NOTES FROM THE "CHALLENGER"*

II.

ON Sunday, March 2, we saw the first patches of gulf-weed drifting past the ship, and flying-fish were abundant. Our position at noon was lat. 22° 30′ N., long. 42° 6′ W., Sombrero Island distant 1,224 miles. At night the phosphorescence of the sea was particularly brilliant, the surface scintillating with bright flashes from the small crustaceans, while large cylinders and globes of lambent light, proceeding probably from *Pyrosoma* and some of the Medusæ, glowed out and slowly disappeared in the wake of the vessel at a depth of a few feet.

The next morning we sounded at 7 A.M. in 2,025 fathoms with No. 1 line, the "Hydra" machine and 3 cwt., a slip water-bottle, and one thermometer; a stop-cock water-bottle was bent on at 925 fathoms from the bottom. The corrected bottom temperature was 1°·9 C., the temperature of the surface being 22°·8 C. During the morning the naturalists were out in a boat with the towing-net, and they brought back a number of fine examples of *Porpita*, several of *Glaucus atlanticus*, some shells of *Spirula* bearing groups of small stalked cirripeds, and many large radiolarians. One of the Spirula shells was covered with a beautiful stalked infusorian.

We proceeded in the evening under all plain sail. The soundings on the chart in advance of us seemed to indicate an extensive rise, with a depth of water averaging not much more than 1,700 fathoms, and it was determined to dredge again on the following day.

On the morning of March 4 we sounded in lat. 21° 38′ N., long. 44° 39′ W., in 1,900 fathoms, with No. 1 line, the "Hydra" and 3 cwt., the slip water-drop, and a thermometer. The bottom was grey ooze, as on the day before, and the bottom temperature 1°·9 C. The dredge was put over at 8 A.M. It was intended to attach a "Hydra" tube with disengaging weight a little below the bottom of the dredge; the weight slipped, however, close to the surface, and the dredge was lowered in the ordinary way with 1½ cwt. 500 fathoms in advance. The dredge came up about 4 o'clock with a small quantity of ooze containing some red clay, a large proportion of calcareous débris, and many foraminifera, chiefly *Orbulina* and *Rotalia*.

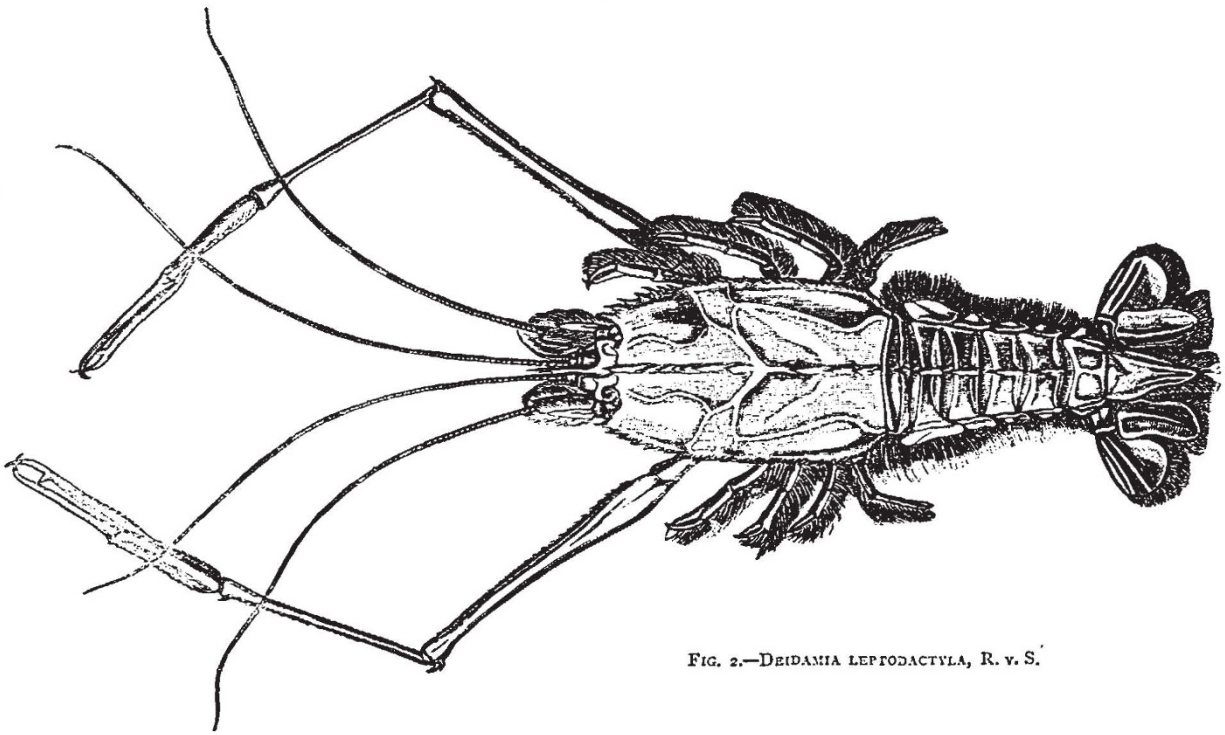

FIG. 2.—DEIDAMIA LEPTODACTYLA, R. v. S.

Warped in the hempen tangle there was a fine specimen of a handsome decapod crustacean, having all the principal characters of the family Astacidæ, but differing from all the typical decapods in the total absence of eye-stalks and eyes. Dr. v. Willemoes-Suhm has given this interesting deep-sea form such a preliminary examination as is possible in the absence of books of reference. I quote from his notes. *Deidamia leptodactyla*, n.g. and sp. (Fig. 2). The specimen, which is a male, is 120 mm. in total length and 33 mm. in width across the base of the cephalo-thorax, which is 60 mm. in length. Three rows of spines, one in the middle line and one on each side, run along the cephalo-thorax, which is divided by a transverse sulcus into an anterior and a posterior part, the former occupied by a central gastric and lateral hepatic regions, and the latter by a central cardiac and latent bronchial regions. The abdomen, which consists as usual of seven segments, has the central series of spines of the cephalo-thorax continued along the middle line. The sixth segment bears the caudal appendages, and in the seventh, the telson, we find the excretory opening. The lateral borders of the body, and all the appendages with the exception of the first pair of ambulatory legs, are edged with a close and very beautiful fringe of a whitish-yellow colour.

There are two pairs, the normal number, of antennæ, then come mandibles, then maxillæ; three pairs of maxillipeds, five pairs of ambulatory legs, and five pairs of swimmerets. As most of the appendages differ from those usually met with in the Astacidæ only in detail, I need here only mention that the anterior antennæ have two pairs of flagella, one of which is very long, longer than the external flagellum of the external pair.

The form of the first pair of ambulatory legs is singularly elegant. They are 155 mm. in length—considerably longer than the body; they are very slender, and end in a pair of very slender denticulated chelæ, with a close,

* Continued from p 30.

velvet-like line of hairs along their inner edges. The rest of the ambulatory legs are much shorter, and all bear chelæ, a character which will demand a certain relaxation of the diagnosis of the Astacidæ if *Deidamia* is to be placed in that family.

The specimen captured being a male, the first pair of swimmerets are somewhat modified. The four other pairs of swimmerets, which are 33 mm. in length, bear each two narrow swimming processes richly fringed with hair, and a short flagellum.

The absence of eyes in many deep-sea animals and their full development in others is very remarkable. I have mentioned ("The Depths of the Sea," p. 176), the case of one of the stalk-eyed crustaceans, *Ethusa granulata*, in which well-developed eyes are present in examples from shallow water. In deeper water, from 110 to 370 fathoms, eye-stalks are present, but the animal is apparently blind, the eyes being replaced by rounded calcareous terminations to the stalks. In examples from 500 to 700 fathoms in another locality, the eye-stalks have lost their special character, have become fixed, and their terminations combine into a strong pointed rostrum. In this case we have a gradual modification, depending apparently upon the gradual diminution and final disappearance of solar light. On the other hand, *Munida*, from equal depths, has its eyes unusually developed and apparently of great delicacy. Is it possible that in certain cases, as the sun's light diminishes, the power of vision becomes more acute, while at length the eye becomes susceptible of the stimulus of the fainter light of phosphorescence? The absence of eyes is not unknown among the Astacidæ. *Astacus pellucidus*, from the Mammoth Cave, is blind, and from the same cause—the absence of light; but morphologically the eyes are not entirely wanting, for two small abortive eye-stalks still remain in the position in which eyes are developed in all normal decapods. In *Deidamia* no trace whatever remains either of the eyes of sight or of their pedicels.

On Thursday the 6th we sounded in 2,325 fathoms, sending down a thermometer and the slip water-bottle. The temperature registered was 1°·7 C., and the specific gravity of the sample of water was 1·02470 at 21° C., that of the surface water being 1·02556, at 23°·3 C.

A good deal of gulf-weed drifted past during the day, and a boat was sent out to collect some. About half a dozen closely twined bundles were procured, and on examining them it was found that the bundle was bound together by strings of the viscid secretion of *Antennarius marmoratus*, and formed a nest containing the eggs of the fish. Several young examples of this grotesque little animal have been from time to time brought in among the gulf-weed; also many crustaceans, several of the nudibranchiate mollusca characteristic of the gulf-weed fauna, such as *Scillæa pelagica* p., and many planarians.

The dredge came up at 4.15 P.M. with a small quantity of red mud, in which we detected only one single but perfectly fresh valve of a small lamelli-branchiate mollusk. In the mud there were also some sharks' teeth of at least two genera, and a number of very peculiar black oval bodies about an inch long, with the surface irregularly reticulated, and within; the reticulates closely and symmetrically granulated the whole appearance singularly like that of the phosphatic concretions which are so abundant in the greensand and trias. My first impression was that both the teeth and the concretions were drifted fossils, but on handing over a portion of one of the latter to Mr. Buchanan for examination, he found that it consisted of almost pure peroxide of manganese.

The character both of the exterior and interior of the nodule strongly recalled the black base of the coral which we dredged in 1,530 fathoms on the 18th of February; and on going into the matter, Mr. Buchanan found not only that the base of the coral retaining its external organic form had the composition of a lump of pyrolusite, but that the glossy black film covering the stem and branches of the coral gave also the reaction of manganese. There seemed to be little doubt that it was a case of slow substitution, for the mass of peroxide of manganese forming the root showed on fracture in some places the concentric layers and intimate structure of the original coral. The coral, where it was unaltered, had the ordinary composition, consisting chiefly of calcic carbonate. Whether the nodules dredged on March 7th are pieces of rolled coral, the ornament on their surface being due to an imperfect crystallisation of the surface layer of the peroxide of manganese, or whether they form another case of pseudomorphy, the peroxide of manganese replacing some other organism, we have not the means of determining. The whole question is a very singular one.

Some of our party, using the towing-net and collecting gulf-weed on the surface from a boat, brought in a number of things beautiful in their form and brilliancy of colouring, and many of them strangely interesting for the way in which their glassy transparency exposed the working of the most subtle parts of their internal machinery; and these gave employment to the microscopists in the dearth of returns from the dredge. Our position was now lat. 19° 57′ N., long. 53° 26′; Sombrero distant 558 miles.

Sunday was a lovely day. The breeze had fallen off somewhat, and the force was now only from 2 to 3. The sky and sea were gloriously blue, with here and there a soft grey tress on the sky, and a gleaming white curl on the sea. A pretty little Spanish brigantine, bright with green paint and white sails, and the merry, dusky faces of three or four Spanish girls, came in the morning within speaking distance and got her longitude. She had been passing and repassing us for a couple of days, wondering doubtless at the irrelevancy of our movements, shortening sail, and stopping every now and then in mid ocean with a fine breeze in our favour. On Monday morning we parted from our gay little companion. We stopped again to dredge, and she got far before us, and we saw with some regret first her green hull and then her white sails pass down over the edge of the world.

The sounding on Monday the 10th gave 2,675 fathoms, with a bottom of the same red clay with very little calcareous matter. The bottom temperature was 1°·6 C., that of the surface being 23°·3 C. We had been struck for some time past with the singular absence of the higher forms of life. Not a bird was to be seen from morning to night. A few kittiwakes (*Larus tridactylus*) followed the ship for the first few days after we left Teneriffe, but even these had disappeared. A single petrel (*Thalassidroma pelagica*) was seen one day from one of the boats on a towing-net excursion, but we had not seen one of the southern sea-birds. For the last day or two some of the larger sea-mammals and fishes had been visible. A large grampus (*Orca gladiator*) had been moving round the ship and apparently keeping up with it. Some sharks hung about, seeking what they might devour, but we had not yet succeeded in catching any of them. Lovely dolphins (*Coryphæna hippurus*) passed in their varying irridescent colouring from the shadow of the ship into the sunshine, and glided about like living patches of rainbow. Flying-fish became more abundant, evidently falling a prey to the dolphins, which are readily deceived by a rude imitation of one of them, a white spinning bait, when the ship is going rapidly through the water.

On Tuesday the 11th we pursued our course during the forenoon at the rate of from six to seven knots, with a light breeze, force 3 to 4. The dredge-line was veered to over 4,000 fathoms, nearly 5 statute miles. The dredge came up at about half-past five o'clock, full of red mud of the same character as that brought up by the sounding machine. Entangled about the mouth of the dredge and embedded in the mud were many long cases of a tube-

building annelid, evidently formed out of the gritty matter which occurs, though sparingly, in the clay. The tubes with their contents were handed over to Dr. v. Willemoes-Suhm, who found the worms to belong to the family Ammocharidæ (Claparéde and Malmgren), closely allied to the Maldania or Clymenidæ, all of which build tubes of sand or mud. The largest specimens dredged are 120 mm. in length by 2 mm. in width. The head is rounded, with a lateral mouth. There is no trace of cephalic branchiæ. The segments are not divided from one another; but the *tori uncinigeri*, which are occupied by the hair-like setæ, and the elevations bearing small *uncini*, indicate the beginning of a new segment.

There is no doubt that this annelid is closely allied to the genus *Owenia*, but it differs from it in the absence of cephalic branchiæ. Malmgren, has, however, already proposed the name of *Myriochele* for a form in which this absence of branchiæ occurs. The description of the northern form on which Malmgren's genus is founded is not at hand, so that it is impossible in the meantime to determine whether the two forms are identical or specifically distinct.

As bearing upon some of the most important of the broad questions which it is our great object to solve, I do not see that any capture which we could have made could have been more important and more conclusive than that of this annelid. The depth was 2,975, practically 3,000, fathoms—a depth which does not appear to be greatly exceeded in any part of the ocean. The nature of the bottom, which consists of a smooth red clay with a few scattered sand grains and a very small number of foraminifera shells, was very unfavourable to higher animal life, and yet this creature, which is closely related to the Clymenidæ, a well-known shallow-water group of high organisation, is abundant and fully developed. It is fortunate in possessing such attributes as to make it impossible even to suppose that it may have been taken during the passage of the dredge to the surface, or have entered the dredge-bag in any other illegitimate way; and its physiognomy and habits are the same as those of allied forms from moderate depths. It affords, in fact, conclusive proof that the conditions of the bottom of the sea to all depths are not only such as to admit of the existence of animal life, but are such as to allow of the unlimited extension of the distribution of animals high in the zoological series, and closely in relation with the characteristic faunæ of shallower zones.

On Thursday the 13th our position at noon was lat. 18° 54′ N., long. 61° 28′ W.

On the forenoon of the 14th we were still 35 miles from land, and we sounded in 1,420 fathoms. The bottom had altered greatly in character: it now consisted chiefly of calcareous foraminifera of many species, mixed with a considerable portion of the broken spicules of siliceous sponges. The bottom temperature registered was 3° C. The water-bottle was accidentally broken in taking in, so that that observation was lost. As we were now within sight of land, and all our results were evidently modified by its immediate proximity, we regarded our first deep-sea section as completed. WYVILLE THOMSON

A MODERN STERNBERGIA

AT a time when botanists of some repute are not ashamed to confess their inability to deduce satisfactory characters for the determination of plants from their internal anatomy, old workers in this field may well turn back to refresh their memories on such points, and to inquire whether their eyes may not have deceived them in the investigations of former years when microscopes were not what they now are. In doing this a few days ago in connection with the examination of a carboniferous conifer, I was surprised to find that I had overlooked or omitted to note the fact that the Balsam Fir of Canada (*Abies balsamea*), which affords the well-known Canada-balsam, has that curious structure of pith well known in Palæozoic Conifers, and which has been named *Sternbergia*. It is well seen in young twigs one or two years old, and though on a smaller scale, is very similar to that of *Dadoxylon materiarium* of the upper coal-formation of Nova Scotia and Prince Edward Island, as I have figured this in my recent report on the geology of the latter province.

This modern Sternbergia is not produced by the mere breaking of the cellular tissue transversely by elongation of the fibre; but, as I pointed out many years ago in the case of the coal-formation Sternbergiæ,* is a true organic partitioning of the pith by diaphragms of denser cells opposite the nodes, as in *Cecropia pellata*, and some species of *Ficus*, &c. The pith of the Balsam Fir is, like that of many other conifers, composed of dotted or transversely marked cells elongated vertically, and reminding one of the pseudo-vascular pith of some Lepidodendroid trees. The transverse diaphragms are composed of denser cells flattened horizontally, and they are, as in Sternbergia, accompanied by constrictions of the medullary cylinder. As in some fossil conifers, the diaphragms are not perfectly continuous.

The plan of growth of the modern fir does not permit its pith to increase in diameter. This was different in the Palæozoic conifers, in which the Sternbergia pith is sometimes nearly two inches in diameter.

In Palæozoic, as in modern times, Sternbergia piths were not confined to one family of trees. Corda has shown this structure in *Lomatophloios*, which is equivalent to *Lepidophloios* or *Ulodendron*. I have shown that it exists in several species of Lepidodendroid and Sigillaroid trees and in *Leptophleum*.† Williamson, who first established it in the Conifers, has also found it in *Dictyoxylon*. Still I have nowhere found these remarkable fossils so abundant as in the upper coal-formation, and either in the interior of calcified or silicified trunks of pine or with fragments of wood attached to them sufficient to indicate their coniferous character.

I may add, that the microscopic structure of young twigs of modern conifers presents many interesting points for comparison with fossil trees, and that in making longitudinal slices of the pith of recent specimens, care should be taken not to be misled by the mere crumpling of the celiular tissue sometimes caused by the pressure of the knife. J. W. DAWSON

NOTES

PROFESSOR CARUS, the well-known naturalist of Leipsic University, who is to fill Professor Wyville Thomson's chair during the absence of the latter with the *Challenger*, commenced his duties on May 2 last, by an able and eloquent address on the study of zoology. He is fully convinced that "the final form of our (zoological) system will be a pedigree."

THE *Challenger* arrived at Halifax on May 9, all well. She had a successful passage from Bermuda, the dredgings and soundings being very satisfactory. On the 18th inst. she will leave this port on a return voyage to Bermuda.

WITH great regret we record the death of Mr. John Stuart Mill, at the age of 67 years, on May 8, at Avignon, from a sudden attack of erysipelas, which cut him off in four days. He has been buried beside his wife at Avignon. A meeting of the friends of Mr. Mill has been convened, at Willis's Rooms, for Tuesday, 20th inst., to consider in what manner the national respect for his memory may be most fittingly testified.

A COMMITTEE for the erection of a monument to Liebig has been constituted at Munich. Councillor von Niethammer is the chairman, Prof. Von Bischoff the vice-chairman, and Professors

* Canadian Naturalist and Geologist, 1857.
† Journal of the Geological Society, May 1871.