

THURSDAY, FEBRUARY 1, 1877

**DARWIN'S "GEOLOGICAL OBSERVATIONS"**

*Geological Observations on the Volcanic Islands and Parts of South America visited during the Voyage of H.M.S. "Beagle."* By Charles Darwin, M.A., F.R.S. Second Edition, with Maps and Illustrations. (London: Smith, Elder, and Co., 1876.)

MR. DARWIN'S important contributions to biological observation and theory have during the last seventeen years attracted so much public attention, that there is some danger—one from which, however, all geologists will claim exemption—of his valuable labours in almost every department of geological research being to some extent lost sight of. Long, however, before the publication of the "Origin of Species," its author had achieved a foremost place in the ranks of the cultivators of geological science; nor must it be forgotten that the great work itself is as much a contribution to geology as to biology. Students of Mr. Darwin's earlier geological writings must all have been impressed by the powers of minute observation, the acumen in testing, and the skill in grouping data, and the boldness and originality in generalisation which distinguish their author; for these characteristics are no less conspicuously displayed in the theory of Coral Reefs than in that of Natural Selection.

In December, 1831, Mr. Darwin sailed from England in H.M. surveying vessel the *Beagle*, having accepted an invitation from the late Capt. FitzRoy to act as volunteer naturalist to the expedition then being despatched to complete the survey of the coast of South America. After an absence of nearly five years—during which many of the islands in the Atlantic were examined, large portions of both the east and west coasts of South America fully explored, several inland traverses of that continent made, the Falkland and Galapagos Islands carefully studied, and more rapid visits paid to Tahiti, New Zealand, Australia, Tasmania, the Cape of Good Hope, and a number of the coral islands in the Indian Ocean—the expedition returned to this country in August, 1836. Not a few important scientific discoveries will be associated with the names of the vessels of the United States Exploring Expedition, with the *Novara*, the *Challenger*, and many another surveying ship that might be mentioned; but it will be long indeed, we suspect, ere any vessel attains such a proud position in the annals of science as was won by the little ten-gun brig which bore our naturalist in his now famous "Voyage Round the World." Wherever in future the sciences of biology and geology shall be cultivated, there will the name of the *Beagle* become a household word.

The ten years which followed his return to England would appear to have been mainly devoted by Mr. Darwin to the publication of the numerous and important results obtained during the voyage. Besides editing the treatises of Prof. Owen, Mr. Waterhouse, Mr. Gould, the Rev. L. Jenyns, and Mr. Bell on the different groups of vertebrate animals, of which specimens were brought home, he wrote two very important works, one addressed to general readers—the "Naturalist's Voyage Round the World"—and the other of a more purely scientific character—the "Geology of the Voyage of the *Beagle*."

Before the publication of the "Origin of Species" had made the author's name so widely famous as it is at present, the works which we have named above, with the several memoirs communicated by their author to the *Transactions* and *Journal* of the Geological Society, had become universal favourites with the students of various branches of natural science; and this, no less on account of the rich store of novel observations which they contained, than for the originality and suggestiveness of their deductions from those observations. And since the appearance of their author's *magnum opus*, we confess that these earlier writings have for ourselves acquired a strange fascination. Again and again have we perused them, only to detect valuable observations and striking suggestions before missed, and to encounter fresh traces of the germs of ideas, that, after twenty-eight years of earnest thought and study, were developed into the theory of descent with modification, which is now exercising so important an influence on the progress of the natural sciences. At the commencement of the present notice we ventured to claim for geology at least a moiety of the advantages which have flowed from the publication of the "Origin of Species;" and, on the other hand, we feel that we are putting forward no undue demands on behalf of the same science, in declaring that the theory of Natural Selection must be regarded in at least as great a degree the prize of geological observation as the reward of biological research.

Such being the case, these "Geological Observations" are well worthy to take their place in the long series of the author's contributions to the doctrine of descent, side by side with those more widely known works on different departments of zoology and botany which have been published subsequently to the "Origin of Species." Two years ago the first part of the "Geology of the Voyage of the *Beagle*"—a work which has long been out of print, and has become extremely scarce—was republished; and naturalists and geologists were alike gratified by the appearance of this revised and enlarged edition of the well-known memoir on Coral Reefs. The work now before us is a re-issue of the remaining portions of the "Geology of the Voyage of the *Beagle*," and will be equally welcome to a large section of the scientific public.

The districts described in the present work, as Mr. Darwin justly observes in his preface to the new edition, "have been so rarely visited by men of science" that very little "could be corrected or added from observations subsequently made." And on the other hand attempts to modernize the terminology could scarcely fail to detract from the minute accuracy of observations, which were clearly either recorded upon the actual spot where they were made, or at all events while the memory of them was still fresh and vivid in the mind of the author. We think, therefore, that a wise discretion has been exercised in allowing the descriptions and discussions of phenomena to remain in precisely the same form as when they were originally drawn up; though we must confess to a feeling of disappointment at the absence of notes from the author's pen, indicating how far in his own view some of these original conclusions have been strengthened or modified by his later studies and researches.

We can only permit ourselves to recall a few of the more important among the valuable contents of this book

to the memories of our readers—and in doing so we shall dwell more particularly on such as, through recent discoveries or controversies, have acquired especial interest at the present day.

Every explorer who, since the publication of the "Observations on Volcanic Islands," has been called upon to investigate districts containing extinct volcanos, has been greatly aided by the valuable store of facts and suggestions contained in that work. We very much doubt, however, whether some of the interesting questions discussed in it—and we more especially refer to those relating to the nature and origin of the banded structure in lavas, with the light which these are calculated to throw on the difficult problem of the cause of foliation in rocks—have received that amount of attention from geologists, of which they are certainly deserving.

The proofs of the long-continued elevation of the shores of South America for thousands of miles, and to the height of many hundreds of feet, yet unattended with marked disturbances of the strata, the gradual disappearance of every trace of organism in rocks which once abounded with them, the survival of a most remarkable fauna of gigantic vertebrates to post-tertiary times, and its seemingly sudden extinction at a very recent period—these are some among the many interesting facts described in the second part of the work which are of especial value to geologists seeking to interpret the records of the past. Mr. Darwin's observation of an admixture of Jurassic and Cretaceous types of life in the same deposits in South America have acquired fresh significance now that the United States geologists have shown that ammonites range up into the tertiary strata, and that Dr. Waagen has described ammonites, goniatites, and ceratites, occurring in India, in the same bed with several carboniferous species of brachiopods. Now, too, that so much has been done by Dana, Le Conte, and others, in determining the mode of origin of the Rocky Mountains, and the part played by the volcanic outbursts which occurred simultaneously with the mountain-forming movements, Mr. Darwin's clear descriptions of the sections noticed by him in his traverses of the chain of the Andes will be referred to with fresh interest by geologists: and the comparison of phenomena displayed in distant parts of the same great chain is highly suggestive. But space fails us to refer to even a tithe of the points of interest which we have noted in our reperusal of this valuable work.

A striking characteristic of all Mr. Darwin's writings, and one which is very eminently displayed in the work before us, is his scientific candour. Like his teacher and friend, the late Sir Charles Lyell, he never forgets in his discussions to look at all sides of the questions before him, and to give the fullest expression and weight, alike to the difficulties which he himself detects, and to arguments which opponents may have advanced. With superficial readers this peculiarity in the writings of Lyell and Darwin has apparently very unjustly detracted from their merits; and we are sometimes amused by finding critics boldly parading as their own, objections which it is perfectly clear that only the candour of the authors has permitted them to rehearse, but which their own knowledge has not sufficed to enable them to understand or to make adequate use of.

Perhaps at no period in the history of the science have the great facts of geology suffered so much distortion from the works of pseudo-scientific writers—through which media alone science is too often, alas! transmitted to the general public—than at present. These writers selecting a few isolated and imperfectly understood facts, in bold defiance or lamentable ignorance of a thousand unmistakable and clearly established principles, proceed to build up the most elaborate hypotheses. We cannot therefore help regarding the republication of Mr. Darwin's "Geological Observations" as a most opportune event. The able geologist, De la Beche, many years ago wrote a charming little book entitled "How to Observe in Geology." To those anxious to learn this most important art at the present time, we would recommend as a model—since example is better than precept—the work now before us. The careful study of the clear and minute descriptions of geological phenomena, and the following step by step of the fair and cautious discussion of facts and arguments contained in this book can scarcely fail indeed to teach the reader something which is even more valuable than "how to observe," namely, how to *reason* in geology.

JOHN W. JUDD

#### TWO "CHALLENGER" BOOKS

*Log Letters from the "Challenger."* By Lord George Campbell. (London: Macmillan and Co., 1876.)

*The Cruise of Her Majesty's Ship "Challenger."* By W. J. J. Spry, R.N. With Map and Illustrations. (London: Sampson Low and Co., 1876.)

IT was to be expected that with so carefully-selected and intelligent a staff, both naval and civilian, on board, the cruise of the *Challenger* would be productive of something more than the official literature. It will have been seen from the "Preamble" which we recently published (*antea*, p. 254) that it must necessarily take a long time to arrange the abundant scientific results that have been obtained, and the complete official accounts may not be in the hands of the public for years. The Report on the Austrian *Novara* Expedition has taken seventeen years' serious labour to complete; but we hope to be in possession of the *Challenger* Reports in a much less space of time. Meantime many readers will be glad to have in a handy form a general account of the work which the expedition has done, and some details concerning the incidents of the long cruise and the many places which the ship visited. From either of the books before us such information may be obtained.

There is a wide difference, however, between the characters of the two works. Lord Campbell's is by no means an attractive book at first sight. It is a big, plain, heavy-looking volume, with a large page well filled with type, enormous paragraphs of sometimes half-a-dozen pages in length, and with not a single picture. One is apt to sigh at first at being compelled to read it, but after perusing a few sentences the reader "puts on the garment of praise for the spirit of heaviness," and finds the real difficulty to be to stop. Lord Campbell's pages bear all the marks of being genuine letters, written with no thought of a public before him, and only for the entertainment of those to whom they were sent. He has evidently not "got up" his subject at all, the information he conveys being almost