
DARWIN'S CORAL REEFS.*

WE regret very much being unable to offer a full notice of Mr. Darwin's last work, as it did not reach us till towards the last week in June. We must therefore content ourselves with a very brief account of this, the second edition of a most remarkable essay which first made its appearance—before Mr. Darwin was known to the general public—in the year 1842; reserving till our next number a more full account of this,

* "The Structure and Distribution of Coral Reefs." By Charles Darwin, M.A., F.R.S. With three Plates. 2nd edition, revised. London: Smith, Elder, & Co., 1874.

the first in more senses than one, English account of the interesting geological facts concerning the growth of coral-reefs. There is, however, one point on which we may observe that the book has especial importance, and that is with reference to the valuable work which has been done within the last few years on the American continent by Professor Dana. It is the more worthy of note because Professor Dana, strange to say, accepts views which are in point of fact diametrically opposed to those advanced by Mr. Darwin. In this book, however, Mr. Darwin endeavours to prove, and we think most satisfactorily so—though we shall dwell on this subject in our next review—that his own views are in the main correct. And he cites the evidence of the late Professor J. Beete Jukes in his favour, for the latter says, in his account of the voyage of H.M.S. *Fly* :—“After seeing much of the Great Barrier Reefs, and reflecting much upon them, and trying if it were possible by any means to evade the conclusions to which Mr. Darwin has come, I cannot help adding that his hypothesis is perfectly satisfactory to my mind, and rises beyond a mere hypothesis into the true theory of coral reefs.” But then, on the other hand, there is the evidence of Chamisso, which is distinctly opposite. However, we shall see in our next notice towards whom the mass of testimony predominates. It will suffice here to point out that Mr. Darwin gives an abundance of evidence, much of it quite new, bearing on this important question; and that it is in his usually happy style, which for terseness and clearness are almost unparalleled in the English language. There is, too, another quality which it would be unjust not to indicate, and that is the manner in which the author deals with his opponents—it is invariably with kindness and consideration. Every one of the points is pushed even more than they would be by the writer himself; and wherever they appear to outweigh Mr. Darwin's evidence, they are constantly and fully admitted. We have, then, said enough to show the quality of the book before us; we regret to have to put off our criticism of it for so long a period.

REVIEWS.

CORAL REEFS.*

ALTHOUGH Mr. Dana, a most distinguished American observer and student of coral reefs, opposes some of Mr. Darwin's conclusions, that fact is rather to be rejoiced at than otherwise, since it has doubtless led to the publication of a new edition of a book which first made its appearance thirty-two years since; and we may congratulate the author when we find that he has not in any material way altered his opinions, but has gone into the subject at greater length than ever, and has found an ample supply of facts to bear out his original views. It is to be regretted that we have not space to go fully into his various arguments, but at all events the following extract from the preface will tolerably explain the differences which exist between Professor Dana and Mr. Darwin. "In this work," says Mr. Darwin, referring to Dana's book published in 1871, "he justly says that I have not laid sufficient weight on the mean temperature of the sea in determining the distribution of coral reefs; but neither a low temperature, nor the presence of mud-banks, accounts, as it appears to me, for the absence of coral reefs throughout certain areas; and we must look to some more recondite cause. Professor Dana also insists that volcanic action prevents the growth of coral reefs much more effectually than I had supposed; but how the heat or poisonous exhalations from a volcano can affect the whole circumference of a large island is not clear. Nor does this fact, if fully established, falsify my generalization that volcanoes in a state of action are not found within the areas of subsidence, whilst they are often present within those of elevation; for I have not been influenced in my judgment by the absence or presence of coral reefs round active volcanoes; I have judged only by finding upraised massive remains within the areas of elevation, and by the vicinity of atolls and barrier-reefs. With reference to the areas of subsidence, Professor Dana apparently supposes that I look at fringing-reefs as a proof of the elevation of the land; but I have expressly stated that such reefs, as a general rule, indicate that the land has either long remained at the same level, or has been recently elevated. Nevertheless, from upraised recent remains having been found in a large number of cases on coasts which are fringed by coral reefs, it appears that of these two alternatives recent elevation has been much more frequent than a stationary

* "The Structure and Distribution of Coral Reefs." By Charles Darwin, M.A., F.R.S., F.G.S. Second edition, revised. London: Smith & Elder, 1874.

condition. Professor Dana further believes that many of the lagoon islands on the Paumotu or Low Archipelago and elsewhere have recently been elevated to a height of a few feet, although originally formed during a period of subsidence; but I shall endeavour to show that lagoon islands, which have long remained at a stationary level, often present a false appearance of having been slightly elevated."

It will readily be seen, from the foregoing quotation, what it is that Mr. Darwin attempts to prove in this volume, and also why the present edition has been given to the world. We shall refer further on to some of his arguments, but in the mean time we may explain in a few words the nature of his book. In the first place we may state that it is to Mr. Darwin that we owe whatever knowledge we possess on the subject of coral reefs. It was he who first explained, more than thirty years ago, the peculiar reason why those singular islands called Atolls had their particular shape. And we are glad to state that the reasons he then gave forth to the world, to explain their origin, are the same he now urges with even stronger arguments than he first advanced in their favour. What, then, is the meaning of an atoll, and how has it arisen from the deep? An atoll is one of those peculiar islands which the navigator sees abundantly in the Pacific Ocean. Taking one that is completely formed, what is its appearance? It is that of a ring of solid rock about a mile or so wide, covered with cocoa-nut trees, and forming a more or less regular circle which is broken at one point. Without, the sea is beating against this belt of rocks with all its fury; within, is a basin ten or twelve or more miles wide, and some thirty or more miles long, of perfectly still water. Finally there is usually an entrance by which boats may enter into this so-called lagoon. This is the constitution of a perfectly formed atoll. Others are not so completely walled in, and in some instances there is an island in the centre. Now leaving for a while the consideration of fringing-reefs and barrier-reefs, we may ask how came about the formation of the Atoll? Well, it is a question whose answer depends on our knowledge of coral reefs, their rapidity and mode and other conditions of growth. In the first place these corals usually commence growing along a shore, for it is found that they cannot live if they are placed at a considerable depth, or if they are exposed by tidal fall to the air; again, that they grow with immense rapidity; and finally, that they will not grow in any position in which fresh water flows. Now, admitting these conditions, and admitting also the fact which no geologist will deny, viz., that in the Pacific Ocean, as elsewhere, islands are constantly sinking and being elevated, we have all the conditions necessary to explain that singular formation, an atoll, or circular coral belt. Suppose, for example, an island has been thrown up in the ocean—no extraordinary thing in a volcanic district—and measures about thirty miles long by ten miles wide. Soon there appears to be coral reefs in its neighbourhood, and these eventually appear all round the island at a certain distance from shore. Here they may go on living and dying for a thousand years or more. Eventually this island begins to descend into the ocean from which it came. But as it descends the corals must grow up, because they cannot live at a great depth. And so on, for thousands of years, this island keeps going down, and, *pari passu*, the coral wall keeps growing upward, till at

last the land has entirely disappeared, and we have a circular line of coral reef, representing what was originally the coast line, and enclosing within it a quantity of water, partly brackish, and having an opening at one part of the reef by which boats can pass into the circle from the outside. Eventually cocoa-nuts and seeds of different kinds get among the coral reefs and grow up, and eventually a perfect wall of coral is found enclosing a vast pond of calm water, many miles in length and breadth. Now there remains one question to be asked, and that is, How came there to be any channel as an entrance from the surrounding sea? This seems difficult to understand, but Mr. Darwin furnishes us at once with a lucid and satisfactory answer. It is this. While the island which formerly existed was in progress of descent, of course during many years, it attracted rain, and thus there was fresh water, which flowed down and most probably formed a river at some point. Well, as this river flowed out to the sea, it utterly prevented the growth of coral at the point of exit, and so it left at last a point of entrance to the atoll.

The above is but a very imperfect sketch of the several operations employed, still it may help the reader to understand the general principle of the process; and we trust he will be led by it to get Mr. Darwin's book, and study the operations more fully for himself. We have given only the description of an atoll-growth, because we doubt not that those who understand it will readily be led to perceive that there is no material difference between the growth of an atoll and that of a barrier- and a fringing-reef. We may therefore pass on to the consideration of some of the points at issue between Mr. Dana and Mr. Darwin. And firstly of the question as to the supposed recent elevation of some of the lagoon islands, Keeling atoll, for example. Of this one Mr. Darwin says:—"Mr. Liesk informed me that he had seen an old chart in which the present long island on the north-east side was divided by several channels into as many islets; and he assures me that the channels can still be distinguished by the smaller size of the trees on them. On several islets also I observed that only young cocoa-nut trees were growing on the extremities, and that older and taller trees rose in succession behind them, which shows that these islets have very lately increased in length. In the upper and south-eastern part of the lagoon I was much surprised at finding an irregular field, of at least a mile square, of branching corals still upright, but entirely dead. . . . They were of a brown colour, and so rotten that in trying to stand on them I sank half way up the leg, as if through decayed brushwood. The tops of the branches were barely covered by water at the time of lowest tide. Several facts having led me to disbelieve in any elevation of the whole atoll, I was at first unable to imagine what cause could have killed so large a field of coral. Upon reflection, however, it appeared to me that the closing up of the above-mentioned channels would be a sufficient cause; for before this a strong breeze, by forcing water into them from the head of the lagoon, would tend to raise its level. But now this cannot happen, and the inhabitants observe that the tide rises to a less height during a high south-east wind at the head than at the mouth of the lagoon."

Thus, in this instance, Mr. Dana is answered; but we must confess that Mr. Darwin does not appear so satisfied with the view that he completely

accepts it. We may therefore imagine that this point of the controversy is still open. In regard to Professor Dana's objection that Mr. Darwin has not laid sufficient weight on temperature in the distribution of coral, it seems to us that he not only has done so, but that he has gone into many other questions on this point. Still we cannot say that he has completely made out the reason why it is that coral reefs abound in certain localities, and are as completely absent from other places which have conditions exactly identical. Indeed, it appears to us that the question is still one of those many problems which are at the present moment utterly insoluble.

Another point of difference between the two authors is as to the effect of volcanoes upon coral reefs. Mr. Dana considers that these eruptive mountains have an impeding influence on coral growth, and so undoubtedly they have when excited. But Mr. Darwin's question as to how the volcano can influence a large district clearly shows that the objection has no real value. The other question which Mr. Dana raised was, we may mention, fairly met by Mr. Darwin, when treating of the entire subject, in that spirit of thorough fair play which we have so frequently admired when studying his different books. There are many other points in connection with this subject which we should wish to touch on, but inexorable space prohibits. However, there are one or two we must refer to, and these are the rate at which coral grows, and the depths at which it can and can not live. The first question is one which is frequently answered, but in no instance is it more fully replied to than in the quotation from Dr. Allan's MS. thesis:—"To ascertain the rise and progress of the coral family, and fix the number of species met with at Foul Point (lat. $17^{\circ} 40'$), twenty species of coral were taken off the reef, and planted apart on a sand-bank, *three feet deep at low water*. Each portion weighed ten pounds, and was kept in its place by stakes. Similar quantities were placed in a clump and secured as the rest. This was done in December 1830. In July following each detached mass was nearly level with the sea at low water, quite immovable, and several feet long, stretching like the parent reef, on the line of the coast current from north to south." This shows clearly enough the tremendous rate of growth which corals have. And although, from the loss by shipwreck of Dr. Allan's splendid collection, the exact species has not been determined, yet it was thought by him to have been a Madreporæ which grew at the most rapid rate.

The other point in which we must quote from our author is as to the depth at which corals will maintain themselves. It seems that they "wholly disappeared at a greater depth than 20 fathoms on the slope round Keeling Atholl, off the reefs in the Pacific (according to Dana), on the leeward side of the Mauritius, and at rather less depth both within and without the atolls of the Maldiva and Chagos Archipelagoes; and when we know that the reefs round these islands do not differ from other coral formations in their form and structure, we may, I think, conclude that in ordinary cases reef-building polypifers do not flourish at greater depths than between 20 or 30 fathoms, and rarely at above 15 fathoms." From this it seems clear enough, but there are many other facts that point to the same conclusion. We hope we have said and abstracted enough of this clever book to induce the reader to take it up himself. If so, we have done sufficient. Still, if it

were allowable, we could go on much further, and we doubt not the matter which we should abstract would prove equally interesting and not less true to nature.

PORTRAITS OF THE MEDICAL PROFESSION.*

THE attempt to produce a series of photographs, accompanied by biographical sketches of the men who are eminent in the medical profession, has been attempted at various times of late years, but unfortunately with very little success; so little indeed, that the work, no matter how well it has been done, has seldom outlived the first year of its existence. In the present issue we have the first volume of a work on this plan, viz., portraits of distinguished men, with short sketches of their lives, and we think it clearly merits the success which its authors, if we may so call the photographers who have executed the portraits, hope it to attain. It contains twenty-four pictures of the cabinet size, of different medical men, some of whom have reached the highest steps of the professional ladder; some who have since its publication deceased, and a few who have hardly merited so much distinction as is awarded to them. Following each portrait is a page sketch of the life of the sitter, and in this we think the artists have done well in confining themselves simply to facts. Thus we are told when the person portrayed was born, when he entered the profession, where he studied, where he graduated or obtained his license, to what hospitals or institutions he belongs, and what he has written, and in some instances to whom he has been married, and what children he possesses. It will thus be seen that it is a fuller biography than that in the "Medical Directory"—in which, by the way, a very excellent though brief account is contained—whilst it possesses the character of that book in strictly confining itself to facts. On the whole, we may express our approval of all the photographs in the present volume; but there are some which merit especial approval, as being eminently life-like portraits. Of these we may mention those of Sir T. Watson, Dr. L. Beale, Sir James Paget, Sir H. Thompson, Sir H. Holland, and Mr. Spencer Smith, the last being an admirable portrait. Some, again, are not so life-like; as, for example, Sir W. Fergusson. Still they all form a very excellent volume, which we trust will meet commercially with so much success that we may soon look forward to this year's volume coming out. We should advise the publishers to issue an index in the next volume, and to have the biographies paged, as thereby much confusion will be avoided in searching for any wished-for biography or portrait.

* "The Medical Profession in all Countries;" containing Photographic Portraits from Life. By Barraud & Jerrard. London: Barraud & Jerrard, Gloucester Place, W.