(aus ein rosenroth gefarbten punkt), and carbonic acid (aus dem Harnorganen) will be long remembered, and even at the present day the satire has not lost its applicability. Then again in a letter purporting to be written from Paris and signed S. C. H. Windler, though doubtless written by Liebig, he laughs to scorn the idea that the theory of substitution, which he himself upheld, could be so far extended as was by some chemists believed possible. In this letter he states, as the last great discovery of the French capital, that it had been found possible to replace in acetate of manganese, first the atoms of hydrogen by chlorine, then the atoms of oxygen, then those of manganese, and lastly that even the atoms of carbon had been replaced by this gas. So that a body was in the end obtained, which, although it contained nothing but chlorine, still possessed the essential properties of the original acetate of manganese. He adds in a note: "Je viens d'apprendre qu'il y a déjà dans les magasins à Londres des étoffes en chlor filé, très recherchés, dans les hôpitaux, et preferés à tout autres pour bonnets de nuits, calecons, etc.!"

Those who wish to read an unsparing critique, may turn to Liebig's remarks on Gerhardt (1846), to those on Mulder as regards his protein theory, or again on Gruber and Sprengel respecting a review of his own book on Organic Chemistry (1841). It was not in Liebig's nature to spare either private persons or Governments when he thought that science would be advanced by plain speaking. In his two papers on "Der Zustand der Chemie in Oestreich" (1838), and in "Preussen" (1840), whilst he points out the shortcomings of both countries, bravely asserts, in the strongest terms, the dependence of national prosperity upon original research, a subject concerning which in England, *most people, thirty years later (to our shame be it said) are altogether in the dark!*

Other and wider questions, to the solution of which Liebig in later life turned his energies, were those respecting the establishment of a Scientific Agriculture, and the foundation of a new science of Physiological Chemistry. It is in this direction that his labours are best known to the general public in England; and there is no doubt, although in many details his views have since proved erroneous, that he was correct in the main issues, and that the stimulus given to British agriculture through Liebig's writing and investigations, has been of the most important kind. Agriculturists have thus been made aware that a scientific basis for their practice exists which, if not as yet complete, can still explain much in their art of what had previously depended on mere empiricism. Then, again, the interest and attention which were thus brought to bear on these subjects, has led to the establishment of Agricultural Colleges and "Versuchs-Stationen," and to the carrying out of researches like those magnificent ones of Lawes and Gilbert, from which we are receiving information concerning the various questions relating to plant life such as long-continued investigation and observation alone can yield.

In the year 1852, having lectured for sixty semestres in Giessen, he left the university to which he had given a world-wide fame, to become the centre of a galaxy of men of science whom Maximilian II. of Bavaria had called to Munich. There, having built himself a good laboratory and a spacious house adjoining, he spent the remainder of his days in quiet labour and well-earned and honoured repose. The active period of his life having passed, he entirely withdrew from discussions on purely theoretical questions, and occupied himself with investigations chiefly of a practical character, such as those on the extract of meat, and on infants' food. He continued to re-edit his various books, indulging occasionally in his old habit of a sharp hit at the views of some scientific brother. His last investigation and critical discussion of the labours of other chemists was published in 1870, "On Fermentation and the Origin of Muscular Force." In this he strenuously upholds his old theory of fermentation against Pasteur's explanation of the phenomena, and his views and arguments are as forcibly and clearly expressed as we find them in his early publications. The last of his hundreds of communications to the Annalen is a notice on the discovery of chloroform, published in March of last year, in which he calls attention to the fact that the discovery of this important substance is due to himself in 1831, and not to Soubeiran, as is generally supposed, although Liebig overlooked the small quantity of hydrogen (0·8 per cent.) which chloroform contains, and termed it a chloride of carbon.

As an author, Liebig is remarkable for the lucidity and grace of his style. The best examples of this are to be found in his "Familiar Letters on Chemistry." His mode of popular treatment of a somewhat obscure subject is seen in the well-known chapter (xxiv.) in his "Familiar Letters," on "Spontaneous Combustion of the Human Body." He there goes step by step through all the better authenticated cases, shows the want of sufficient evidence in each case, points out the fallacies of the theories proposed to explain them, and concludes with proving, by the application of known physical and chemical laws, that the supposed phenomena cannot possibly occur.

Looking once more back upon the labours of Liebig, we again come to the conclusion that the chief and characteristic glory of his life is the impulse which he gave to the study of our science and the personal influence which he exerted among his numerous and distinguished pupils.

The present short and imperfect sketch of the scientific bearings of a great life is not one in which personal qualities can be discussed; suffice it to say that though Liebig was an awkward adversary, he was a faithful friend, and always ready and anxious to assist deserving merit.

H. E. ROSCOE

## *NOTES FROM THE "CHALLENGER"*

WE left Santa Cruz on the evening of Friday, the 14th of February. The weather was bright and pleasant with a light breeze—force equal to about 5—from the north-east. Our course during the night lay nearly westward, and on the morning of the 17th we sounded, about 75 miles from Teneriffe, and 2,620 miles from Sombrero Island, the nearest point in the Virgin group, in 1,891 fathoms, with a bottom of grey globigerina ooze, mixed with a little volcanic detritus. The average of two Miller-Casella thermometers gave a bottom temperature of 2° C.

The slip water-bottle which was used by Dr. Meyer and Dr. Jacobsen in the German North-Sea Expedition of last summer was sent down to the bottom, and Mr. Buchanan determined the specific gravity of the bottom water to be 1·02584 at a temperature of 17°·9 C., the specific gravity of surface water being 1·02648 at a temperature of 18°·5 C.

All Sunday, the 16th, we spent sailing with a light air from the northward, and by Monday morning we had made about 130 miles from our previous sounding. The dredge was put over at 5.15 A.M. with 2,700 fathoms rope, and a weight of 2 cwt. 300 fathoms before the dredge.

After steaming up to the dredge once or twice, hauling-in was commenced at 1.30 P.M., and the dredge came up at 3.30 half full of compact yellowish ooze. The ooze was carefully sifted, but nothing was found in it with the exception of foraminifera, some otolites of fishes, some dead shells of pteropods, and one mutilated specimen of what appears to be a new Gephyrean. This animal has been examined by Dr. von Willemœs-Suhm, who finds that it shows a combination of the character of the Sipunculacea and the Priapulacea. As in the former group, the excretory orifice is near the mouth, in the anterior part of

the body, while, as in the latter, there is no proboscis and there are no tentacles. The pharynx is very short, and is attached to the walls of the body by four retractor muscles. The pharynx shows six to seven folds ending in a chitinous border. The mouth is a round aperture, beset with small cuticular papillæ. The perisom is divided into four muscular bands, the surface large, showing a tissue of square meshes, in each of which there are four to five sense-bodies. For the reception of this singular species Dr. von Willemœs-Suhm proposes to establish the genus *Leioderma*, which will represent a family intermediate between the Sipunculids and the Priapulids.

On the 18th we sounded at 9 A.M. in 1,525 fathoms, lat. 25° 45′ N., long. 20° 12′ W., 160 miles S.W. of the Island of Ferro, and 50 miles to the west of the station of the day before, in 1,525 fathoms. The "Hydra" tube brought up no bottom, and we sounded again with a depth of 1,520 fathoms, and again no bottom. It thus seemed that we had got upon hard ground, and as the sounding of the following day gave 2,220 at a distance of only 19 miles, we had evidently struck the top of a steep rise. The dredge was lowered at 10 A.M. with 2,220 fathoms of line and 2 cwt. leads 300 fathoms before the dredge. At 5.30 P.M. the dredge was hauled up, and contained a few small pieces of stone resembling the volcanic rocks of the Canary Islands, and some large bases of attachment and some branches of the calcareous axis of an Alcyonarian polyp allied to *Corallium*. Some of the larger stumps were nearly an inch in diameter; the central portion very compact, and of a pure white colour: the surface longitudinally grooved, and of a glossy black. The pieces of the base of the coral which had been torn off by the dredge were in one or two cases several inches across and upwards of an inch thick, forming a thick crust from which the branches of the coral sprang. The crust was of a glossy black on the surface, showing a fine regular granulation, and a fracture through the crust was of a uniform dark brown colour and semi-crystallised. The whole of the coral was dead, and appeared to have been so for a long time. It was so fresh in its texture, however, that it was scarcely possible to suppose that it was sub-fossil, although from the comparatively great depth at which it was found, and the many evidences of volcanic action over the whole of this region, one could scarcely avoid speculating whether it might not have lived at a higher level and been carried into its present position by a subsidence of the sea-bottom. I hope we may have an opportunity of determining this question in returning over the same ground later in the season.

Attached to the branches of the coral there were several specimens of a magnificent sponge belonging to the Hexactinellidæ. One specimen, consisting of two individuals united together by their bases, is about 60 centimetres across, and has very much the appearance of the large example of the tinder-fungus attached to the trunk of a tree (Fig. 1). Both surfaces of the sponge are covered with a delicate network of square meshes closely resembling that of *Hyalonema*, and formed by spicules of almost the same patterns. The sponge is bordered by a fringe of fine spicules, and from the base a large brush of strong, glassy, anchoring spicules project, fixing it to its place of attachment. The form of the barbed end of the anchoring spicules is as yet unique among sponges. Two wide, compressed flukes form an anchor very much like that of one of the skin-spicules of *Synapta*. The sponge when brought up was of a delicate cream colour. It was necessary to steep it in fresh water to free it from salt, and the colour changed to a leaden grey. A number of small examples of the sponge, some of them not much beyond the condition of gemmules, were found attached to the larger specimens and to branches of the coral, so that we have an opportunity of studying the earlier stages of its development.

For this sponge, which forms the type of a new genus, I propose the name *Poliopogon*[1] *amadou*.

Attached to the sponge were two examples of a fine Annelid which Dr. v. Willemœs-Suhm refers to the family Amphinomidæ, sub-family Euphrosyninæ, with many of the characters of the genus *Euphrosyne*. The body is 12 mm. long and 5 mm. broad, and consists of fifteen segments. The surface of the head is covered with a caruncle extending over the anterior segments, and the whole surface is clothed with milk-white two-branched setæ, which radiate over each segment like a fan.

On the following day a series of temperatures were taken from the surface to 1,500 fathoms at intervals of 100 fathoms.

| Depth. | Temp. | Depth. | Temp. |
|---|---|---|---|
| Surface | 19°·5C. | 800 fathoms | 5°·6C. |
| 100 fathoms | 17·2 | 900 ,, | 4·7 |
| 200 ,, | 13·7 | 1000 ,, | 4·6 |
| 300 ,, | 11·0 | 1100 ,, | 3·8 |
| 400 ,, | 9·5 | 1200 ,, | 3·5 |
| 500 ,, | 7·6 | 1300 ,, | 3·1 |
| 600 ,, | 6·5 | 1400 ,, | 2·8 |
| 700 ,, | 6·2 | 1500 ,, | 2·6 |

The dredge was not used, but, as is our custom whenever the rate of the ship is such as to make it practicable, a large towing-net was put out astern.

In hot, calm weather the towing-net is usually unsuccessful. It seems that the greater number of pelagic forms retire during the heat of the day to the depths of a few fathoms, and come up in the cool of the evening and in the morning, and in some cases in the night. The larger phosphorescent animals are frequently abundant during the night round the ship and in its wake, while none are taken in the net during the day. Mr. Moseley has been specially engaged in working up the developmental stages of *Pyrosoma*, and the intricate structure of the tissues and organs of some of the surface groups, whose extreme transparency renders them particularly suitable for such researches.

*Feb.* 21.—Up to 2.15 P.M. sailing under all plain sail at the rate of six knots an hour before the N.E. trades, force 3 to 4.

The dredge was put over at 5 P.M. with 3,400 fathoms of line, and was kept down till one o'clock A.M. on the following morning, the ship drifting slowly. Our position at noon on the 21st was about 500 miles S.W. of Teneriffe, lat. 24° 22′ N., long. 24° 11′ W., Sombrero Island S. 58° W. 2,220 miles. Work began early on the 22nd, and the dredge, which had begun its ascent at 1.15 A.M., came up at 5.45 half full of a yellowish ooze, which was not so tenacious as usual, and on the whole singularly poor in higher living things. A careful and laborious sifting of the whole mass gave us three small living mollusca, referred to the genera *Arca*, *Limopsis*, and *Leda*; and two Bryozoa apparently undescribed. Foraminifera were abundant, many examples of miliolines being of unusually large size. Some beautiful radiolarians were sifted out of the mud. These may have been taken into the dredge on its way up, or more probably they may have lived on the surface or in intermediate water and have sunk to the bottom after death, since they consist of continuous fenestrated shells of silica.

On Tuesday the 25th a small dredge was lowered at 6.30 A.M. with 3,500 fathoms of line (2,500 fathoms of 2½ in. rope and 1,000 of 2-in.), and 2 cwt. leads attached 300 fathoms in advance. At 7.30 we sounded in 2,800 fathoms, with a bottom of the same reddish ooze, and a temperature of 2° C. A series of temperatures were taken at intervals of 100 fathoms down to 1,000, the result agreeing closely with those of the previous series. At 5.15 P.M. the dredge came up clean and empty. It had either never reached the bottom, owing to some local current or the drift of the ship, or else everything had

[1] Πολιος, white, and πώγων, a beard.

been completely washed out of it on its way to the surface. The bottom water gave a specific gravity of 1·02504 at 19°·6 C., that of the surface being 1·02617 at 21°·3 C. While sounding, the current-drag was tried, and indicated a slight north-westerly current.

As the attempt to dredge on the previous day had been unsuccessful, it was determined to repeat the operation with every possible precaution on the 26th. The morning was bright and clear, and the swell, which had been rather heavy the day before, had gone down considerably. A sounding was taken about 10 o'clock A.M. with the "Hydra" machine and 4 cwt. The sounding was thoroughly satisfactory, a sudden change of rate in the running out of the line indicating in the most marked way when the weight had reached the bottom. During the sounding a current-drag was put down to the depth of 200 fathoms, and it was then ascertained that, by means of management and by meeting the current by an occasional turn of the screw, the ship scarcely moved from her position during the whole time the lead was running out. The depth was 3,150 fathoms; the bottom a perfectly smooth red clay, containing scarcely a trace of organic matter—merely a few coccoliths, and one or two minute granular masses. The thermometer indicated a bottom temperature of 1°·9 C.

The small dredge was sent down at 2.15 P.M. with two hempen tangles; and, in order to ensure its reaching the bottom, attached to the iron bar below the dredge which is used for suspending the tangles, a "Hydra" instrument with detaching weight of 3 cwt. Two additional weights of 1 cwt. each were fixed to the rope 200 fathoms before the dredge. 3,600 fathoms of rope were payed out—1,000 fathoms 2 in. in circumference, and the remainder (2,600 fathoms) 2½ in. The dredge came up at 10.15 P.M. with about 1 cwt. of red clay.

This haul interested us greatly. It was the deepest by several hundred fathoms which had ever been taken, and, at all events coincidentally with this great increase in

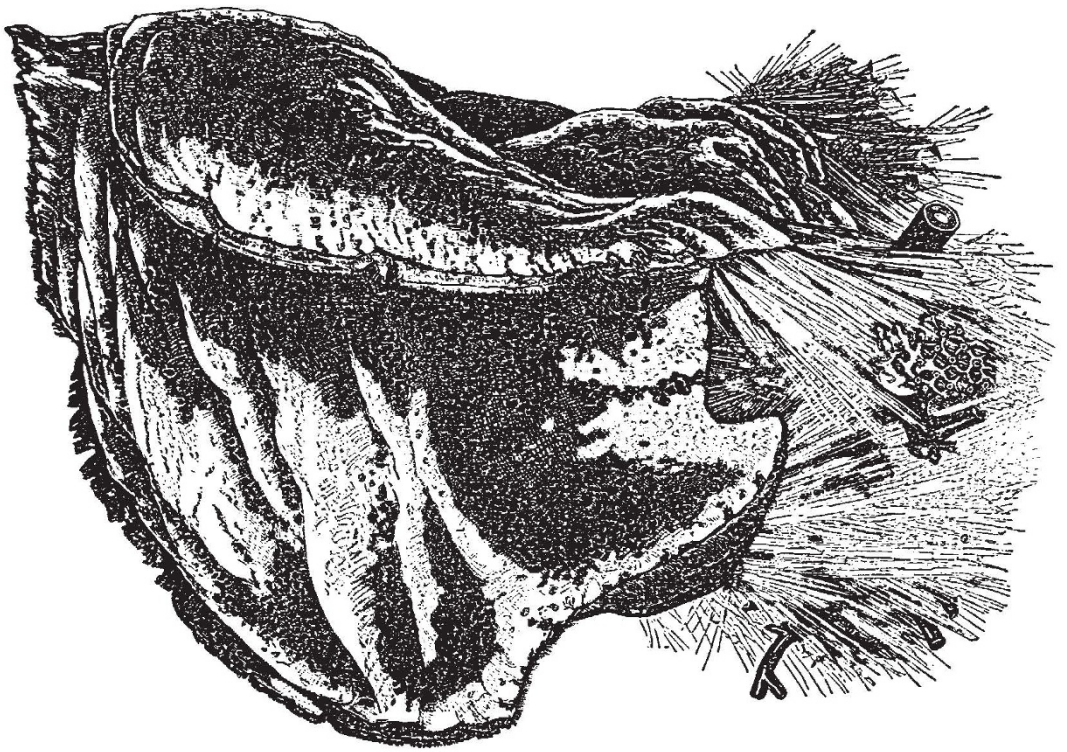


Fig. 1.—Polypogon Amadou Wy. T. Base

depth, totally different from what we had been in the habit of meeting with in the depths of the Atlantic. For a few soundings part of the ooze had been assuming a darker tint, and showed on analysis a continually lessening amount of calcareous matter, and, under the microscope, a smaller number of foraminifera. Now calcareous shells of foraminifera were entirely wanting, and the only organisms which could be detected after washing over and sifting the whole of the mud with the greatest care, were three or four foraminifera of the Cristellarian series, with their tests made up of particles of the same red mud. The shells and spines of surface animals were entirely wanting; and this is the more remarkable as the clay-mud was excessively fine, remaining for days suspended in the water, looking in colour and consistence exactly like chocolate, indicating therefore an almost total absence of movement in the water where it is being deposited. When at length it settles, it forms a perfectly smooth red-brown paste, without the least feeling of grittiness between the fingers, as if it had been levigated with extreme care for a process in some refined art. On analysis it is almost pure clay, a silicate of alumina and the sesquioxide of iron, with a small quantity of manganese.

It is of course a most interesting question whether the peculiar nature of this deposit is connected in any way with the extreme depth. I am certainly inclined at present to believe that it is not. The depth at Station 5 was 2,740 fathoms, and on that occasion foraminifera were abundant, and several bivalve mollusca were taken living. I cannot believe there can be any difference between a depth of 2,740 fathoms and one of 3,150 so essential as to arrest the life of the organisms to the secretions of whose tests the grey Atlantic ooze is due. I am rather inclined in the meantime to attribute this peculiar deposit to the movement of water from some special locality—very possibly the mouths of the great South American rivers—the movement possibly directed in some measure by the form of the bottom. This, however, is a question for the solution of which we may hope to procure sufficient data. WYVILLE THOMSON

## 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*.

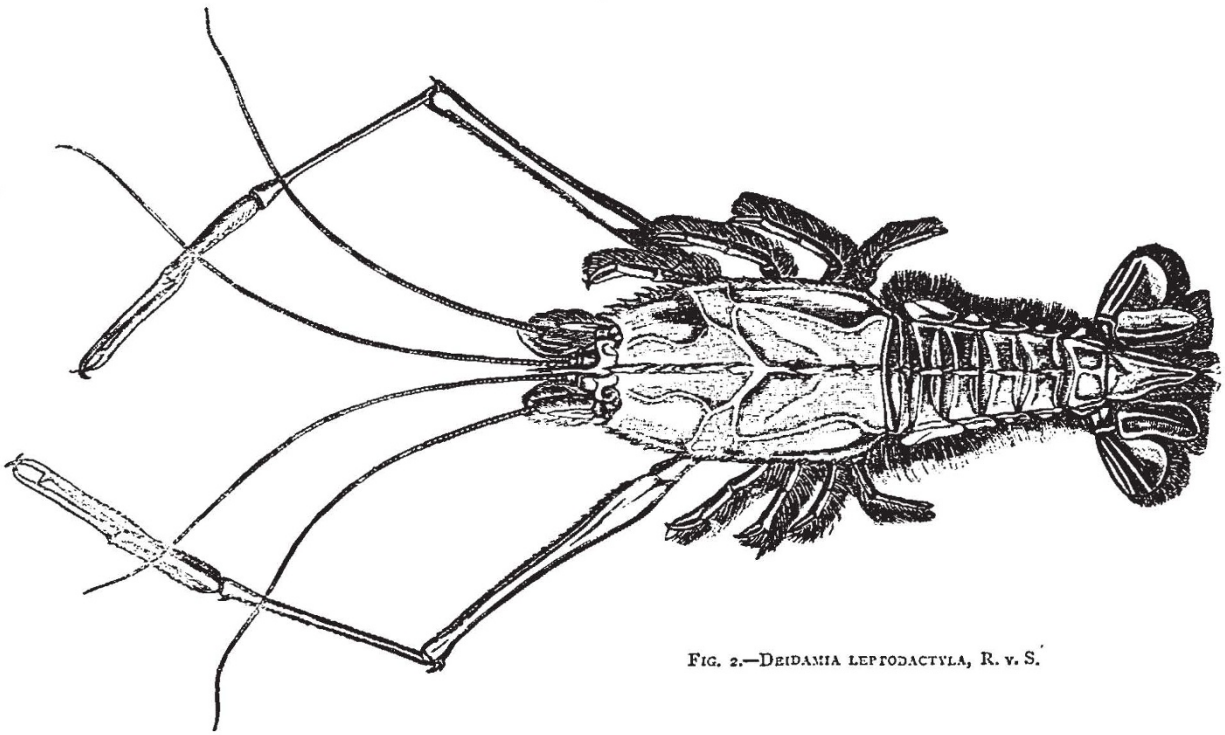


FIG. 2.—DEIDAMIA LEPTODACTYLA, R. v. S.

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.

tional supply of food. In the former case the embryo is more likely to survive; but, on the other hand, when the eggs are large, they cannot be numerous, and a multiplicity of germs is, in some circumstances, a great advantage. Even in the same species the development of the egg offers certain differences.*

The metamorphoses of insects depend then primarily on the fact that they quit the egg in a very early condition; many—as, for instance, flies and bees—before the thoracic segments are differentiated; others—as locusts, dragon flies, &c., after the formation of the legs, but before that of the wings.

We may now pass to the second part of the subject, that is to say, the sudden and abrupt instance of the changes which insects undergo. The development of an Orthopterous insect, indeed—say, for instance, of a grasshopper—from birth to maturity is so gradual, that but for the influence on our nomenclature exercised by the most striking changes which occur in insects of the Heteromorphous series, they would perhaps never have been classed as metamorphoses. But though the changes from the caterpillar to the chrysalis, as from the chrysalis to the butterfly, are apparently sudden and abrupt, this is in reality more apparent than real; the changes in the internal organs, though rapid, are in reality gradual; and even as regards the external form, though the metamorphosis may take only a few moments, this is but the change of outer skin—the drawing away, as it were, of the curtain; and the new form which then appears has been in preparation for days or, perhaps, weeks before.

Swammerdam, indeed, supposed (and his view was adopted by Kirby and Spence) that the larva contained within itself "the germ of the future butterfly, enclosed in what will be the case of the pupa, which is itself included in three or more skins, one over the other, that will successively cover the larva." This is a mistake; but it is true that, if a larva is examined shortly before it is full grown, the future pupa may be traced within it. In the same manner, if we examine a pupa which is about to disclose the butterfly, we find the future insect, soft indeed and imperfect, but still easily recognisable, lying more or less loosely within the pupa-skin.

One important difference between an insect and a vertebrate animal is, that whereas in the latter, as for instance in ourselves, the muscles are attached to an internal bony skeleton, in insects no such skeleton exists. They have no bones, and their muscles are attached to the skin. Hence the necessity for the hard and horny dermal investment of insects, so different from the softness and suppleness of our own skin. Moreover the result is, that without a change of skin a change of form is impossible. The chitine, or horny substance, forming the outside of an insect, is formed by a layer of cells lying beneath it, and, once secreted, cannot be altered. From this it follows that every change of form is necessarily accompanied by a change of skin. In some cases, as for instance in *Chloëon*, each change of skin is accompanied by a change of form, and thus the perfect insect is more or less gradually evolved. In others, as for instance in caterpillars, several changes of skin take place without any material alteration of form, and the change, instead of being spread over many, is confined to the last two moults.

The explanation of this difference is, I believe, to be found in the structure of the mouth. That of the caterpillar is provided with a pair of strong jaws, fitted to eat leaves; and the digestive organs are adapted for this kind of food. On the contrary, the mouth of the butterfly is suctorial; it has a long proboscis, beautifully adapted to suck the nectar from flowers, but which would be quite useless, and indeed only an embarrassment to the larva. The digestive organs also are adapted for the assimilation, not of leaves, but of honey. Now it is evident that if the mouth-parts of the larva were slowly metamorphosed into those of the perfect insect, through a number of small changes, the insect would in the meantime be unable to feed, and liable to perish of starvation in the midst of plenty. On the contrary, in the Orthoptera, and as a general rule, among those insects in which the changes are gradual, the mouth of the so-called larva resembles that of the perfect insect, and the principal difference is in the presence of wings.

Similar considerations throw much light on the nature of the chrysalis or pupa state—that remarkable period of death-like quiescence which is one of the most striking characteristics of insect metamorphosis. The comparative quiescence of the pupa is mainly owing to the rapidity of the changes going on in it. In the chrysalis of a butterfly, for instance, not only (as has been already mentioned) are the mouth and digestive organs undergoing change, but the same is the case with the muscles. The powerful ones which move the wings are in process of formation; and even if they were in a condition favourable to motion, still the nervous system, by which the movements are set on foot and regulated, is also in a state of such rapid change that it could scarcely act.

It must not be forgotten that all insects, indeed all articulate animals, are inactive for a longer or shorter space of time after each moult.

The slighter the change the shorter the period of inaction. Thus, after the ordinary moult of a caterpillar, the insect only requires rest until the new skin is hardened. When, however, the change is great and gradual, the period of inaction is correspondingly prolonged. The inactivity of the pupa is therefore not a new condition peculiar to this stage, but a prolongation of the inaction which accompanies every change of skin. Most pupæ indeed have some slight powers of motion; those which assume the chrysalis state in wood or under ground usually come to the surface when about to assume the perfect state, and the aquatic pupæ of certain Diptera, swim about with much activity. Among the Neuroptera certain families have pupæ as quiescent as those of the Lepidoptera; others, as, for instance, Raphidia, are quiescent at first, but at length acquire sufficient strength to walk, though enclosed within the pupa skin, a power dependent partly on the fact that this skin is very thin. Others again, as, for instance, dragon-flies, are quiescent on assuming the pupa state, only in the same manner and for a similar time as at other changes of skin.

JOHN LUBBOCK

*(To be continued.)*

* For differences in larvæ consequent on variation in the external conditions, see *ante*, p. 31.

## *NOTES FROM THE "CHALLENGER"*

### III.

### THE MILLER-CASELLA THERMOMETER

AT 8 A.M., on March 26, we sounded, lat. 19° 41′ N. long. 65° 7′ W., in 3,875 fathoms. The sounding was perfectly satisfactory, and left no doubt that the depth was estimated within a very small error. The "Hydra" sounding instrument was used weighted to 3 cwt. A slip water-bottle, and two Miller-Casella thermometers (Nos. 39 and 42) were sent down along with it as usual. The tube of the "Hydra" came up filled with a reddish clay containing a considerable quantity of carbonate of lime. The two thermometers were broken, and as the mode in which the fracture occurred is in itself curious, and has an important bearing upon the use of these instruments at extreme depths, I will briefly describe the condition of the thermometers when they came to the surface.

No. 39, a valuable instrument, with a small and constant error, which we had used for some time whenever

for any reason we required extreme accuracy, was shattered to pieces (Fig. 1).

In No. 42 this instrument was externally complete, with the exception of a crack in the small unprotected bulb on the right limb of the U-tube. The inner shell of the protected bulb was broken to pieces (Fig. 2).

In both of these cases there seems little doubt that the damage occurred through the giving way of the unprotected bulb. In No. 39 the upper part of that bulb was ground into coarse powder, and the fragments packed into the lower part of the bulb and the top of the tube. The large bulb and its covering shell were also broken, but into larger pieces, disposed as if the injury had been produced by some force acting from within. The thermometer tube was broken through in three places; at one of these, close to the bend, it was shattered into very small fragments. The creosote, the mercury, and bubbles of air were irregularly scattered through the tube, and it is singular that each of the steel indices had one of the discs broken off. The whole took place no doubt instantaneously by the implosion of the small bulb, which at the same time burst the large bulb and shattered the tube.

In No. 42 a crack only occurred in the small bulb, either through some pre-existing imperfection in the glass or from the pressure. When the pressure became extreme the crack yielded a little, and the sea-water was gradually forced in, driving the contents of the thermometer before it, and taking it at a disadvantage from within, breaking the shell of the large bulb, which was unsupported on account of the belt of rarified vapour between it and its outer-shell. The pressure was now equalised within and without the instrument, and the injury went no farther. Alcohol, creosote, mercury, and sea-water were mixed up in the outer case of the large bulb, with the debris of the inner bulb, and one of the steel indices lay uninjured across the centre of it.

It now becomes an important question why the thermometer should give way at that particular point, and one still more important, how the defect is to be remedied. At first sight it is difficult to imagine why the small bulb should give way rather than the outer shell of the large one. The surface exposed to pressure is smaller, the glass is thicker, and it is somewhat better supported from within, as the tube is nearly filled with fluid under the pressure of an atmosphere. I believe the cause must be that the end of the small bulb is the last point of the instrument heated and sealed after the tube is filled with liquid, and that, consequently, the annealing is imperfect at that point. It is evidently of no use to protect the small bulb in the same way in which the large bulb is protected. The outer shell is merely a precaution to prevent the indications being vitiated by the action of pressure on the elastic bulb. Against crushing, it is

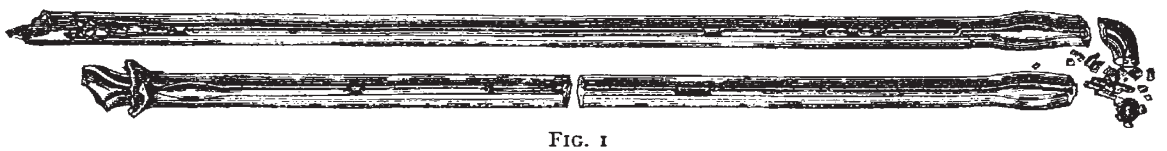


FIG. 1

FIG. 2

no protection; rather a source of weakness, from its greatly increasing the surface. The only plan which seems to be feasible is to thicken the small bulb itself, and, if possible, to improve its temper. It is only fair to say that these thermometers were tested and guaranteed to only three tons on the square inch, and that the pressure to which they were subjected was equal to four tons.

WYVILLE THOMSON

## NOTES

THE Albert Gold Medal of the Society of Arts has this year been awarded to M. Chevreul, Member of the Institute of France, and Director of the Gobelins and of the Jardin des Plantes at Paris, for his valuable researches in connection with Saponification, Dyeing, Agriculture, and Natural History, which, for more than half a century, have exercised a wide influence on the industrial arts of the world.

PROF. HUMPHRY announces that the Cambridge class for Practical Histology will meet during the months of July and August at the Anatomical Museum on Tuesdays, Thursdays, and Saturdays, at 9 A.M., commencing July 1. The Class for Human Osteology will meet on Mondays, Wednesdays, and Fridays at the Anatomical Museum at 9 A.M. during July and August, commencing July 2. The Professor of Zoology and Comparative Anatomy (Mr. Newton) announces that a class for practical work will be carried on in July and August by the Demonstrator in Comparative Anatomy, commencing July 2. The fee for the course will be one guinea.

THE following gentlemen have been recommended by the French Academy of Sciences to the Minister of Public Instruction for the four vacant posts in the Bureau des Longitudes:—M. Serret, M. Mouchez, M. Perrier, and M. Janssen.

THE Council of the Society of Arts having been informed that Her Majesty's Commissioners do not intend to publish reports on the different departments of the exhibition of the present year, have decided to undertake that duty, and for this purpose have engaged the services of gentlemen specially skilled in the subjects of the several sections, to prepare such reports for publication in the Society's *Journal*. A report on Ancient Objects, by Mr. C. Drury Fortnum, F.S.A., and another on Surgical Instruments and Appliances, by Mr. R. Bradenell Carter, F.R.C.S., appear in the *Journal* for May 30.

AT a meeting of the Council of the Leeds Naturalists' Field Club and Scientific Association, three of its members—Mr. Wm. Todd (vice-president), Mr. W. D. Roebuck (secretary), and Mr. John W. Taylor—were appointed a sub-committee to consider the best manner of collecting information for a series of catalogues of the natural productions of the district. The sub-committee having taken into consideration all the facts bearing upon the subject in hand, are of opinion that the following procedure should be adopted:—1. That in view of the approaching meeting in Bradford, in August next, of the British Association for the Advancement of Science, it is advisable that there should be produced by this society, and under its auspices, a brief account of the present state of our knowledge of the fauna, flora, and geological and topographical features of the district. 2. That for present use the most convenient district to illustrate would

## NOTES FROM THE "CHALLENGER"

### IV.

ON Saturday, the 15th of March, before going into the harbour of St. Thomas, a sounding was taken in 450 fathoms off the island of Sombrero. The bottom brought up by the sounding machine was globigerina mud largely mixed with broken shells, chiefly those of pteropods. The dredge was put over early, and veered to 1000 fathoms. At noon it was hauled up half

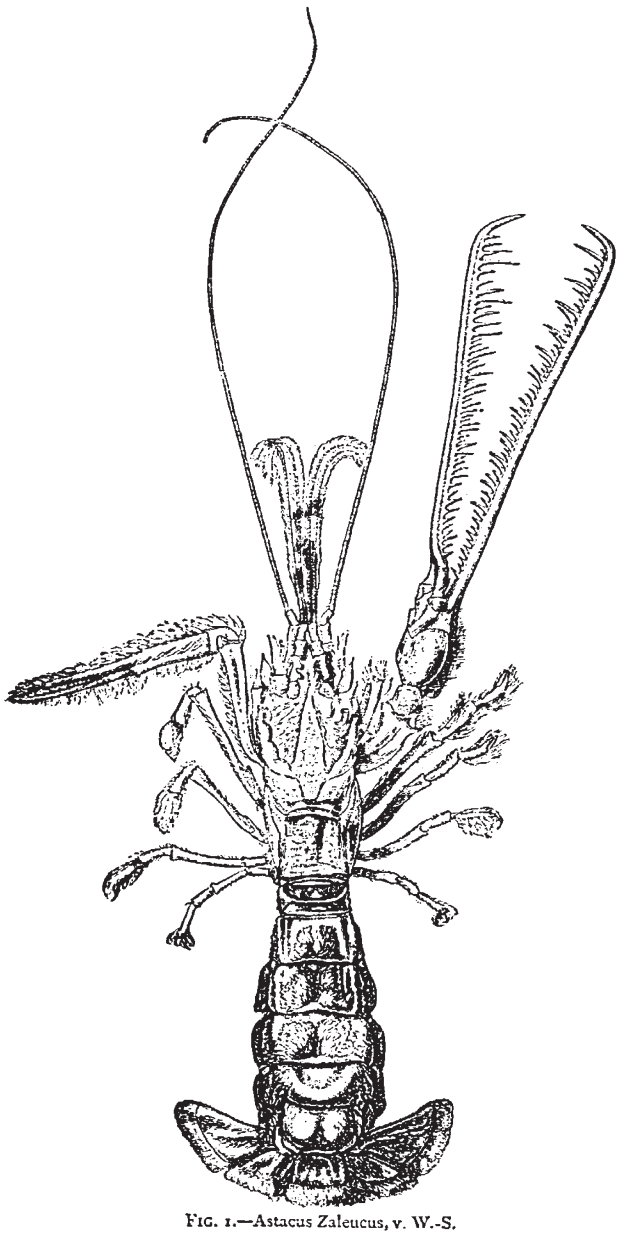


FIG. 1.—Astacus Zaleucus, v. W.-S.

filled with calcareous ooze. It was again sent down, and brought up early in the afternoon with a like freight. These dredgings, which we did not regard as entering into the regular work of the sections, but which were only undertaken to give us a general idea of the deep-water fauna of the West Indian province, may be taken in connection with one or two hauls taken with the same object and under the same circumstances, in waters of nearly equal depth on the 25th of March, after leaving St Thomas. The careful examination of this zone, between 300 and 1,200 fathoms among the West Indian Islands, will undoubtedly add enormously to zoological knowledge. The objects of the present expedition do not, of course, include a detailed investigation of this kind, which must be done quietly in a small steamer, by some one on the spot, and will require the patient work of several years. Even the few hauls of the dredge which we had it in our power to make, brought to light a number of new and highly interesting forms, representing nearly all the invertebrate groups. A thorough investigation of the belt must yield a wonderful harvest.

In those dredgings on the 15th we got several sponges belonging to the Hexactinellidæ, very closely allied to

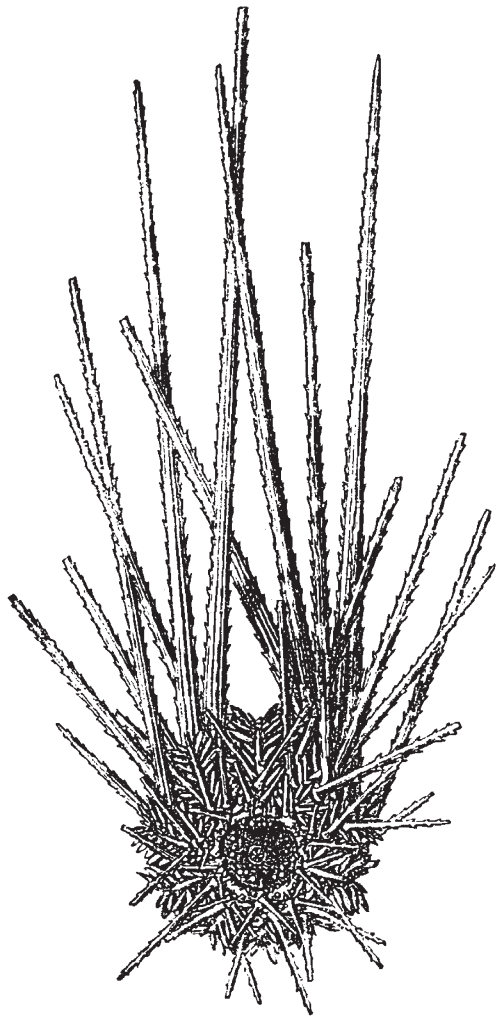


FIG. 2.—Salenica Varispina, A Ag.

those which we had previously met with in moderately deep water off the coast of Portugal, showing that the distribution of this remarkable order in deep water is very wide. Several stony corals occurred, but of all these, with the exception of a species of *Stylaster*, which was very abundant at this station, we got better examples on a subsequent occasion. The *Stylaster* agrees very closely with the description and figure given by Pourtalés of *S. complanatus*. The only marked difference is that the primary and secondary septa do not unite to the same extent as shown in the figure.

In this dredging two very interesting crustaceans occurred, both belonging to the decapod family Astacidæ,

and both participating in a singular deficiency, the total absence of eyes. One of these has been referred by Dr. v. Willemoes-Suhm to his genus Deidamia. It agrees with the species described in my former report in all its leading characters, although certain marked differences must lead to a slight modification of the characters of the genus as formerly defined. In *Deidamia leptodactyla* all the five pairs of ambulatory legs bear chelæ, while it is a character of the typical Astacidæ that chelæ are present on three pairs only. In the new species there are chelæ on four pairs of the ambulatory legs, the fifth pair ending in simple curved claws. The two species agree with one another, and with *Astacus*, in possessing a lamellar appendage at the base of the outer antennæ, and with this they have the flattened carapace of *Palinurus*. These characters have not been hitherto observed in combination, and their so occurring seems to be a more valuable generic character than the variable one of the form of the limbs. The character of this genus will now stand thus :—

*Deidamia*.—Cephalothorax flattened, with a compressed free lateral margin. A lamellar appendage at

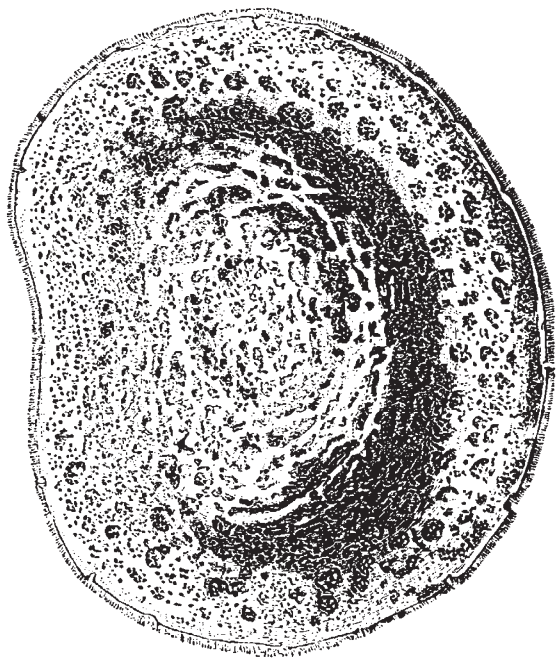


Fig. 3.—Hyalonema Toxeres, Wyville Thomson (Upper surface of sponge body).

base of each of the outer antennæ. Swimmerets, consisting of three joints with two palpi. No trace of eyes or of eyestalks.

*D. leptodactyla* v. W.-S.—All the ambulatory feet bearing chelæ.

*D. crucifer* v. W.-S.—Four pairs of the ambulatory feet bearing chelæ.

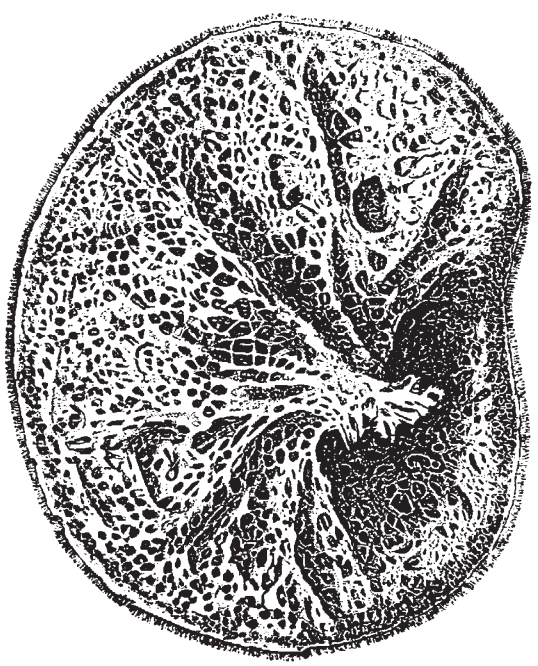
As in *D. leptodactyla*, not only are the eyes and eyestalks absent, but there is no indication of a space for their accommodation in the position in which eyes are normally developed.

*Deidamia crucifer* certainly differs widely in general appearance from the recent Astacidæ, at the end of which family we should, however, be inclined to place it for the present. It has a very close resemblance to some fossil forms, particularly the varying species of the genus *Eryon*. It has been already remarked that *Deidamia*, in its flattened cephalothorax, approaches the Palinuridæ; in all the living members of that family, however, the first pair of legs are monodactylous, while in *Deidamia* they are didactylous. The fossil genus *Eryon* forms an exception in this particular among Palinurids, with which it has hitherto been arranged, and has the first pair of limbs didactylous, as in *Deidamia*. It has not yet been ascertained whether *Eryon* has a lamellar appendage at the base of the outer antennæ. If this appendage be absent, there is probably scarcely sufficient ground for separating *Deidamia* generically from *Eryon*. It is very likely that when the recent deep-sea forms near the Astacidæ and Palinuridæ come to be carefully correlated with the cretaceous and Jurassic species, it may be necessary to establish an additional family.

The second crustacean, although having little of the facies of the typical *Astaci*, presents apparently no characters of sufficient value to warrant its separation from that genus.

*Astacus zaleucus*, v. W.-S. (Fig. 2), with its long compressed cephalothorax, flattened abdomen and unequal chelæ, has at first sight somewhat the appearance of a *Calianassa*.

The total length of the animal is 120 mm.; the cephalothorax, 50, and the abdomen, 60 mm. The



[Fig. 4.—Hyalonema (Lower surface).

carapace is hard, and firm, though only slightly calcified. It is greatly compressed laterally, rising into a high arch. It terminates in front in a slender spiny rostrum, 8 mm. in length. The rostrum is covered with a thick felting of hair, which extends backwards, forming two hairy triangles on the anterior part of the cephalothorax In front of the carapace, between its anterior and upper edge and the insertions of the antennæ, in the position of the eyes in such forms as *Astacus fluviatilis*, there are two round vacant spaces which look as if the eyestalks and eyes had been carefully extirpated and the space they occupied closed with a chitinous membrane. The lamellar appendage of the outer antennæ has teeth along its inner border. It extends to the middle of the second basal segment of the antenna, which is remarkably long. The flagella of the outer antennæ are 130 mm. in length. The inner antennæ originate in a line with the outer. The funiculus is shorter, and the flagella, which are equal in length, are much shorter than those of the outer antennæ.

The parts of the mouth are normal. The three first pairs of ambulatory legs are terminated by chelæ, the fourth pair bear recurved claws, and the fifth abortive stump-like claws. The chelæ of the first pair of legs are strangely developed, particularly the right chela, which is double the length of the left, and with its formidable ranges of long spines along the inner border of each claw reproduces on a small scale the jaws of the Gangetic gavial. The last segment of the pereion is not covered by the carapace but is in moveable connection with it. The first segment of the abdomen is very small, and the segments gradually increase up to the fourth, which the fifth and sixth equal in size. The abdominal segments are flattened from above downwards. The telson is quadrate, and combines with the two pairs of caudal appendages, which are widely expanded laterally to form the caudal fin. The dorsal surfaces of the second, third, and fourth abdominal segments, and the margin of the tail, are thickly covered with woolly hair. The individual being a male, the first pair of swimmerets consist of long slender appendages, and the four succeeding pairs have one strong, round, basal joint, to which are attached two palpi fringed with hair. There is some resemblance between this form and *Calianassa*, but in this genus the lamellar appendage to the outer antenna is absent. There are four pairs of limbs with chelæ instead of three, and the carapace is soft.

To the genus *Astacus*, therefore, with which it has all characters in common except the great development of the right chela and the total absence of eyes—neither characters of generic value—the present species must be referred.

*A. Zaleucus*, n. sp. (Fig. 1).

Rostrum spiny, elongated. Lamellar appendage of the outer antennæ reaching to the middle of the second joint of the funiculus. Chelæ on three pairs of ambulatory feet, those on the first pair strongly but unequally developed. Cephalothorax very much compressed laterally, eyestalks and eyes entirely wanting.

On Sunday, March 16, we anchored in the Gregaria Channel, at the entrance of the harbour of Charlotte Amalia. We spent a few very pleasant days at St. Thomas, some of the civilians of our party enjoying greatly their first experience of life and scenery within the tropics. M. Gardé, the Danish Governor, received us with the most friendly hospitality. He is a naval man, and was greatly interested in our investigations, and his Aide-de-Camp, Baron Eggers, had collected and worked out the plants of the Island with care, and was otherwise well acquainted with its natural history.

The natural history of the island of St. Thomas is tolerably well known, and large collections of its fauna and flora have been sent home from time to time by very competent naturalists to the Museum at Copenhagen. On the present occasion our time was much too limited to attempt to make collections, so the naturalists contented themselves with a little shallow water dredging, and such a general survey of the island and shores as might familiarise them with the more characteristic forms of animal and vegetable life; for while the Atlantic Islands Madeira, and the Canaries, although gradually assuming a more tropical character, maintain the most intimate relations in natural products with the south of Europe, in Tropical America everything is changed, and it takes a little time to become familiar with new acquaintances whom one has hitherto known, if he has known them at all, only from descriptions or figures, or at best mummied or pickled, or otherwise in inadequate effigy. Ophiurideas are particularly plentiful at St. Thomas, and we made large collections of these, particularly of the many large and characteristic West Indian species of the genus *Ophioderma*.

On the 24th of March we left the harbour of Charlotte Amalia and proceeded with a light north-easterly breeze towards the Culebra passage. The next morning we sounded in 625 fathoms. The ooze was closer and more free from shells and coral than in the former haul, but otherwise much of the same character. This time the dredge came up about half full, and on sifting its contents many interesting additions were made to our collections. Here we met for the first time with the curious little crinoid, *Rhizocrinus lofotensis*, for which we had been on the outlook since the beginning of the cruise, and *Salenia varispina*, which we now recognise as a very widely distributed inhabitant of the deeper water.

This elegant little urchin (Fig. 2) is about 10 mm. in diameter of the test. It resembles in general appearance young specimens of *Cidaris hystrix*. The ambulacral zones are narrow, the interambulacral correspondingly wide, and both are furnished with double rows of flat, paddle-shaped, secondary spines beautifully striated in purple and white, ranged along the middle line, from which they shed outwards on either side. The primary tubercles are large, imperforate, and distinctly crenated. Some of the larger of the primary spines are 50 mm. in length, ·8 mm. in diameter, and cylindrical, gradually tapering towards the point. They are fluted and serrated along the ridges with sharp prickles. The spines in all the specimens we have dredged are very uniform; some are slightly curved, but they scarcely agree with the description given by Prof. A. Agassiz, from a young specimen, of being "of all shapes." The spines round the mouth are short, some of them slightly flattened and sharply denticulated.

The corals which were abundant in individuals were all deep-water forms. They have been examined by Mr. Moseley, who refers the majority to species which have been described by M. de Pourtalés* from the Straits of Florida.

Two examples of the sponge-body of a very handsome Hyalonema were sifted out of the coral mud. Unfortunately in both cases the sponge had been torn from the central coil, and the absence of the coil might have thrown some little doubt upon the form and mode of finish of the complete animal, so that it was extremely fortunate that a young specimen of the same species about 40 mm. in length was caught in the tangles quite perfect.

*Hyalonema loxeres*, new species, resembles closely the other known species *H. lusitanicum* and *H. sieboldi* in general appearance and in the arrangement of its parts. A more or less funnel-shaped sponge presents two surfaces covered with a network of different patterns formed by varying arrangements of large fine rayed spicules. The upper concave surface shows a number of oscular openings irregularly arranged, and the lower surface a more uniform network of pores, some of which seem to be inhalent and others exhalent.

The central axis of the sponge is closely warped into the upper part of a coil of long and strong glassy spicules which, as in the other species, serve to anchor the sponge in the soft mud. Both of the species dredged have the sponge more flattened and expanded than it is in *H. lusitanicum*. In one of them it is nearly flat (Fig. 3), forming a reniform cake-like expansion 80 mm. in length by 70 mm. in width, and about 8 mm. in thickness. The upper or oscular surface is covered by an exceedingly close network with groups of large openings at nearly equal intervals. It is slightly raised in the centre. The central elevation is followed by a slight depression, and the upper wall then passes out nearly horizontally to a sharp peripheral edge fringed with long delicate spicules, each consisting of a slender central shaft with a cross of four short transverse processes in the centre. The outer half of the central axis is delicately feathered. The lower surface of the sponge (Fig. 4) is protected by a singularly

* Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College, No. 4—Deep-sea Corals. By L. F. de Pourtalés, Cambridge (Mass.), 1871.

elegant net-work of sarcode with wide oval and round meshes radiating irregularly from a central point. The membrane is traversed by irregularly radiating ridges of firmer substance, which unite in the centre in a projecting boss at the point where, in this specimen, the "glass-rope" has unfortunately been torn out.

WYVILLE THOMSON

(*To be continued.*)

## THE ANCESTRY OF INSECTS

WITHIN a very few days after my last article on the "Origin and Metamorphoses of Insects" appeared in NATURE, I received from Mr. Packard a memoir,* under the above title, in which he developes his latest views on the same subject; and I am happy to find that his views do not differ so much from mine as I had supposed. He lays great stress, as is natural, on the larval forms. "If we compare," he says, "these early stages of mites and myriopods, and those of the true six-footed insects, as in the larval Meloë, Cicada, Thrips, and Dragon-fly, we shall see quite plainly that they all share a common form. What does this mean? To the systematist who concerns himself with the classification of the myriads of different insects now living, it is a relief to find that all can be reduced to the comparatively simple forms sketched above. It is to him a proof of the unity of organisation pervading the world of insects. He sees how Nature, seizing upon this archetypal form has, by simple modifications of parts here and there, by the addition of wings and other organs wanting in these simple creatures, rung numberless changes in this elemental form." And again (p. 151), "Going back to the larval period, and studying the insect in the egg, we find that nearly all the insects yet observed agree most strikingly in their mode of growth, so that, for instance, the earlier stages of the germ of a bee, fly, or beetle, bear a remarkable resemblance to each other, and suggest again, more forcibly than when we examine the larval condition, that a common design or pattern pervades all."

He distinguishes, as in his previous writings (p. 175), two principal types of larvæ :—

"There are two forms of insectean larvæ which are pretty constant. One we call leptiform, from its general resemblance to the larvæ of the mites (Leptus). The larvæ of all the Neuroptera, except those of the Phryganeidæ and Panorpidæ (which are cylindrical, and resemble caterpillars), are more or less leptiform, *i.e.*, have a flattened or oval body, with long thoracic legs. Such are the larvæ of the Orthoptera and Hemiptera, and the Coleoptera (except the Curculionidæ; possibly the Cerambycidæ and Buprestidæ, which approach the maggot-like form of the larvæ of weevils). On the other hand, taking the caterpillar or bee larvæ, with their cylindrical fleshy bodies, in most respects typical of larval forms of the Hymenoptera, Lepidoptera, and Diptera, as the type of the eruciform larva," &c.

At first sight it would appear that Mr. Packard's conclusions differ widely from those which I have advocated. He rejects, indeed, the suggestion made by Haeckel that the "common stem form of all Tracheata" may be found in "Zoeaform Crustacea." It is evident, he says (p. 159), that "the Leptus fundamentally differs from the Nauplius and begins life on a higher plane. We reject, therefore, the crustacean origin of the insects." And elsewhere "we find through the researches of Messrs. Hartt and Scudder that there were highly-developed insects, such as may-flies, grasshoppers, &c., in the Devonian rocks of New Brunswick, leading us to expect the discovery of low insects even in the Upper Silurian rocks. At any rate this discovery pushes back the origin of insects beyond a time when there were true Zoëæ, as the shrimps and other allies are not actually known to exist so far back as the Silurian, not having as yet been found below the coal-measures."

But then he observes that the "larvæ of the earliest insects were probably leptiform, and the eruciform condition is consequently an acquired one, as suggested by Fritz Müller." Again, "for reasons which we will not pause here to discuss, we have always regarded the eruciform type of larva as the highest. That it is the result of degradation from the Leptus or Campodea form, we should be unwilling to admit." And once more, "The Caterpillar is a later production than the young, wingless Cockroach."

Mr. Packard had already expressed these opinions elsewhere, and as I have on the contrary suggested that the grublike, or Lindia-forms were the first to come into existence, then the Tardigrade-form, and lastly, the Campodea-form, I had supposed that our views were in direct opposition to one another: but I am glad to find from other passages that after all there is not so much difference as these passages would seem to indicate. I cannot, indeed, agree with him in his classification of Insect larvæ; he ranks the Caterpillars with the grubs and maggots of Bees and Flies, as a class for which he proposes the term "eruciform" in opposition to the "leptiform" larvæ of Orthoptera, Hemiptera, and most Coleoptera. It seems to me, on the contrary, that the two great groups are the Hexapod or Campodea-form, and the apod, grublike type, which I have proposed to call the Lindia-form. At the first glance, no doubt, the heavy sluggish Caterpillar seems to have more in common with the grub of a Bee than with the active larvæ of Coleoptera. The difference, however, is one of habit, not of type.

As regards the ancestral forms of Insects, Mr. Packard considers that "while the Poduras (p. 154) may be said to form a specialised type, the Bristle-tails (*Lepisma*, *Machilis*, *Nicolitea*, and *Campodea*) are, as we have seen, much more highly organised, and form a generalised or comprehensive type. They resemble, in their general form, the larvæ of Ephemerids, and perhaps more closely the immature Perla, and also the wingless Cockroaches. Now such forms as these Thysanura, together with the mites and singular Pauropus, we cannot avoid suspecting to have been among the earliest to appear upon the earth; and putting together the facts, first, of their low organisation, secondly, of their comprehensive structure, resembling the larvæ of other insects, and thirdly, of their probable great antiquity, we naturally look to them as being related in form to what we may conceive to have been the ancestor of the class of insects. Not that the animals mentioned above were the actual ancestors, but that certain insects bearing a greater resemblance to them than any others with which we are acquainted, and belonging possibly to families and orders now extinct were the prototypes and progenitors of the insects now known."

As regards the probable origin of this Leptus form, Mr. Packard's views are expressed in the following passage (p. 169):—"While the Crustacea may have resulted from a series of prototypes leading up from the Rotifers, it is barely possible that one of these creatures may have given rise to a form resulting in two series of beings, one leading to the Leptus form, the other to the Nauplius. For the true Annelides (Chætopods) are too circumscribed and homogeneous a group to allow us to look to them for the ancestral forms of insects. But that the insects may have descended from some low worms is not improbable, when we reflect that the Syllis and allied genera of Annelides bear appendages consisting of numerous joints; indeed, the strange *Dujardinia rotifera*, figured by Quatrefages, in its general form is remarkably like the larva of Chloëon."

Moreover, though Mr. Packard says that "the caterpillar is a later production than the young wingless, cockroach," he elsewhere (p. 182) says, "it is evident that in the

* Being a chapter from "Our Common Insects," by A. S. Packard, jun. (Printed in advance.)

## 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

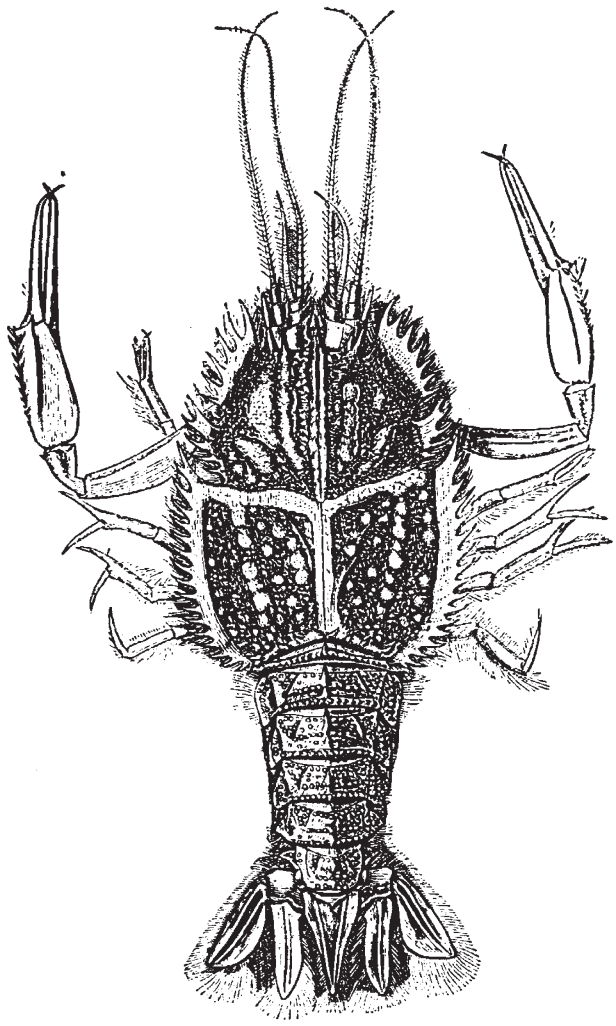


FIG. 1.—Deidamia crucifer, v. W.-S.

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

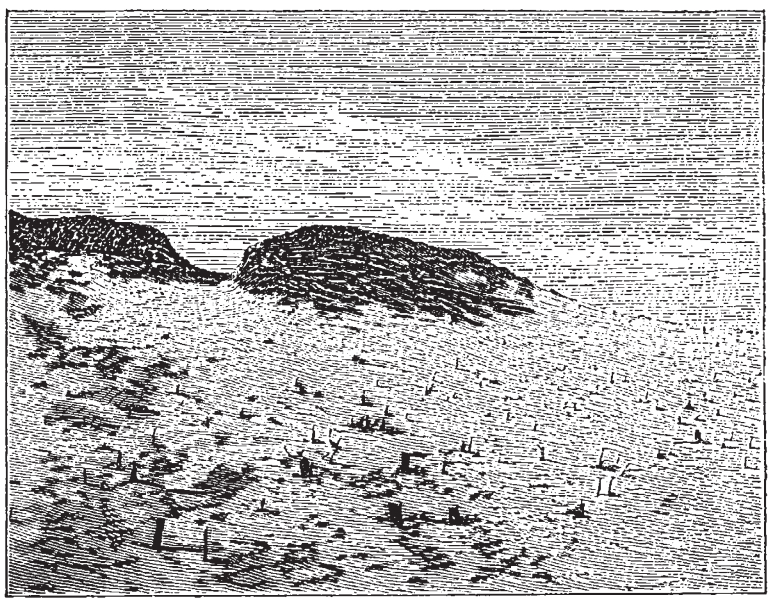


Fig. 2.—Rocks of Coral Sand in Bermudas in process of formation, showing Stratification, and the Stumps of Cedars which have been overwhelmed.

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.

WYVILLE THOMSON

## *NOTES FROM THE "CHALLENGER"*

### VI.

WE left Bermudas on Thursday, June 12, for the Azores. His Excellency Gen. Lefroy, C.B., F.R.S., Governor of the Island, with his private secretary, Capt. Trench and Capt. Aplin, R.N., Captain Superintendent of the Dockyard, and a party of ladies, came on board in the afternoon, and we bade farewell, with great regret, to the friends from whom we had received such unvaried kindness during our stay. At half-past five we steamed out of the Camber and passed among the reefs to Murray's Anchorage, on the north-east side of the island, where we anchored for the night. Next morning we proceeded through the narrows, and early in the forenoon, having seen the last of the treacherous and beautiful purple shadows in the bright green waters of Bermudas, we set all plain sail and stood on our course to Fayal. In the afternoon we got up steam and sounded, lat. 32° 37′ N., long. 64° 21′ W., in 1,500 fathoms, with the usual grey-white chalky bottom which surrounds the reefs.

Our position, at noon of the 15th, was lat. 33° 41′ N., long. 61° 28′ W., 1,610 miles from Fayal.

On the morning of the 16th we sounded in 2,575 fathoms, the bottom a reddish ooze, containing a large number of foraminifera. The bottom temperature was 1°·5 C. A small, rather heavy trawl, with a beam 11½ feet long, was put over in the morning, but when it was hauled in, about five in the afternoon, it was found that it had not reached the bottom. This was the first case of failure with the trawl. It was probably caused by the drift of the ship being somewhat greater than was supposed. The net contained a specimen of one of the singular and beautiful fishes belonging to the Sternoptychidæ, an aberrant family of the Physostomi, distinguished by having on some part of the body ranges of spots or glands producing a phosphorescent secretion. The surface of the body is, in most of the species, devoid of scales, but, in lieu of them, the surface of the skin is broken up into hexagonal or rectangular areæ, or separated from one another by dark lines, and covered with a brilliant silvery pigment, dashed with various shades of green or steel blue. We have taken, in all, four or five species of these fishes, all in the net, when dredging or trawling, at great depths. I do not think they come from the bottom, however. It seems more probable that they are caught in the net on its passage to the surface, possibly at a depth of two or three hundred fathoms, where there is reason to believe there is a considerable development of a peculiar pelagic fauna.

On Tuesday, the 17th, the trawl was lowered at seven in the morning, and in the forenoon a sounding was taken in 2,850 fathoms.

Several examples of a large and handsome species of the genus *Scalpellum* came up in the trawl, a few still adhering to some singular-looking concretionary masses which they brought up along with them. One of these lumps, to which a large example of the barnacle was attached, was irregular in form, about three centimetres in length, and two in width. The surface was mammellated and finely granulated, and of a dark-brown colour, almost black. A fracture showed a semi-crystalline structure, the same dark-brown material arranged in an obscurely radiating manner from the centre, and mixed with a small quantity of a fragment of greyish-white clayey matter. This nodule was examined by Mr. Buchanan, and found to consist, like the nodules dredged in 2,435 fathoms at Station 16, 700 miles to the east of Sombrero, almost entirely of peroxide of manganese. Some other concretionary lumps were of a grey colour, but all of them contained a certain proportion of pyrolusite, and they seemed to be gradually changing into nodules of pyrolusite by some process of alteration or substitution. This is undoubtedly very singular, and it is difficult to conceive what can be the source of so widespread a formation of manganese. It is, of course, a matter of great difficulty to make anything like accurate analyses on ship-board. Mr. Buchanan is giving his careful attention to the whole subject of the chemical composition of the sea-bed, and I hope that the determination of the composition of a number of samples, when a favourable opportunity occurs, will throw additional light upon this and a number of other obscure points connected with the chemistry of modern geological formations.

*Scalpellum regium*, n. sp. (Fig. 1), is by far the largest of the known living species of the genus. The extreme length of a full-sized specimen of the female is 60 mm., of which 40 mm. are occupied by the capitulum, and 20 mm. by the peduncle. The capitulum is much compressed, 25 mm. in width from the occludent margin of the scutum to the back of the carina. The valves are 14 in number; they are thick and strong, with the lines of growth strongly marked, and they fit very closely to one another,

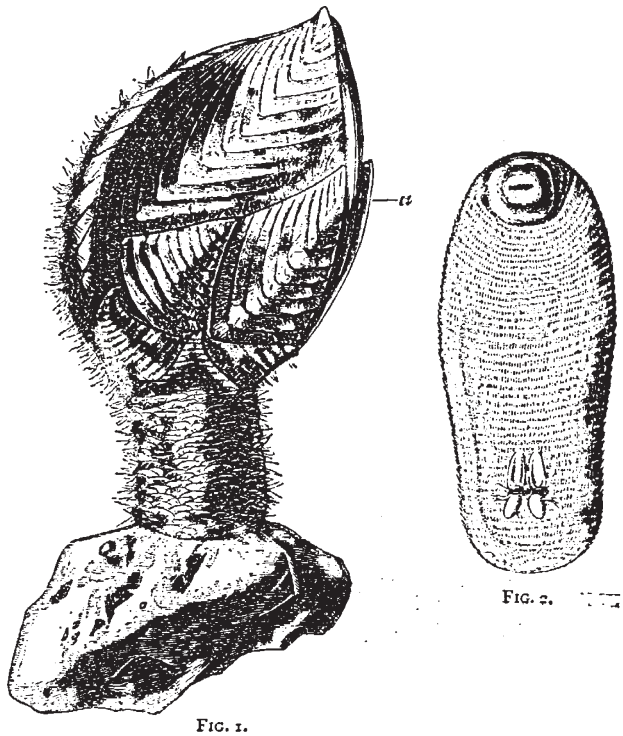



FIG. 1.

FIG. 2.

FIG. 1.—Scalpellum regium, Wy. Thomson. *a*, Males lodged within the edge of the scutum. FIG. 2.—Male of Scalpellum regium.

in most cases slightly overlapping. When living, the capitulum is covered with a pale-brown epidermis, with scattered hairs of the same colour.

The scuta are slightly convex, nearly once and a half as long as broad. The upper angle is considerably prolonged upwards, and, as in most fossil species, the centre of calcification is at the apex. A defined line runs downwards and backwards from the apex to the angle between the lateral and nasal margins. The occludent margin is almost straight. There is no depression for the adductor muscle, and there is no trace of notches or grooves along the occludent margin for the reception of the males; the interior of this valve is quite smooth. The terga are large, almost elliptical in shape, the centre of calcification at the upper angle. The carina is a handsome plate, very uniformly arched, with the umbo placed at the apex. Two lateral ridges, and a slight median ridge run from the umbo to the basal margin. The lower part of the valve widens out rapidly, and the whole is deeply concave. The rostrum, as in *Scalpellum vulgare*, is very minute, entirely

hidden during life by the investing membrane. The upper latera are triangular, the upper angle curving rather gracefully forwards; the umbo of growth is apical.

The rostral latera are long transverse plates lying beneath the basal margins of the scuta. The carinal latera are large and triangular, with the apex curved forwards very much like the upper latera, and the inframedian latera are very small, but in form and direction of growth nearly the same.

The peduncle is round in section and strong, and covered with a felting of light-brown hair. The scales of the peduncle are imbricated and remarkably large, somewhat as in *S. ornatum* Darwin. About three, or at most four scales, pass entirely round the peduncle. The base of attachment is very small, the lower part of the peduncle contracting rapidly. Some of the specimens taken were attached to the lumps of clay and manganese concretions, but rather feebly, and several of them were free, and showed no appearance of having been attached. There is no doubt, however, that they had all been more or less securely fixed, and had been pulled from their places of attachment by the trawl. On one lump of clay there were one mature specimen and two or three young ones, some of these only lately attached. The detailed anatomy of this species will be given hereafter, but the structure of the soft parts is much the same as in *Scalpellum vulgare*.

In two specimens dissected there was no trace of a testis or of an intromittent organ, while the ovaries were well developed; I conclude, therefore, that the large attached examples are females, corresponding, in this respect, with the species otherwise also most nearly allied, *S. ornatum*.

In almost all the specimens which were procured by us, several males, in number varying from five to nine, were attached within the occludent margins of the scuta, not imbedded in the chitinous border of the valve, or even in any way in contact with the shell, but in a fold of the body-sac quite free from the valve. They were ranged in rows, sometimes stretching—as in one case where there were seven males on one side—along the whole of the middle two-thirds of the edge of the tergum.

The male of *Scalpellum regium* (Fig. 2) is the simplest in structure of these parasitic males which has yet been observed. It is oval and sac-like, about 2 mm. in length by ·9 mm. in extreme width. There is an opening at the upper extremity which usually appears narrow, like a slit, and this is surrounded by a dark, well-defined, slightly raised ring. The antennæ are placed near the posterior extremity of the sac, and resemble closely in form those of *S. vulgare*. The whole of this sac, with the exception of a small bald patch near the point of attachment, is covered with fine chitinous hairs arranged in transverse rings. There is not the slightest rudiment of a valve, and I could detect no trace of a jointed thorax, although several specimens were rendered very transparent by boiling in caustic potash. There seems to be no œsophagus nor stomach, and the whole of the posterior two-thirds of the body in the mature specimens was filled with a lobulated mass of sperm-cells. Under the border of the mantle of one female there were the dead and withered remains of five males, and in most cases one or two of the males were not fully developed; several appeared to be mature, and one or two were dead, empty, dark-coloured chitine sacs.

On Wednesday, June 18, we resumed our course with a fine breeze, force 5 to 7, from the south-east. In this part of our voyage we were greatly struck with the absence of the higher forms of animal life. Not a sea-bird was to be seen, with the exception of a little flock of Mother Carey's chickens, here apparently always *Thalassidroma wilsoni*, which kept playing round the ship, on the watch for food, every now and then concentrating upon some peculiarly rich store of offal as it passed astern, and staying by it while the ship went on for a quarter of a mile, fluttering above the water and daintily touching it with their feet as they stooped and picked up the floating crumbs, and then rising and scattering in the air to overtake us and resume their watch.

The sea itself in the bright weather, usually under a light breeze, was singularly beautiful—of a splendid indigo-blue of varying shades as it passed from sunlight into shadow, flecked with curling white crests; but it was very solitary: day after day went by without a single creature (shark, porpoise, dolphin, or turtle) being visible. Some gulf-weed passed from time to time, and bunches of a species of *Fucus*, either *F. nodosus* or a very nearly allied form, evidently living and growing, and participating in the wandering and pelagic habits of *Sargassum*. The floating islands of the gulf-weed, with which we have become familiar as we have now nearly made the circuit of the "Sargasso Sea," are usually from a couple of feet to two or three yards in diameter, sometimes much larger; we have seen, on one or two occasions, fields several acres in extent, and such expanses are probably more frequent nearer the centre of its area of distribution.

They consist of a single layer of feathery bunches of the weed *Sargassum bacciferum*, not matted together, but floating nearly free of one another, only sufficiently entangled for the mass to keep together. Each tuft has a central brown thread-like branching stem studded with round air-vesicles on short stalks, most of those near the centre dead, and coated with a beautiful netted white polyzoon. After a time vesicles so encrusted break off, and where there is much gulf-weed the sea is studded with these little separate white balls. A short way from the centre, towards the ends of the branches, the serrated willow-like leaves of the plant begin, at first brown and rigid, but becoming, farther on in the branch, paler, more delicate, and more active in their vitality. The young fresh leaves and air-vesicles are usually ornamented with the stalked vases of a *Campanularia*. The general colour of the mass of weed is thus olive in all its shades, but the golden olive of the young and growing branches greatly predominates. This colour is, however, greatly broken up by the delicate branching of the weed, blotched with the vivid white of the encrusting polyzoon, and riddled by reflections from the bright blue water gleaming through the spaces in the network. The general effect of a number of such fields and patches of weed, in abrupt and yet most harmonious contrast with the leaves of intense indigo which separate them, is very pleasing.

These floating islands have inhabitants peculiar to them, and I know of no more perfect example of protective resemblance than is shown in the gulf-weed fauna. Animals drifting about on the surface of the sea with such scanty cover as the single broken layer of the seaweed, must be exposed to exceptional danger from the sharp sea-birds hovering above them, and from the hungry fishes searching for prey beneath, but one and all of these creatures imitate in such an extraordinary way, both in form and colouring, their floating habitat, and consequently one another, that we can well imagine their deceiving both the birds and the fishes. Among the most curious of the gulf-weed animals is the grotesque little fish, probably *Antennarius marmoratus*, which finds its nearest English ally in the "fishing frog" (*Lophius piscatorius*), often thrown up on the coast of Britain, and conspicuous for the disproportionate size of its head and jaws, and for its general ugliness and rapacity. None of the examples of the gulf-weed *Antennarius* which we have found are more than 50 mm. in length, and we are still uncertain whether such individuals have attained their full size. It is this little fish which constructs the singular nests of gulf-weed bound in a bundle with cords of a viscid secretion, which have been already mentioned as abundant in the path of the gulf-stream.

*Scillæa pelagica*, one of the shell-less mollusca, is also a frequent inhabitant of the gulf-weed. A little short

tailed crab (*Nautilograpsus minutus*) swarms on the weed and on every floating object, and it is odd to see how the little creature usually corresponds in colour with whatever it may happen to inhabit. Mr. Murray, who has the general superintendence of our surface work, brings in curious stories of the habits of these little crabs. We observe that although every floating thing upon the surface is covered with them, they are rarely met swimming free, and that whenever they are dislodged and removed a little way from their resting place, they immediately make the most vigorous efforts to regain it. The other day he amused himself teasing a crab which had established itself on the crest of a *Physalia*. Again and again he picked it off and put it on the surface at some distance, but it always turned at once to the *Physalia* and struck out, and never rested until it had clambered up into its former quarters.

On Thursday, the 19th, we sounded in 2,750 fathoms in a grey mud containing many foraminifera. Position of the ship at noon, lat. 35° 29′ N., long. 50° 53′ W.

The wind now gradually freshened, and for the next three days we went on our course with a fine breeze, force from 4 to 7, from the southward, sounding daily at a depth of about 2,700 fathoms, with a bottom of reddish grey ooze. On Tuesday the 24th the trawl was put over in 2,175 fathoms, lat. 38° 3′ N., long. 39° 19′ W., about 500 miles from the Açores. As in most of the deep trawls on grey mud, a number of the zoœcia of delicate branching polyzoa were entangled in the net. One of these on this occasion was very remarkable from the extreme length (4 to 5 mm.) of the pedicels on which its avicularia were placed. Another very elegant species was distinguished by the peculiar sculpture of the cells, reminding one of those of some of the more highly ornamented *Lepraliæ*. WYVILLE THOMSON

(*To be continued.*)

## *THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE*

THE second session of the French Association was opened at Lyons last Thursday, by an inaugural address from the President, M. de Quatrefages, who pointed out the almost inconceivable advance of Science during the past century, and the importance of Science in education.

In speaking of scientific education, the President said that the devotees of literature accused Science of stifling sentiment and imagination; she kills, say they, the ideal and stunts intelligence by imprisoning it within the limits of reality; she is incompatible with poetry. The men who speak thus have never read Kepler the astronomer, Pascal the geometer, Linnæus the naturalist, Buffon the zoologist, Humboldt the universal *savant*. What! says the President, Science stifle sentiment, imagination, she who brings us every hour into the presence of wonders! She lower intelligence, who touches on all the infinities! When *littérateurs* and poets know Science better, they will come and draw from her living fountain. Like Byron of our time, like Homer of yore, they will borrow from her striking imagery, descriptions whose grandeur will be doubled by their truth. Homer was a *savant* for his time. He knew the geography, the anatomy of his era; we find in his verses the names of islands and capes, technical terms like *clavicle* and *scapula*. None the less he wrote the Iliad.

No, the study of Science will never suppress the genius of an inspired poet, of a true painter, of a great sculptor. But she will bring more light to the path of an erring soul. She will perhaps transform into a wise man, or at least into a citizen useful to himself and others, one who without her would only have been one of those pretended incomprehensible geniuses, destined to perish of misery, of impotency, and of pride. While fully admitting the important place of literature in education, he would wish to see children initiated at an early age into the facts, the ideas, the methods of Science.

Governments, such as they have hitherto been, have almost always acted as if they had no need for the men who study Nature and her forces. But when any critical or important event occurs, then it is found necessary to appeal to them. Of whom are the juries of International Exhibitions composed? No doubt each State sends its worthy merchants, its tried chiefs of industry, its eminent agriculturists, but it also, and above all, sends its men of science. At these important times peoples are comparing their real strength, and each feels that it is for its honour in the present and its prospects in the future that the truth should appear; and to enlighten them, whether it be concerning cannons or silk-manufactures, telescopes or crystals, jewellery or hardware, it is felt that Science is indispensable, and men of science are appealed to.

But once the Exposition is closed, the State leaves the men of science to return to their studies. I wish, said M. de Quatrefages, it kept them in the service of their country. These men whom we ask to understand and judge of wonders would certainly be able to show how to produce them. When Science is everywhere, it would certainly not be useless to Government to have it in their power to be enlightened at any time on scientific questions. Although less pressing, less imperious than in the days of peril, the wants of agriculture, of industry, of commerce, like those of the army and navy, do not change their nature. Why wait the necessity for appealing to the *savants?*

A day will come when every great Administration will have its Consulting Committee, composed almost exclusively of men of science, and then many mistakes will be avoided, and many forces utilised which are at present lost. But in order that such an institution should be born and developed, it is necessary that the function of Science be universally comprehended and accepted. To attain this result is one of the chief aims of the French Association.

## *CHRISTOPHER HANSTEEN*

ON the 11th of April last, Hansteen died at Christiania at the advanced age of 88, having been born on the 26th September, 1784. On leaving the cathedral school of Christiania, where he received his early education, he entered the University of Copenhagen in 1802, as a student of law, which, however, he soon abandoned for the more congenial study of mathematics. In 1806, he began his work as a public instructor in the capacity of mathematical tutor in the gymnasium of Fredricksburg, in the island of Zealand, and there he began also his life work as an original investigator by instituting researches into terrestrial magnetism. He first acquired distinction by taking the prize which had been offered for the best essay on this subject, by the Royal Society of Science of Copenhagen; and shortly thereafter, viz. in 1814, was appointed to the chair of Astronomy in the University of Christiania, which had been recently founded by Frederick VI. of Norway.

His great work, entitled "Untersuchungen über den Magnetismus der Erde," was published in 1819, at the expense of the King. This work was illustrated with an Atlas of Maps, and was the most satisfactory collection of observations on the variations of the needle, and was besides distinguished for its broad philosophical generalisations. In the further prosecution of his physical researches, he made his well-known journey into Siberia as far as Kiachta and Irkutsk, accompanied by Erman and Due, the expenses of this journey being liberally defrayed by the Norwegian Government. The establish-

## NOTES FROM THE "CHALLENGER"

### VII.

ON Monday the 30th of June we sounded in 1,000 fathoms, about 114 miles westward from Fayal. The dredge was put over early in the forenoon, and came up half filled with a grey sandy ooze with a large proportion of the dead shells of Pteropods, many Foraminifera, and many pebbles of pumice. Many animal forms of great interest were found entangled in the swabs, or sifted out of the mud. Another Schizopod crustacean of large size and great beauty of form and brilliancy of colouring came up in this haul. Dr. von Willemoes-Suhm regards it as congeneric with the species taken at Station 69, at a

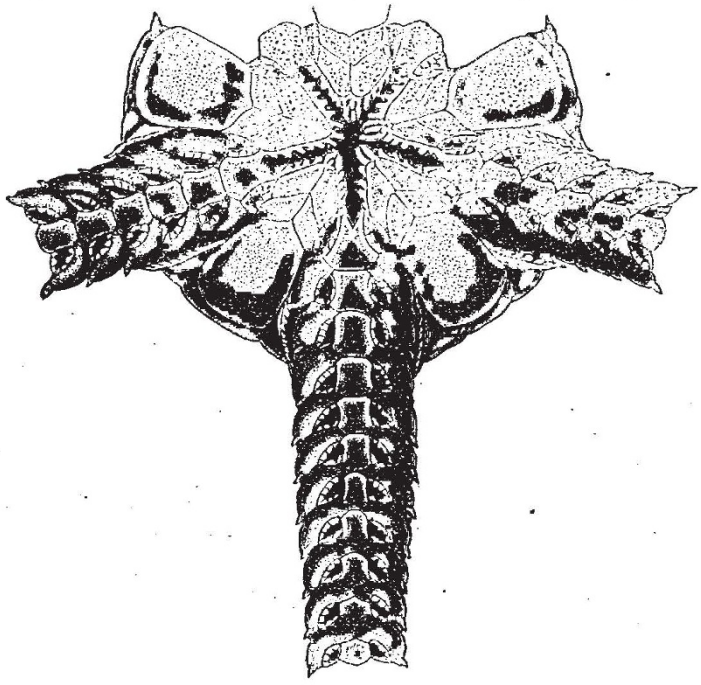


FIG. 1.—Ophioglypha bullata, Wy. Thomson—six times the natural size.

depth of 2,200 fathoms, and as these crustaceans are among our most interesting acquisitions during the voyage between Bermudas and the Açores, I will abstract a brief description of them from his notes.

The two crustaceans for whose reception Dr. von Willemoes-Suhm proposes to establish the genus *Gnathophausia* present characters which have hitherto been found partly in Schizopods and partly in Phyllopods, but not combined in the same animal. They are, however, essentially Schizopods, and have much in common with

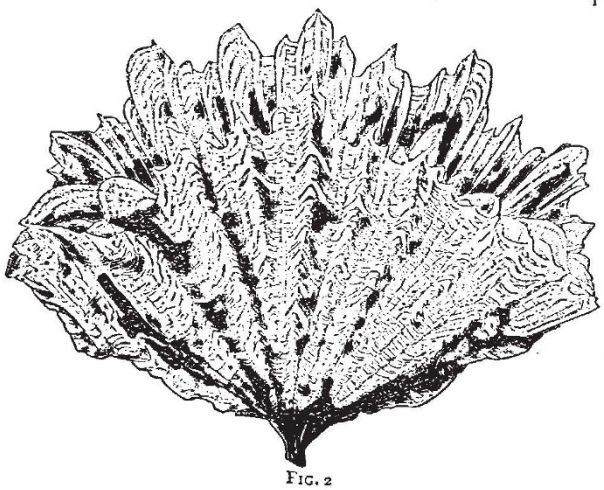


FIG. 2

FIG. 2.—Flabellum alabastrum, H. N. M.

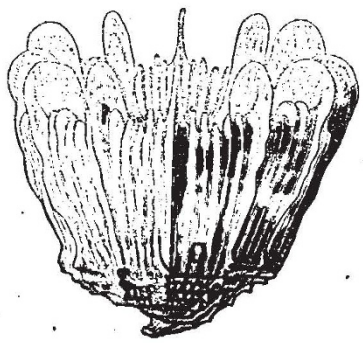


FIG. 3

FIG. 3.—Ceratotrochus nobilis, H. N. M.

*Lophogaster*, a genus described in great detail by the late Prof. Sars. It is proposed to refer *Gnathophausia* to the family Lophogastridæ, which must be somewhat modified and expanded for its reception.

In *Gnathophausia* the dorsal shield covers the thoracic segments of the body, but it is unconnected with the last five of these. The shield is prolonged anteriorly into a spiny rostrum. The stalked eyes are fairly developed in the ordinary position. There is an auxiliary eye on each of the maxillæ of the second pair.

The two species of the genus are thus distinguished: *G. gigas*, n. sp. (Figs. 4 and 5). Scale of the outer an-

tenna with five teeth; dorsal shield with the outer angles of its posterior border produced into spines; no posterior spine in the middle line; length 142 mm. Of this species one specimen was taken from a depth of 2,200 fathoms, with a bottom of Globigerina ooze, at Station 69, 400 miles to the west of the Açores.

*G. zoëa*, n. sp. (Fig. 6): Scale of the outer antenna with one tooth. A long central spine on the posterior border of the dorsal shield, but no lateral spines; length, 60 mm. A single specimen at the present station likewise from a bottom of Globigerina ooze.

On comparing the figures of these two species and of their anatomical details with that of *Lophogaster* given by Sars, one is struck by their great general similarity; but

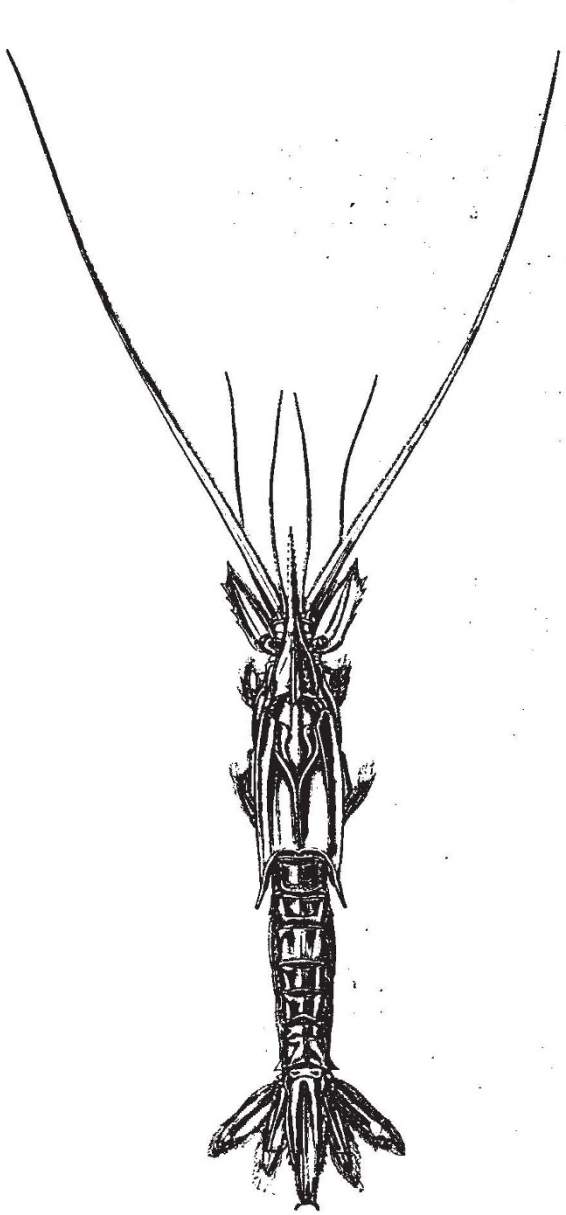


FIG 4

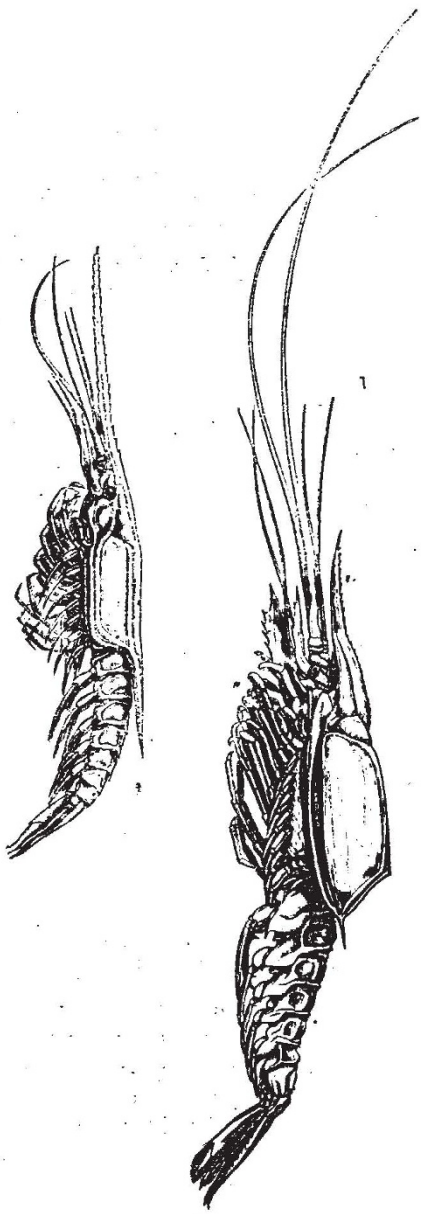


FIG. 6 FIG. 5

FIGS. 4 & 5.—Gnathopha sia gigas, v. W.-S. FIG. 6.—Gnathophansia zoea, v. W.-S.

there are characters presented by the new genus, particularly in connection with the dorsal shield, which not only entirely separate it from Lophogaster, but enlarge our views on the whole Schizopod group. In both species the shield is sculptured by ridges traversing it in different directions, and in both there is a long spiny rostrum; but this shield is merely a soft duplicature of the skin, connected with the body only anteriorly, and leaving five thoracic segments entirely free. In the structure of the shield and its mode of attachment *Gnathophausia* has the greatest resemblance to *Apus* among all crustaceans, but it differs from it widely in all other respects. *Nebalia* is the only Schizopod in which the carapace is not connected with the posterior thoracic segments, but in that genus the form of the carapace is totally different, and the genera are otherwise in no way nearly related.

Neither the antennæ, nor the scales, nor the parts of the mouth present any marked differences from those of

*Lophogaster*, with the exception of the second maxillæ. These, with nearly the same form as in the Norwegian genus, bear a pair of accessory eyes. Such eyes are well known at the base of the thoracic and even of the abdominal limbs in the Euphansidæ, a family with which the Lophogastridæ have otherwise nothing in common, but hitherto they have not been met with in any other animal or in any of the manducatory organs.

Of the eight pairs of legs seven are ambulatory, only the first pair is, as in *Lophogaster*, transformed into maxillipeds. The gills are arborescent and attached to the bases of the legs. The abdomen and its appendages scarcely differ from those of *Lophogaster*. We find here also that the last segment is apparently divided into two. This would indicate an approach to such forms as *Nebalia*, which has nine abdominal segments, or at all events a tendency to a multiplication of segments which if really existing would scarcely allow the association of the genus with the true Schizopods.

The weather was remarkably fine. During the day the island of Flores was visible like a cloud on the horizon, about 50 miles to the northward. In the afternoon we obtained a series of temperature soundings at intervals of 100 fathoms down to 1,000, and in the evening proceeded under steam towards Fayal.

On the following day, the 1st of July, we sounded in 1,350 fathoms, about 20 miles west of Fayal, apparently in a depression which separates the western group of the Açores, Flores and Corvo from the central group Fayal, Pico, San Jorge, Terceira, and Gracioza, and during the afternoon we gradually approached the fine island of Fayal, and enjoyed the development of its bold outlines and rich and varied colouring. In the evening we passed into the narrow channel between Fayal and Pico, and anchored in the roadsteads of Hortes. We found to our great disappointment that small-pox was prevalent in Fayal, and as Captain Nares considered it imprudent to give general leave, one or two of us only landed to pick up what general impression we might of the appearance of the place, and on the following morning we proceeded towards San Miguel, first taking a few hauls of the dredge in shallow water between Fayal and Pico, where we found a rather scanty fauna, resembling in character that of southern Europe, on a bottom of dark volcanic sand.

On Friday, July 4, we sounded in 750 fathoms on a rocky bottom. The ship water-bottle was sent down and brought up a sample of the bottom water. In the afternoon we shortened and furled sails, and proceeded under steam towards San Miguel, and in the evening stopped abreast of Ponta Delgada, the capital of the island, where we lay-to for the night, secured to a buoy. Next morning, as we found, greatly to our satisfaction, that the town was considered free from any epidemic of small-pox, we steamed in to the anchorage, and cast anchor in 13 fathoms.

We remained at San Miguel until Wednesday the 9th. We were well aware that the time at our disposal was quite insufficient to enable us to do anything of importance to add to the knowledge of the natural history of the island already so well worked out, and as we had had a long sea-cruise, we were in no way disinclined for a few days of complete relaxation. We accordingly combined into a large party, totally unscientific in its object, and by the aid of mules and donkeys made a most enjoyable raid among the caldeiras and volcanic ranges of the east end of the island. The random impressions collected during these *horæ subsecivæ* may perhaps be chronicled elsewhere.

Our first haul after leaving Ponta Delgada, was in 1,000 fathoms, mid-way between the islands of San Miguel and Santa Maria, and about fifteen miles north-west of the Formigas. The bottom was Globigerina ooze. The principal feature in this dredging was the unusual abundance of stony corals of the deep-sea group.

Two living specimens of a large species of *Flabellum* were sifted out, the same as the one which we had dredged previously at station 73, to the west of Fayal. The corallum is wedge-shaped, the calicle rising from an attenuated pedicle. The extreme height, from the end of the pedicle to the margin of the cup, is 50 mm.; the greatest diameter of this calicle is 65 mm., and the smallest 30 mm. The three species are very nearly of the same dimensions.

The lateral costæ make an angle with one another of 120° to 140°, and are sharp and moderately prominent, with an irregular edge. The external surface of the calicle is covered with a glistering epitheca, and near the margin is of a light pink colour. The costæ of the faces corresponding to the primary and secondary septa are almost as well marked as the lateral costæ, and appear as irregularly dental ridges, separated by slight depressions. The ends of the calicle are broadly rounded, and it is compressed laterally in the centre. The upper margin is curved, describing about one-third of a circle.

There are six systems of septa disposed in five cycles. The septa are extremely thin and fragile. They are tinged with pink, and covered with rounded granules, disposed in rows. The primary septa are approximately equal to the secondary, giving somewhat the appearance of twelve systems. These septa are broad and prominent, with a rounded superior margin, and curved lines of growth. The septa of the third, fourth, and fifth cycles successively, diminish in breadth, and are thus very markedly distinguished from one another, and from the primary and secondary septa. The septa of the fourth cycle join those of the third a short distance before reaching the columella. The septa of the fifth cycles are incomplete. The margin of the calicle is very deeply indented, the costal corresponding to the primary and secondary septa being prolonged in conjunction with the outer margins of these septa, into prominent pointed processes; similar but shorter prolongations accompany the tertiary, and some of the quaternary septa. Between each of the sharp projections thus formed, the edge of the wall of the calicle presents a curved indentation.

Two of the specimens procured, expanded their soft parts when placed in sea-water. The inner margin of the disc round the elongated oral aperture, presents a regular series of dentations, corresponding with the septa, and is of a dark madder colour; the remainder of the disc is pale pink. The tentacles take origin directly from the septa. They are elongated and conical. Those of the primary and secondary septa are equal in dimensions, and along with the tertiary tentacles, which are somewhat shorter, but in the same line, are placed nearest the mouth, and at an equal distance from it. The tentacles of the fourth and fifth cycles are successively smaller and at successively greater distances from the mouth. Placed on either side of each tentacle of the fifth cycle, and again somewhat nearer the edge of the calicle, there are a pair of very small tentacles which have no septa developed in correspondence with them. There are thus four successive rows of tentacles, and the normal number is ninety-six. The tentacles are of a light red colour, and between their bases are stripes of yellowish red and light grey.

This group belongs to the group *Flabella sub-pedicellata* of Milne-Edwards, and probably to that division in which the costæ are prominent and ridge like on the faces of the corallum, as well as on its lateral margins, but it differs from those described under this head by Milne-Edwards, in that it has five cycles, the fifth being incomplete, and in other particulars which appear from the description given.

A single living specimen of a coral referred by Mr. Moseley to the genus *Ceratotrochus* was obtained from this haul. The corallum is white. The base sub-pedicellate with a

small scar of original adherence. The principal costals are prominent, and round the region of the base beset with small spines directed somewhat upwards. The upper portion of the costa is without spines. The primary and secondary septa are broad and exsert. Pali are absent, the columella is fascicular. The absence of pali, the form of the columella, and the nature of the base, associate this form with the *Ceratrotrochi*, as defined by Milne-Edwards.

The animal is of a dark madder colour on the region of the margin of the calicle between the exsert primary and secondary septa, and on the membrane investing the wall of the corallum from the margin down to the commencement of the spines. This dark colour is succeeded on the disc by a band of pale bluish within which there is again a zone of very dark madder colour round the mouth. The dark colouring-matter is interesting, as it gives an absorption spectrum of three distinct bands.

On Friday, July 11, we sounded in 2,025 fathoms, 376 miles to the west of Madeira, the bottom very well marked "globigerina ooze," and the bottom temperature 1° 5′ C.

The weather for the last few days had been remarkably fine, with a pleasant light breeze. When we turned up on deck on the morning of the 16th, we were already at anchor in the beautiful bay of Funchal, and looking at the lovely garden-like island, full of anticipations of a week's ramble among the peaks and "currals" and the summer "quintas" of our friends—anticipations which were doomed to be disappointed.

WYVILLE THOMSON

## *THE INTERNATIONAL METRIC COMMISSION AT PARIS*

IN continuation of the notices of the proceedings of this Scientific Commission (see NATURE, vol. vii. p. 237), it may now be stated that the French Section have been engaged during the present year in the work of the Commission entrusted to them, and have continued their sittings up to the present time. It appears from the printed "Procès Verbaux" that their attention has been principally directed to the further investigations and experiments required for the melting and casting of the large mass of alloy of platinum and iridium, determined upon as the material of all the new standards, with the view of obtaining a homogeneous ingot of these two metals in the proper proportions. This preliminary work is now so far completed that the twelve members of the Commission elected as the Permanent Committee, have been summoned to meet at Paris on October 1, to consult upon the subject with the French Section, and more particularly to discuss and decide the following points :—

1. The date of the definitive of the melting platinum-iridium intended for the construction of the new International metric standards.

2. The question whether the *Mètres-a-bouts* requested by some countries shall be constructed from the metal of the same melting as the *Mètres-à-traits*.

3. Whether the kilograms shall be made from the metal of the same melting as the *Mètres-à-traits*.

As to the number of metric standards required to be constructed by the Commission, the greater number of the Governments represented at the Commission have already intimated their wishes to have in all 31 metres and 24 kilograms. Germany and Italy have not yet notified their decision. Austria and Switzerland have declined to reply until the question of the creation of an International Bureau is satisfactorily settled, and it is understood that the same course is being followed by Germany. Russia is favourable to the creation of the Bureau, but has not yet decided on the number of standards she will require.

In addition to the number of fifty delegates already appointed by twenty-nine Governments to take part in the International Metric Commission, and whose names have been already announced, the Haytian Government has nominated M. Ch. Laforestie, Chargé d'Affaires of the Haytian Republic, and the Government of Brazil has nominated Prof. Such de Capanema as their respective delegates of the Commission. The French Government has also invited the Governments of Central America, Persia, China, and Japan to send delegates to take part in the proceedings of the Commission.

As it will be expedient to construct a number of spare copies of the new metric standards, it will probably be necessary to prepare for the construction of not less than fifty metres and nearly as many kilograms.

But difficulties must inevitably and at once arise at Paris from the course taken by the Governments of Germany, Austria, and Switzerland, as it tends materially to impede the attainment of the declared primary objects of the Commission to construct and furnish every Government interested with uniform metric standards, which are to be accurately verified, and of equal authority. After the expiration of four years from the date of the appointment of the Commission by the French Government, on September 2, 1869, and the passing of almost unanimous resolutions at a full meeting of the Commission in 1872, upon the mode of constructing the new standards, the time has now arrived when everything has been got ready for commencing the actual construction of the new standards. It can hardly be expected that this, the real work of the Commission, is to be stopped until the ulterior question of the creation of an International Metric Bureau is settled to the satisfaction of the three above-mentioned Governments. Nor does a further significant step which has been recently taken by the Austrian Government lead to much hope of a satisfactory solution of this question.

The Austrian Government has officially declared that it accepts in principle the establishment of an International Metric Bureau upon the basis of the resolutions passed by the Commission, so far as relates to the objects and functions of this Bureau; and that it is quite disposed to take part in a Convention upon the subject, provided that all the other Governments represented at the Commission give their adherence. But it expressly reserves the right of making new propositions when the questions of the organisation, the seat, and the direction of the Bureau are discussed, as well as the right of definitively approving the Convention.

It proposes, at the same time, that in order to maintain the international character of the negociation, the seat of the Conference shall be at Berne, where the International Telegraphic Conference is now held, or at Brussels, these two cities being equally upon neutral territory.

And that for facilitating the proceedings of the Conference, the Permanent Committee appointed by the Metric Commission, shall previously elaborate a project of Convention to be communicated to the several governments interested; and that the Conference be not convoked for completing the definitive Convention until the preliminary negociations shall be sufficiently advanced to allow of a favourable result.

The invitation given by the French Government to the Austrian and other governments, was to take part in the creation of the International Metric Bureau based upon the five points proposed by the Commission, and it now appears that Austria objects to three out of these five points. And even as regards the other two points, Austria's adhesion is conditional upon the concurrence of all the other governments represented at the Commission. Up to the present time, however, the governments of five countries only have officially notified their concurrence, whilst those of twelve countries have formally declined to take any part in the establishment of the proposed International Metric Bureau. Under these circumstances, its creation at all seems very problematical, however desirable it may be in the interests of metrological science.