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‘New Publications. Island Life.’

Island Life: Or, the Phenomena and Causes of Insular Faunas and Floras. Including a Revision and Attempted Solution of the Problem of Geological Climates. By Alfred Russel Wallace. New-York: Harper & Brothers. 1881.

For the study of the distribution of organisms in their most comprehensive sense, Mr. Wallace has chosen the principal islands of the world as affording the best opportunity of arriving at a knowledge of such phenomena. The reasons for this choice are manifest. Islands possess many advantages for the study of the laws of distribution. Having a restricted area and definite boundaries, in many cases their geographical and biological limits coincide. Again, “the number of species and of genera they contain is always much smaller than in the case of continents, and their peculiar species and groups are usually well defined and strictly limited to the range.” As to the relations of the fauna to that of the continents, they are perhaps “easier to comprehend, and, in addition, islands show certain influences in the form of life and certain peculiarities of distribution which continents do not present, and whose study offers many points of interest.”

In islands, though the facts of distribution are at times presented in their simplest form, it frequently occurs that they become complex. If, however, we commence with the easier forms, it often becomes quite possible for us to unravel the more abstruse problems. In “Island life,” Mr. Wallace calls forth in support of his explanations almost all that modern science presents on subjects related to his particular topics, and the amount of erudition the author possesses is cosmical in its character.

The first chapter of the book supposes that an Englishman, familiar with the birds of his country, travels to Northern Japan. In the woods and fields of England he has seen the tits, hedge sparrows, wagtails, and larks. He arrives at Hakodadi, some 13,000 miles distant from England. In Japan he finds birds almost identical with those he has left in England; others so closely resembling the home birds that it requires a practical ornithologist to appreciate the differences. If he is curious as to the insects, he notices that the beetles and butterflies, though apparently the same in aspect, are distinct. If he studies these topics more closely, though he may find some birds or beetles quite different, there is a wonderful resemblance between the productions of remote Japan and England, and yet there is the whole width of Europe and Asia, with its endless succession of plains and mountains, which separate the fauna. Now, let an Englishman who has lived in Australia set sail for New-Zealand, an island only 1,300 miles distant, and he will find himself in a country whose productions are totally unlike those of Australia. The birds are new—kangaroos and wombats are absent, insects are unlike, and vegetables are changed. Japan is 13,000 miles from England, New-Zealand but 1,300 miles from Australia, and the changes in the animal and bird life are in inverse proportion to the distances of separation. But there are more striking cases of this diversity in countries nothing like so far apart. Two islands, named Bali and Lombok, each about the size of Corsica, belonging to the Malay Archipelago, are separated by a strait only some 15 miles wide. The birds on one island differ *in toto* from those on the other. On Lombok are screaming cockatoos and friar birds, with mound-building megapodes, while these are unknown on Bali. There may be resemblance in vegetation between two continents such as Brazil and the west coast of Africa, but animal life is totally

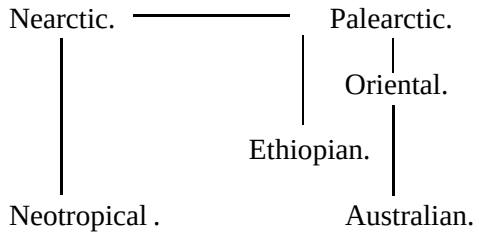
diverse. In South America there are the tapirs, sloths, and prehensile-tailed monkeys; in Africa, elephants, antelopes, and man-like apes. We see that climate can have but little influence, for, though temperatures differ but slightly in south temperate Africa, America, and South Australia, birds and quadrupeds are completely unlike. There ought, then, to be semblance in form between the fauna of an island and those of the nearest continent, but in Madagascar these are extremely unlike those found in Africa. Exactly questions of this character occupy Mr. Wallace's attention, "for each continent, every country, and every island on the globe offer similar problems of greater or less complexity and interest."

Mr. Wallace does not pretend to pass over lightly the difficulties of grasping a subject of this character in all its details, for to be proficient would require a knowledge of all the fauna and flora of the whole world. Now, as knowledge of this kind is of very slow growth, it must be as yet imperfect. There is still a graver obstacle, increasing every day, and that is as the foot of man intrudes on the little visited spots of the world destruction of forests go on, and with it the obliteration of not only the normal plants but original animals. What Mr. Wallace most specially insists upon is that by the modern theory of "descent by modification" alone can distribution be studied, for "so long as the belief of 'special creation' of each species prevailed, no explanation of the complex facts of distribution could be arrived at or even conceived, for if each species was created where it is now found no further inquiry can take us beyond that fact, and there is an end of the whole matter."

A most important factor in a study of this kind is an acquaintance with the extinct forms that have inhabited each country during the tertiary and secondary periods of geology. Though the facts are scanty so far, they alone throw light on migrations of animals and plants in past ages. There is another subject, which must be understood before the movement of animals can be appreciated, and that is the evidence derived from stratiographical geology. We would be in the dark unless we knew what parts of a country had been elevated or submerged, so that islands were made, or islands and continents united, affording, as in the latter case, methods of travel for animals, or cutting off fauna from their original source of birth. Without information of a special character, derived from soundings or the study of sea depths, Mr. Wallace declares that one of the most difficult of all the questions of geographical biology, the origin of the fauna and flora in New-Zealand, would have forever remained unsolved.

The bearing that evidence of this character has on the distribution of organisms is important, but there are others of even a more fundamental character, "the importance of which is now only beginning to be recognized by students of nature." There are two topics, then, to which Mr. Wallace devotes a large portion of the present work. One treats of the wonderful alterations of climate which have occurred in temperature and polar zones, "proved by the evidences of glaciation in the one and of luxuriant vegetation in the other, and, secondly, the theory of the permanence of existing continents and oceans." As to the first, the author expresses his conviction that, as the theory accounts for both the glacial epochs and warm polar climates, it is especially valuable for the light it throws on the dispersal and existing distribution of organisms. As to the second, the permanence of oceans and continents, this seems to us, though yet awaiting further proof, to be perfectly tenable so far, and to be the fundamental question in regard to the subjects Mr. Wallace has to do with, "since," as the author writes, "we once admit that continents and oceans may have changed places over and over again, (as many writers maintain,) we lose all power of reasoning on the migrations of ancestral forms of life, and are at the mercy of every wild theorist who chooses to imagine the former existence of a now submerged continent to explain the existing distribution of a group of frogs or a genus of beetles."

The chapter on “Elementary Distribution” is founded on the theory of evolution. From the old point of view the diversities of animal life in separate continents, even when physical conditions were almost identical, was the fact that excited astonishment, “but, seen by the light of the evolution theory, it is the resemblances rather than the diversities in these distant countries and islands that are the most difficult to explain.” Passing without comment on the zoological divisions and regions, which are the Palearctic, Ethiopian, Oriental, Australian, Nearctic, and Neotropical, arranged in the following relation to one another on the face of the globe—



we come to the biographical relations of the islands of the globe. The most interesting questions are “How do new species arise? or what becomes of them when they have arisen?” We cannot believe that a perfect balance of organisms can ever have existed. It is a well-known fact that while some species are common, others are rare. This is prima facie evidence that one species is better adapted to is surroundings than another. “This belief is strengthened when we find the individuals of one species ranging into different climates, subsisting on different food, and competing with different sets of animals, while the individuals of another species will be limited to a small area, beyond which they seem unable to extend.” Given, then, the earliest changes of a violent character, as caused by climate or geography, such as from glacial disturbance, or submergence, or elevation, or severance from mainlands, the small and ill-adapted species would probably die out altogether, and leave room for others to increase, or for forms with adaptive possibilities to occupy their places. It is not to be supposed that this change of condition would always be beneficial. There might have been long struggles for existence before a puny form adapted itself to its surroundings. This variation was always, then, indicative of a struggle for existence. “All the weaker and less perfectly organized individuals die out, while those which vary in such a way as to bring them into more harmony with the new conditions constantly survive. If, then, through centuries these changes continued, after a while some quasi stable form was built up, which was what we call a ‘new species.’” In proof of this, Mr. Wallace goes back to what is so familiar to us—the absolute shaping of our domestic animals. “Think,” writes Mr. Wallace, “of the difference in every limb, and every bone and muscle, and probably in every part, internal and external, of the whole body, between a greyhound and a bull-dog.”

There is even a great amount of variation in wild creatures. Mr. Wallace quotes Mr. J. A. Allen, one of our American naturalists, who has made elaborate observations and measurements of the birds in the United States. These were found to differ in marking and distribution of color. Thus the Wilson thrush—*Turdus fuscensces*—varies in length of wing from 3.58 to 4.16 inches in birds taken from the same locality. All facts, then, seem to prove the variability of wild animals, and that some process of natural selection is always at work.

One of the most interesting facts shown by Mr. Wallace is in regard to discontinuity in distribution. He takes the European and Japanese jays—the *Garrulus glandarius* and *G. japonicus.* This jay inhabits Northern Europe, but is not known in Asia, being represented by quite distinct species. Now, a jay turns

up as almost the identical bird in Japan. The only theory to explain this ornithological fact is that once these birds were common all over the continents of Europe and Asia, and thence were found in Japan, and that the original type was persistent. From this is argued that discontinuity is in itself a proof of antiquity, and the more widely the fragments are scattered the more ancient we may presume a group to be. "Whenever, then, we find two or more living genera belonging to the same family or order, but not very closely allied, we may be sure that they are the remnants of a once extensive group of genera, and if we find them now isolated in remote parts of the globe, the natural inference is that the family of which they are fragments once had an area embracing the countries in which they were found."

The methods of dispersal of animals and plants are numerous. Oceans are barriers, for without artificial help neither the mammalia nor land birds could pass them. If larger mammals could not migrate, smaller arboreal ones might occasionally pass broad seas by means of floating trees. On such rafts as are formed of tangled limbs of trees launched from a continent, small animals like squirrels or mice might colonize an island. But how account for the presence of large mammals? When we find that a considerable number of the mammals of two countries exhibit distinct marks of relationship, we may be sure that a possible land connection, or, at all events, an approach to within a few miles of each other, had at one time existed. This is an exceedingly interesting theory, and must be accepted as the only solution of what heretofore has been but little understood. We see, then, how stratiography enters into the subject, and the lesson it teaches. As to the dispersion of reptiles, there is less difficulty in understanding it than in regard to mammals, on account of their greater tenacity of life and their oviparous mode of reproduction. An instance is cited of a boa-constrictor having floated when twined around a cedar tree from the coast of South America to St. Trinidad, a distance of nearly 200 miles, and so little injured by the voyage as to have at once been strong enough to capture some sheep. The lizards or their eggs may be thus carried long distances. As to the vertebrates, amphibia, and fresh-water fishes, such possess even special facilities for dispersal, flourishing in Arctic regions and having eggs which stand freezing without injury. Floating ice might be constant sources for dispersal. It requires no explanation to understand how the same fish are found in various rivers of a continent. Hurricanes and water-spouts must act in removing small individuals or their eggs from one quarter of a continent to another. Aquatic birds act as common carriers, taking the eggs of fish or seeds of plants from one country to another. In insects dispersal reaches its maximum. Having powers of flight and lightness, they are carried immense distances by gales of wind. Eggs and larvæ inhabit solid timber, which are floated. Another important factor in the problem of their dispersion is the immense antiquity of insects. In the miocene period of Switzerland 156 genera of fossil beetles have been found, of which not less than 114 are still living. If they were then present in large quantities over immense areas, their similarity to-day in many countries is not surprising. That some of them have become extremely specialized is not be wondered at when we consider their delicacy and the effects of food and climate on them. The dispersal of land mollusks or sea-shells presents no great difficulties. When we come to the scattering of plants, at once it is quite evident that they possess great advantages over animals, since they are propagated by seeds and spores, which are infinitely harder to kill than the eggs of insects. Winds, rivers, ocean currents, icebergs, birds, and animals, human agencies, are always moving them. If a million of seeds were brought to the British Islands by winds blowing from the Continent, though there would be only 10 seeds to the square mile, and the observations of a life would not detect one of them, "yet a hundredth part of this number would serve in a few centuries to stock an island like Great Britain with a great variety of Continental plants."

It is to the geographical and geological changes, restricted, however, by the permanence of the present continents and oceans, that the great dispersal of animal and plant life is due. As the glacial periods have come with the intervals of milder climate, animals and plants have been repelled and killed out at one time by the cold or attracted and developed by the warmth. The paleontological evidences of these alternate cold and warm periods no one denies to-day, and consequently we must admit of developments, migrations, and extinctions of organisms. In pliocene times large and powerful mammalia may have survived the first glacial epochs, but hardly withstood subsequent ones, and they must have died out on the spot of origin or continued their existence in more Southern or congenial lands. Down to the pliocene times, when we study plants, the flora of Europe was similar to that which prevails in Eastern Asia and Eastern North America. Trees which flourished now in these last two countries are to-day wanting in the first. Possibly, when a milder epoch came chains of mountains just upheaved or new seas just bursting old barriers cut off their return, running athwart their lines of progress. Again, when mountains have been piled up parallel with the line of continents, as in America, no great barriers presented themselves to dispersal, as there were lines of travel on both sides of such mountain ranges. It is impossible, for want of space, to give full weight to the very strong arguments advanced by Mr. Wallace in regard to the glacial epochs, their extent and their periodicity, or to the persistency of continents and oceans. Mr. Wallace does not believe that continents or oceans were in former periods precisely the same in shape as they are found to-day, but that they approximated in contour to their present condition. Such continents might have been submerged or elevated at various epochs, oceans might have advanced or retreated, but toward all geological periods that man's inquiry can be directed they were identical with the continents and oceans of to-day. We doubt if there has ever been presented in a more able manner than in the volume under review the properties of air and water, snow and ice, in relationship to climate and the action of meteorological causes in intensifying glaciation. In a certain measure Mr. Wallace agrees with Dr. Croll, believing that once these alternations of cold occurred every 10,500 years, and that these periods of eccentricity happened as much as 2,500,000 years ago. But effects of climate, of course, having to do with the change of position of the present poles, are due to geographical surroundings and other causes, such as elevation of land, the presence of seas, and the course of the winds. Having thus laid down in the briefest manner some of the laws which govern the study of animal or plant biology, we can now apply these rules, after the author's dictation, to island life. Now, islands are continental or oceanic, and both these conditions of existence have marked bearings on biological life. Continental islands are varied in their geological formation, containing ancient and recent stratified rocks. Rarely remote from a continent, they always contain certain land mammals and amphibia, as well as representatives of the other classes and orders in considerable variety. Their subdivision is that of ancient or recent. Ancient continental islands are divided from the continents by depths of sea of 1,000 fathoms and upward. Such is Madagascar. Recent islands have no such depths of water flowing between them and continents. The type of a recent island is Great Britain. In oceanic islands, of which St. Helena is a type, situated in midocean, total absence of warm-blooded terrestrial animals proves that the island is "no fragment of any existing or submerged continent, but one that has been actually produced in midocean."

Let us take Madagascar as a typical island and apply Mr. Wallace's rules to account for its fauna and flora. Madagascar is 1,000 miles long, with an extreme width of 360 miles, and is 250 miles from Africa. It has high granitic plateaus. When the shallow bank on which Madagascar stands is passed the sea is deep, the Mozambique Channel varying from 500 to 1,500 fathoms. To the east the sea deepens, and between it and Bourbon and the Mauritius a profound channel of 2,400 fathoms exists. On the north,

toward the Seychelles, there are extensive banks of 1,000 fathoms, in a sea of 2,000 fathoms. It seems probable, then, that to the north-east of Madagascar there was once a series of islands. Looking further east, we find the Chagos and Maldville coral atolls, “marking the position of other large islands, which, together, would form a line of communication by comparatively easy stages of 400 to 500 miles each between Madagascar and India.” All these facts must be borne in mind when the biological features of the island are to be studied. The island possesses a very rich and beautiful fauna and flora. It has 66 species of mammals—conclusive evidence that it once formed part of a continent. But, what is most strange, the assemblage differs from that found in Africa or any other existing continent. There are no lions, leopards, hyenas, no zebras, rhinoceroses, elephants, buffaloes, giraffes. Then it has neither the tigers, bears, tapirs, deer, nor squirrels of Asia. Let us study to what groups of mammalia those of Madagascar belong, or where their probable allies are to be found. Of the lemurs, there are six genera and 33 species. These are found in West Africa, but also in India and Ceylon. Now, as to the insectivora, some exist in Madagascar only approached by forms in the far remote Cuba and Hayti. In the carnivora, however, are peculiar cat-like animals—cryptoprocta and cerets. Here we have, decidedly, origin derived from African sources. When we come to the reptiles, they are neither African nor Asiatic, but American, notably Philodryas and Heterodon, and there is another Herpetodryas found in America and China. In the lizards there are African genera, but the iguanidæ are exclusively American, while the geckoes found on the island are both American and Australian. Is it not extraordinary, then, that in many cases the affinities are greater between Madagascar and America than with Africa? And, again, that the most striking and characteristic groups of animals now inhabiting Africa are entirely wanting in Madagascar? The explanation, Mr. Wallace tells us, “is not so difficult.” In the Miocene age in France, Germany, in Europe, and North-east India all the great mammals that inhabited Africa were present. In Eocene times tropical Africa was cut off from Europe and Asia by a sea stretching from the Atlantic to the Bay of Bengal. Then Africa must have been a detached island continent such as Australia, and was poor in the higher forms of life. But in the Europe of the Miocene age these mammals throve. Then came new convulsions of nature and migrations southerly of these mammals into Africa. But during the Miocene age, when the mammals were not to be found in Africa, Madagascar was detached, and this accounts for the absence of these larger African forms to-day in the island. But how arrange for the anomalous distributions of American forms? Returning, then, to the rule that when dispersions exist with discontinuity it is a proof of antiquity, we must study such anomalous forms as are found in Madagascar. We have no right to suppose that there ever was direct land communication between Madagascar and the Antilles. But it is safe to assert that, as a widely distributed family, these insectivorous centetidæ existed in the American Continent; that from thence they were driven by climatic influences across Behring Straits to Asia, and from Asia to Europe; then southerly to Africa, and from Africa to Madagascar, in a time when Madagascar was not insular. Mr. Wallace explains most lucidly the peculiar fauna and flora of the Azores, the Galapagos Islands, St. Helena, the Sandwich Islands, Great Britain, Borneo and Java, Japan, Formosa, Celebes, and New-Zealand, tracing them back to their possible source. From the description of our author’s method of research, it is hardly necessary to state that, having adopted the theory of permanency for continents and oceans, he entirely rejects such purely imaginative lands as the lost Atlantis and Lemuria.

Mr. Wallace, by his two compilations—“The Malay Archipelago” and “The Geographical Distribution of Animals”—has already asserted his right to be considered as one of the leaders in this most difficult study of distribution and dispersal of the fauna and flora of the world. Endowed with philosophic research, he has arranged his innumerable facts with wonderful skill and accuracy. In island

fauna he has taken even wider ground, and shows a cosmical acquaintance with all the phenomena of nature. A work of this character acts as the keenest stimulant to research, as it furnishes an immense amount of material, not to be passed over lightly, but to be carefully weighed and digested. Not less praiseworthy is Mr. Wallace's invariable method of giving full credit to those whose labors in various branches of science have been incorporated in his text, and the studies of Profs. Marsh and Cope and of Mr. Thomas Bland, all find due recognition in his pages.

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