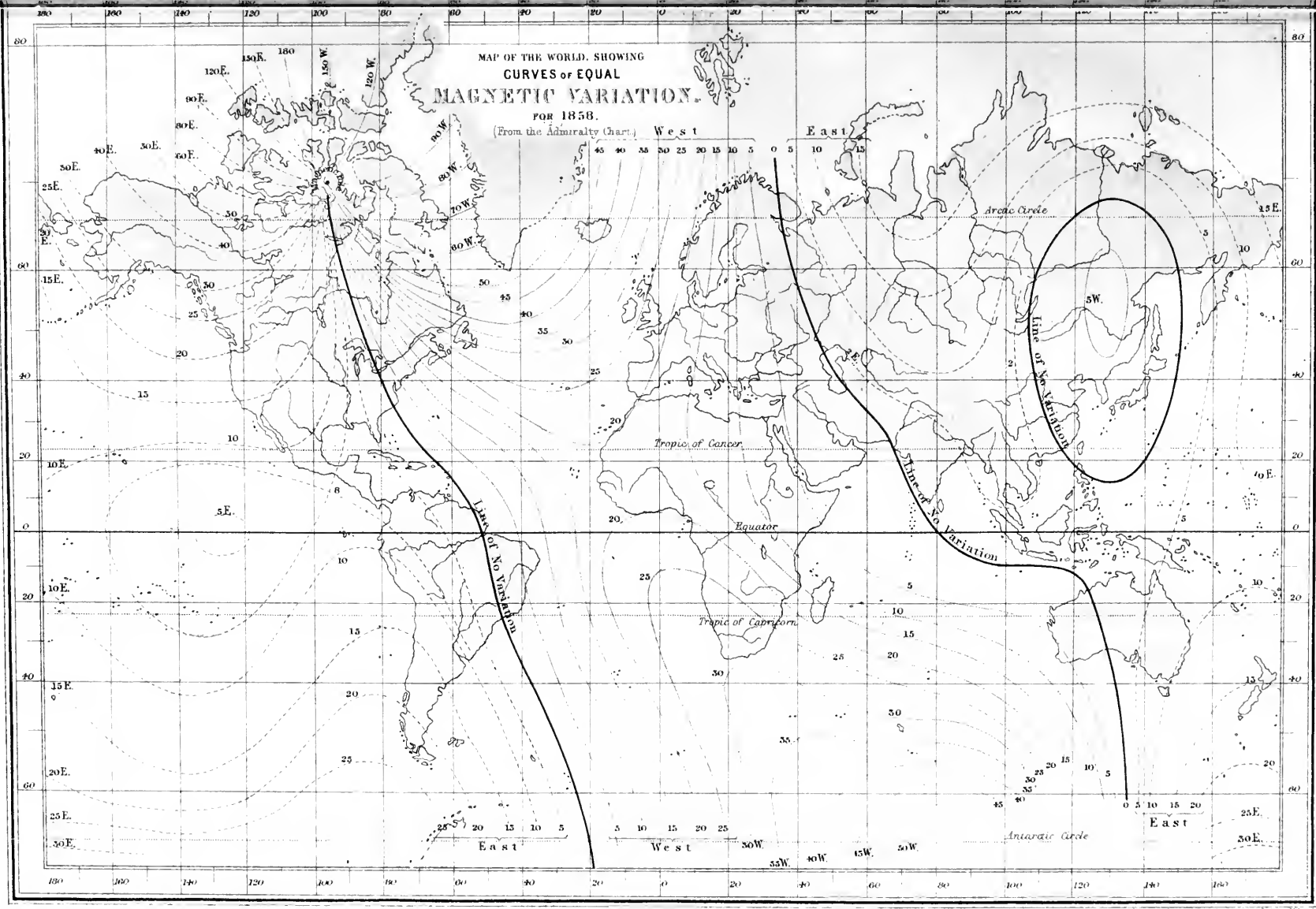
ISOTHERMS OF MEAN WINTER TEMPERATURE.

DISTRIBUTION OF RAIN.

W. Hughes, London

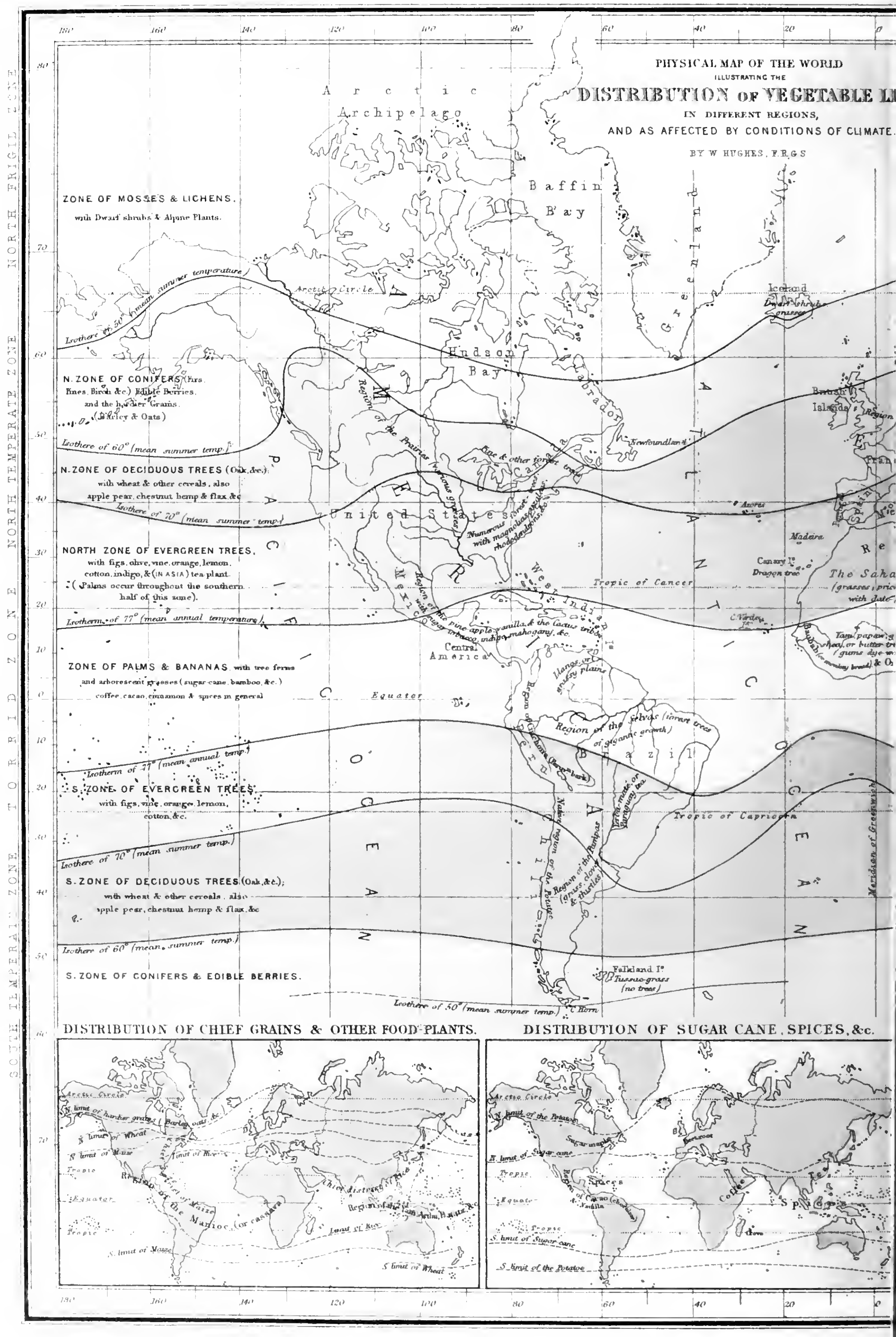
NDON & LIVERPOOL.


MAP OF THE WORLD, SHOWING
CO-TIDAL LINES,
BY W. HUGHES, F.R.G.S.
A R C T I C O C E A N
Arctic Circle
N O R T H
A M E R I C A
E U R O P E
A S I A
A T L A N T I C
O C E A N
Tropic of Cancer
Equator
P A C I F I C
O C E A N
A F R I C A
S O U T H
A M E R I C A
I N D I A N
O C E A N
Tropic of Capricorn
AUSTRALIA
S O U T H E R N O C E A N
Antarctic Circle
The figures show the time of high water at New and Full Moon along the courses of the lines to which they are attached. The lines themselves are Co-tidal Lines.

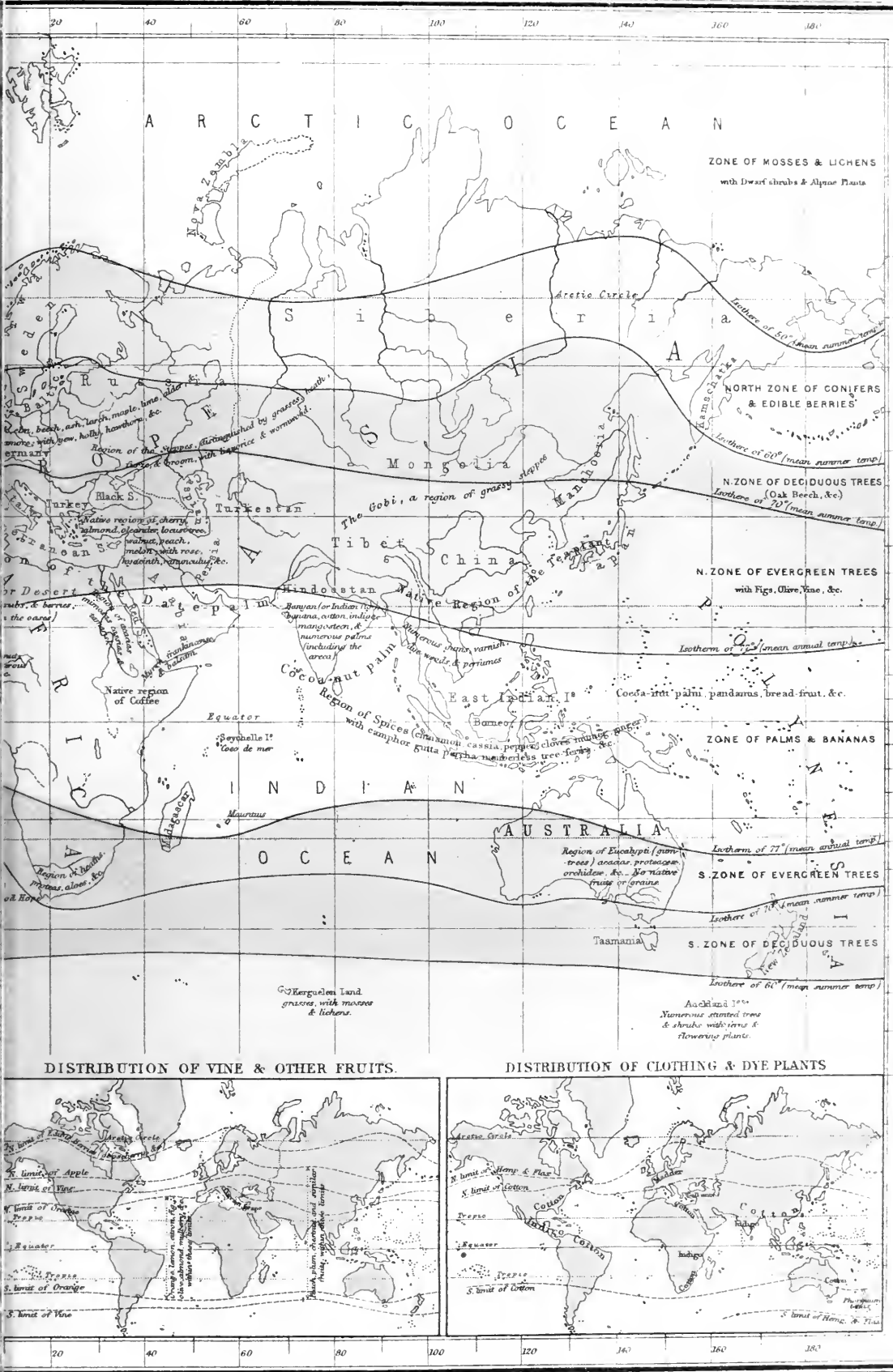


Engraved by J. Bartholomew & Son Edin.

GEORGE PHILIP & SON, LONDON & LIVERPOOL.



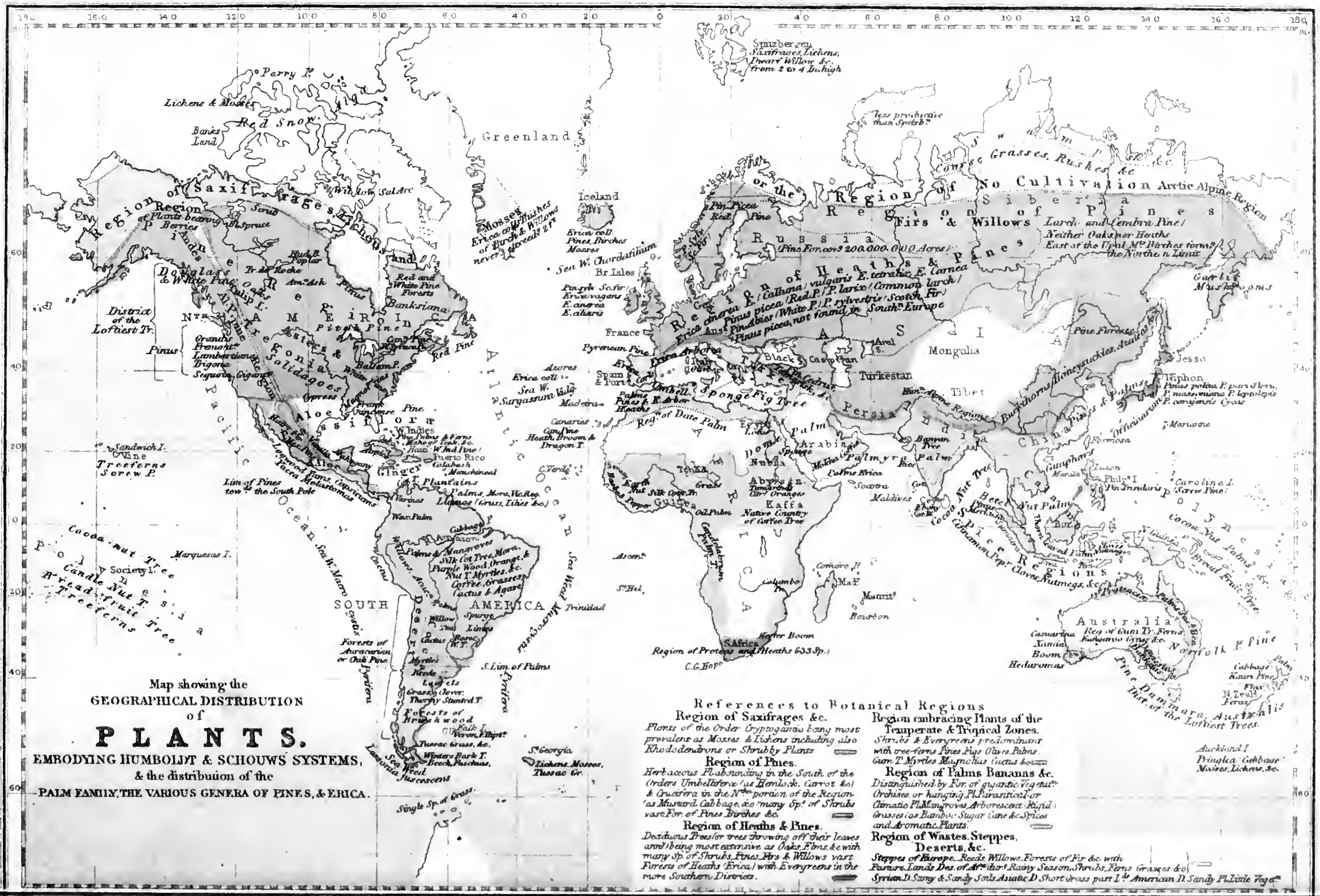
GEORGE PHILIP & SO

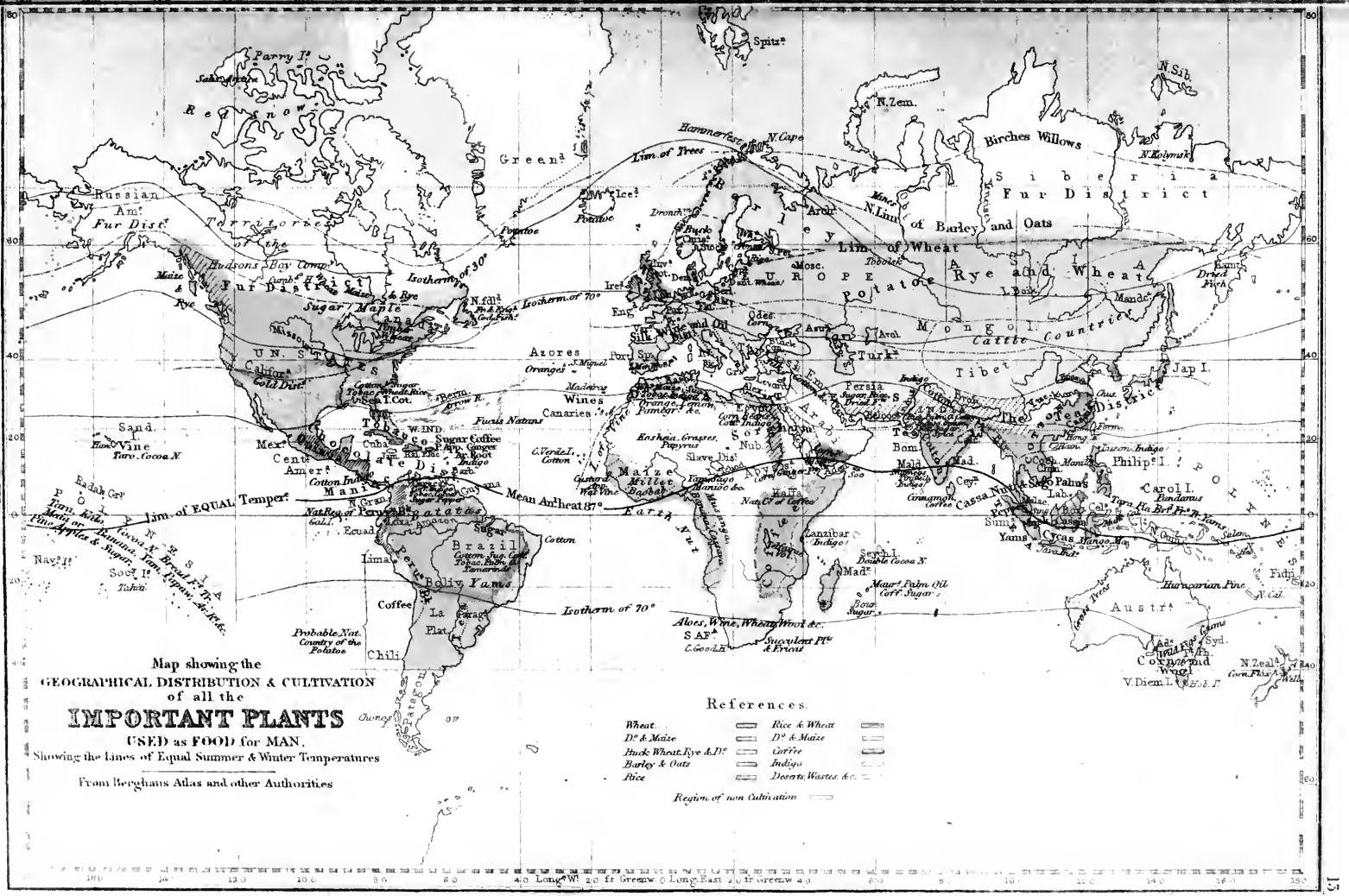


DISTRIBUTION OF VINE & OTHER FRUITS.

DISTRIBUTION OF CLOTHING & DYE PLANTS

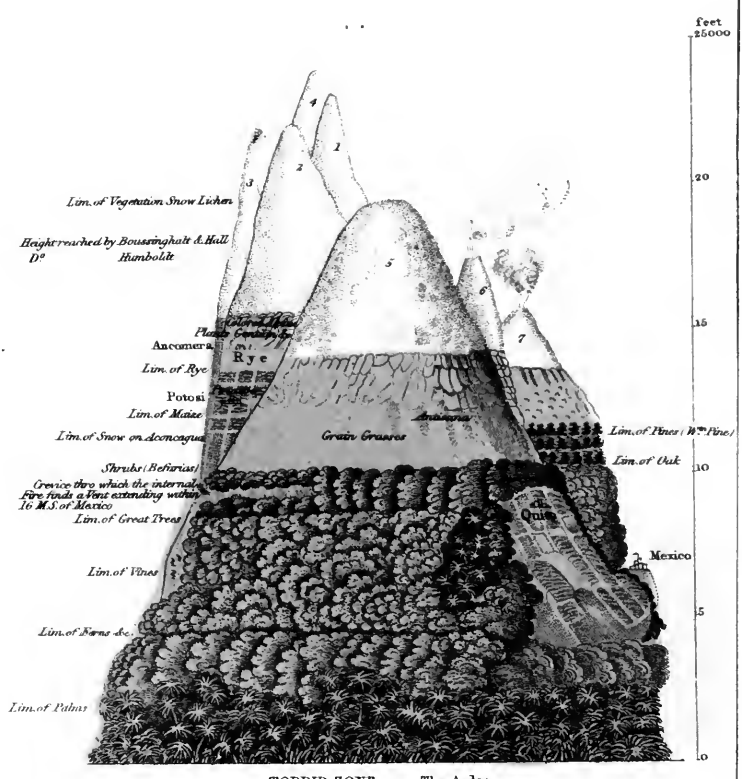
W. Hughes, London


Map showing the
GEOGRAPHICAL DISTRIBUTION
of
PLANTS.
EMBODYING HUMBOLDT & SCHOUWS SYSTEMS,
& the distribution of the
PALM FAMILY, THE VARIOUS GENERA OF PINES, & ERICA.
References to Botanical Regions
Region of Saxifrages &c.
Plants of the Order Cryptogamia being most prevalent as Mosses & Lichens including also Rhododendrons or Shrubby Plants
Region of Pines.
Region of Heaths & Pines.
Region embracing Plants of the Temperate & Tropical Zones.
Region of Palms Bananas &c.
Region of Wastes, Steppes, Deserts, &c.
Greenland
Iceland
Russia
Mongolia
Tibet
Turkestan
Persia
Australia
SOUTH AMERICA
Atlantic Ocean
Pacific Ocean



GEORGE PHILIP & SON, LONDON & LIVERPOOL.

PERPENDICULAR GROWTH OF PLANTS IN THE TORRID ZONE

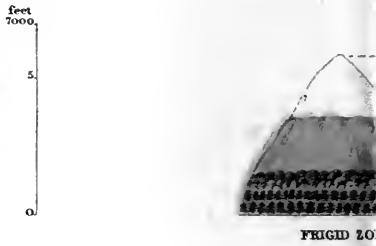


TORRID ZONE ——— The Andes

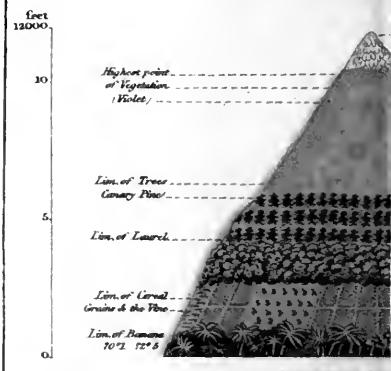
1 Sahama 22.350 f.
2 Nevado de Sorata 21.286 f.
3 Nevado de Illimani 21.140 f.
4 Volcano of Aconcagua 23.310 f.
5 Chimborazo 21.422 f.
6 Cotopaxi 18.875 f.
7 Popocatapetl 17.720 f.

DISTRIBUTION OF PLANTS IN AI

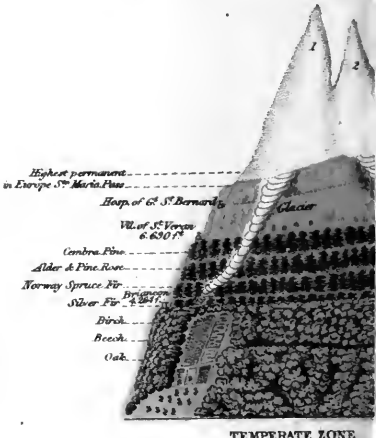
FRIGID & TEMPE



FRIGID ZO



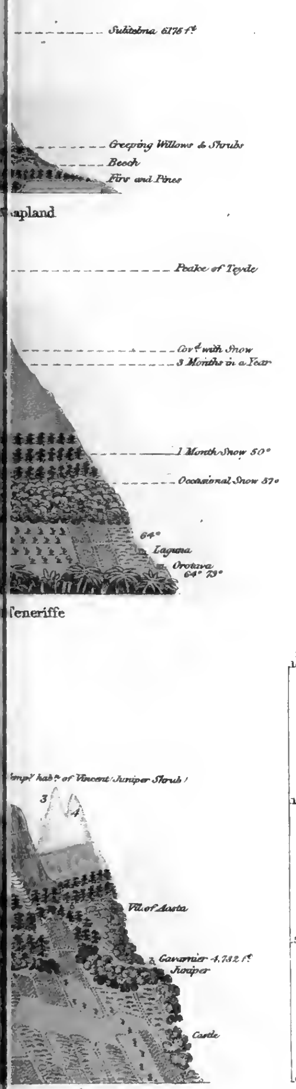
TEMPERATE ZON



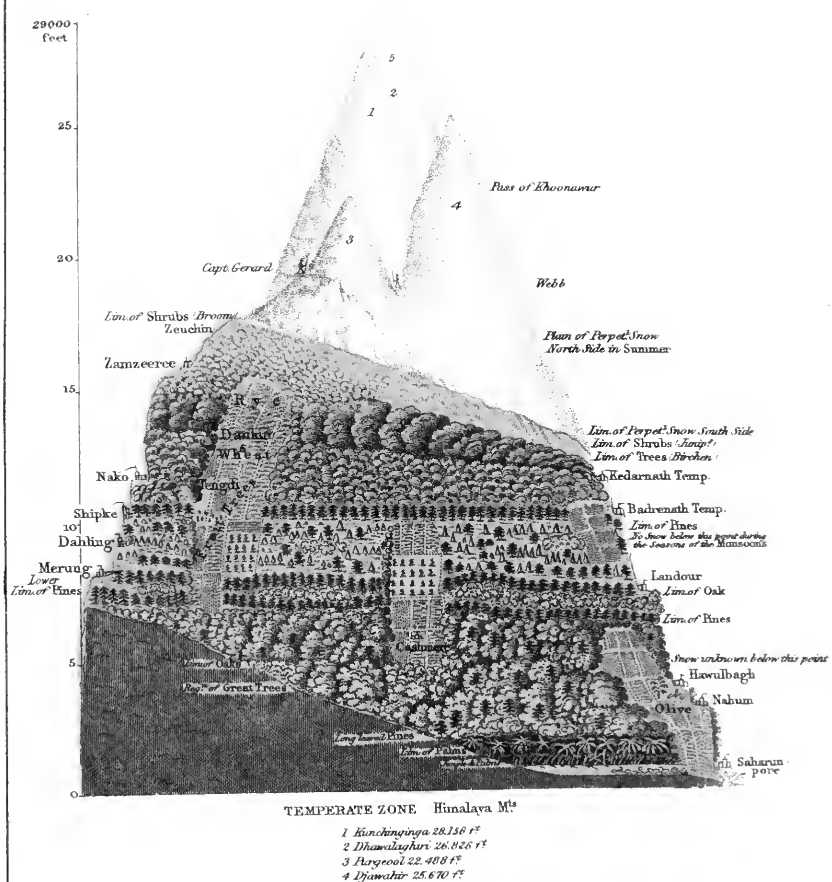
TEMPERATE ZONE

1 Mt. Blanc
2 Mt. Rosa
3 Pic. Nethou
4 Mt. Perdu

PENDICULAR DIRECTION
E ZONES

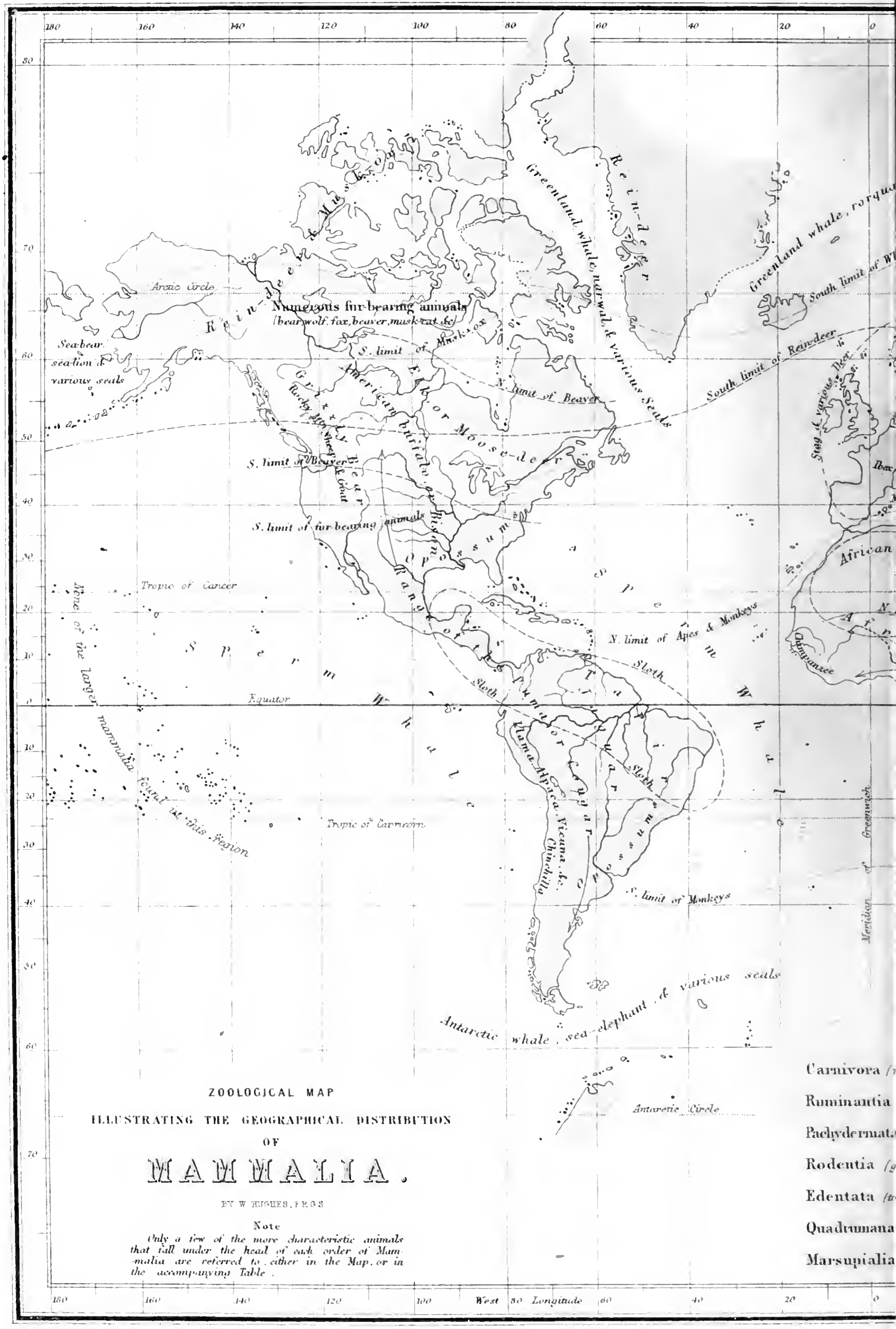

Sulitelma 6178 ft
Creeping Willows & Shrubs
Beech
Firs and Pines
apland
Peake of Teyde
Covd with Snow
3 Months in a Year
1 Month Snow 50°
Occasional Snow 57°
64°
Laguna
Orotava
64° 73°
Teneriffe
feet
15000
10
5
0
3
4
Vil. of Aosta
Gavarnier 4,732 ft
Juniper
Castle
and Pyrenees

PERPENDICULAR GROWTH OF PLANTS IN THE TEMPERATE ZONE

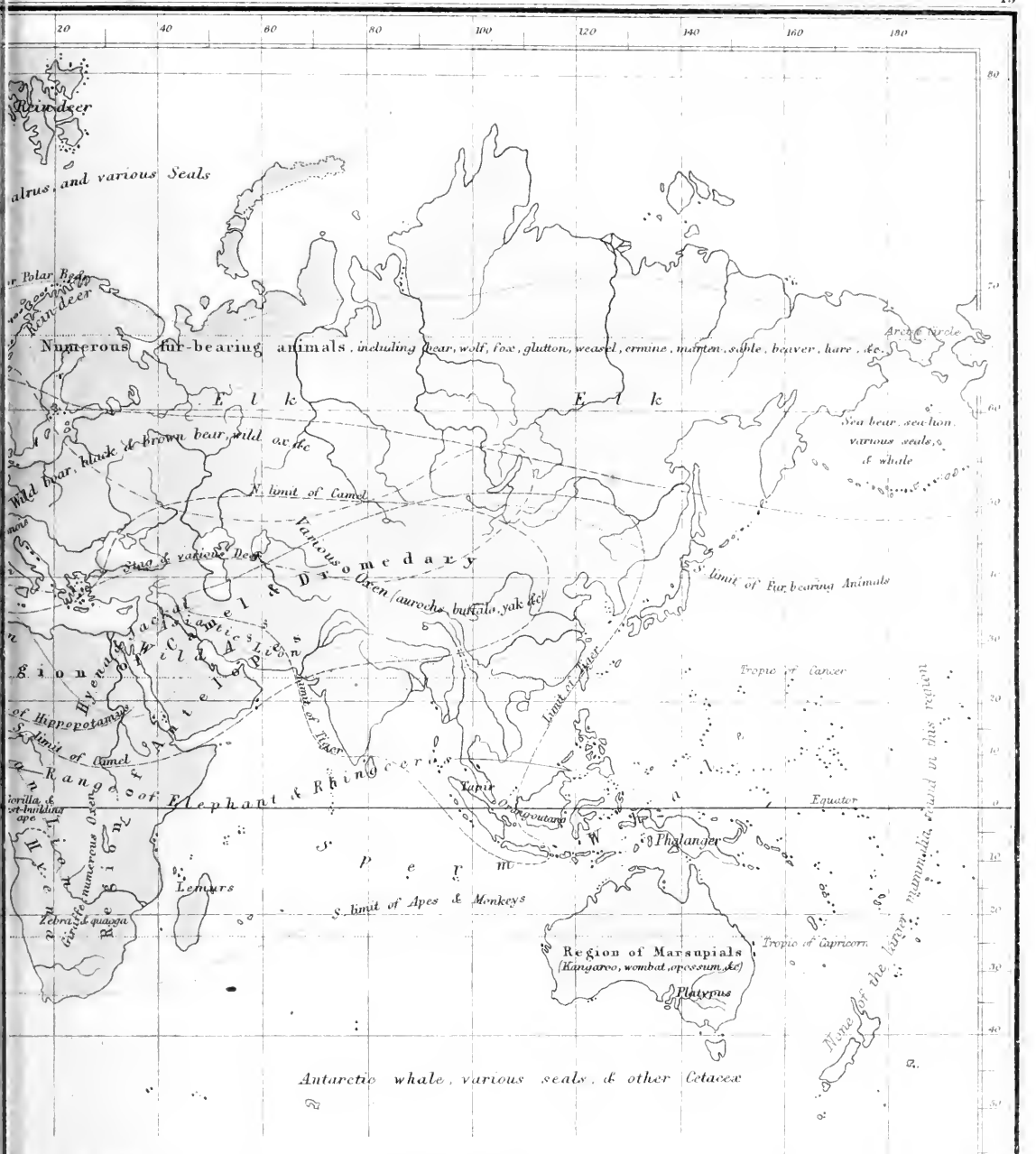

29000
feet
25
20
15
10
5
0
5
2
1
3
4
Pass of Khoonawur
Capt. Gerard
Webb
Lim. of Shrubs Broom
Zeuchin
Plain of Perpetl Snow
North Side in Summer
Zamzeeree
Rye
Dankur
Wheat
Nako
Shipke
Dabling
Merung
Lower
Lim. of Pines
Lim. of Perpetl Snow South Side
Lim. of Shrubs Junipr
Lim. of Trees Birchen
Kedarnath Temp.
Badrenath Temp.
Lim. of Pines
No Snow below this point during the Seasons of the Monsoons
Landour
Lim. of Oak
Lim. of Pines
Lim. of Oaks
Regn of Great Trees
Cashmeer
Snow unknown below this point
Hawulbagh
Nahum
Olive
Long leaved Pines
Lim. of Palms
Saharun-
pore

TEMPERATE ZONE Himalaya Mts

1 Kunchinginga 28.156 ft
2 Dhawalaghiri 26.826 ft
3 Pargeool 22.488 ft
4 Djawahir 25.670 ft
5 Everest 29.002 ft



GEORGE PHILIP &



le illustrating the distribution of the principal Land-animals.

	EUROPE	ASIA	AFRICA	NORTH AMERICA	SOUTH AMERICA	AUSTRALIA
ating)	Wolf, dog, fox, lynx, bear, wild-cat	Lion, tiger, leopard, hyena, dog, fox, wolf, bear, glutton	Lion, panther, hyena, jackal, fox	Puma, bear, glutton, racoon	Puma, jaguar	Dingo (or native dog)
ewing)	Ox, sheep, deer, goat	Camel, ox, antelope, deer, goat	Camel, ox, antelope, giraffe	Moose-deer, bison, musk-ox	Llama	
-skinned)	Horse, ass, wild-boar	Elephant, rhinoceros, horse, ass, tapir	Elephant, rhinoceros, hippopotamus, zebra		Peccary, tapir	
g)	Beaver, rat, mouse, squirrel, hare	Squirrel, porcupine, hare, jerboa	Squirrel, porcupine, hare, jerboa	Beaver, squirrel, hare	Porcupine, chinchilla	Porcupine
s)		Manis (or scaly ant-eater)	Scaly ant eator	Armadillo	Ant-eater, Sloth, armadillo	Echidna (or porcupine ant eater), platypus
handed)		Orang-outang, gibbon, & numerous monkeys	Gorilla, chimpanzee, monkeys, lemurs		Howling monkeys	
ched)				Opossum	Opossum	Kangaroos, wombat, phalanger, opossum

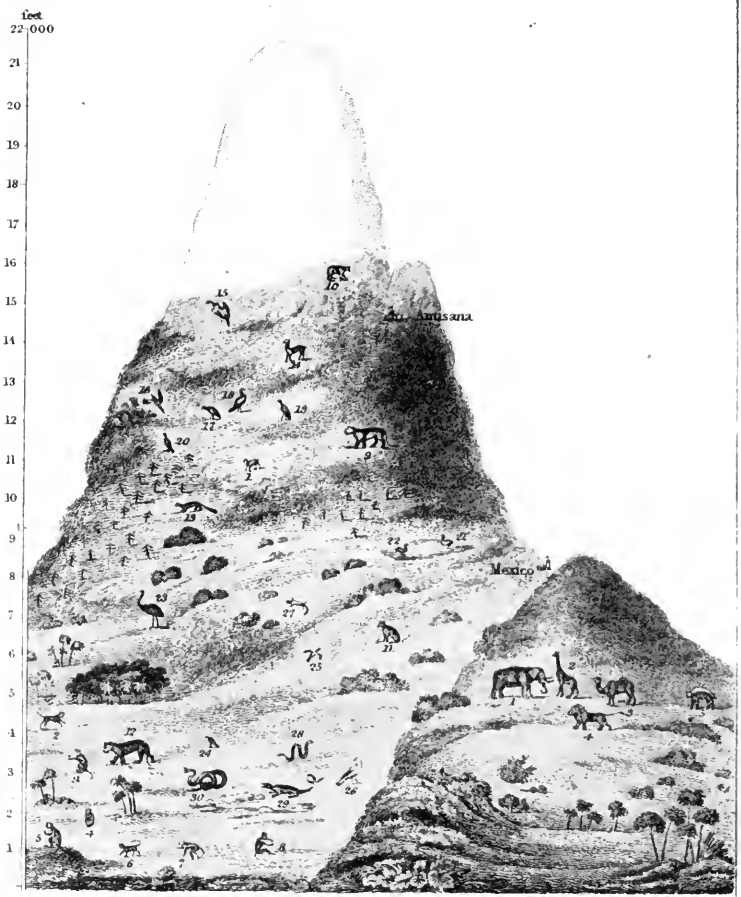
20 40 60 East 80 Longitude 100 120 140 160 180

W. Hughes

LONDON & LIVERPOOL.

PERPENDICULAR DISTRIBUTION OF ANIMALS IN THE TORRID ZONE.

The Andes S. America, & African Mount.s
(Chimborazo)



America

1 2 Howling Monkeys
3 Weeping D.o
4 Mouse D.o
5 Night Ape
6 Spider Monkey
7 Squirrel D.o
8 Marmouset
9 Puma
10 Boar
11 Ocelot
12 Jaguar
13 Skunk
14 Llama
15 Condor
16 Great Hawk
17 Turkey Bustard
18 King Vulture
19 Black Do
20 Hawk
21 Duck
22 Colymbus
23 American Ostrich
24 Chatterer
25 Cassicun
26 Green Macaw
27 Axolotl
28 Coluber
29 Crocodile
30 Boa

Africa

1 Elephant 3 Camel
2 Giraffe 4 Lion
5 Hyena

PERPENDICULAR DISTRIBUTION O

Himayla

1 Burrhel
2 Tumar Sheep
3 Yak
4 Bactrian Camel
5 Royal Tiger
6 Horse Shoe Bat
7 Stin
8 Wea
9 Stou
10 Ele
11 Rou
12 Lio

IMALS IN THE TEMPERATE ZONE.

ountains.

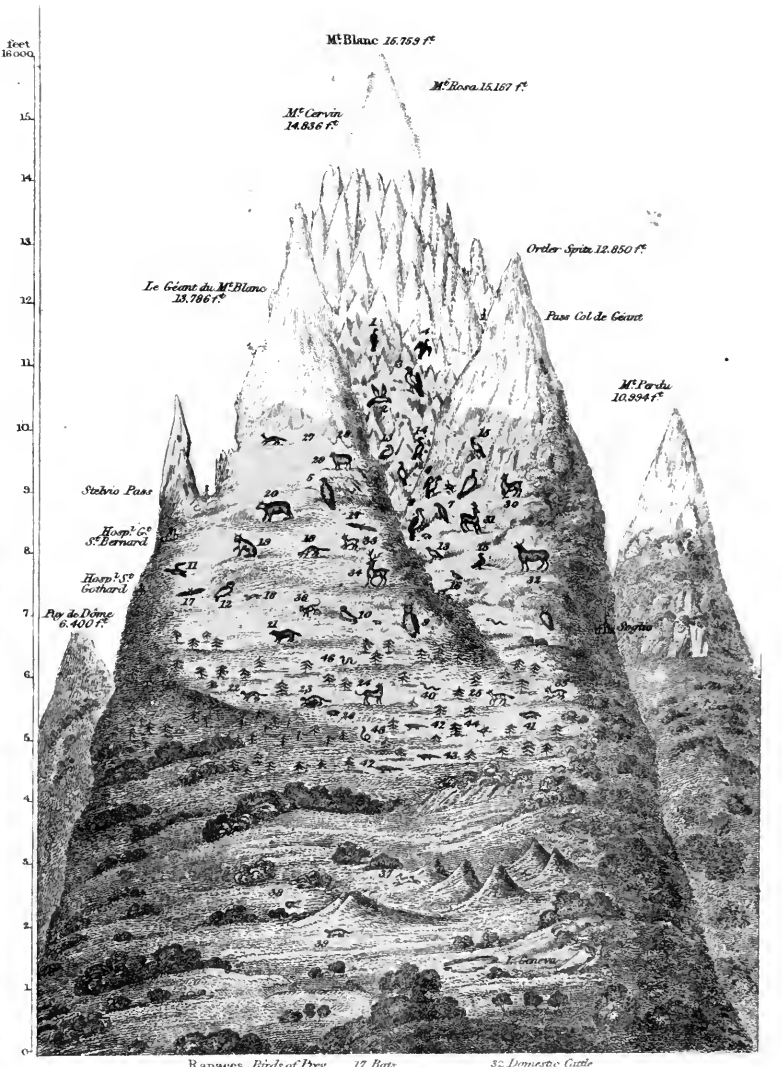
13 Hoonuman
14 Mountain Macae
15 Macae
16 Solemn Apes
17 Chimpanzee
18 Flocky Lemur

ed Rousette
at

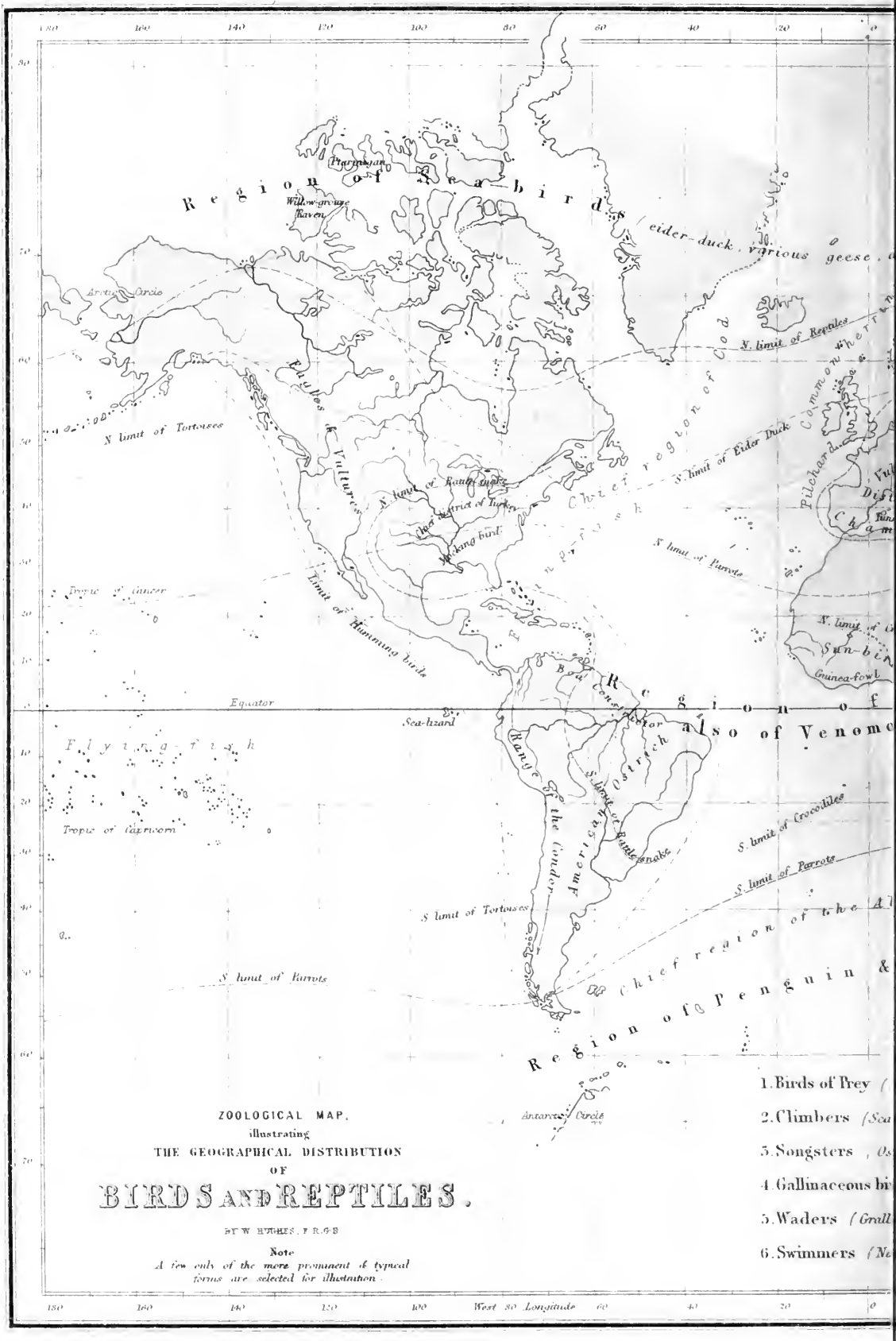
PERPENDICULAR DISTRIBUTION OF ANIMALS

TEMPERATE ZONE

Alps & Pyrenees



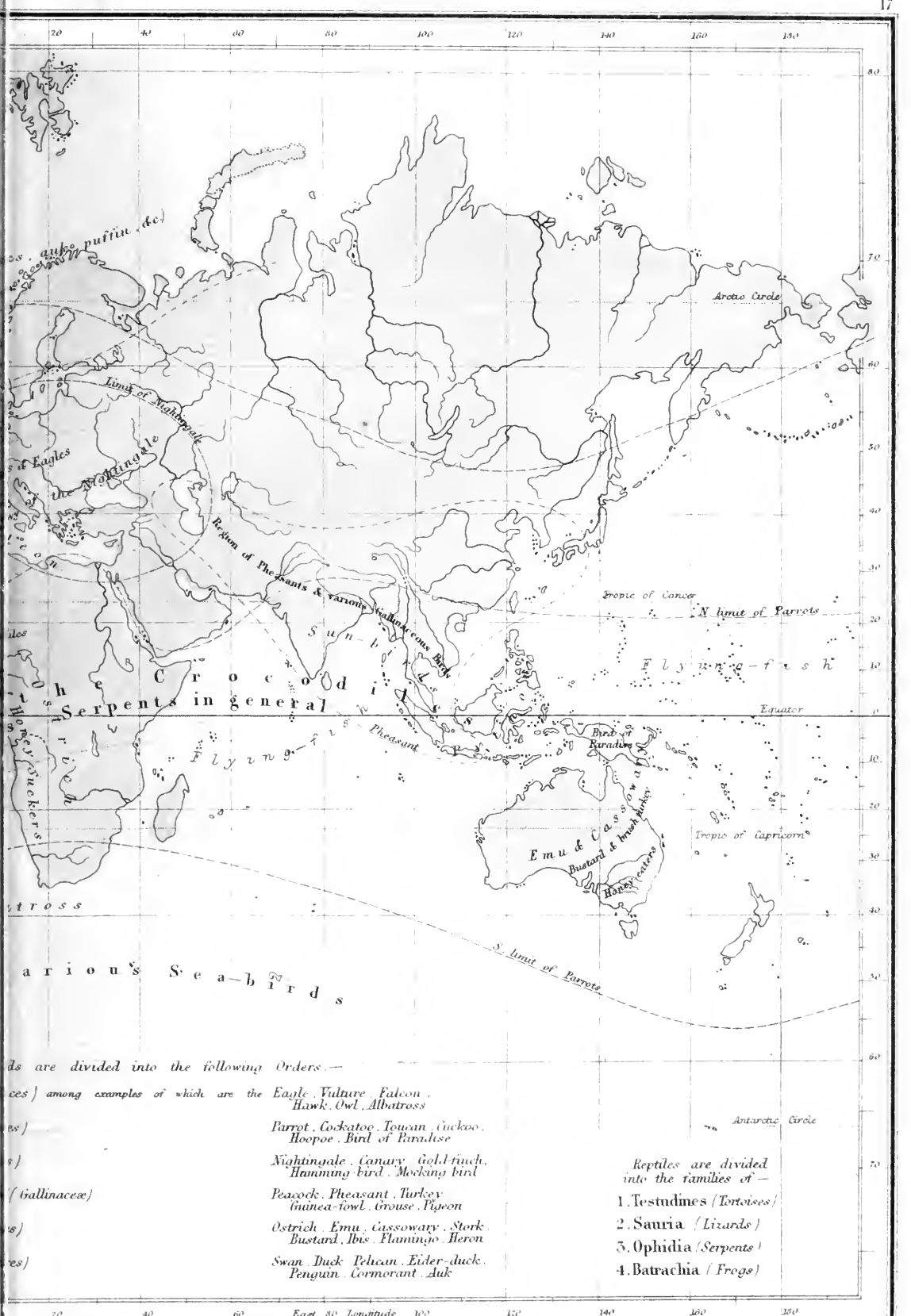
Rapaces Birds of Prey
Falcons 1 Gyrfalco
2 Vespertinus
Vulture 3 Gypaetus
Eagles 4 Ursus
5 Aquila Ossifr.
Owls 6 Flammea
7 Ulula
8 Surnia
9 Bubo
10 Otus
11 Nyctale
12 Brachyotus
Gallinaceæ Fowls
13 Lagopus
14 Tetrix Urogallus
15 D.o Tetrix
16 D.o Bonasia
17 Bats
18 Marten
19 Lynx European
20 Pyrenean Bear
21 Badger
22 Fitchet
23 Weasel
24 Wolf
25 Fox
26 Hedgehog
27 Com.n Mouse
28 Economic D.o
29 Sheep
30 Chamois
31 Steinbok
32 Domestic Cattle
33 Alpine Hare
34 Com.n Stag
35 D.o Hare
36 Wild Cat
37 Rabbit
38 Beaver
39 Hamster
40 Ringed Snake
41 Otter
42 Newts
43 Lizard
44 Alpine Frog
45 Viper
46 Com.n Snake



ZOOLOGICAL MAP,
illustrating
THE GEOGRAPHICAL DISTRIBUTION
OF
BIRDS AND REPTILES.

BY W. HUGHES, F.R.G.S.

Note
A few only of the more prominent & typical forms are selected for illustration.



ds are divided into the following Orders.—

ces)	*among examples of which are the*	*Eagle. Vulture. Falcon. Hawk. Owl. Albatross*
ds)		*Parrot. Cockatoo. Toucan. Cuckoo. Hoopoe. Bird of Paradise*
s)		*Nightingale. Canary. Gold-finch. Humming-bird. Mocking bird*
(Gallinaceæ)		*Peacock. Pheasant. Turkey. Guinea-fowl. Grouse. Pigeon*
s)		*Ostrich. Emu. Cassowary. Stork. Bustard. Ibis. Flamingo. Heron*
es)		*Swan. Duck. Pelican. Eider-duck. Penguin. Cormorant. Auk*

Reptiles are divided into the families of—

1. Testudines *(Tortoises)*
2. Sauria *(Lizards)*
3. Ophidia *(Serpents)*
4. Batrachia *(Frogs)*

W. Hughes

LONDON & LIVERPOOL.

MAP OF THE WORLD

showing the

DISTRIBUTION OF MAN

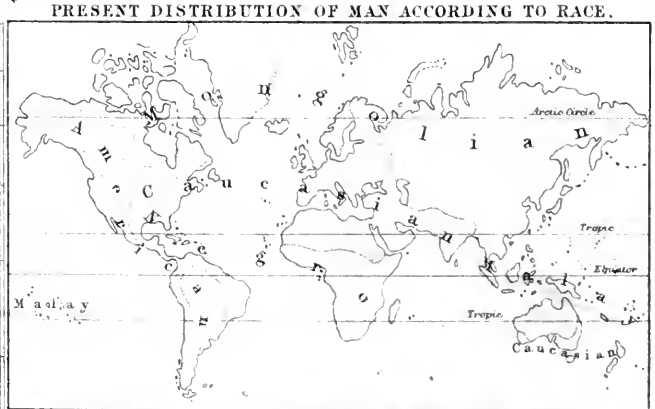
according to the

AMOUNT & COMPARATIVE DENSITY OF POPULATIO

IN DIFFERENT LANDS.

BY W. HUGHES, F.R.G.S.

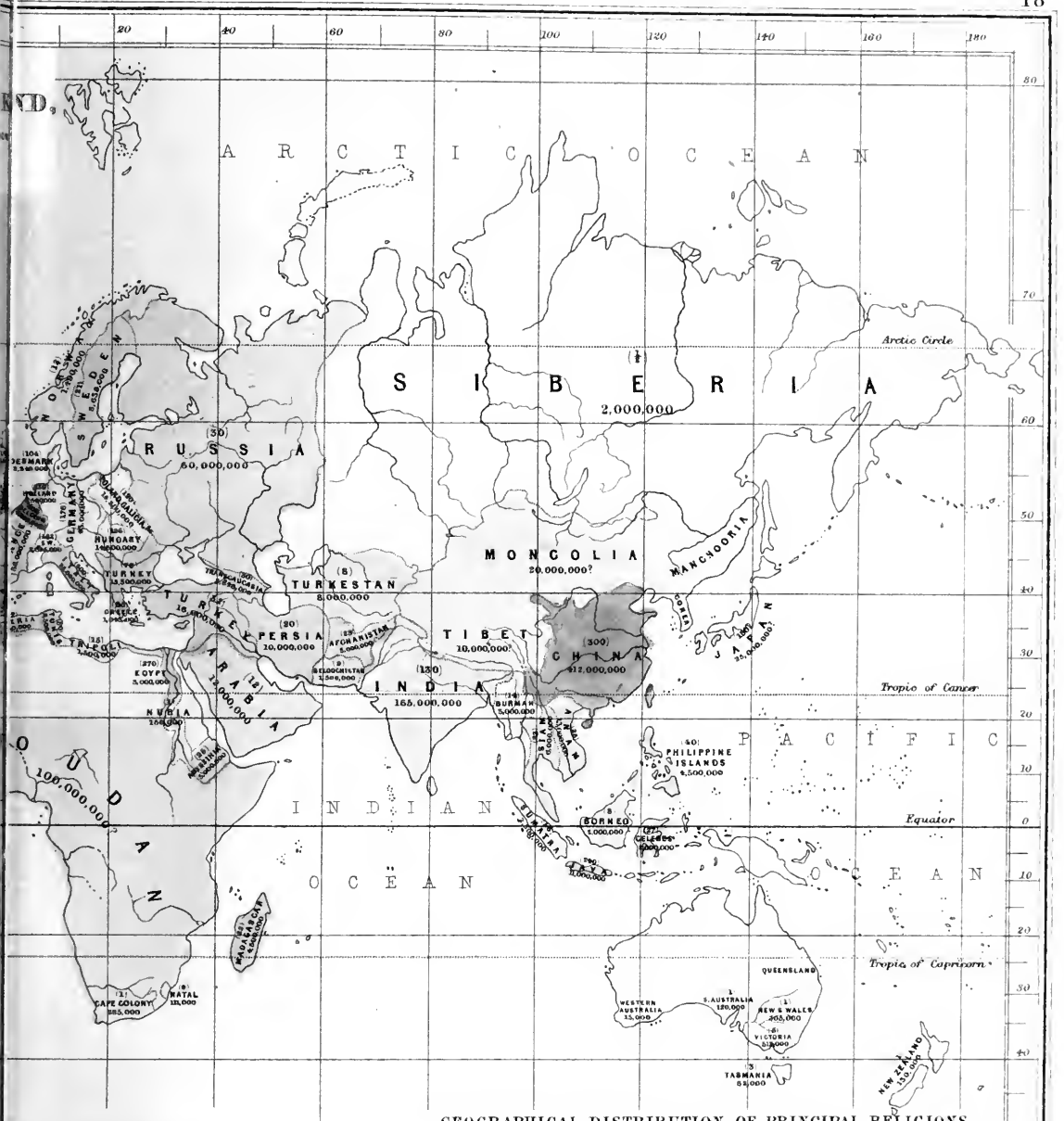
PRESENT DISTRIBUTION OF MAN ACCORDING TO RACE.



Note. The figures und
population of each in rou
between parentheses give the
to a square mile. Thus, 1
or 38,000,000, has 776 inhab

Table of Countries, arranged accor

Below 1 inhabitant to every square mile	*Between 1 & 10 inhabitants to the square mile*			*Between 10 & 20 in to sq. mil*
Hudson Bay Territory	Beloochistan	Interior Africa	Newfoundland	Arabia
Labrador	Bolivia		Nubia	Burmah
Patagonia	Borneo	La Plata	Peru	Cent. Ameri
Queensland	Brazil	Liberia	South Australia	Manchoor
Russian America	British Columbia	Mexico	Tasmania	Mongolia
Sahara, the	Canada	Natal	Turkestan	Norway
Siberia	Cape Colony	New Brunsw.	Uruguay	Nova Scot
Western & Interior Australia	Chili	New Granada	Vancouver I.	Paraguay
	Ecuador	New South Wales	Venezuela	Sumatra
	Guiana	New Zealand	Victoria	Tibet
	Iceland			Tripoli
				United Sta

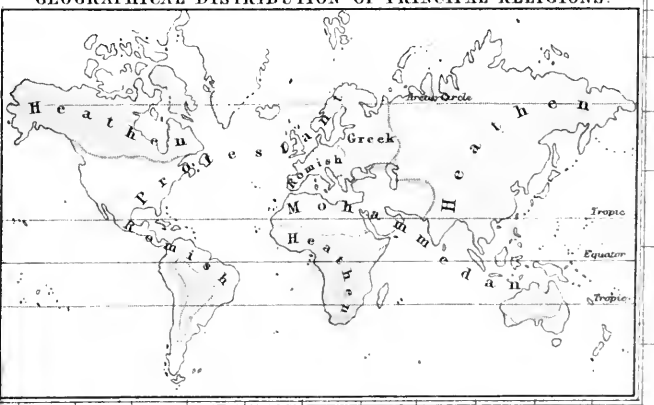


mes of countries express the
umbers. The appended figures
ortionate number of inhabitants
, with a population
to the square mile.

to comparative density of Population.

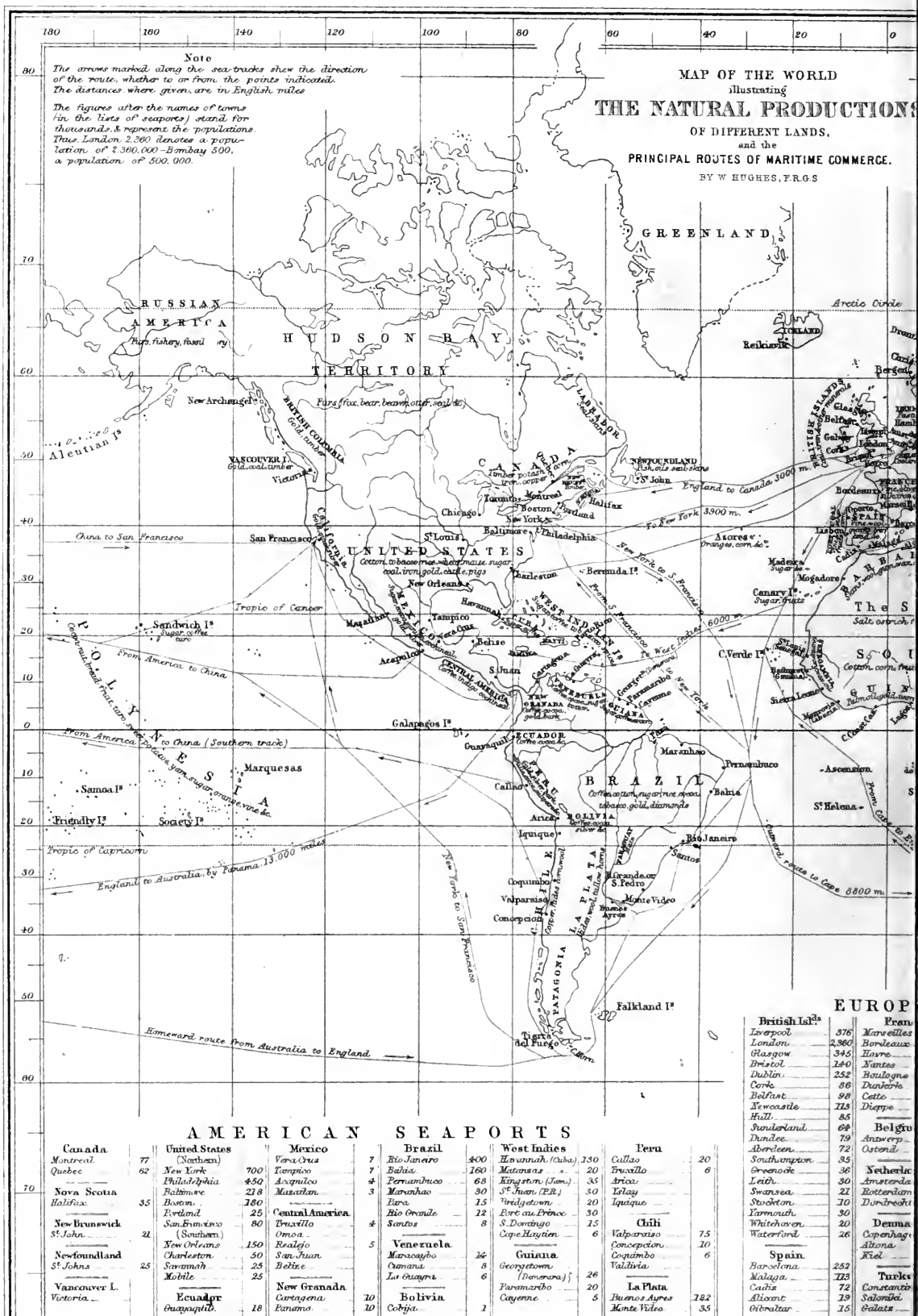
Between 20 & 50 inhabitants to the sq. mile		Between 50 & 100 inh. to sq. mile	Between 100 & 200 in to sq. mile	Between 200 & 300 in. to sq. m.
byssinia	Pr. Edward I.	Ceylon	Denmark	Egypt
fghanistan	Russia	Greece	France	Holland
lgeria	Siam	Jamaica	Germany	Ireland
nam	Sweden	Scotland	Hungary	Italy
dobes	Transcau-casia	Spain	India	Java
uba	Turkey (in Asia)	Tunis	Japan	
layti		Turkey (in Europe)	Poland	Above 300 inhabitants to sq. m.
lorocco		West Indian Is.	Portugal	Belgium
ladagascar			Prussia	China
ersia			Switzerland	England
hilippine Islands			Wales	

GEOGRAPHICAL DISTRIBUTION OF PRINCIPAL RELIGIONS.



Engraved by J. Bartholomew & Son, Edin.r

LONDON & LIVERPOOL.



AMERICAN SEAPORTS

Canada		United States (Northern)		Mexico		Brazil		West Indies		Peru	
Montreal	77	New York	700	Vera Cruz	7	Rio Janeiro	400	Havannah (Cuba)	130	Callao	20
Quebec	62	Philadelphia	450	Acapulco	4	Bahia	160	Matanzas	20	Truxillo	6
Nova Scotia		Baltimore	218	Mazatlan	3	Pernambuco	68	Kingston (Jam.)	35	Arica	
Halifax	35	Boston	180			Maranhao	30	St Juan (P.R.)	30	Islay	
New Brunswick		Portland	25	**Central America**		Para	15	Bridgetown	20	Iquique	
St John	21	San Francisco (Southern)	80	Truxillo	4	Rio Grande	12	Port au Prince	30	**Chili**	
Newfoundland		New Orleans	150	Omoa		Santos	8	S. Domingo	15	Valparaiso	75
St Johns	25	Charleston	50	Realejo	5	**Venezuela**		Cape Haytien	6	Concepcion	10
Vancouver I.		Savannah	25	San Juan		Maracaybo	14	**Guiana**		Coquimbo	6
Victoria		Mobile	25	Belize		Caracas	8	Georgetown (Demerara)	26	Valdivia	
Ecuador		**New Granada**		**Bolivia**		La Guayra	6	Paramaribo	20	**La Plata**	
Guayaquil	18	Carthagena	10	Cobija	1			Cayenne	5	Buenos Ayres	182
		Panama	10							Monte Video	35

EUROP

British Isl.ds		Pran	
Liverpool	576	Marseilles	
London	2,360	Bordeaux	
Glasgow	345	Havre	
Bristol	140	Nantes	
Dublin	252	Boulogne	
Cork	86	Dunkirk	
Belfast	98	Cette	
Newcastle	113	Dieppe	
Hull	85		
Sunderland	64	**Belgiu**	
Dundee	79	Antwerp	
Aberdeen	72	Ostend	
Southampton	35		
Greenock	36	**Nederla**	
Leith	30	Amsterda	
Swansea	21	Rotterdam	
Stockton	10	Dordrecht	
Yarmouth	30		
Whitehaven	20	**Denma**	
Waterford	26	Copenhag	
		Altona	
Spain		Kiel	
Barcelona	252		
Malaga	113	**Turke**	
Cadiz	72	Constanti	
Alicant	19	Salonika	
Gibraltar	15	Galatz	

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30	Lubeck	28	Christiania	33
25	Rostock	23	Bergen	25
19	Elbing	22		
18	Stralsund	19	**Russia**	
	Emden	15	S.t Petersburg	532
	Wismar	11	Odessa	187
108	Memel	11	Riga	70
16	Dantzic	66	Astrakhan	45
	Konigsberg	75	Revel	28
			Archangel	24
260	**Hungary**		Taganrog	19
96	Fiume	10		
21			**Greece**	
	Italy		Athens	32
	Naples	416	Patras	8
144	Palermo	200	Syra	14
37	Genoa	120		
15	Messina	97	**Portugal**	
	Leghorn	30	Lisbon	280
	Venice	128	Oporto	80
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60	Ancona	36		
50	Marsala	21	Valetta (Malta)	51

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Jiddah	20	Colombo	35	Nangasaki	100	Sourabaya	130
Macha	7	Trincomalee		Kanagawa	25	Manilla	140
		Moulmein	17	Hakodadi			
Anam		Rangoon		Simoda		**Siam**	
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		Freetown (S.L.)		Quillimane		Funchal (Mad.)	30
North Africa		Monrovia	2			S.ta Cruz (Canary I.s)	
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Freemantle	
New Zealand	
Wellington	
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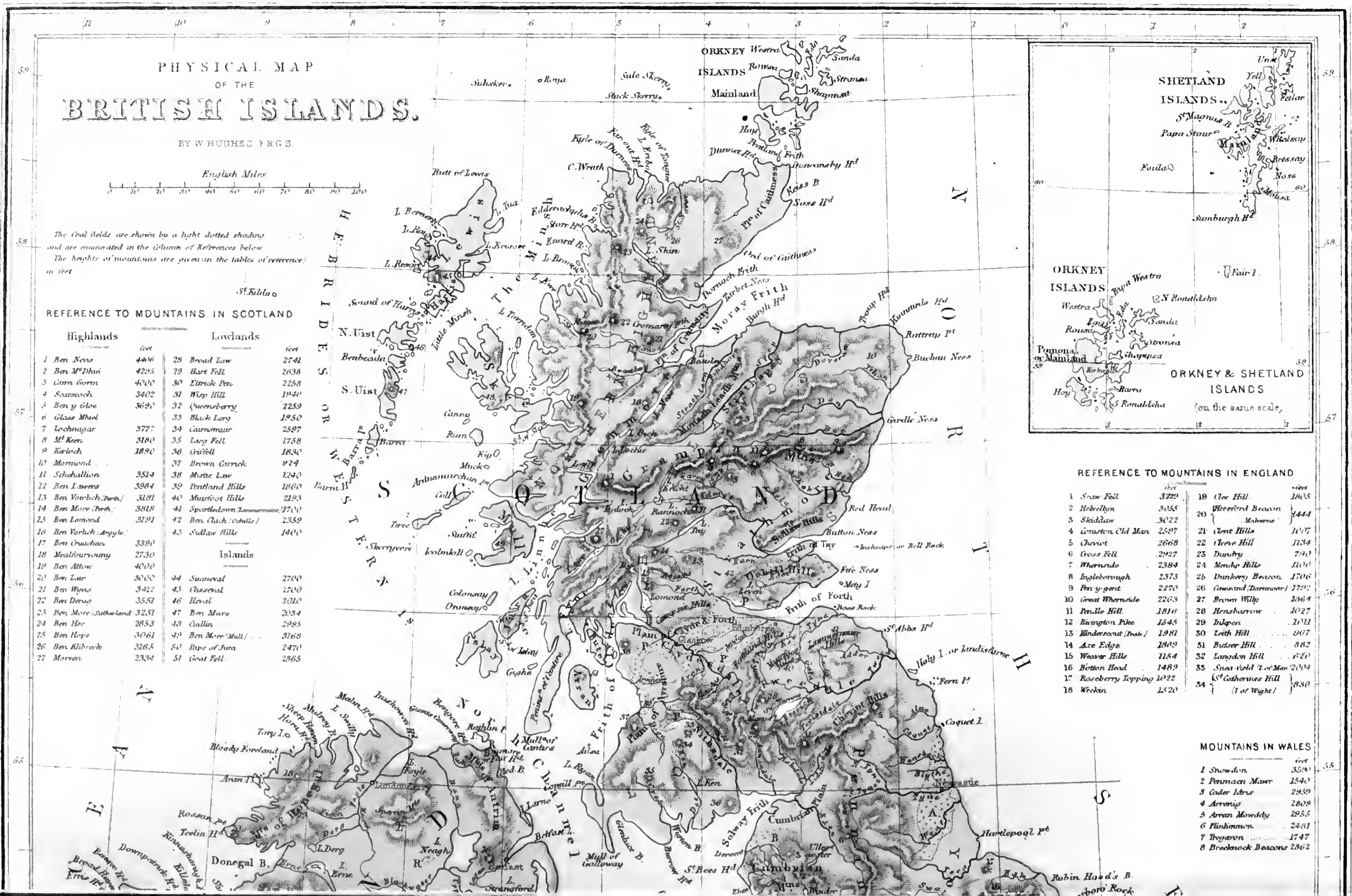
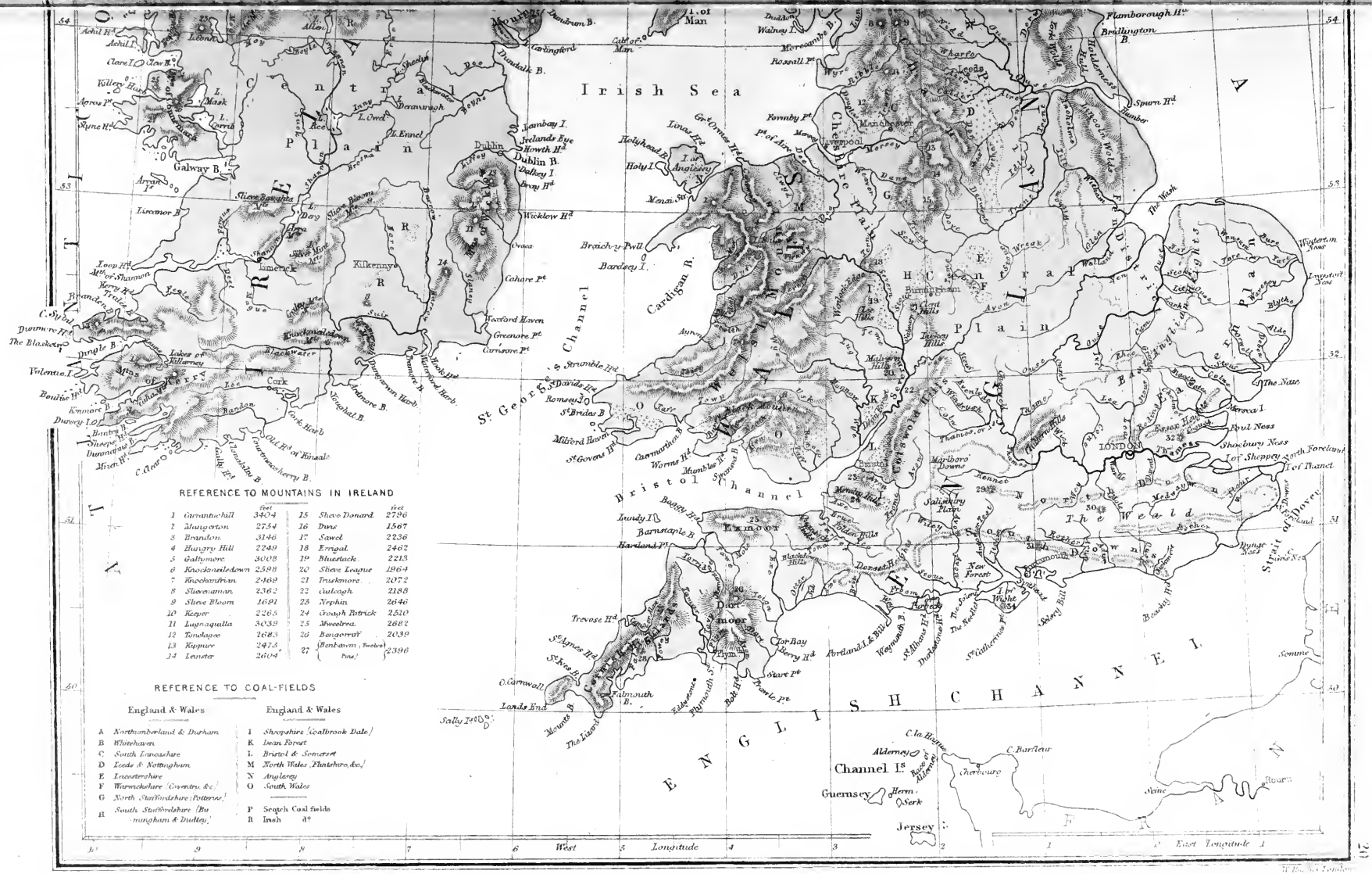

PHYSICAL MAP
OF THE
BRITISH ISLANDS.
BY W. HUGHES F.R.G.S.
English Miles
The Coal fields are shown by a light dotted shading and are enumerated in the Column of References below
The heights of mountains are given in the tables of reference in feet
REFERENCE TO MOUNTAINS IN SCOTLAND
Highlands
1 Ben Nevis 4406
2 Ben McDhui 4295
3 Carn Gorm 4000
4 Sosnoch 3402
5 Ben y Gloe 3690
6 Glass Mhel
7 Lochnagar 3777
8 Mt Keen 3180
9 Kerloch 1890
10 Mormond
11 Schehallion 3514
12 Ben Lawers 3984
13 Ben Vorlich (Perth) 3181
14 Ben More (Perth) 3818
15 Ben Lomond 3191
16 Ben Vorlich (Argyle)
17 Ben Cruachan 3390
18 Mealfourvonny 2730
19 Ben Attow 4000
20 Ben Lair 3000
21 Ben Wyvis 3422
22 Ben Derug 3551
23 Ben More (Sutherland) 3231
24 Ben Hee 2853
25 Ben Hope 3061
26 Ben Klibreck 3165
27 Morven 2334
Lowlands
28 Broad Law 2741
29 Hart Fell 2638
30 Ettrick Pen 2258
31 Wisp Hill 1940
32 Queensberry 2259
33 Black Larg 1950
34 Cairnsmuir 2597
35 Larg Fell 1758
36 Criffell 1830
37 Brown Carrick 924
38 Mistie Law 1240
39 Pentland Hills 1860
40 Muirfoot Hills 2193
41 Spartledown (Lammermuir) 1700
42 Ben Clach (Ochills) 2359
43 Sidlaw Hills 1400
Islands
44 Sueeval 2700
45 Clisseval 2700
46 Heval 2010
47 Ben More 2034
48 Cuillin 2993
49 Ben More (Mull) 3168
50 Paps of Jura 2470
51 Goat Fell 2865
REFERENCE TO MOUNTAINS IN ENGLAND
1 Scaw Fell 3229
2 Helvellyn 3055
3 Skiddaw 3022
4 Coniston Old Man 2597
5 Cheviot 2668
6 Cross Fell 2927
7 Whernside 2384
8 Ingleborough 2373
9 Pen-y-gent 2270
10 Great Whernside 2263
11 Pendle Hill 1816
12 Rivington Pike 1545
13 Kinderscout (Peak) 1981
14 Axe Edge 1809
15 Weaver Hills 1154
16 Botton Head 1489
17 Roseberry Topping 1022
18 Wrekin 1320
19 Clee Hill 1805
20 Herefordshire Beacon (Malverns) 1444
21 Clent Hills 1007
22 Cleeve Hill 1134
23 Dundry 790
24 Mendip Hills 1100
25 Dunkery Beacon 1706
26 Cawsand (Dartmoor) 1792
27 Brown Willy 1364
28 Hensbarrow 1027
29 Inkpen 1011
30 Leith Hill 967
31 Butser Hill 882
32 Langdon Hill 620
33 Snaefield (I. of Man) 2004
34 St Catherines Hill (I. of Wight) 830
MOUNTAINS IN WALES
1 Snowdon 3590
2 Penmaen Mawr 1540
3 Cader Idris 2959
4 Arrenig 2809
5 Arran Mowddy 2955
6 Plinlimmon 2481
7 Tregaron 1747
8 Brecknock Beacons 2862
SHETLAND ISLANDS
ORKNEY ISLANDS
ORKNEY & SHETLAND ISLANDS (on the same scale)
HEBRIDES OR WESTERN IS.
NORTH SEA
SCOTLAND
Moray Frith
Frith of Forth
North Channel
Grampian
Cheviot Hills
Solway Frith
Antrim
Donegal B.



REFERENCE TO MOUNTAINS IN IRELAND

		feet			feet
1	Carrantuohill	3404	15	Sheve Donard	2796
2	Mangerton	2754	16	Duns	1567
3	Brandon	3146	17	Sawel	2236
4	Hungry Hill	2249	18	Errigal	2462
5	Galtymore	3008	19	Bluestack	2213
6	Knockaneledown	2588	20	Sheve League	1964
7	Knockanfinan	2469	21	Truskmore	2072
8	Slieveaman	2362	22	Aulcagh	2188
9	Sheve Bloom	1691	23	Nephin	2646
10	Keper	2265	24	Croagh Patrick	2510
11	Lugnaquilla	3039	25	Mweelrea	2682
12	Tonelagee	2688	26	Bengorrat	2039
13	Kippure	2473	27	Benbawn (Twelve Pins)	2396
14	Leinster	2604			

REFERENCE TO COAL-FIELDS

England & Wales		England & Wales	
A	Northumberland & Durham	I	Shropshire (Coalbrook Dale)
B	Whitehaven	K	Dean Forest
C	South Lancashire	L	Bristol & Somerset
D	Leeds & Nottingham	M	North Wales, Flintshire, &c.
E	Leicestershire	N	Anglesey
F	Warwickshire (Coventry, &c.)	O	South Wales
G	North Staffordshire (Potteries)		
H	South Staffordshire (Birmingham & Dudley)	P	Scotch Coal fields
		R	Irish do

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10 France, in Departments
11 Belgium
12 Holland
13 Prussia
14 Sweden and Norway, with the Circuit of the Baltic Coasts
15 Denmark, with Iceland and Faroe Islands
16 Russia in Europe
17 Minor States of Germany
18 Austrian Empire
19 Switzerland
20 Spain and Portugal
21 Italy
22 Turkey in Europe, and Greece
23 Asia
24 Turkey in Asia
25 Russia in Asia, including Siberia and Transcaucasia
26 India
27 The Empires of China and Japan
28 Australia and New Zealand
29 New South Wales, Victoria, and the settled portions of South Australia
30 East Indian Archipelago
31 Africa
32 Egypt and Arabia Petræa, with Nubia and Abyssinia
33 North America
34 United States
35 Canada, and the adjoining Provinces of British North America
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37 The West Indies, and the States of Central America
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19 Switzerland
20 Italy
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22 Tuscany and the States of the Church
23 Venetian States
24 Naples and Sicily
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28 Germany—Southern Part
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30 Belgium
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32 Denmark
33 Sweden and Norway
34 Russia in Europe
35 Asia—General Map
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37 Turkey in Asia
38 Palestine
39 Persia and Cabool
40 Arabia, Egypt, Abyssinia & Nubia
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42 China
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61 Jamaica
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