

ALFRED RUSSEL WALLACE

**THE HISTORY OF MALAY
ARCHIPELAGO**

Alfred Russel Wallace

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PREFACE.

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My readers will naturally ask why I have delayed writing this book for six years after my return; and I feel bound to give them full satisfaction on this point.

When I reached England in the spring of 1862, I found myself surrounded by a room full of packing cases containing the collections that I had, from time to time, sent home for my private use. These comprised nearly three thousand bird-skins of about one thousand species, at least twenty thousand beetles and butterflies of about seven thousand species, and some quadrupeds and land shells besides. A large proportion of these I had not seen for years, and in my then weakened state of health, the unpacking, sorting, and arranging of such a mass of specimens occupied a long time.

I very soon decided that until I had done something towards naming and describing the most important groups in my collection, and had worked out some of the more interesting problems of variation and geographical distribution (of which I had had glimpses while collecting them), I would not attempt to publish my travels. Indeed, I could have printed my notes and journals at once, leaving all reference to questions of natural history for a future work; but, I felt that this would be as unsatisfactory to myself as it would be disappointing to my friends, and un instructive to the public.

Since my return, up to this date, I have published eighteen papers in the "Transactions" or "Proceedings of the Linnean Zoological and Entomological Societies", describing

or cataloguing portions of my collections, along with twelve others in various scientific periodicals on more general subjects connected with them.

Nearly two thousand of my Coleoptera, and many hundreds of my butterflies, have been already described by various eminent naturalists, British and foreign; but a much larger number remains undescribed. Among those to whom science is most indebted for this laborious work, I must name Mr. F. P. Pascoe, late President of the Entomological Society of London, who had almost completed the classification and description of my large collection of Longicorn beetles (now in his possession), comprising more than a thousand species, of which at least nine hundred were previously undescribed and new to European cabinets.

The remaining orders of insects, comprising probably more than two thousand species, are in the collection of Mr. William Wilson Saunders, who has caused the larger portion of them to be described by good entomologists. The Hymenoptera alone amounted to more than nine hundred species, among which were two hundred and eighty different kinds of ants, of which two hundred were new.

The six years' delay in publishing my travels thus enables me to give what I hope may be an interesting and instructive sketch of the main results yet arrived at by the study of my collections; and as the countries I have to describe are not much visited or written about, and their social and physical conditions are not liable to rapid change, I believe and hope that my readers will gain much more than they will lose by not having read my book six years ago, and by this time perhaps forgotten all about it.

I must now say a few words on the plan of my work.

My journeys to the various islands were regulated by the seasons and the means of conveyance. I visited some

islands two or three times at distant intervals, and in some cases had to make the same voyage four times over. A chronological arrangement would have puzzled my readers. They would never have known where they were, and my frequent references to the groups of islands, classed in accordance with the peculiarities of their animal productions and of their human inhabitants, would have been hardly intelligible. I have adopted, therefore, a geographical, zoological, and ethnological arrangement, passing from island to island in what seems the most natural succession, while I transgress the order in which I myself visited them, as little as possible.

I divide the Archipelago into five groups of islands, as follows:

I. THE INDO-MALAY ISLANDS: comprising the Malay Peninsula and Singapore, Borneo, Java, and Sumatra.

II. THE TIMOR GROUP: comprising the islands of Timor, Flores, Sumbawa, and Lombok, with several smaller ones.

III. CELEBES: comprising also the Sula Islands and Bouton.

IV. THE MOLUCCAN GROUP: comprising Bouru, Ceram, Batchian, Gilolo, and Morty; with the smaller islands of Ternate, Tidore, Makian, Kaióá, Amboyna, Banda, Goram, and Matabello.

V. THE PAPUAN GROUP: comprising the great island of New Guinea, with the Aru Islands, Mysol, Salwatty, Waigiou, and several others. The Ke Islands are described with this group on account of their ethnology, though zoologically and geographically they belong to the Moluccas.

The chapters relating to the separate islands of each of these groups are followed by one on the Natural History of that group; and the work may thus be divided into five

parts, each treating one of the natural divisions of the Archipelago.

The first chapter is an introductory one, on the Physical Geography of the whole region; and the last is a general sketch of the races of man in the Archipelago and the surrounding countries. With this explanation, and a reference to the maps which illustrate the work, I trust that my readers will always know where they are, and in what direction they are going.

I am well aware that my book is far too small for the extent of the subjects it touches upon. It is a mere sketch; but so far as it goes, I have endeavoured to make it an accurate one. Almost the whole of the narrative and descriptive portions were written on the spot, and have had little more than verbal alterations. The chapters on Natural History, as well as many passages in other parts of the work, have been written in the hope of exciting an interest in the various questions connected with the origin of species and their geographical distribution. In some cases I have been able to explain my views in detail; while in others, owing to the greater complexity of the subject, I have thought it better to confine myself to a statement of the more interesting facts of the problem, whose solution is to be found in the principles developed by Mr. Darwin in his various works. The numerous illustrations will, it is believed, add much to the interest and value of the book. They have been made from my own sketches, from photographs, or from specimens—and such, only subjects that would really illustrate the narrative or the descriptions, have been chosen.

I have to thank Messrs. Walter and Henry Woodbury, whose acquaintance I had the pleasure of making in Java, for a number of photographs of scenery and of natives,

which have been of the greatest assistance to me. Mr. William Wilson Saunders has kindly allowed me to figure the curious horned flies; and to Mr. Pascoe I am indebted for a loan of two of the very rare Longicorns which appear in the plate of Bornean beetles. All the other specimens figured are in my own collection.

As the main object of all my journeys was to obtain specimens of natural history, both for my private collection and to supply duplicates to museums and amateurs, I will give a general statement of the number of specimens I collected, and which reached home in good condition. I must premise that I generally employed one or two, and sometimes three Malay servants to assist me; and for nearly half the time had the services of an English lad, Charles Allen. I was just eight years away from England, but as I travelled about fourteen thousand miles within the Archipelago, and made sixty or seventy separate journeys, each involving some preparation and loss of time, I do not think that more than six years were really occupied in collecting.

I find that my Eastern collections amounted to:

- 310 specimens of Mammalia.
- 100 specimens of Reptiles.
- 8,050 specimens of Birds.
- 7,500 specimens of Shells.
- 13,100 specimens of Lepidoptera.
- 83,200 specimens of Coleoptera.
- 13,400 specimens of other Insects.

125,660 specimens of natural history in all.

It now only remains for me to thank all those friends to whom I am indebted for assistance or information. My thanks are more especially due to the Council of the Royal Geographical Society, through whose valuable recommendations I obtained important aid from our own Government and from that of Holland; and to Mr. William Wilson Saunders, whose kind and liberal encouragement in the early portion of my journey was of great service to me. I am also greatly indebted to Mr. Samuel Stevens (who acted as my agent), both for the care he took of my collections, and for the untiring assiduity with which he kept me supplied, both with useful information and with whatever necessities I required.

I trust that these, and all other friends who have been in any way interested in my travels and collections, may derive from the perusal of my book, some faint reflexion of the pleasures I myself enjoyed amid the scenes and objects it describes.

CHAPTER I. PHYSICAL GEOGRAPHY.

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From a look at a globe or a map of the Eastern hemisphere, we shall perceive between Asia and Australia a number of large and small islands forming a connected group distinct from those great masses of land, and having little connection with either of them. Situated upon the Equator, and bathed by the tepid water of the great tropical oceans, this region enjoys a climate more uniformly hot and moist than almost any other part of the globe, and teems with natural productions which are elsewhere unknown. The richest of fruits and the most precious of spices are Indigenous here. It produces the giant flowers of the Rafflesia, the great green-winged Ornithoptera (princes among the butterfly tribes), the man-like Orangutan, and the gorgeous Birds of Paradise. It is inhabited by a peculiar and interesting race of mankind—the Malay, found nowhere beyond the limits of this insular tract, which has hence been named the Malay Archipelago.

To the ordinary Englishman this is perhaps the least known part of the globe. Our possessions in it are few and scanty; scarcely any of our travellers go to explore it; and in many collections of maps it is almost ignored, being divided between Asia and the Pacific Islands. It thus happens that few persons realize that, as a whole, it is comparable with the primary divisions of the globe, and that some of its separate islands are larger than France or the Austrian Empire. The traveller, however, soon acquires different ideas. He sails for days or even weeks along the shores of

one of these great islands, often so great that its inhabitants believe it to be a vast continent. He finds that voyages among these islands are commonly reckoned by weeks and months, and that their several inhabitants are often as little known to each other as are the native races of the northern to those of the southern continent of America. He soon comes to look upon this region as one apart from the rest of the world, with its own races of men and its own aspects of nature; with its own ideas, feelings, customs, and modes of speech, and with a climate, vegetation, and animated life altogether peculiar to itself.

From many points of view these islands form one compact geographical whole, and as such they have always been treated by travellers and men of science; but, a more careful and detailed study of them under various aspects reveals the unexpected fact that they are divisible into two portions nearly equal in extent which differ widely in their natural products, and really form two parts of the primary divisions of the earth. I have been able to prove this in considerable detail by my observations on the natural history of the various parts of the Archipelago; and, as in the description of my travels and residence in the several islands I shall have to refer continually to this view, and adduce facts in support of it, I have thought it advisable to commence with a general sketch of the main features of the Malayan region as will render the facts hereafter brought forward more interesting, and their bearing upon the general question more easily understood. I proceed, therefore, to sketch the limits and extent of the Archipelago, and to point out the more striking features of its geology, physical geography, vegetation, and animal life.

Definition and Boundaries.—For reasons which depend mainly on the distribution of animal life, I consider the Malay

Archipelago to include the Malay Peninsula as far as Tenasserim and the Nicobar Islands on the west, the Philippines on the north, and the Solomon Islands, beyond New Guinea, on the east. All the great islands included within these limits are connected together by innumerable smaller ones, so that no one of them seems to be distinctly separated from the rest. With but few exceptions all enjoy an uniform and very similar climate, and are covered with a luxuriant forest vegetation. Whether we study their form and distribution on maps, or actually travel from island to island, our first impression will be that they form a connected whole, all the parts of which are intimately related to each other.

Extent of the Archipelago and Islands.—The Malay Archipelago extends for more than 4,000 miles in length from east to west, and is about 1,300 in breadth from north to south. It would stretch over an expanse equal to that of all Europe from the extreme west far into Central Asia, or would cover the widest parts of South America, and extend far beyond the land into the Pacific and Atlantic oceans. It includes three islands larger than Great Britain; and in one of them, Borneo, the whole of the British Isles might be set down, and would be surrounded by a sea of forests. New Guinea, though less compact in shape, is probably larger than Borneo. Sumatra is about equal in extent to Great Britain; Java, Luzon, and Celebes are each about the size of Ireland. Eighteen more islands are, on the average, as large as Jamaica; more than a hundred are as large as the Isle of Wight; while the isles and islets of smaller size are innumerable.

The absolute extent of land in the Archipelago is not greater than that contained by Western Europe from Hungary to Spain; but, owing to the manner in which the

land is broken up and divided, the variety of its productions is rather in proportion to the immense surface over which the islands are spread, than to the quantity of land which they contain.

Geological Contrasts.—One of the chief volcanic belts upon the globe passes through the Archipelago, and produces a striking contrast in the scenery of the volcanic and non-volcanic islands. A curving line, marked out by scores of active, and hundreds of extinct, volcanoes may be traced through the whole length of Sumatra and Java, and thence by the islands of Bali, Lombok, Sumbawa, Flores, the Serwatty Islands, Banda, Amboyna, Batchian, Makian, Tidore, Ternate, and Gilolo, to Morty Island. Here there is a slight but well-marked break, or shift, of about 200 miles to the westward, where the volcanic belt begins again in North Celebes, and passes by Siau and Sanguir to the Philippine Islands along the eastern side of which it continues, in a curving line, to their northern extremity. From the extreme eastern bend of this belt at Banda, we pass onwards for 1,000 miles over a non-volcanic district to the volcanoes observed by Dampier, in 1699, on the north-eastern coast of New Guinea, and can there trace another volcanic belt through New Britain, New Ireland, and the Solomon Islands, to the eastern limits of the Archipelago.

In the whole region occupied by this vast line of volcanoes, and for a considerable breadth on each side of it, earthquakes are of continual recurrence, slight shocks being felt at intervals of every few weeks or months, while more severe ones, shaking down whole villages, and doing more or less injury to life and property, are sure to happen, in one part or another of this district, almost every year. On many of the islands the years of the great earthquakes form the chronological epochs of the native inhabitants, by the aid of

which the ages of their children are remembered, and the dates of many important events are determined.

I can only briefly allude to the many fearful eruptions that have taken place in this region. In the amount of injury to life and property, and in the magnitude of their effects, they have not been surpassed by any upon record. Forty villages were destroyed by the eruption of Papandayang in Java, in 1772, when the whole mountain was blown up by repeated explosions, and a large lake left in its place. By the great eruption of Tomboro in Sumbawa, in 1815, 12,000 people were destroyed, and the ashes darkened the air and fell thickly upon the earth and sea for 300 miles around. Even quite recently, since I left the country, a mountain which had been quiescent for more than 200 years suddenly burst into activity. The island of Makian, one of the Moluccas, was rent open in 1646 by a violent eruption which left a huge chasm on one side, extending into the heart of the mountain. It was, when I last visited it in 1860, clothed with vegetation to the summit, and contained twelve populous Malay villages. On the 29th of December, 1862, after 215 years of perfect inaction, it again suddenly burst forth, blowing up and completely altering the appearance of the mountain, destroying the greater part of the inhabitants, and sending forth such volumes of ashes as to darken the air at Ternate, forty miles off, and to almost entirely destroy the growing crops on that and the surrounding islands.

The island of Java contains more volcanoes, active and extinct, than any other known district of equal extent. They are about forty-five in number, and many of them exhibit most beautiful examples of the volcanic cone on a large scale, single or double, with entire or truncated summits, and averaging 10,000 feet high.

It is now well ascertained that almost all volcanoes have been slowly built up by the accumulation of matter—mud, ashes, and lava—ejected by themselves. The openings or craters, however, frequently shift their position, so that a country may be covered with a more or less irregular series of hills in chains and masses, only here and there rising into lofty cones, and yet the whole may be produced by true volcanic action. In this manner the greater part of Java has been formed. There has been some elevation, especially on the south coast, where extensive cliffs of coral limestone are found; and there may be a substratum of older stratified rocks; but still essentially Java is volcanic, and that noble and fertile island—the very garden of the East, and perhaps upon the whole the richest, the best cultivated, and the best governed tropical island in the world—owes its very existence to the same intense volcanic activity which still occasionally devastates its surface.

The great island of Sumatra exhibits, in proportion to its extent, a much smaller number of volcanoes, and a considerable portion of it has probably a non-volcanic origin.

To the eastward, the long string of islands from Java, passing by the north of Timor and away to Banda, are probably all due to volcanic action. Timor itself consists of ancient stratified rocks, but is said to have one volcano near its centre.

Going northward, Amboyna, a part of Bouru, and the west end of Ceram, the north part of Gilolo, and all the small islands around it, the northern extremity of Celebes, and the islands of Siau and Sanguir, are wholly volcanic. The Philippine Archipelago contains many active and extinct volcanoes, and has probably been reduced to its present fragmentary condition by subsidences attending on volcanic action.

All along this great line of volcanoes are to be found more or less palpable signs of upheaval and depression of land. The range of islands south of Sumatra, a part of the south coast of Java and of the islands east of it, the west and east end of Timor, portions of all the Moluccas, the Ke and Aru Islands, Waigiou, and the whole south and east of Gilolo, consist in a great measure of upraised coral-rock, exactly corresponding to that now forming in the adjacent seas. In many places I have observed the unaltered surfaces of the elevated reefs, with great masses of coral standing up in their natural position, and hundreds of shells so fresh-looking that it was hard to believe that they had been more than a few years out of the water; and, in fact, it is very probable that such changes have occurred within a few centuries.

The united lengths of these volcanic belts is about ninety degrees, or one-fourth of the entire circumference of the globe. Their width is about fifty miles; but, for a space of two hundred miles on each side of them, evidences of subterranean action are to be found in recently elevated coral-rock, or in barrier coral-reefs, indicating recent submergence. In the very centre or focus of the great curve of volcanoes is placed the large island of Borneo, in which no sign of recent volcanic action has yet been observed, and where earthquakes, so characteristic of the surrounding regions, are entirely unknown. The equally large island of New Guinea occupies another quiescent area, on which no sign of volcanic action has yet been discovered. With the exception of the eastern end of its northern peninsula, the large and curiously-shaped island of Celebes is also entirely free from volcanoes; and there is some reason to believe that the volcanic portion has once formed a separate island. The Malay Peninsula is also non-volcanic.

The first and most obvious division of the Archipelago would therefore be into quiescent and volcanic regions, and it might, perhaps, be expected that such a division would correspond to some differences in the character of the vegetation and the forms of life. This is the case, however, to a very limited extent; and we shall presently see that, although this development of subterranean fires is on so vast a scale—has piled up chains of mountains ten or twelve thousand feet high—has broken up continents and raised up islands from the ocean—yet it has all the character of a recent action which has not yet succeeded in obliterating the traces of a more ancient distribution of land and water.

Contrasts of Vegetation.—Placed immediately upon the Equator and surrounded by extensive oceans, it is not surprising that the various islands of the Archipelago should be almost always clothed with a forest vegetation from the level of the sea to the summits of the loftiest mountains. This is the general rule. Sumatra, New Guinea, Borneo, the Philippines and the Moluccas, and the uncultivated parts of Java and Celebes, are all forest countries, except a few small and unimportant tracts, due perhaps, in some cases, to ancient cultivation or accidental fires. To this, however, there is one important exception in the island of Timor and all the smaller islands around it, in which there is absolutely no forest such as exists in the other islands, and this character extends in a lesser degree to Flores, Sumbawa, Lombok, and Bali.

In Timor the most common trees are Eucalypti of several species, also characteristic of Australia, with sandalwood, acacia, and other sorts in less abundance. These are scattered over the country more or less thickly, but, never so as to deserve the name of a forest. Coarse and scanty grasses grow beneath them on the more barren hills, and a

luxuriant herbage in the moister localities. In the islands between Timor and Java there is often a more thickly wooded country abounding in thorny and prickly trees. These seldom reach any great height, and during the force of the dry season they almost completely lose their leaves, allowing the ground beneath them to be parched up, and contrasting strongly with the damp, gloomy, ever-verdant forests of the other islands. This peculiar character, which extends in a less degree to the southern peninsula of Celebes and the east end of Java, is most probably owing to the proximity of Australia. The south-east monsoon, which lasts for about two-thirds of the year (from March to November), blowing over the northern parts of that country, produces a degree of heat and dryness which assimilates the vegetation and physical aspect of the adjacent islands to its own. A little further eastward in Timor and the Ke Islands, a moister climate prevails; the southeast winds blowing from the Pacific through Torres Straits and over the damp forests of New Guinea, and as a consequence, every rocky islet is clothed with verdure to its very summit. Further west again, as the same dry winds blow over a wider and wider extent of ocean, they have time to absorb fresh moisture, and we accordingly find the island of Java possessing a less and less arid climate, until in the extreme west near Batavia, rain occurs more or less all the year round, and the mountains are everywhere clothed with forests of unexampled luxuriance.

Contrasts in Depth of Sea.—It was first pointed out by Mr. George Windsor Earl, in a paper read before the Royal Geographical Society in 1845, and subsequently in a pamphlet "On the Physical Geography of South-Eastern Asia and Australia", dated 1855, that a shallow sea connected the great islands of Sumatra, Java, and Borneo with the

Asiatic continent, with which their natural productions generally agreed; while a similar shallow sea connected New Guinea and some of the adjacent islands to Australia, all being characterised by the presence of marsupials.

We have here a clue to the most radical contrast in the Archipelago, and by following it out in detail I have arrived at the conclusion that we can draw a line among the islands, which shall so divide them that one-half shall truly belong to Asia, while the other shall no less certainly be allied to Australia. I term these respectively the Indo-Malayan and the Austro-Malayan divisions of the Archipelago.

On referring to pages 12, 13, and 36 of Mr. Earl's pamphlet, it will be seen that he maintains the former connection of Asia and Australia as an important part of his view; whereas, I dwell mainly on their long continued separation. Notwithstanding this and other important differences between us, to him undoubtedly belongs the merit of first indicating the division of the Archipelago into an Australian and an Asiatic region, which it has been my good fortune to establish by more detailed observations.

Contrasts in Natural Productions.—To understand the importance of this class of facts, and its bearing upon the former distribution of land and sea, it is necessary to consider the results arrived at by geologists and naturalists in other parts of the world.

It is now generally admitted that the present distribution of living things on the surface of the earth is mainly the result of the last series of changes that it has undergone. Geology teaches us that the surface of the land, and the distribution of land and water, is everywhere slowly changing. It further teaches us that the forms of life which inhabit that surface have, during every period of which we possess any record, been also slowly changing.

It is not now necessary to say anything about how either of those changes took place; as to that, opinions may differ; but as to the fact that the changes themselves have occurred, from the earliest geological ages down to the present day, and are still going on, there is no difference of opinion. Every successive stratum of sedimentary rock, sand, or gravel, is a proof that changes of level have taken place; and the different species of animals and plants, whose remains are found in these deposits, prove that corresponding changes did occur in the organic world.

Taking, therefore, these two series of changes for granted, most of the present peculiarities and anomalies in the distribution of species may be directly traced to them. In our own islands, with a very few trifling exceptions, every quadruped, bird, reptile, insect, and plant, is found also on the adjacent continent. In the small islands of Sardinia and Corsica, there are some quadrupeds and insects, and many plants, quite peculiar. In Ceylon, more closely connected to India than Britain is to Europe, many animals and plants are different from those found in India, and peculiar to the island. In the Galapagos Islands, almost every indigenous living thing is peculiar to them, though closely resembling other kinds found in the nearest parts of the American continent.

Most naturalists now admit that these facts can only be explained by the greater or less lapse of time since the islands were upraised from beneath the ocean, or were separated from the nearest land; and this will be generally (though not always) indicated by the depth of the intervening sea. The enormous thickness of many marine deposits through wide areas shows that subsidence has often continued (with intermitting periods of repose) during epochs of immense duration. The depth of sea produced by

such subsidence will therefore generally be a measure of time; and in like manner, the change which organic forms have undergone is a measure of time. When we make proper allowance for the continued introduction of new animals and plants from surrounding countries by those natural means of dispersal which have been so well explained by Sir Charles Lyell and Mr. Darwin, it is remarkable how closely these two measures correspond. Britain is separated from the continent by a very shallow sea, and only in a very few cases have our animals or plants begun to show a difference from the corresponding continental species. Corsica and Sardinia, divided from Italy by a much deeper sea, present a much greater difference in their organic forms. Cuba, separated from Yucatan by a wider and deeper strait, differs more markedly, so that most of its productions are of distinct and peculiar species; while Madagascar, divided from Africa by a deep channel three hundred miles wide, possesses so many peculiar features as to indicate separation at a very remote antiquity, or even to render it doubtful whether the two countries have ever been absolutely united.

Returning now to the Malay Archipelago, we find that all the wide expanse of sea which divides Java, Sumatra, and Borneo from each other, and from Malacca and Siam, is so shallow that ships can anchor in any part of it, since it rarely exceeds forty fathoms in depth; and if we go as far as the line of a hundred fathoms, we shall include the Philippine Islands and Bali, east of Java. If, therefore, these islands have been separated from each other and the continent by subsidence of the intervening tracts of land, we should conclude that the separation has been comparatively recent, since the depth to which the land has subsided is so small. It is also to be remarked that the great chain of active

volcanoes in Sumatra and Java furnishes us with a sufficient cause for such subsidence, since the enormous masses of matter they have thrown out would take away the foundations of the surrounding district; and this may be the true explanation of the often-noticed fact that volcanoes and volcanic chains are always near the sea. The subsidence they produce around them will, in time, make a sea, if one does not already exist.

But, it is when we examine the zoology of these countries that we find what we most require—evidence of a very striking character that these great islands must have once formed a part of the continent, and could only have been separated at a very recent geological epoch. The elephant and tapir of Sumatra and Borneo, the rhinoceros of Sumatra and the allied species of Java, the wild cattle of Borneo and the kind long supposed to be peculiar to Java, are now all known to inhabit some part or other of Southern Asia. None of these large animals could possibly have passed over the arms of the sea which now separate these countries, and their presence plainly indicates that a land communication must have existed since the origin of the species. Among the smaller mammals, a considerable portion are common to each island and the continent; but the vast physical changes that must have occurred during the breaking up and subsidence of such extensive regions have led to the extinction of some in one or more of the islands, and in some cases there seems also to have been time for a change of species to have taken place. Birds and insects illustrate the same view, for every family and almost every genus of these groups found in any of the islands occurs also on the Asiatic continent, and in a great number of cases the species are exactly identical. Birds offer us one of the best means of determining the law of distribution; for

though at first sight it would appear that the watery boundaries which keep out the land quadrupeds could be easily passed over by birds, yet practically it is not so; for if we leave out the aquatic tribes which are pre-eminently wanderers, it is found that the others (and especially the Passeres, or true perching-birds, which form the vast majority) are generally as strictly limited by straits and arms of the sea as are quadrupeds themselves. As an instance, among the islands of which I am now speaking, it is a remarkable fact that Java possesses numerous birds which never pass over to Sumatra, though they are separated by a strait only fifteen miles wide, and with islands in mid-channel. Java, in fact, possesses more birds and insects peculiar to itself than either Sumatra or Borneo, and this would indicate that it was earliest separated from the continent; next in organic individuality is Borneo, while Sumatra is so nearly identical in all its animal forms with the peninsula of Malacca, that we may safely conclude it to have been the most recently dismembered island.

The general result therefore, at which we arrive, is that the great islands of Java, Sumatra, and Borneo resemble in their natural productions the adjacent parts of the continent, almost as much as such widely-separated districts could be expected to do even if they still formed a part of Asia; and this close resemblance, joined with the fact of the wide extent of sea which separates them being so uniformly and remarkably shallow, and lastly, the existence of the extensive range of volcanoes in Sumatra and Java, which have poured out vast quantities of subterranean matter and have built up extensive plateaux and lofty mountain ranges, thus furnishing a vera causa for a parallel line of subsidence—all lead irresistibly to the conclusion that at a very recent geological epoch, the continent of Asia

extended far beyond its present limits in a south-easterly direction, including the islands of Java, Sumatra, and Borneo, and probably reaching as far as the present 100-fathom line of soundings.

The Philippine Islands agree in many respects with Asia and the other islands, but present some anomalies, which seem to indicate that they were separated at an earlier period, and have since been subject to many revolutions in their physical geography.

Turning our attention now to the remaining portion of the Archipelago, we shall find that all the islands from Celebes and Lombok eastward exhibit almost as close a resemblance to Australia and New Guinea as the Western Islands do to Asia. It is well known that the natural productions of Australia differ from those of Asia more than those of any of the four ancient quarters of the world differ from each other. Australia, in fact, stands alone: it possesses no apes or monkeys, no cats or tigers, wolves, bears, or hyenas; no deer or antelopes, sheep or oxen; no elephant, horse, squirrel, or rabbit; none, in short, of those familiar types of quadruped which are met with in every other part of the world. Instead of these, it has Marsupials only: kangaroos and opossums; wombats and the duckbilled Platypus. In birds it is almost as peculiar. It has no woodpeckers and no pheasants—families which exist in every other part of the world; but instead of them it has the mound-making brush-turkeys, the honeysuckers, the cockatoos, and the brush-tongued lories, which are found nowhere else upon the globe. All these striking peculiarities are found also in those islands which form the Austro-Malayan division of the Archipelago.

The great contrast between the two divisions of the Archipelago is nowhere so abruptly exhibited as on passing

from the island of Bali to that of Lombock, where the two regions are in closest proximity. In Bali we have barbets, fruit-thrushes, and woodpeckers; on passing over to Lombock these are seen no more, but we have abundance of cockatoos, honeysuckers, and brush-turkeys, which are equally unknown in Bali, or any island further west. [I was informed, however, that there were a few cockatoos at one spot on the west of Bali, showing that the intermingling of the productions of these islands is now going on.] The strait is here fifteen miles wide, so that we may pass in two hours from one great division of the earth to another, differing as essentially in their animal life as Europe does from America. If we travel from Java or Borneo to Celebes or the Moluccas, the difference is still more striking. In the first, the forests abound in monkeys of many kinds, wild cats, deer, civets, and otters, and numerous varieties of squirrels are constantly met with. In the latter none of these occur; but the prehensile-tailed Cuscus is almost the only terrestrial mammal seen, except wild pigs, which are found in all the islands, and deer (which have probably been recently introduced) in Celebes and the Moluccas. The birds which are most abundant in the Western Islands are woodpeckers, barbets, trogons, fruit-thrushes, and leaf-thrushes; they are seen daily, and form the great ornithological features of the country. In the Eastern Islands these are absolutely unknown, honeysuckers and small lorries being the most common birds, so that the naturalist feels himself in a new world, and can hardly realize that he has passed from the one region to the other in a few days, without ever being out of sight of land.

The inference that we must draw from these facts is, undoubtedly, that the whole of the islands eastwards beyond Java and Borneo do essentially form a part of a

former Australian or Pacific continent, although some of them may never have been actually joined to it. This continent must have been broken up not only before the Western Islands were separated from Asia, but probably before the extreme southeastern portion of Asia was raised above the waters of the ocean; for a great part of the land of Borneo and Java is known to be geologically of quite recent formation, while the very great difference of species, and in many cases of genera also, between the productions of the Eastern Malay Islands and Australia, as well as the great depth of the sea now separating them, all point to a comparatively long period of isolation.

It is interesting to observe among the islands themselves how a shallow sea always intimates a recent land connexion. The Aru Islands, Mysol, and Waigiou, as well as Jobie, agree with New Guinea in their species of mammalia and birds much more closely than they do with the Moluccas, and we find that they are all united to New Guinea by a shallow sea. In fact, the 100-fathom line round New Guinea marks out accurately the range of the true Paradise birds.

It is further to be noted—and this is a very interesting point in connection with theories of the dependence of special forms of life on external conditions—that this division of the Archipelago into two regions characterised by a striking diversity in their natural productions does not in any way correspond to the main physical or climatal divisions of the surface. The great volcanic chain runs through both parts, and appears to produce no effect in assimilating their productions. Borneo closely resembles New Guinea not only in its vast size and its freedom from volcanoes, but in its variety of geological structure, its uniformity of climate, and the general aspect of the forest

vegetation that clothes its surface. The Moluccas are the counterpart of the Philippines in their volcanic structure, their extreme fertility, their luxuriant forests, and their frequent earthquakes; and Bali with the east end of Java has a climate almost as dry and a soil almost as arid as that of Timor. Yet between these corresponding groups of islands, constructed as it were after the same pattern, subjected to the same climate, and bathed by the same oceans, there exists the greatest possible contrast when we compare their animal productions. Nowhere does the ancient doctrine—that differences or similarities in the various forms of life that inhabit different countries are due to corresponding physical differences or similarities in the countries themselves—meet with so direct and palpable a contradiction. Borneo and New Guinea, as alike physically as two distinct countries can be, are zoologically wide as the poles asunder; while Australia, with its dry winds, its open plains, its stony deserts, and its temperate climate, yet produces birds and quadrupeds which are closely related to those inhabiting the hot damp luxuriant forests, which everywhere clothe the plains and mountains of New Guinea.

In order to illustrate more clearly the means by which I suppose this great contrast has been brought about, let us consider what would occur if two strongly contrasted divisions of the earth were, by natural means, brought into proximity. No two parts of the world differ so radically in their productions as Asia and Australia, but the difference between Africa and South America is also very great, and these two regions will well serve to illustrate the question we are considering. On the one side we have baboons, lions, elephants, buffaloes, and giraffes; on the other spider-monkeys, pumas, tapirs, anteaters, and sloths; while among birds, the hornbills, turacos, orioles, and honeysuckers of

Africa contrast strongly with the toucans, macaws, chatterers, and hummingbirds of America.

Now let us endeavour to imagine (what it is very probable may occur in future ages) that a slow upheaval of the bed of the Atlantic should take place, while at the same time earthquake-shocks and volcanic action on the land should cause increased volumes of sediment to be poured down by the rivers, so that the two continents should gradually spread out by the addition of newly-formed lands, and thus reduce the Atlantic which now separates them, to an arm of the sea a few hundred miles wide. At the same time we may suppose islands to be upheaved in mid-channel; and, as the subterranean forces varied in intensity, and shifted their points of greatest action, these islands would sometimes become connected with the land on one side or other of the strait, and at other times again be separated from it. Several islands would at one time be joined together, at another would be broken up again, until at last, after many long ages of such intermittent action, we might have an irregular archipelago of islands filling up the ocean channel of the Atlantic, in whose appearance and arrangement we could discover nothing to tell us which had been connected with Africa and which with America. The animals and plants inhabiting these islands would, however, certainly reveal this portion of their former history. On those islands which had ever formed a part of the South American continent, we should be sure to find such common birds as chatterers and toucans and hummingbirds, and some of the peculiar American quadrupeds; while on those which had been separated from Africa, hornbills, orioles, and honeysuckers would as certainly be found. Some portion of the upraised land might at different times have had a temporary connection with both continents, and would then