

the changes wrought by man's influence in the extension of the area occupied by some wild animals (as of the horse in South America), and in the restriction of that occupied by others (as of the beaver in Europe), led naturalists to see that very slight causes could powerfully influence the simple presence or absence of animals in particular regions. It became clear that whole groups of animals—Faunæ, as they are termed—were constantly on the move, shifting their territory, extending in this direction, and shrinking in another, as conditions varied. Geology taught that conditions had varied, and were even now slowly changing, so that a dim perception of the reason why some animals are found here and others there was obtained.

Whilst the doctrine of special creation was dominant, a favourite hypothesis in connexion with this subject was that of "centres of creation." Every species must, it was said, have been created at some particular spot, and the problem of the student of geographical zoology was to trace the species back through its wanderings to its original home or "centre of creation." Not the least striking part of the new theory of the origin of species propounded by Mr. Darwin, and by the author of the book which serves as our text, was the remarkable way in which it illuminated the mass of facts ascertained by naturalists as to the distribution of the various species of animals, in past and present times, on the surface of the globe. It was shown that the more salient features, as well as the special details relating to the presence and absence of species and whole tribes of animals on various tracts of land, could be explained, as they could be in no other conceivable way, by the consideration of what must necessarily result from the interaction of two great natural processes, the one the slow change of specific form due to the preservation of favoured races in the struggle for existence, the other the well-ascertained constant change of the form of the globe's dry land—peninsulas separating from continents as islands, islands fusing to form new continents—continents breaking up or effecting junction with, or isolation from, one another. Thus Australia received the germ of her present abundant Fauna of pouched mammals when she was part of the Old-World continent, but separated from that connexion too soon to receive the various placental mammals which have, except in her isolated area, superseded these older forms. Thus South America, at one time unconnected with North America, developed her great sloths and armadilloes, and, on fusing with the latter, sent her megatheriums to the north, and received mastodons and large cats in exchange.

The value of the Darwinian theory in connexion with the explanation of the geographical distribution of animals depends on the vast number of curious relations between past changes of the land surface, of which there is independent geological evidence on the one hand, and the positions occupied by species or groups of species, the migrations of which appear to have been hindered or facilitated by those changes, on the other. A great deal of most valuable fact and speculation on the subject is to be found in Mr. Wallace's earlier writings, in Mr. Darwin's 'Origin of Species,' in Sir Charles Lyell's 'Principles of

SCIENCE

The Geographical Distribution of Animals.
By Alfred Russel Wallace. (Macmillan & Co.)

To the uninstructed a work on the geographical distribution of animals will probably suggest something in the form of a catalogue enumerating the kinds of animals found in this and that recognized territory or sub-division of the earth's surface, just as a catalogue of post-boxes might inform us of the distribution of the varieties of those useful institutions among the various streets and parishes of London. As a matter of fact, that was the kind of information which the naturalists of the last century and of earlier times assiduously collected, without further thought or question on the matter. About the beginning of the present century, however, the restless scientific spirit set itself to asking "the reason why" of the association of such different kinds of organisms in one and another part of the globe. The notion of the solidarity of a Fauna, that all its constituent members were interdependent, working together unconsciously for their common welfare, was propounded by Treviranus. The discovery and recognition of the remains of extinct animals, such as elephants and lions, in Northern Europe gave conclusive evidence that the distribution of the kinds of animals at present observed is not the distribution which has always obtained, and further consideration of

Geology,' and in memoirs by Prof. Huxley and by Dr. Sclater. The two bulky octavo volumes which Mr. Wallace has now produced are intended to bring before us all the available evidence on the various questions involved, to present us not only with the catalogue of animals and their habitats, but to discuss "the reason why" they are thus distributed, and, as he says, to stand in the same relation to those chapters of the fundamental work (Mr. Darwin's 'Origin of Species') which treat of geographical distribution, as does Mr. Darwin's own book, 'Animals and Plants under Domestication,' to the chapter on "Variation."

The result of Mr. Wallace's labours is a book which contains the most valuable information industriously put together, and certain to be of the highest importance to the zoological student. It would be, however, wrong to suggest that it is fitted for the general reader, and, probably, when the author determined to make it so complete a compilation as it is of all that is known of the geographical distribution of terrestrial animals, he abandoned the notion of addressing a wide public. The highly elaborate maps and the valuable catalogues of families and genera with their accurately stated geographical position appear somewhat ill-matched with the curious lithographed drawings of groups of mammals and birds dispersed through the volumes. These can be of no interest to the professed zoologist, and, on account of inaccurate portraiture (for instance, the sketch of the Cape ant-eater), may mislead the unskilled layman who has the courage to attempt the more generally interesting chapters of the book.

On the whole, the impression produced by Mr. Wallace's two volumes is, that neither our knowledge of geological phenomena nor of the distribution of some important groups of animals is sufficiently definite to render the production of a well-knit book on geographical zoology possible at the present time. To treat the subject succinctly, it would seem necessary that we should have the knowledge after which we are still groping, namely of the exact distribution of land and water in past geological epochs, and of the characteristic Fauna of each of those successively evanescent continents and islands. Then it would be possible, looking at the existing animals of any one region, to say that this species came during such and such an epoch into this area from such and such a tract of land, where it had been developed in connexion with this or that group of forms, the rest of which have migrated and undergone special modifications in another direction; and so on with all the various inhabitants of the territory under consideration.

Such a treatment of geographical zoology is the perfect one at which naturalists distantly aim. Those who are interested in following out the various hypotheses, methods of observation and comparison, by which they are endeavouring to compass this result, will find most thorough information in Mr. Wallace's work. We find there chapters on "The Means of Dispersal and Migration of Animals," on "Distribution as affected by the Conditions and Changes of the Earth's Surface," on "Zoological Regions," those tracts of the earth's surface first accurately distinguished by Dr. Sclater, in each of which there appears to be an individuality of the Fauna or assemblage of

animal forms, marking it off more or less distinctly from neighbouring zoological regions, and which do not, we need hardly say, necessarily correspond to the regions recognized by political geography. Then there follows an account, with elaborate enumeration of families and genera, of the existing and extinct Fauna of each of these great zoological provinces, and finally, a series of chapters on the distribution of the recent and fossil mammals, birds, reptiles, amphibia, fishes, butterflies and beetles, and of molluscs, especially the land-snails.

The groups of animals just enumerated are the only ones of which Mr. Wallace treats. It is of these only that our knowledge is as yet extended enough, to furnish important evidence towards the real question at issue, the distribution of land and water in past geological epochs. When we reflect that the evidence to be derived from the distribution of the wingless kinds of insects with more than six legs—the spiders, centipedes, &c.—from the distribution of earth-worms, and even from the overwhelming crowd of witnesses furnished by the vegetable kingdom, has not been as yet worked into the treatment of the great problem before us, it becomes apparent how much remains to be done, and that such a work as Mr. Wallace's, being none the less meritorious and useful to the student, must be regarded—in the absence of any further comprehensive generalizations similar to that for which science became indebted to him eighteen years ago—rather as a collection of materials to serve for the elucidation of the problem of geographical distribution than as a work making marked progress towards the complete solution of that problem.