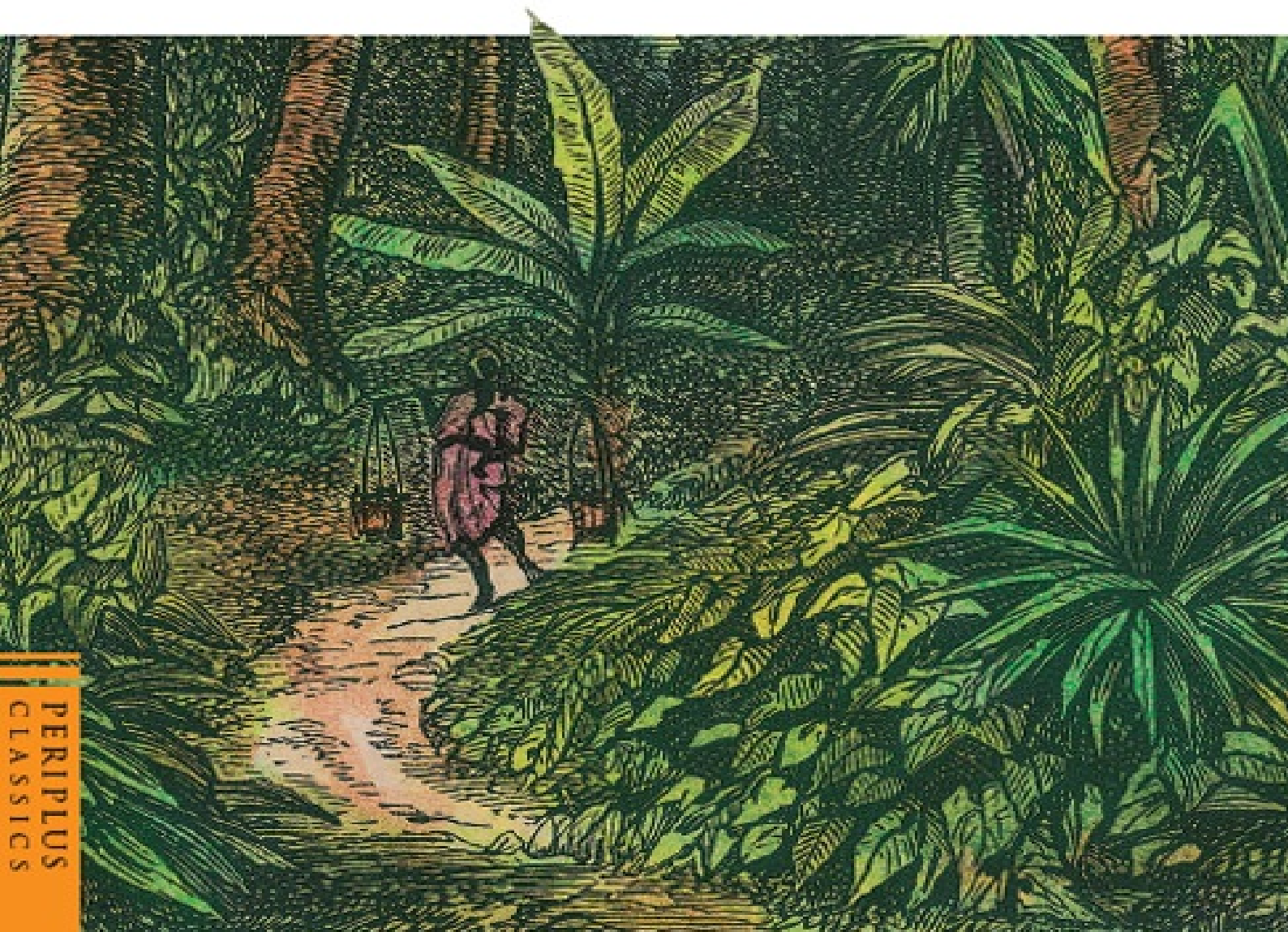




THE MALAY ARCHIPELAGO

ALFRED RUSSEL WALLACE

Introduction by Tony Whitten



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**THE
MALAY
ARCHIPELAGO**

**THE
MALAY
ARCHIPELAGO**

Alfred Russel Wallace

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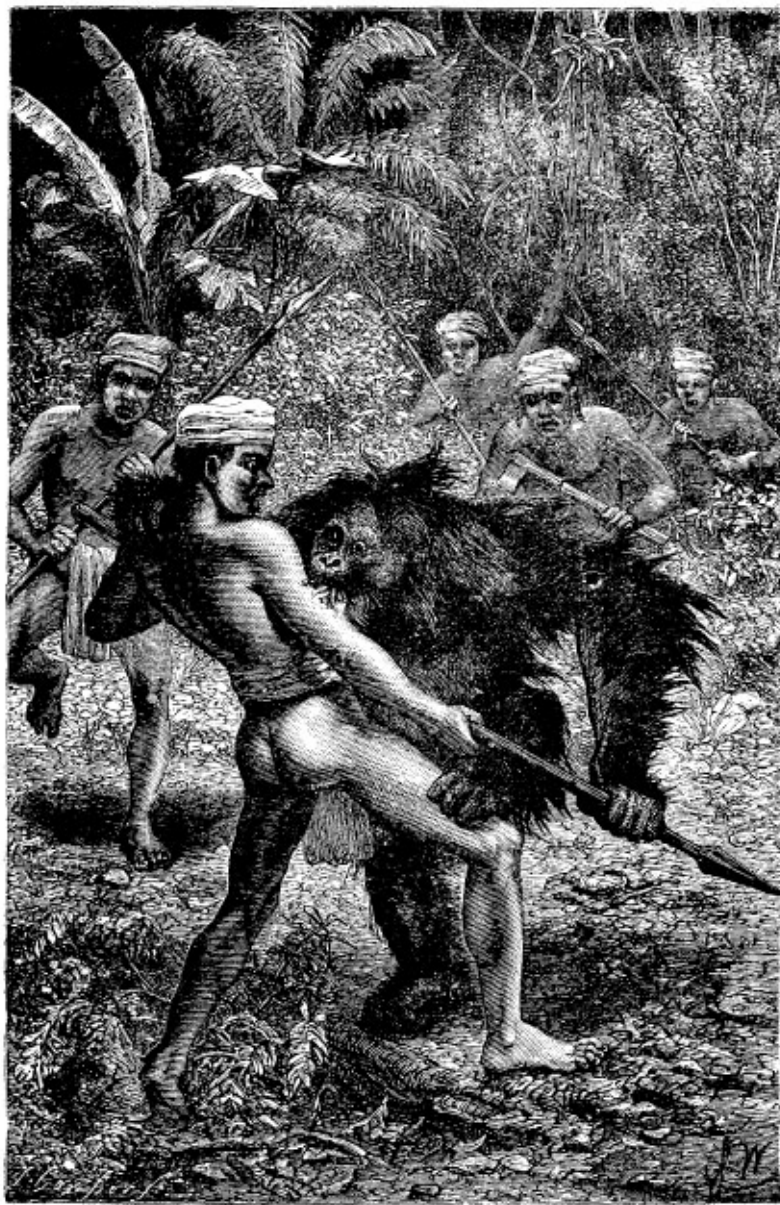
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An orangutan attacked by Dayaks.

To
Charles Darwin
Author of *The Origin of Species*
I Dedicate this Book
not only
as a token of personal esteem and friendship
but also to express my deep admiration
for his genius and his works

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Introduction

OH, HOW I WISH I HAD KNOWN WALLACE! He was such a pleasant man, rather shy but passionate about what he did. I don't think he would have appreciated my company for long periods, but I hope I would not have suffered me now and again. To have travelled and conversed with him would have been a great pleasure; what a lot there would have been to talk about. We could have shared many stories, everything from the debilitating effects of suppurating tropical ulcers (while he conquered his through rest, mine landed me in a sex-change hospital in Singapore needing plastic surgery), the woes of being "often up to our knees in mud and much annoyed by the leeches," to the many times each of us thought we had arranged an early morning departure from a village but had to change plans when the expected guides or paddlers didn't turn up. I think we would have agreed that our frustrations were rooted in our failure to appreciate the different pace and priorities of village life; a life where the concepts of urgency and materialism don't translate easily.

I would have liked to talk about the excitement and fascination that we both feel when climbing mountains in tropical Asia, and which Wallace describes so well. The higher one goes, the smaller and more gnarled the trees become with heavier loads of dripping moss and exquisite orchids, and the more the plants become reminiscent of those found in the cooler parts of the Himalayas, Europe and even North America—with rhododendrons, hypericums, gentians, primulas, violets, buttercups and many other familiar garden plants. The best description he gives is of Mt Gede-Pangrango to the south of Bogor in West Java which is very accessible to the reasonably fit, but a climb up any of the major mountains in Sumatra, Java, Sulawesi, Maluku or Papua is enormously rewarding.

I would love to have squatted on a roadside with Wallace, sticky-fingered, with an ever-growing pile of empty durian skins in front of us. We completely agree on the supremacy of this fruit which he called the "King" and "Emperor" of fruits, suggesting it was "worth a journey to the East, if only for the taste of its fruit." By contrast, Professor J.W. Purseglove, a renowned agriculturalist, botanist and author of the two-volume horticulturalist's "bible", *Tropical Crops*, held the view that the ripe fruit "gives off an abominable stench of over-ripe cheese, rotten onions, turpentine and bad drains. Malay and other people in the Far East are very partial to it, as are some Europeans who have managed to overcome the odour. The fruit taste is difficult to describe but it is sweet, aromatic, persistent and with a touch of garlic; it has also been described as French custard passed through a sewer".

Wallace was born in 1823 in Usk, Monmouthshire. The family moved to Hertford when he was six, and moved frequently within that area over the next seven years, a peripatetic pattern he was to continue throughout his life. He left school at 13 moving to join first one brother and then another. Always inquisitive, he read books on mathematics and geometry and, at 16, his first book on botany. He continued to move around Britain, trying different jobs, but nothing lasted very long. At 21 he met the great British naturalist and explorer, H.W. Bates, and four years later the two of them set off to the Amazon to collect plants and animals. After four years he returned to England, but his entire collection was lost in a fire at sea. Back in London he was unemployed but wrote his first book *Narrative of Travels on the Amazon and Rio Negro*. He then set off again, this time alone, and headed for the Malay Archipelago.

Wallace had the right temperament to work in Southeast Asia for he rarely seems to have boiled over in frustration. Even when some of his writings were lost, he seems to have been able to take a deep breath and get on with life rather than have the loss gnaw at him. For example, he made an amazing (and still useful) vocabulary of 117 useful words in 59 languages which is included in the

book's appendix. Well, it would have been 59 languages had a friend not lost the sheets of paper with 26 of them when moving house. As a result only nine words are shown in all 59 languages. Wallace tells this story without any hint of rancour but only sympathy for the movers who must have assumed that the papers had no significance.

Wallace was a delightful naturalist, not a specialist in any one branch of biology and there are times, modern regulations apart, when I would love to have the same freedom to wander as him. Never rich, he made his living by collecting animals and selling them, through an agent in London, to public and private museums. He took great joy in the environment around him, and could wax lyrical about the pitcher plants which “continually excited our admiration,” and when local helpers brought him birds they had caught, it kept him “in a continual state of pleasurable excitement.” The agent sent money out to Wallace to sustain him, and it was not until he got back to England that he discovered the agent had also been putting aside a sum for when he returned. He was not a scholar, having left school at 14, and despite attempts, was never successful in getting what one might call a “proper job”.

Returning to London after nine years in Asia, he lived with his mother, sister and brother-in-law and during this time he met with all the elite in the exciting world of natural history—people like Charles Darwin, Charles Lyell and Thomas Huxley. He also sorted his collection of 3000 bird skins and 20,000 butterflies and wrote descriptions of many of the previously unknown species. Over the years he applied unsuccessfully for many positions, including Director of the Bethnal Green Museum, Assistant Secretary of the Royal Geographical Society and Superintendent of Epping Forest. He also challenged “flat earth” believers in print, but was attacked for his views.

Between 1845 and 1846 he wrote *The Malay Archipelago* and was awarded the Royal Medal by the Royal Geographical Society. The book was well received and at last earned him some money. Continuing to move around southern England, he wrote several other books: *Contributions to the Theory of Natural Selection*, *Miracles and Modern Spiritualism*, *Geographical Distribution of Animals*, and *Tropical Nature and Other Essays*. Sadly he invested the proceeds badly and lost much of his money. In desperation he wrote for *Encyclopaedia Britannica*.

I am deeply envious of the huge sense of discovery in the time in which Wallace lived. At one site he collected some 1000 species of Longicorn beetles with long antenna of which at least 900 were new to science. Mind you, I am enormously grateful to him and others of his ilk who have helped to document so much of the region's biodiversity. And there are still many new and fascinating species to discover if one goes to the right places with the sharp eyes and the right degree of diligence.

Some parts of his work and life do not sit easily today. He reports shooting a dozen or so orangutans in Borneo, and this section of the book is rather ghoulish by today's standards. He did however adopt a baby orangutan for three months and took great delight in it until it died, having had no milk. He was a man of his times, and if alive today he would have been an ardent and practical conservationist.

Wallace was a great traveller and nowadays would more likely be seen at a hostel or homestay than in a hotel—in part because most “nice” hotels would balk at the pickled animal corpses and drying skins which surrounded him at his many stops. Wallace had one or two assistants but unlike Raffles, who travelled through Sumatra with dozens of bearers and others to transport the chairs, French wine, and other “necessary” accoutrements, he didn't travel with the entourage normal for the Victorian traveller. Wallace was content with the bare essentials—clothing, bedding, and of course the collecting boxes, the pins to lay out his specimens, the preserving spirit, and knives for skinning the mammal and bird specimens.

I've been able to see many wonderful places but I agree totally with Wallace in his view that “Java

may fairly claim to be the finest tropical island in the world, and equally interesting to the tourist seeking after new and beautiful scenes; to the naturalist who desires to examine the variety and beauty of tropical nature; or to the moralist and the politician who want to solve the problem of how man may be best governed under new and varied conditions." Visitors to Jakarta or Yogyakarta seem to rush away to other islands, but the highways and byways of Java bring all sorts of surprises. It is certainly densely populated in places, but elsewhere one can walk for a day and meet barely a soul, and the landscapes are breathtakingly stunning. Wallace was also struck by the relatively dry, austere north of Bali and I wonder what he would have written had he gone to the verdant and even more beautiful southern part where the people were so vehement in their stand against Dutch colonial rule.

His sections on the distribution of animals and plants among the islands are a continuous theme through the book, and he poses questions about, for example, why there are peacocks in Java but not in Sumatra or Borneo, while there are other species of pheasants which are found on those two islands but not on Java. These magnificent birds with their hugely long tails can be seen at Alas Purwo National Park and to see them flying is a great thrill, as Wallace describes.

But it was other writing which pushed him reluctantly towards the limelight. Darwin is usually given credit for formulating the theory of evolution by natural selection, but the primary reason he was encouraged to write down his thoughts was because Wallace had written to him from Ternate in 1858 enclosing a manuscript for Darwin's "perusal" showing that he had reached more or less the same conclusions as Darwin. Both men had been stimulated by what they had seen while travelling and the interpretation of their observations did not match with the contemporary wisdom concerning the creation of the world. The thoughts of these two men on the distribution and evolution of species turned modern thinking upside-down and Wallace's contribution should not be underestimated even though he was always self-effacing about his contribution, always passing any praise and honour towards Darwin, the wealthy and establishment figure.

Wallace was of the view that the Indonesian archipelago was inhabited by two distinct faunas, one found in the east, one in the west. The following year he defined these two regions, based on the distribution of birds, by placing the boundary between Lombok and Bali and between Borneo and Sulawesi. He was struck that Borneo and Sulawesi should have such different birds and yet be separated by no major physical or climatic barrier. He believed that Borneo, along with Java and Sumatra, had once been part of Asia, and that Timor, Maluku, New Guinea and perhaps Sulawesi had once been part of a Pacific-Australian continent. The fauna of Sulawesi seemed so peculiar that he suspected it might have been connected with both the Asian and the Pacific-Australian continents. He insisted that an explanation of the origin of the fauna of Sulawesi would have to accept that there had been vast changes in the surface of the earth, a concept which challenged the established view by which we now know to be true. The line that Wallace drew east of the Philippines, through the Makassar Straits and between Bali and Lombok came to be known as Wallace's Line. In 1910, three years before he died, Wallace decided that the predominance of Asian forms on Sulawesi should be reflected in the Line being moved east of Sulawesi. Since then other people have examined the placement of the lines and almost every permutation now exists based on different groups of animals and plants. To be sure, "Wallace's Line" does not work very well for many groups of organisms but the principles are still valid and in fact almost any neat line or definition in biology tends to be criticized by someone.

The Malay Archipelago is neither pure travelogue nor a truly scientific tome for his real scientific and scientific descriptions were written in other books and papers. *The Malay Archipelago* is more like a long letter written to an interested friend who would be intrigued by not only what animals and plants he had encountered, but also by the stories of the travels by land, river and sea, and by the

conversations he had with local villagers or the kings, princes, rajahs and sultans alike.

A word has to be said about certain rather offensive passages relating to the character of the people he meets and his gross extrapolations from individual conduct to racial traits. Wallace was a man of his age—but he was generally sympathetic to everyone he met. He was concerned about the labor endured by women and saw that the advance of civilization (or development as we would call it now) required that the situation of women be ameliorated. Indeed, some of the passages describing his village conversations are delightful. I have certainly also experienced the persistent enquiries as to my purposes for being in a forest area and my careful explanations have been met with disbelief, if foreign did they seem. I was reminded how aberrant my behaviour must seem when blowing my nose on a handkerchief made one group of people, struggling to understand my odd habits, conclude that I had wrapped up the snot to take back to England!

The abundance of wildlife was very different in the mid nineteenth century. Wallace tells us that there were always a few tigers running around Singapore, and they killed on average “a Chinaman every day.” Similarly, in 1861, just after he arrived in Wonosalem in East Java, a young boy had been pulled off a bullock cart, dragged into the forest and eaten by a tiger. Some 700 men with spears went after the tiger and killed it. Of course the forest edge has also progressively pushed back since his day and many of the areas he visited, especially in the western regions, are now covered with plantations of oil palm Acacia trees, sugar cane, and rubber.

While it would be a privilege to bring him up to date on the condition of the natural ecosystems and think it would take him a long time to absorb the rate and extent of the loss of natural ecosystems and the biodiversity within them. He saw things I would give my eye teeth to see. Imagine, that while he noted that elephants were, by the 1860s, some way distant from Palembang in South Sumatra as a result of human disturbance, Sumatran rhinoceroses abounded and he “continually saw its tracks and its dung.” The lucky man even glimpsed one feeding until it crashed away into the undergrowth. The same species is now critically endangered with scant hope of a future in fractured and small populations in Sumatra, Borneo, the Malay Peninsula and possibly Myanmar. Those in the foothills of the Himalayas to Indochina are long gone, prey to hunters seeking to benefit from the demand for the horn for Chinese traditional medicine and for Arab daggers.

When Wallace was 41 he proposed to 18-year-old Annie Mitten and they married the next year, in 1865. At this time he became involved in spiritualism and séances and also wrote on the subject. At 50 he moved yet again and wrote *Land Nationalisation*, having become very interested in the social issues of his time—even if he was unable to find any regular work. Influential friends finally procured Wallace a small Civil List pension of £200 per annum, which must have been very welcome. The following year Darwin died and at the grand funeral at Westminster Abbey ten years later Wallace acted as one of the pall bearers. Wallace never ceased to give the greater honour to Darwin for the “discovery” of evolution by natural selection and the dedication page of *The Malay Archipelago* is testament to this.

In 1886, at 63, he embarked on a year-long American lecture tour presenting his travels and thoughts, illustrated with lantern slides. In 1889 he received an honorary degree from Oxford University and published yet another book, *Darwinism*. His enormous (and continuing) contributions to science were recognized when he was made a Fellow of the Royal Society. Between the ages of 70 and 84 he published seven more books including his autobiography, *My Life*, and at 85 gave a major lecture at the Linnean Society of London, from the spot where his and Darwin's papers on evolution had been read 50 years before. He was awarded a variety of other honours and medals, including the Order of Merit. He did not receive it directly from King Edward VII on the grounds of old age and ill health, but given that he was never one for pomp and ceremony he probably preferred to get his from

one of the King's equerries in his own home.

In his final years his thoughts turned more to social concerns and he engaged with the Prime Ministers of the time, Asquith and Lloyd George, on the matters. He continued to write, and his last book, *Social Environment and Moral Progress*, was published in 1913, the same year that he died aged 90. What an amazing life!

* * * * *

It has been my enormous good fortune to have travelled and worked in most of the places Wallace visited and even to have seen in the wild many of the things he saw, but on re-reading *The Malay Archipelago* I was reminded of the concept of ecological amnesia or “shifting baselines.” This refers to the phenomenon by which succeeding generations expect to see less nature because their experience has been of a depleted world. We laugh at the old fisherman who tries to convince us that in his day the fish were so much larger and so much more abundant—but in most cases he is probably right. We expect Sumatran rhinoceros to be rare because they have always been rare. No, they haven't. They used to “abound.”

I have related above how *The Malay Archipelago* produces an affinity with Wallace because of the similar things we have witnessed and enjoyed. But in fact anyone with some time and an adventurous spirit can share a great deal of this even today—and with the comforts of malarial prophylactics and mobile phones. There are still Rajas on small islands in Maluku, there are still plenty of leeches, there are still innumerable butterflies to enjoy, and unique sights like the mating displays of the extravagant Wallace's Standard Wing are still there to be seen in the forests of Halmahera. Your patience and good humour in the Malay archipelago will often be rewarded with sights and experiences which will be remembered for the rest of your life—just as Wallace did.

Tony Whitt

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The Ecology of Sulawesi

The Ecology of Java and Bali, and Wild Indonesia

Preface to the First Edition

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 a thousand species; and at least twenty thousand beetles and butterflies, of about seven thousand species; besides some quadrupeds and land shells. A large proportion of these I had not seen for years; and in my then weak 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. I could, indeed, at once have printed my notes and journals, leaving all reference to questions of natural history for a future work; but I felt that this would be unsatisfactory to myself as it would be disappointing to my friends, and uninformative to the public.

Since my return, up to 1868, I have published eighteen papers, in the Transactions or Proceedings of the Linnæan Zoological and Entomological Societies, describing or cataloguing portions of my collections; besides 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 remain 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 has 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 transgress the order in which I myself visited them as little as possible.

I divide the archipelago into five groups of islands, as follow:—

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. Sulawesi: comprising also the Sula Islands and Buton.

IV. The Maluku Group: comprising Buru, Seram, Bacan, Halma-hera, and Morotai; with the smaller islands of Ternate, Tidore, Makian, Kayoa, Ambon, Banda, Gorong, and Watubelu.

V. The Papuan Group: comprising the great island of New Guinea, with the Aru Islands, Misool, Salawati, Waigeo, and several others. The Kai Islands are described with this group on account of their ethnology, though zoologically and geographically they belong to Maluku.

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 of 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, if they 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 subjects only have been chosen as would really illustrate the narrative or the descriptions.

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 three

years had the services of a young Englishman, Mr. Charles Allen. I was just eight years away from England, but as I travelled about fourteen thousand miles within the archipelago, and made sixty 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	— Reptiles
8,050	— Birds
7,500	— Shells
13,100	— Lepidoptera
83,200	— Coleoptera
13,400	— other Insects
125,660	specimens of natural history

It now only remains for me to thank all those friends to whom I am indebted for assistance and 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 reflection of the pleasures I myself enjoyed amid the scenes and objects it describes.

Preface to the Tenth Edition

SINCE THIS WORK was first published, twenty-one years ago, several naturalists have visited the archipelago; and in order to give my readers the latest results of their researches I have added footnotes whenever my facts or conclusions have been modified by later discoveries. I have also made a few verbal alterations in the text to correct any small errors or obscurities. These corrections and additions are however not numerous, and the work remains substantially the same as in the earlier editions. I may add that my complete collections of birds and butterflies are now in the British Museum.

Parkstone, Dorset

October, 1890

CHAPTER 1:

Physical Geography

IF WE 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 here indigenous. 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.¹ 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 for weeks, along the shores of one of the 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 widely differ in their natural products, and really form parts of two 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 such of the main features of the Malayan region as will render the facts hereafter brought forward more interesting, and their bearing on 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 a 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 Sulawesi 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 islands 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 Sermata Islands, Banda, Ambon, Bacan, Makian, Tidore, Ternate, and Halmahera, to Morotai Island. Here there is a slight but well-marked break, or shift, of about 200 miles to the westward, where the volcanic belt again begins, in North Sulawesi, and passes by Siau and Sangir 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.



The British Isles and Borneo on the Same Scale.

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, whole 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. In 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 round. Even quite recently since I quit the country, a mountain which had been quiescent for more than 200 years suddenly burst into activity. The island of Makian, one of Maluku, was rent open in 1646 by a violent eruption, which left a huge chasm on one side, extending into the heart of the mountain. When I last visited it, in 1862, it was 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.¹

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, frequent

shift their position; so that a country may be covered with a more or less irregular series of hills and 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 the 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 Buru, and the west end of Seram, the north part of Halmahera, and all the small islands around it, the northern extremity of Sulawesi, and the islands of Siau and Sangir, 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 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 Maluku, the Kai and Aru Islands, Waigeo, and the whole south and east of Halmahera, consist in a great measure of upraised coral-reefs, 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 on each side of them, evidences of subterranean action is to be found in recently elevated coral-rock, or 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 Sulawesi 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 Maluku, and the uncultivated parts of Java and Sulawesi, 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, so characteristic of Australia, with sandal-wood, 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 lesser degree to the southern peninsula of Sulawesi 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-laut and the Kai Islands, a moister climate prevails, the south-east wind 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, till in the extreme west near Jakarta 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 islands adjacent to Australia, all being characterized 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. (See Physical Map.)

In Mr. Earl's pamphlet, however, he argues in favour of the former land-connection of Asia and Australia, whereas it appears to me that the evidence, taken as a whole, points to 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

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