NOTES FROM THE "CHALLENGER"

V.

ON Wednesday, March 26, we sounded (Station 25) in lat. 19° 41′ N., long. 65° 7′ W., nearly 90 miles north of St. Thomas, in 3,875 fathoms. The bottom brought up in the hydra tube was reddish mud, containing, however, a considerable quantity of carbonate of lime. It is singular that the colour and composition of this mud were not uniform. The upper layer, that which had been forced farthest into the tube, was much redder than that which was nearest the mouth of the tube, and which had consequently come from a greater depth. I am inclined to attribute this to the

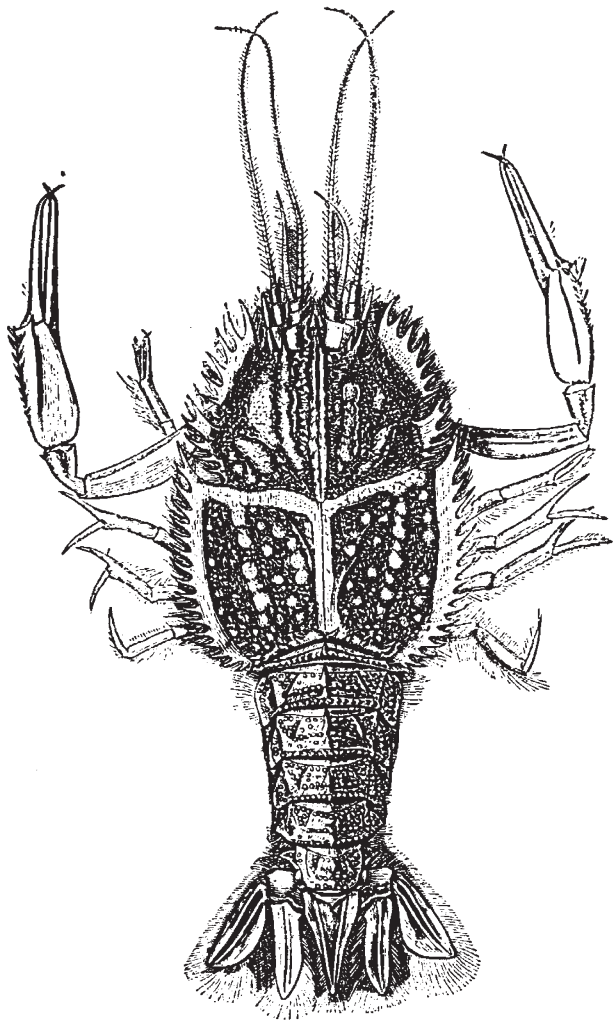

FIG. 1.—Deidamia crucifer, v. W.-S.

steepness of the slope from the plateau of the Virgin Islands. It is easy to conceive that, under the influence of currents varying from time to time in force and direction, the calcareous mud, the product of the disintegration of the coral reefs, may be washed down the incline in varying proportions.

Two thermometers were sent down in this sounding, and a slip water-bottle. The thermometers were unable to bear the extreme pressure, and both were broken. I have already (vol. viii. p. 109) in a former report described the circumstances connected with the loss of these two instruments. The water bottle appeared to have answered its purpose. Mr. Buchanan finds that the bottom water has a specific gravity slightly greater than usual at great depths, but not materially so. The amount of carbonic acid is somewhat in excess.

As this was the deepest sounding which we had taken, we were anxious to try whether the dredge would still prove serviceable. The small dredge was accordingly lowered with the usual bar and tangles, and from the centre of the bar a "hydra" sounding tube weighted with 4 cwt. was suspended about two fathoms behind the dredge. A two-inch rope was veered to 4 400 fathoms; a toggle was stopped on the rope 500 fathoms from the dredge, and when the dredge was well down two weights of one cwt. each were slipped down the rope to the toggle. We commenced heaving in about 1.30, and at 5 P.M. the dredge appeared, with a considerable quantity of reddish-grey ooze, mottled like the contents of the sounding-tube. The whiter portion effervesced freely with acids, the redder only slightly. The mud was carefully examined, but no animals were detected except a few small foraminfera, with calcareous tests, and some considerably larger of the arenaceous type. This dredging, therefore, only confirmed our previous conviction, that very extreme depths, while not inconsistent with the existence of animal life, are not favourable to its development. In the afternoon a series of temperatures were taken at intervals of 100 fathoms from the surface to 1,500. The temperature at the surface was 24°·5 C., and that at 1,500 2°·4 C. The curve constructed from this series indicates a very rapid and uniform fall of about 20 C. during the first 600 fathoms, and generally a distribution of temperature almost identical with that of some of the later stations on the section from Santa Cruz to Sombrero. In this way we pursued our course northwards under all plain sail.

On the following day we sounded in much shallower water—2,800 fathoms. The bottom was much of the same character, and on the 28th in 2,960 fathoms with a like result, but at our next sounding in 2,850 fathoms on the 29th, the calcareous element in the mud had almost entirely disappeared, and the contents of the tube seemed to be identical with the "red clay" which occupied so large a portion of our first section. The occurrence of this clay is a large and important phenomenon. In the section of the Atlantic, from the Canaries to the West Indies, it occupies about 1,900 miles, a distance twice as great as that occupied by the globigerina mud. What its lateral extension from that line may be, we do not know; but we now find that it extends more or less from over the greater part of the distance between St. Thomas and Bermudas. The nature and source of this deposit, and the causes of its peculiar distribution in the deeper parts of the ocean, are therefore questions of the highest interest.

On the 2nd of April, at a distance of 134 miles from Bermudas, a series of temperature soundings was taken at intervals of 20 fathoms from the surface to 300 fathoms.

The pilot came on board in the afternoon of April 4 and we passed through the narrows, the reefs which make the navigation of this singular little group of islands so dangerous spreading round us in rich purple patches, contrasting with the vivid pale green of the channels of deeper water between them.

The evening was falling as we anchored in Grassy Bay and received our first impressions of Bermudas. On the Monday following we moved from Grassy Bay to the Camber, in the great Dockyard. We remained there till the 21st of April, and employed the interval in taking such a general survey of the natural beauty of the island as our time allowed.

As Bermudas, on account of its isolated position, its structure, and its peculiar conditions of temperature, presents many points of great interest, I will defer giving a

detailed account of it until some investigations which we have still in hand are completed.

We met at Bermudas with a singular confirmation and illustration of our view as to the organic origin of the "red clay" of the Atlantic sea-bed.

The Islands of Bermudas consist exclusively of limestone, in some places very compact and hard, almost crystalline; more usually soft and crumbling easily when first quarried, but hardening on exposure to the air. The limestone is very irregular in the direction of its dip. In amount, however, the dip seems never to exceed 30°. The beds are thrown about in a curious way, every quarry or road-cutting showing contortions of all kinds in the strata and every amount of irregularity consistent with uniformly low angle of dip. One would imagine at first sight that the islands exhibited, on a small scale, an epitome of the geological phenomena of a disturbed palæozoic district.

Lieut. (now General) Nelson, R.E., at that time a young man, stationed at Bermudas, communicated to the Geological Society of London on April 23, 1834, a very valuable paper on the geology of Bermudas, which was published in the fifth volume of the Transactions of the Society. Lieut. Nelson pointed out that the great proportion if not the whole of the Rocks of Bermudas are formed simply by the blowing up by the wind of the fine calcareous sand the product of the disintegration of the coral, shells, serpula-tubes, and the other constituents of the Bermudas reefs, that white sand which we found to extend at varying depths through a radius of about 20 miles round the island. The sand is washed in by the sea; it is then caught at certain exposed points by the prevailing winds, blown into sand-hills 40 to 50 ft. in height, which slowly move along, forming shoreward a glacis at the angle of repose of loose sand, on which lamina after lamina is deposited, overwhelming a large tract of country with its fields, gardens, and cottages, in a comparatively short time, and advancing until its progress is stopped by an opposing slope of sufficient height, or by the binding of the sand by vegetation. On these wind-blown beds of lime, aptly called by Lieut. Nelson, Æolian formations, which are originally formed at a considerable inclination, changes in the direction and force of the wind-floods of sub-tropical rain and other transitory and accidental

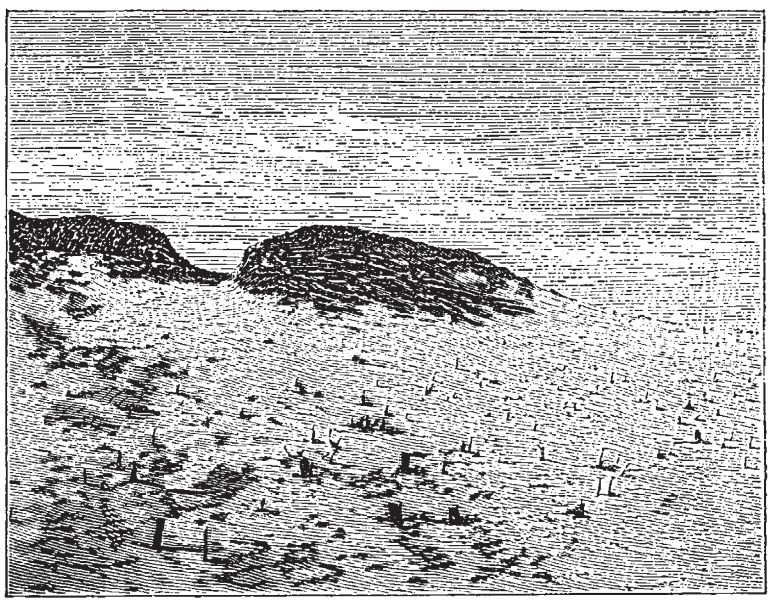

Fig. 2.—Rocks of Coral Sand in Bermudas in process of formation, showing Stratification, and the Stumps of Cedars which have been overwhelmed.

causes produce with great rapidity all the appearances, denudation, unconformability, curving, folding, synclinal and anticlinal axes, &c., which are produced in real rocks, if I may use the expression, by combined aqueous and metamorphic action, extending over incalculable periods of time.

Rain-water contains a considerable quantity of free carbonic acid. Water thus charged dissolves the lime rapidly, and the solution of bicarbonate of lime percolating through the bed, loses a portion of its carbonic acid, and deposits a cement of carbonate of lime between the particles of the coral sand. This process is kept up not only by the surface rain but by the water of the sea, which, as we shall see, percolates through the porous stones of the islands. As evidence of the universality of this process, we have every crack and fissure of the rock filled with semi-crystalline stalagmite, and every here and there the rock is hollowed out into caves which in some places assume the proportions of magnificent caverns with lofty roofs, supported by huge stalagmitic columns, and fretted and enriched by curtains and fringes of stalactite.

One very striking thing about Bermudas is the total absence of running water. There is not a trace of a stream or pool, or even of a ditch. The rain, which often falls in great quantities, sinks through the soil at the spot where it falls as it might sink through a sieve. The islands are perfectly permeable to water horizontally as well as vertically, so that below the level of the sea the stone is saturated, or filled with salt water. The fresh water lakes and wells, of which there are many, are thus merely catches of fresh water lying upon the surface of salt water, and they are nearly all slightly brackish, and those near the sea rise and fall perceptibly with the tide.

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