

THE "TALISMAN" EXPEDITION¹

AT the public meeting of the five Academies on October 29, 1882, I had the honour of reporting on the explorations of the *Travailleur*, and I announced that this year a new scientific campaign would be undertaken in the Atlantic. The Minister of Marine, responding to the desire expressed by his colleague, the Minister of Public Instruction, and by the Academy, had, in fact, issued the necessary orders to have the *Talisman* equipped for this purpose. The *Talisman* is an excellent screw steamer, provided with a good spread of canvas, sufficient to make good way without the aid of its engines. For several months it was placed in dock at the Rochefort Arsenal, where the naval engineers undertook to refit it for the service to which it had been appointed. The old hempen ropes intended for raising the dredges were replaced by a steel cable of great strength and flexibility, capable of a strain of about 4500 kilogrammes, and worked by two steam-engines. One of these set in motion the enormous bobbin on which the cable was wound. The other, a still more powerful engine, was intended for raising the dredges.

Large bag-nets, or trawls, with an opening of two or three yards, advantageously replaced the heavy drags we had formerly used. The soundings were executed by means of an apparatus perfected by M. Thibaudier, naval engineer, and so disposed as to prevent the motions of the vessel from in any way affecting the tension of the steel cable, which was arrested by an automatic break as soon as the sounder touched the bottom.

In order to gauge the temperature at great depths I had an apparatus constructed by which a mercurial thermometer (Negretti and Zambra) could be turned over at any moment. At the same time the capillary extremity of a glass tube, where a vacuum had been made, and into which the sea water then rushed, broke, supplying perfectly pure specimens, capable of being preserved for any length of time by soldering the tubes. Our friend, Colonel Perrier, had kindly lent me a Gramme machine, which generated the electricity for some Edison lamps, so disposed as to light up our apparatus, or, when needed, to penetrate to depths not exceeding 35 metres. At my request the command of the *Talisman* had been intrusted to M. Parfait, frigate captain, who had held the same position the year before on board the *Travailleur*.² I may here be permitted to express to the officers of the *Talisman* the feelings of gratitude inspired in us by their devotion. They cooperated with us with unflinching zeal, and for whatever success attended our mission we are indebted to them.

On May 30, the scientific mission³ met at Rochefort, and on June 1 the *Talisman* set sail. The voyage of 1883 may be divided into several distinct stages. Our object was to study the coast of Africa as far as Senegal, then the waters of the Cape Verde, Canary, and Azores Archipelagos, volcanic lands which could not fail to supply us with interesting materials. Lastly, we hoped to be able to devote our attention to the Sargassum Sea, its fauna, and the nature of its bed.

The sea bed stretching westward of Morocco and the Sahara is extremely uniform, no longer presenting those rugged reliefs that had so impeded our operations on the coast of Spain. On the contrary, the slope is here so gentle that at greater or less distances from the land it was always possible almost infallibly to light upon the

needed depths. In these waters we made about 120 dredgings, and in a few days we had determined the bathymetric distribution of the local fauna with sufficient accuracy to enable us to indicate the levels explored from the contents of our nets.

At 500 or 600 metres live numerous fishes, such as *Macrurus*, *Malacocephalus*, *Hoplostethus*, *Pleuronectes*, as well as prawns of the genus *Pandalus*, belonging to a new species with a rostrum pointed like a sword; some *Peneæ*, *Pasiphaæ*, a few small crabs (*Oxyrhynchidæ*, *Portunidæ*, *Ebalidæ*), pink *Holothurians*, some rare specimens of *Calveria*, that soft Echinoderm discovered in our waters by the naturalists of the *Porcupine*, and previously known in the fossil state; several very large sponges, such as *Askonema* and *Farrea*.

At greater depths, from 1000 to 1900 metres, fishes still abound,¹ and often formed the bulk of our captures. They were generally of a dull colour, with gelatinous flesh, and their skin covered with a thick mucous coating. Several had phosphorescent spots, serving to give them light in the dark regions they inhabit. Here *Pandali* give place to the new genus *Heterocarpus*, and to gigantic blood-red prawns with enormously long antennæ, which were new to science and may be placed in the genus *Aristeus*. The *Nephropsis* make their appearance at this level. They are blind, coral-tinted Crustaceæ, who seem to be distributed over a wide geographical range, for they have been found on the other side of the Atlantic in the Caribbean Sea, and a closely allied species has been fished up at a great depth near the Andaman Islands. The blind *Polychæles*, which in the present epoch represent the Jurassic *Eryons*, burrow in the mud, leaving nothing visible except their long hooked nippers, adapted for seizing the passing prey. Some crabs are still found, such as *Maiadæ* (*Scyramathia*, *Lispognathus*), a new species of *Homolia*, and *Lithodes*, hitherto supposed to be peculiar to Arctic and Antarctic seas. Lastly, numerous forms were also observed of the genus *Galathea*, several of which have their eyes transformed to spines. Sponges are extremely common, most of them with siliceous skeletons. We brought up great numbers of *Rosella*, *Holtenia* of several species, the rock crystal-like beards white as snow were buried in the mud, the sponge mass alone emerging; some *Aphrocallistes*, with solid skeletons of the most elegant form. *Calveria* became more numerous; *Holothurians* of the genus *Loetmogone*, and other species of the same family, crawled on the bottom in the midst of *Asteria*, *Ophiuria*, and *Brisinga*. The nets often returned filled with so much treasure that they could not all be classed within the day.

While rounding Cape Ghir and Cape Nun, some 120 miles from the coast, the *Talisman* spent several days in exploring a very regular bank at a depth of about 2000 to 2200 metres. It was on this ground that on Aug. 2, 1882, the *Travailleur* had captured the curious fish described by M. Vaillant under the name of *Eurypharynx pelecanoides*, and two specimens of which were taken this year.

Our prizes were again of great value. Magnificent sponges, allied to those that have been described under the name of *Euplectella suberea* were here found mingled with large violet *Holothurians* of the genus *Benthodytes*, and with other species of the same genus, remarkable for their dorsal appendices. A *Calveria*, distinct from those found at lesser depths, some *Brisingæ*, *Polyps* of rare beauty (*Flabellum*, *Stephanotrochus*), a *Democrinus* and a *Bathyrinus*, not yet described, very numerous Crustaceæ, nearly all new to us and belonging to the group of the *Galatheæ* (*Galathodes*, *Galacantha*, *Elastomonotus*), completed the list of invertebrates. The fishes were very varied, and their study will furnish new facts of the greatest interest to science. Amongst the most remarkable I may mention *Melanocetus johnsoni*, *Bathy-*

¹ Preliminary Report on the *Talisman* Expedition to the Atlantic Ocean. By M. Alphonse Milne-Edwards, President of the Submarine Dredging Commission. Communicated by the author.

² The staff consisted of M. Antoine and M. Jacquet, lieutenant, of MM. Gibory and Bourget, midshipmen, of M. Vincent, doctor of the first class, of M. Huas, assistant doctor, and of M. de Plas, chief mate.

³ The mission consisted of M. A. Milne-Edwards, Member of the Institute, President, of M. de Folin, MM. Vaillant and Perrier, professors in the Museum, MM. Marion and Filhol, professors in the Faculty, M. Fischer, assistant naturalist in the Museum, MM. Ch. Brongniart and Poirault, added as assistants.

¹ To *Macrurus* are here added the following genera: *Bathynectes*, *Coryphænoïdes*, *Malacocephalus*, *Bathygadus*, *Argyropelecus*, *Chauliodus*, *Bathypterois*, *Stomias*, *Malacosteus*, *Alepocephalus*.

trochtes, a Stomias with phosphorescent spots, and several Malacostei.

Between Senegal and the Cape Verde Islands our trawls reached depths varying from 3200 to 3699 metres, and brought up most of the preceding species besides many others (Crustaceans, Mollusks, Zoophytes, Sponges) which had never elsewhere been met.

These last takes brought to a close the first part of our programme, and on July 20, after ninety-one days of navigation, we cast anchor in the Bay of La Praia, at Santiago in the Cape Verde Archipelago. This volcanic group detained us a few days, and while zoological, botanical, and geological excursions were being made ashore, the *Talisman* was searching the irregular beds on the coasts for marine animals, and especially for the red coral, which for some years back has formed the object of an active trade in these islands. I will not dwell on these in-shore explorations, nor on those of the islet Blanco, where we were able to study on the spot the large Saurians (*Macroscoincus coctei*) which seem limited to this isolated rock.

All these details are recorded in the report which I have addressed to the Minister and which will soon be published.

In the deep waters of the Cape Verde Archipelago life displays a surprising energy. Our nets came up overflowing with specimens after a single plunge. We captured at one take more than 1000 fishes belonging mostly to the genus *Melanocephalus*, about 1000 *Pandali*, 500 prawns of a new species of the genus *Nematocarcinus*, with disproportionately long claws, as well as many other species.

On the evening of July 30 the *Talisman* took a north-westerly course in the direction of the Sargassum Sea. I need not enter into details on this part of our journey, and it will suffice to say that we nowhere met those dense floating masses of vegetation mentioned by the old navigators. The Gulf weed was seen in isolated patches drifting either with the marine or atmospheric currents, and harbouring a whole pelagic population, whose colours harmonised admirably with those of the algæ that afforded them a refuge. Our naturalists made a careful study of these forms.

The soundings of the *Talisman* in this region show in a general way that, starting from the Cape Verde Islands, the marine bed falls regularly as far as about the 25th parallel, where it attains a depth of 6267 metres. Then it gradually rises towards the Azores and the 35th parallel, where it is about 3000 metres. These results are far from agreeing with the curves indicated on the most recent bathymetric charts. The bed of the Sargassum Sea seems formed of a thick layer of a very fine mud of a pumice nature, covering fragments of pumice and volcanic rocks. Here there would appear to stretch, at over three miles from the surface of the ocean, a vast volcanic chain parallel with the African seashore, and of which the Cape Verde Islands, the Canaries, Madeira, and the Azores are the only parts not submerged. The submarine fauna is poor, consisting of few fishes, some Crustaceans, such as *Paguri*, which lodge in colonies of *Epizoanthus*, prawns of the genus *Nematocarcinus*, *Pasiphaæ*, a few mollusks (*Fusus*, *Pleurotoma*, and *Leda*), which scarcely sufficed to repay the time required for such deep dredgings. Not that our captures did not again become abundant towards the northern limit of the Sargasse Sea, when the depths shrank to 3000, 2000, and 1500 metres. It was here that we took the giant of the family of the Schizopodes, a *Gnathophausia* of a blood-red colour measuring nearly 25 centimetres in length.¹

A short delay at Fayal, and again at San Miguel in the Azores, enabled us to compare the volcanic phenomena still active at certain points with those we had studied on the summit of the Peak of Teneriffe. The analogy is very striking between the rocks, the gaseous products, and the

¹ *Gnathophausia goliath*, new species.

sulphur deposits of the two islands. From what is now taking place on the surface of the ground, an idea may be formed of the submarine convulsions which have covered the bed of the Sargassum Sea with pumice and igneous rocks.

The return voyage from the Azores to France was effected under the most favourable conditions, and we were able to make daily dredgings in depths of from 4000 to 5000 metres. These difficult operations, very skilfully carried out by Captain Parfait, brought us an extremely valuable harvest. Under this tremendous pressure, in perfect darkness, and without a trace of vegetation, animal life is still vigorous. Large fishes of the genus *Macrurus*, as well as some *Scopeli* and *Melanoceti* seem to be here far from rare. Some *Pagures* and *Galatheæ* of new form, a gigantic Nymphon of the genus *Colossendeis*, some unknown *Ethusæ*, besides *Amphipods* and *Cirripeds* represent the Crustacean group. But this abyssal fauna owes its peculiar physiognomy to the number, variety, and size of the *Holothurians*.

The marine bed is carpeted throughout this region with a thick white mud, composed almost exclusively of *Globigerini*, and covering pumice deposits and fragments of various kinds of rocks. Some of these rocks brought up in our nets bore the impress of fossils, amongst others of *Trilobites*. But what still more surprised us was to find at a distance of over 700 miles from the European coast pebbles polished and striated by the action of ice. The sharpness of the striæ excludes the supposition of transport by the currents. The presence of these pebbles is probably due to the action of the icebergs, which in the Quaternary epoch advanced further southwards than at present, and which, by melting in the region of the Atlantic comprised between the Azores and France, deposited on the bottom of the sea the stones carried off from the glacier beds and conveyed to this distance from Europe.

On August 30 we dredged for the last time on the steep slope by which the oceanic depths are connected with the Bay of Biscay, and our captures added to the fauna of the French waters a large number of new or interesting species.

It was high time to return to Rochefort. Our casks and cases were full, our alcohol exhausted. This voyage has furnished us with unrivalled materials for study, materials which must now be put in order. The Minister of Public Instruction has recognised their importance, and has supplied me with the means of beginning the publication of the results. It is my intention to place before the public the collections that have been made during the explorations of the *Travailleur* and *Talisman*. These treasures will be exposed in a special exhibition, which will be held in one of the halls of the museum towards the beginning of January.

MUSIC AND SCIENCE¹

IT would seem that Science, like History, may at times repeat itself: for in this bright little pamphlet we have a revival of the Old World controversy, which dates from the days of Pythagoras, Plato, Aristotle, and Euclid. The author takes, however, for its text, a somewhat declamatory and *ad captandum* modern passage from the *Revue de Paris*, which declares, with an emotional warmth totally uncalled for under the circumstances, that harmony is not a science, and that music is an art, "but a divine art." To appreciate thoroughly the question in debate it is necessary to go back to the sense of the original Greek words—*ἀρμονία* and *μουσική*. The former means "mathematical agreement"; the second "artistic culture." It is with their "second intentions," or acquired and more limited meanings, that we now have

¹ "La Musica è una Scienza." Saggio Acustico fisiologico Del Dott. Primo Crotti. Pp. 55. Luigi Bettei Editore. (Parma, 1883.)