
Account of Christmas Island, Indian Ocean

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OF THE

ROYAL GEOGRAPHICAL SOCIETY

AND MONTHLY RECORD OF GEOGRAPHY.

Account of Christmas Island, Indian Ocean.

By Captain W. J. L. WHARTON, R.N., F.R.S., Hydrographer to the
Admiralty.

(Read at the Evening Meeting, June 25th, 1888.)

I PROPOSE to give you a short account of an island that presents some rather unusual peculiarities, and is particularly interesting from the point of view of its geological construction, and of the operations at work during long ages.

Lying some 200 miles south of the western end of Java is an island that goes on our charts and maps by the name of Christmas Island, though how and when it got its name I have been unable to discover. Though its position is such that it is frequently sighted by some of the numerous vessels passing through the Strait of Sunda, it may be said that until last year absolutely nothing was known of it. On an old Dutch map of 1666 by one Pieter Goos it is called Moni. Later charts and maps call it indifferently Moni or Christmas, under the different forms of Natividad, Isle de Noel, according to the nationality of the map-maker.

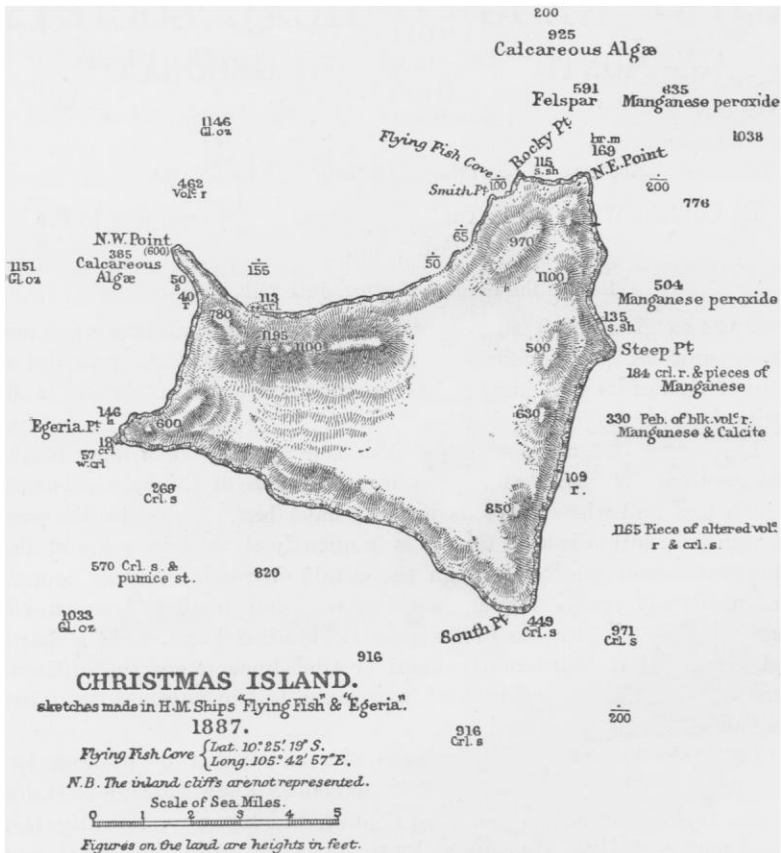
The earliest mention of it with any circumstance is in old Dampier, who called off the island in 1688. He evidently knew nothing of it, for he was trying to reach the Keeling Islands, and mentions sighting this island unexpectedly. He calls it by no name, but sailed in near it, and sent a boat in for a tree to make a pump, and to look for water; but though he says they saw a stream on the south-western side of the island, they were unable to approach it on account of the sea. His carpenters cut a tree, and brought the boat back full of frigate birds, boobies, and land crabs. Of the latter he says, "They were very good sweet meat, and so large that two of them were more than a man could eat, being almost as thick as one's leg."

Since then no description can be found of it, and beyond the very apparent fact of its being high and wooded, no record could be found of its ever having been examined, except that in 1771 an English East

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Indiaman, the *Pigot*, sailed round it in search of an anchorage, and found none, and that in 1857 a party from an English frigate, the *Amethyst*, had landed with the intention of climbing to the summit, but were frustrated by inland cliffs. What, therefore, were its characteristics, what its formation, and even its size were unknown; and the depths of the surrounding ocean were also as yet unfathomed. The



Pigot's people reported wild hogs on the island, and from other accounts by passing vessels, coco-nut and lime trees were reported abundant.

The nearest small islands to Christmas Island, the Cocos or Keeling Islands, are coral atolls, the larger island containing a good harbour. It seemed, therefore, far from improbable that Christmas Island, like Rodriguez, Seychelles, and other lofty islands of the Indian Ocean, might be in some parts surrounded with a broad fringing coral reef, a break in which might afford a convenient harbour, as the search of the

Pigot had been evidently but of a perfunctory nature. It appeared a disgrace that no accurate knowledge of this island should be forthcoming, and the Admiralty therefore in 1886 directed H.M. surveying vessel *Flying Fish*, Captain Maclear, to call at the island on her way home from Australia and gain some knowledge of it.

The *Flying Fish* approached the island from the north in December, and on getting within a few miles saw a white fringe of reef apparently beating against the very shores of it. A still nearer approach revealed low cliffs undermined by the water, and forbidding any hope of landing. No sign of bottom was found until close to the coast, when 115 fathoms was struck. The ship steamed round to the eastward, and so round the island; everywhere the same aspect was found. At the sea-level were cliffs from 30 to 100 feet in height, undermined by the sea, and quite unapproachable for the purpose of landing. Behind them rose the slopes of the island, covered with dense forest, amongst which ranges of cliff appeared at different altitudes here and there. Little or no coral reef was seen, and in many places the water was deep close up to the cliffs.

At length a small beach to the eastwards of the north-west point was seen, but no anchorage was found off it. When, however, the circumnavigation of the island was nearly completed, a small bay with a white beach was found a little west of the north point, and here, after an examination by the boats, the ship crept in and managed to find a spot to drop her anchor in deep water, securing her stern to a tree on the beach. On landing it was soon found that any exploration would be arduous, and occupy much time. The jungle was dense, and a few hundred yards back a lofty cliff apparently barred all further progress. As the island was plainly useless for ordinary naval purposes, and his time was limited, Captain Maclear contented himself with making a plan of the bay, which he named Flying Fish Cove, and collecting what animal life he could find. Most numerous were the large robber-crab, the *Birgus Latro*, and a rat which appeared to swarm everywhere. A large species of fruit-eating pigeon was also seen in great numbers.

Captain Maclear landed some fowls, but as he remarked that the crabs began at once to chase them, he did not expect them to prosper, an expectation which seems unfortunately justified by the subsequent visitors seeing nothing of them.

Captain Maclear's running survey showed the island to be an irregular quadrilateral, about nine miles from north to south, and the same from east to west, with gently sloped hills on all sides without defined peaks. The summit was a double round-topped elevation on the north-western part, about 1200 feet in height. The island is densely wooded all over, except where the cliffs are too steep to allow anything to grow.

No running water was seen, but the rainfall must be heavy. It was raining during a great part of the *Flying Fish's* visit, clouds being con-

tinually formed over the island from the moist air driven up the sides by the wind. Thus the great amount of water deposited must be mostly absorbed by the soil and porous rock. Holes in the rocks here and there were found full of water.

Captain Maclear's collection was received at the British Museum with much interest. The majority of the specimens were new to science, and seemed to promise much more of a like nature on a larger and closer search. From a geological point of view also the island seemed of interest. The shore cliffs turned out to be of coral rock, the inner cliff, which prevented further advance inland, was also of coral, and nothing but coral rock was seen anywhere.

An opportunity afforded by the fact that another surveying ship, the *Egeria*, Captain Pelham Aldrich, would pass not far from Christmas Island was therefore seized, and a further examination of the island was directed.

The *Egeria* secured herself, on 30th September, 1887, in the same precarious position as before occupied by the *Flying Fish*. As Captain Aldrich had been enjoined to endeavour to reach the summit of the island if possible, he had before anchoring successfully landed a party under Lieutenants Marescaux and Monro at the small beach near the north-west point, which was nearly under the summit.

The exploration of the island at once commenced. To give you an idea of its character, I cannot do better than quote from Captain Aldrich's account of his ascent of the island on the day after his arrival.

"As soon as the steam pinnacle was ready, I started in her with my cockswain, and passed close along the coast between Flying Fish Cove and the north-west beach, on which the party were landed yesterday.

"The shore-line is all steep cliff, much underworn by the action of the sea; the height varies on the north-western face from 38 to 55 feet, as measured in different places. In other parts, as on the south-eastern side, the sea cliffs are quite 100 feet high. The height of the underworn portion is much beyond the sea-level, and in one place, not far from Rocky Point, where I measured it on a subsequent occasion, it was $11\frac{1}{2}$ feet above the water, and the depth inward from a vertical line at the edge of the overhanging portion 26 feet. There are a few caverns, and one which apparently went in for some distance, but the swell was enough to cause a great and constant inrush and outflow, so that a perfectly calm smooth day would be necessary to enter it in a boat. In two places were small beaches of the same broken coral as that met with at Flying Fish Cove and the north-west beach, but they did not appear to offer the same facility for landing as the latter, though doubtless had it been necessary a landing could have been effected at either. For the most part of the way deep water extended close up to the base of the cliff, but in one place a broad plateau of nearly level coral rock extended for some yards from the cliff. I noticed

one or two spots in the shore-cliff where perhaps it might have been climbed, but, with these exceptions, its overhanging nature would quite prevent anything of the kind. Numerous frigate birds, gannets, and boobies flew about the boat, sometimes within striking distance. The trees on the slope of the island are dotted about with the gannets, who frequent them in great numbers.

"About an hour after leaving the ship we landed on the north-west beach in the skiff, the steamboat being anchored in 10 fathoms, just clear of the off-lying rocky ledge. A note from Marescaux, which I received on landing, told me that on the previous afternoon, he, Monro, and their party had started inland from the coast, and after going a short distance they were brought up by a cliff; that after casting about they finally found a way up it, and having got up to an elevation of some 800 feet, had returned to the camp, starting again this morning, hoping to reach the summit.

"My cockswain and I followed in their track, which was easily done, from the trees and undergrowth having been well blazed. I was very agreeably surprised at finding that, although the travelling was exceedingly rough, the undergrowth was not so very dense, and that no very heavy cutting was necessary, it being confined to young saplings, the leaves of the young screw pine, long trailing creepers, and the like.

"The ground between the beach and the first inland cliff was composed of hard and sharp fixed masses of coral limestone, worn into holes, on the surface, with very hard and sharp edges, so that the leather and soles of our boots were cut to pieces. Here and there high pinnacles of rock stood up, amid the lower rock, loose soil being distributed in the interstices, in which latter grew the jungle, a dead tree or two lay across the track, and various creepers extended from tree to tree, causing delay in getting on.

"In a short time we came to the base of the cliff before mentioned, which was found to be 120 feet above the sea-level. In the place we struck it, it was perpendicular, almost entirely bare of any vegetation, and would have proved a barrier to further progress. Following the blaze on the undergrowth, we now turned to the eastward, close along the base of the cliff, for a distance of some 200 or 300 yards, until we came to a place where some portions of the cliff had fallen partially away.

"A steep clamber up the rock, which was perfectly firm, or nearly all of it so, brought us above this inland cliff No. 1. The actual height of the clamber was 85 feet (on either side this cliff was much higher) and when above it, we were 205 feet above the sea. We now passed over ground of a similar nature as below the cliff, the slope being moderate, and perhaps rather more soil among the rocky patches, which latter, however, were thickly distributed about.

"It is not easy to estimate distance travelled under such circumstances, but I do not think we had gone more than half-a-mile when we came to

a second sharp rise in the coral, almost similar to the first, but not so steep. The bottom of this cliff No. 2 is 455 feet above the sea.

"Beyond this the ground assumed again its moderate slope, the same coral rock cropping up, though not in such large quantities, until a third rugged and steep bit of coral rock was met with. The surface of this was if anything more broken, confused, and rugged than in either of the other two inland cliffs, and necessitated care in crossing it.

"After getting above this, at 550 feet above the sea, we were on a moderate incline again, the coral rock above the ground ceased, the soil was much thicker and apparently richer, consisting of leaf mould with loose and small broken fragments of coral limestone met with now and then.

"The travelling now became very good indeed, and the large trees were more abundant. One which had fallen, and possibly not so very long since, I measured, and found to be 106 feet in length, and 76 inches in girth, and four feet above the buttress of the roots. This was, comparatively with some of those we saw standing, a small tree; it was perfectly straight, and had not the sign of a branch in the whole of this length. When I say the large trees became more abundant, I mean that large trees are met with the whole way up, but they are not so frequent, and this I think arises probably from the great difference there is in the amount and quality of the soil, after getting above the level of the third cliff. I have not much hesitation in calling them all 'cliffs,' for although they did not offer any obstacle except a clamber in each case, yet, when sounding in a ship round the island, these cliff terraces were seen in places most distinctly; and, while in the main, it appears as if the island was terraced in this manner nearly all round (the spurs running down to the various points being apparently more free from them than the bights and indentations of the land), yet it would appear that in this locality the cliffs have been more worn away and broken up.

"I could not observe any difference in the rock forming the different terraces. To quote Moseley's notes in the *Challenger* at Bermuda:— 'The rock is honeycombed by action of the rain and sea-water, and in its surface has a remarkably corroded appearance. It is eaten into cup-like hollows all over, separated from each other by extremely sharp projecting points and edges. In some places the rock has been left by denudation, projecting in isolated pinnacles and peaks of fantastic form.' I have not quoted exactly word for word, but the form here given will convey a very tolerably accurate idea of what this coral limestone is like. When struck with a hammer the sound produced is as if hard metal had been hit, and a good heavy blow is required to dislodge a piece from *in situ*.

"An easy ascent of about a quarter of an hour brought us within hailing distance of the two lieutenants and their party, who, after cutting the way, by which we had profited, had reached a spot hereafter

known as the 'Luncheon Tree,' whence the ground began to slope downward, and we thus hoped we had reached the summit of the island; but although the undergrowth was by no means very thick, we were surrounded on all sides by trees, and the foliage was so thick that no sign of the sky was visible except immediately overhead, where it was seen in all its blueness, with small vapoury masses of cumulus driven across it by the south-east wind which was blowing. To make quite certain we had reached the summit, it would be necessary to explore around, and that was left for another day.

"Before going down we walked for a short distance in a southerly direction, and came in a small area of loose small stones; these were examined, and some have been brought down as specimens. These were very much weatherworn, and some of them more or less rounded as if by the action of water. The soil under these stones was quite damp, which very possibly may be from previous rains or dew, as the sun does not penetrate through the leafy canopy above the area. It is curious how this little patch of stones comes here, all round about within a limited compass. There are certainly loose stones lying here and there, and sometimes they are plentiful; but in this case there is an area absolutely covered with them, none large, and all very dark in colour." These stones turn out on examination to be volcanic.

On a subsequent visit Captain Aldrich thus describes the discovery of the summit, starting from the Luncheon Tree:—

"The direction was nearly due south, and we first went down a gradual slope over ground in which there were few stones, undergrowth not very thick, and travelling good.

"After descending perhaps 50 feet, we commenced rising again on a gentle slope, the ground being more or less covered with boulders and stones of coral limestone, of a dark greenish hue, from damp and exposure. These made the travelling not nearly so good, but it did not last long before the ascent was much more rapid, the ground amid the trees being covered with large fern, here and there a large hart's-tongue, the fronds of which were often some six feet in length. This soon led us to a steep clamber, on to a pinnacle of weather-worn coral limestone, the highest part of which formed a ridge not more than 12 inches in width and about four feet long. The rock was standing up, having nothing on top but a little soil in the small holes and crevices, but all round it and below was a tangled mass of undergrowth, dead wood, ferns, and with large trees round about. The pinnacle was not the only rock, for within a few feet of it, and not more than eight feet below it, lay another mass of coral rock, much pitted and worn on the top, having at its lower part, which was facing the east, the appearance of having been worn away by the action of the waves—being very similar to the under portion of the shore cliffs which now surround the island. I give a photograph of this rock which Lieutenant Monro took at my request. This rock

struck me as being very peculiar, and was the only one of a similar nature which was seen. It appears as if at one time it formed the lower portion of a cliff washed by the sea—the back portions of which have all been worn away—the hollowed part having from its form been protected. It will be seen from the photograph what is the tangled state of the vegetation around it. The cavity is from one to two feet in depth. This, the highest point of the island, is 1190 feet above the sea.

“From the pinnacle we observed, through the trees, what appeared to be another, quite close to, and on the same level. We made our way to this, over what proved to be not more than 150 yards on exceedingly rough ground, the rock and undergrowth being mixed in a most confused state. From here we could see the sky here and there through the foliage, on a level with and below us, all round except in an easterly direction, this small arc being obscured by the increased density of the foliage. The sea on the western coast was seen in places, and the tangent of the south-western point of the island was also visible.”

Captain Aldrich further gives some details of a night's camp on the ridge. “It was dusk when we reached a spot on the ridge, and camped for the night. About 11 p.m. a breeze sprang up, and it was quite cold enough to enable us to enjoy a good blazing fire, which we had no difficulty in making from the large amount of dry wood round about.

“When we first arrived the huge crabs came about us in large numbers; in fact, they swarm all over the island, so far as we saw it, and when halted for a few minutes one hears them approaching in all quarters. These are of a bluish-yellow colour, with large claws and outstarting eyes, and most offensive to look at.” You will remember that Dampier and his men welcomed these crustacea as good sweet meat, from which you will probably justly infer that sailors nowadays are better fed, and consequently more particular. “At dark these creatures apparently ceased roaming about, for we neither saw nor heard any of them. We were not without company, however, for the rats came out and were as abundant as the crabs. I shot a couple, and two were killed with one blow from a stick, and very many more might have been got had we thought it worth while procuring them.

“We brought hammocks with us, and slung them under the trees; mine was between two and three feet from the ground, and three rats I know came over me as I lay in it, how many more when I was asleep I have no means of telling. We could well have used a blanket, but they would have added too much to our weights for carriage.

“There was a wonderful paucity of insect life; I had hoped by watching to have secured some by means of a light which I had placed on a fallen tree, but a close study for two hours only produced one small moth. It was very still in the bush; beyond the rustling of the trees and the expressions of certain differences of opinion among the rats there was no sound.

"The largest trees met with are those which grow with large buttresses which support the stem. The latter itself is not so large, and may be perhaps four to five feet in diameter. These trees are generally devoid of branches, except near the top, where they have a somewhat scrubby appearance, and are much overgrown with creepers, which latter would seem to take the life out of the upper part of the tree. In many cases there are numerous stems of these creepers reaching down from the highest parts, ranging from an inch to eight or nine inches in circumference. I took the following measurements about one of the largest trees I saw, which was about 800 feet above sea-level. The photograph is one taken by Lieutenant Monro. Outside the buttress on the ground, 75 feet; outside the buttress 2 feet above ground, 56·2 feet. From outer edge of the biggest buttress to the trunk, 13·8 feet; from the top of the buttress to the ground, 15·6 feet. There are large trees without buttresses in the island; Lieutenant Baker measured one in the neighbourhood of Flying Fish Cove which was perfectly straight, and at four feet from the ground was 34 feet in circumference."

No coco-nuts nor limes were seen, nor any of the wild hogs reported by the *Pigot*. Captain Aldrich brought back specimens of rock from various parts, and also caused a hole to be dug on the ridge, whence from a depth of nearly six feet some earth and stones were taken. These stones are volcanic, and the earth is also volcanic. The limestone rocks, to judge from the hand specimens, are of various natures: hard crystalline limestones with no trace of fossils, and fossiliferous limestones with foraminifera, the size of these shells varying in different localities.

Ascents were also made in the neighbourhood of Flying Fish Cove, which resulted in proving that the character of the island was there also precisely similar; coral limestone everywhere, and the same cliffs at intervals. Here also, however, some fragments of basaltic rock were found about 200 feet above the sea.

Botanical and zoological collections were made during this exploration by Mr. Lister.

Now what inference are we to draw from this description? We have a high island, on the surface of which wherever examined we find limestone, bearing in most places the appearance of coral origin, though in some specimens the shells of the foraminifera abound, and in none of them have direct evidence of coral structure been detected. It must be remembered, however, that coral limestone becomes so altered by the deposition of lime by infiltration, that a large surface of it may be searched before a piece retaining its coralline structure is found, and that the specimens sent home are very small.

From the description of Captain Aldrich, who is well acquainted with coral formations, it may be taken for granted that the majority of this rock is of coral origin. The rock forming the summit is of this

structureless character. In two spots, and at the bottom of a hole in the summit of the ridge, we have volcanic rock.

The island is very steep on all sides, great depths being found close to the cliffs, while on all sides, at a short distance, soundings over three miles in depth were obtained.

It appears, then, most probable that Christmas Island is founded on a volcanic mound which rose from the bottom to a certain distance from the surface of the sea; that foraminifera shells dying on the surface were rained upon it in sufficient number to form a stratum, since solidified into limestone rock; that as the mound neared the surface, corals built upon it, and it is possible from the sketch of the island, and from Captain Aldrich's description of the slope of the ridge inwards, that it first assumed an atoll form. This, however, is a mere inference from probabilities.

The island was next gradually upheaved, the coral growing outwards on the gentle slope until a period of immobility ensued long enough to permit the waves to erode the upper cliff. Another short period of upheaval, and one of stationary character ensued, when the second cliff was worn away. A third interval of upheaval, probably longer than the others, and then a longer stand, when the lowest and highest inland cliff was formed. Finally, another lift was given, and the stationary period now in existence completed the process.

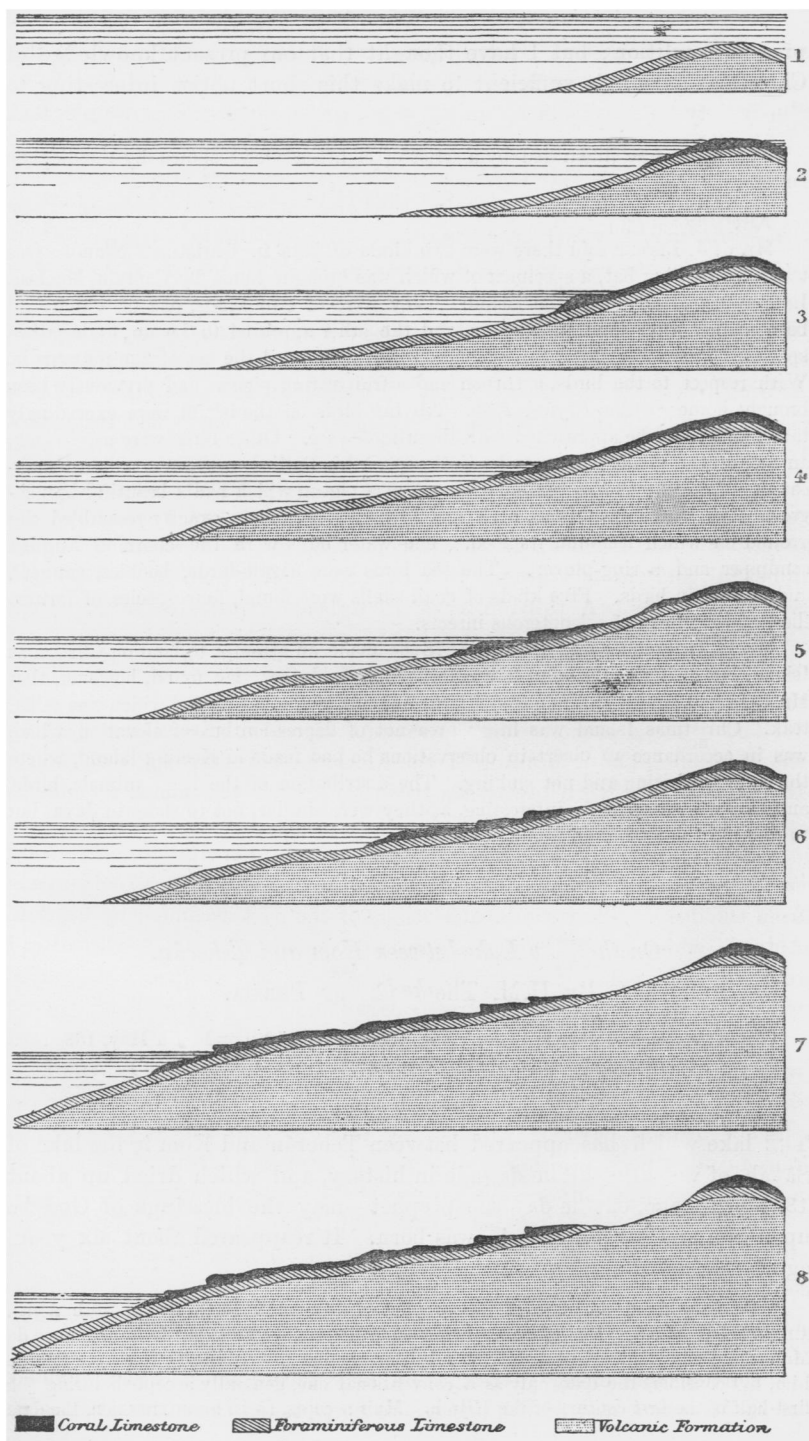
The volcanic stones found in various places on the higher parts of the island point to a thinning of the limestone covering in those places. Denudation has worn away the limestone, and the volcanic core is consequently exposed.

The diagrams show my ideas as to the manner in which the coral casing has been gradually formed, as the island has been slowly raised from the deep. They are ideal sections of the part ascended by Captain Aldrich, which is shown in its present condition in No. 8, while No. 1 represents the volcanic mound still deep below the surface, but covered with the relics of marine calcareous organisms.

Man has never lived on Christmas Island, nor would it be a pleasant residence, as, apart from the fact that there is no water—the rain sinking into the limestone rock—the extreme discomfort of locomotion, and the absence of any harbour whence the produce that might possibly be raised could be conveniently shipped, will deter any settlers from seeking a home there until other more favourable spots are occupied.

There is no other instance with which I am acquainted of an island of this height retaining its coral covering so intact. Coral reefs have been found at heights of 1000 feet in Cuba, in the Fiji Islands, and other places; but in all cases they are mere fragments, and the intervening spaces show no signs of coral.

Further and closer investigation may record more direct evidence of its structure, and of the successive steps which have resulted in its



present condition; but I have thought that our present knowledge of Christmas Island is sufficient to make this short notice interesting to the Society.

The paper was illustrated by a series of eighteen views shown by the dioptric lantern.

After the paper,

Mr. J. J. LISTER said there were two kinds of bats in Christmas Island. One was a fruit-eating bat, a specimen of which was brought home by Captain Maclear. Rats swarmed all about the island. They were of two kinds, one of which had been named after Captain Maclear, and the other appeared to be an undescribed species. There was also a shrewmouse, which completed the list of the mammalia. With respect to the birds, a thrush and a fruit-eating pigeon had previously been brought home by the *Flying Fish*. All the birds on the island were exceedingly tame, and could be approached with the utmost ease. Other birds were a goshawk, an owl of the genus *Ninox*, and a *Zosterops*, a kind allied to the Australian honey-eaters. A swift was also common, as well as a pigeon which had a beautiful bronze-green back, and brown head, neck, and breast. Its colours exactly resembled the ground on which it found its food. The water birds were the common English sandpiper and a ring-plover. The sea birds were frigate-birds, boobies, gannets, and boatswain birds. Five kinds of snail shells were found, four species of butterflies, and eighteen of coleopterous insects.

Mr. H. O. FORBES said that in 1878 he made an attempt to land on Christmas Island, but owing to the wind it was impossible to do so. He found, however, that Mr. Ross had landed and removed a large amount of the hard wood which was called teak. Christmas Island was in an area not of depression but of elevation, which was in accordance with certain observations he had made in Keeling Island, where the coral was rising and not sinking. The distribution of the land animals, birds, and bats was exceedingly interesting, as they were similar, not to those in Java, but to those in the farther off Molucca Islands.

On the New Lake between Kôm and Teherân.

By H.M. THE SHÂH OF PERSIA.

(From the Teherân gazette 'Irân,' Nos. 655 and 656, 10th and 19th May, 1888 :
translated and annotated by General A. HOUTUM-SCHINDLER.)

Map, p. 676.

THE lake which has appeared between Teherân and Kôm is the lake of Sâvah, of which mention is made in history, and which dried up about 1357 years ago, on the day the prophet—may the blessings of God be upon him and his posterity!—was born. It reappeared about six years ago.*

* De Sacy fixed the date of the prophet Muḥammed's birth as the 20th April, A.D. 571, but added, "En vain chercherait-on à déterminer l'époque de la naissance de Mahomet d'une manière qui ne laissât subsister aucune incertitude." Sprenger follows him, but considers the date only as a conventional one, generally accepted during the first half of the first century of the Hijrah. Muir accepts, as an approximation, the date