CHAPTER VII.

Bahia to the Tristan da Cunha Group—Ipnops—Account of Tristan Island and the Settlement—Inaccessible and Nightingale Islands—Tristan Group to the Cape—The Cephalopoda—The Holothurioidea—The Cape—Peripatus—The Cetacea—The Chitons.

Bahia to the Tristan da Cunha Group.

On the 25th September, at 4 P.M., the Challenger left Bahia for the Tristan da Cunha group of islands, and proceeded to the southward until the 30th, without sounding or dredging, as it was desirable to get into cool weather at once to avoid any risk of yellow fever spreading amongst the ship's company.

The S.E. trade wind continued to the 22nd parallel; from thence to the 34th parallel the wind had an easterly tendency, varying from N.E. by N. to S.E. by E. On the 9th October, in lat 34° S., long. 24° W., after a gale from the eastward, the wind shifted round by north to west, and continued between south and west till Tristan da Cunha was reached. North of the 30th parallel the weather was fine, afterwards it was cloudy, with passing rain squalls. The sea was moderate throughout. The first albatross was seen on the 2nd October, in lat. 25° S., long. 34° W., but no Cape Pigeons until the 7th, in lat. 29° S., long. 26° W.

As no soundings were taken until the 20th parallel was reached, the section was drawn from Abrolhos Island on the American coast to Tristan da Cunha. On this section six soundings, six serial temperature soundings, two dredgings, and three trawlings were obtained. The dredge rope parted on the 30th September, at Station 129, before the dredge was off the bottom; and when trawling on the 3rd October, at Station 130, great difficulty was found in heaving in the trawl rope, only a few fathoms being gained at a time. After a long struggle the trawl was lifted off the bottom, but the strain on the accumulators, which were elongated to the full length of the safety pendant, indicated that something weighty was in the net. By careful manipulation, however, the trawl was brought to the surface, the beam and part of the net being visible from the deck, but when on the point of hooking the burton to hoist it on board, the iron swivel, between the rope and the span from the beam, parted, and the trawl with its contents sank to the bottom. This was a great mortification, as intense curiosity had been excited to learn the cause of the strain on the rope.

The surface temperature ranged from 78° at Bahia to 52°·8 near lat. 36° 7′ S., long. 14° 27′ W., at 8 A.M. on the 13th October, and thereafter rising to 53°·5 at Tristan da Cunha.

The temperature of the water at the bottom ranged from 34°·2 to 36°·0; but the

indications of the coldest water being at the greatest depth, were not so marked as between St. Paul's Rocks and the American coast, for the temperature of 34°·2 was found at the depth of 2150 fathoms, whilst at 2350 fathoms there was a temperature of 34°·7. The former temperature, however, rests on the indication of one thermometer, whilst the latter is the mean of two, and the thermometer that gave the temperature of 34°·2 at 2150 fathoms gave a temperature of 34°·4 at 2350 fathoms. It is probable, therefore, that the temperature of 34°·2 may be 0°·5 too low.

The serial temperature soundings showed that, notwithstanding a change of surface temperature of 24°, and of latitude of 18°, the isotherm of 40° was nearly parallel with the surface, its average depth being 410 fathoms, and its range 80 fathoms, viz., from 380 to 460 fathoms. Above the isotherm of 40° the temperature increased gradually to the surface (see Diagram 5).

No observations on currents were made, except the ordinary ones of ascertaining its direction and strength, by means of the difference of the position of the ship, by observation and dead reckoning.

On the 3rd October, at Station 130, the velocity of the wind was 18 miles per hour in the forenoon and 20 in the afternoon, the force registered being 4; on the 6th October, at Station 131, the velocity was 12 miles per hour, the force registered being 3; and on the 14th October, at Station 134, the velocity was 11 miles per hour, the force registered being 2. On the 15th October, at anchor off Tristan da Cunha, the velocity was 16 miles per hour, the force registered 4 to 5.

On the 14th October, at daylight, the peak of Tristan da Cunha was sighted, bearing S.S.W., distant 54 miles, and at 7 A.M. the ship stopped to sound and dredge at Station 134 (see Sheet 16). At 3 P.M., having completed dredging, a course was shaped for the island, the weather being fine; and at 10 P.M. the vessel was stopped off it, and "laid to" for the night. The peak of Tristan was visible in the early morning, but clouded over at 8 A.M., and was not seen during the remainder of the day, except for a short interval at 5 P.M.

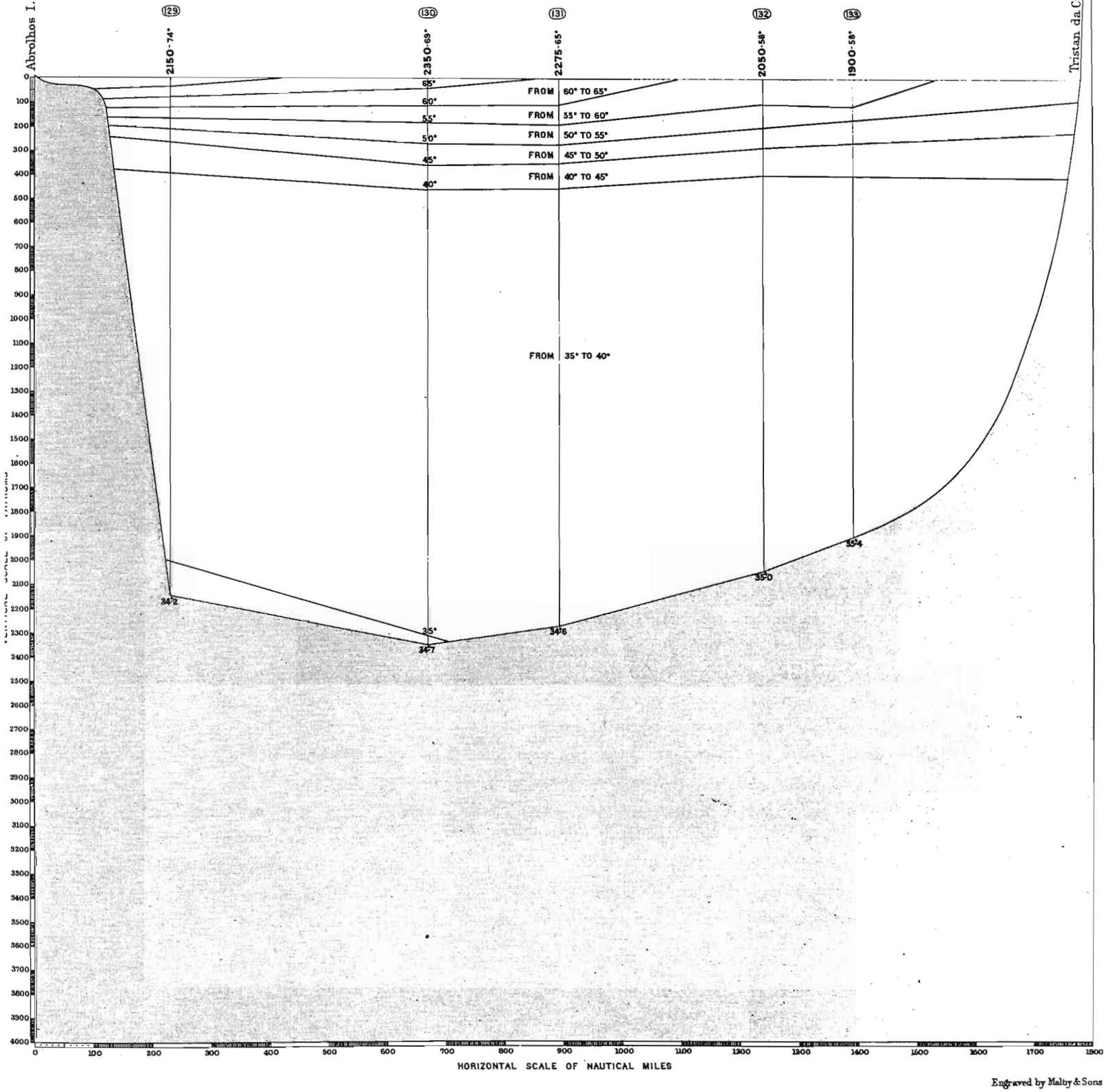
Between the coast of America and Tristan the greatest depth obtained was 2350 fathoms. There were many indications of an extensive plateau surrounding the Tristan group, with depths varying from 1425 to 2000 fathoms.

The deposits in depths less than 2100 fathoms on the Tristan plateau contained from 85 to 95 per cent. of carbonate of lime, which was almost wholly composed of the shells of pelagic organisms, whilst the three soundings in depths greater than 2100 fathoms towards the American coast contained from 35 to 55 per cent. It was observed that as the ship proceeded southward the Foraminifera in the deposits became dwarfed, and some tropical species disappeared. There were quartz fragments in the deposits near the American shores, but these disappeared or were exceedingly rare in the deposits towards the centre of the South Atlantic.

AGRAM 5

ATLANTIC OCEAN Diagonal Temperature Section. Abrolhos I.ds to Tristan da Cunha I.ds

For explanation of Symbols see Appendix 1.



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The trawlings, with the exception of the failures mentioned above, were very productive, and a large number of new forms were procured. At a trawling in 1900 fathoms, 400 miles west of Inaccessible Island, two specimens of a very remarkable new genus of fishes were captured, described by Dr. Günther as follows:—

Ipnops.—"This genus belongs to the Scopeloid family; the shape of the body is elongate, subcylindrical, the caudal portion much exceeding the abdominal in length. The scales are large, but deciduous. Fins normally developed. The head is depressed, with a long, broad, spathulate snout; the mouth wide, with the lower jaw projecting, and armed with rows of minute teeth.

"The structure of the eyes is quite unique. Externally they appear as a continuous flat cornea-like organ, longitudinally divided into two halves, which covers the whole of the upper surface of the snout and partly overlie the bone. The functions of the organ are difficult to determine. From Professor Moseley's examination it seems at present probable that it is an organ of modified vision and not of luminosity as I at first believed."

Mr. John Murray was the first to examine by means of sections the structure of the organs, and point out their remarkable peculiarities. Professor Moseley, who has lately

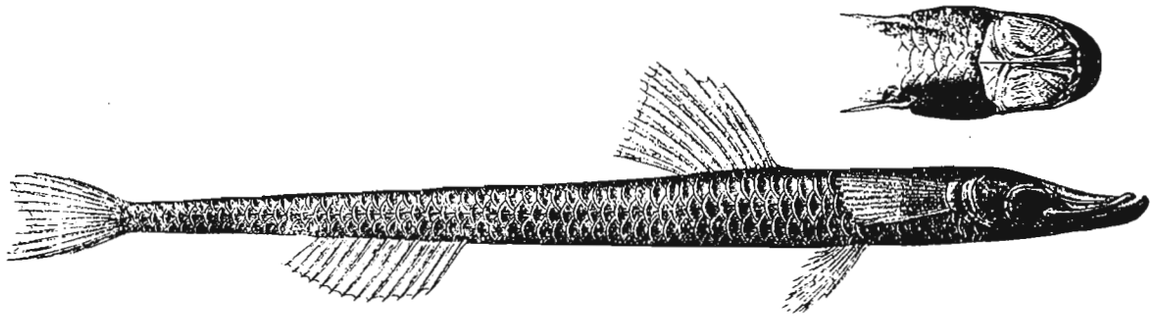


FIG. 97.—*Ipnops murrayi*, Günth. 1600 to 1900 fathoms.

re-examined the eyes of this fish by means of Mr. Murray's preparations, writes:—"Their structure is quite unique. They are flattened out to an extraordinary extent, closely united together along a straight line traversing the middle line of the snout, and at first sight appear like a single white patch or label covering the whole upper surface of the snout. Each eye is covered by a transparent flat membrane probably the representative of the cornea, beneath which, and separated from it by a shallow chamber filled with fluid, is a retina of very remarkable structure. The retina extends over the whole area covered by the cornea, and is composed of a layer of remarkably long rods, without, as far as can be detected, any cones. The rods, which break up with more than usual readiness into transverse disks, have their free ends turned towards the pigmented choroid. A very thin layer of nerve fibres intervenes between them and the light, and apparently represents the entire remaining layers of the retina usually present. The choroid is divided into a series of hexagonal areas which

are concave towards the cavity of the eye, and on these areas the ends of the rods rest; the rods being seen to be aggregated into corresponding bundles in transverse sections. It is not improbable that these curious expansions of the recipient surface of the eye and its retina are a device for detecting the presence of very small quantities of light, at the expense of all apparatus for forming an image."

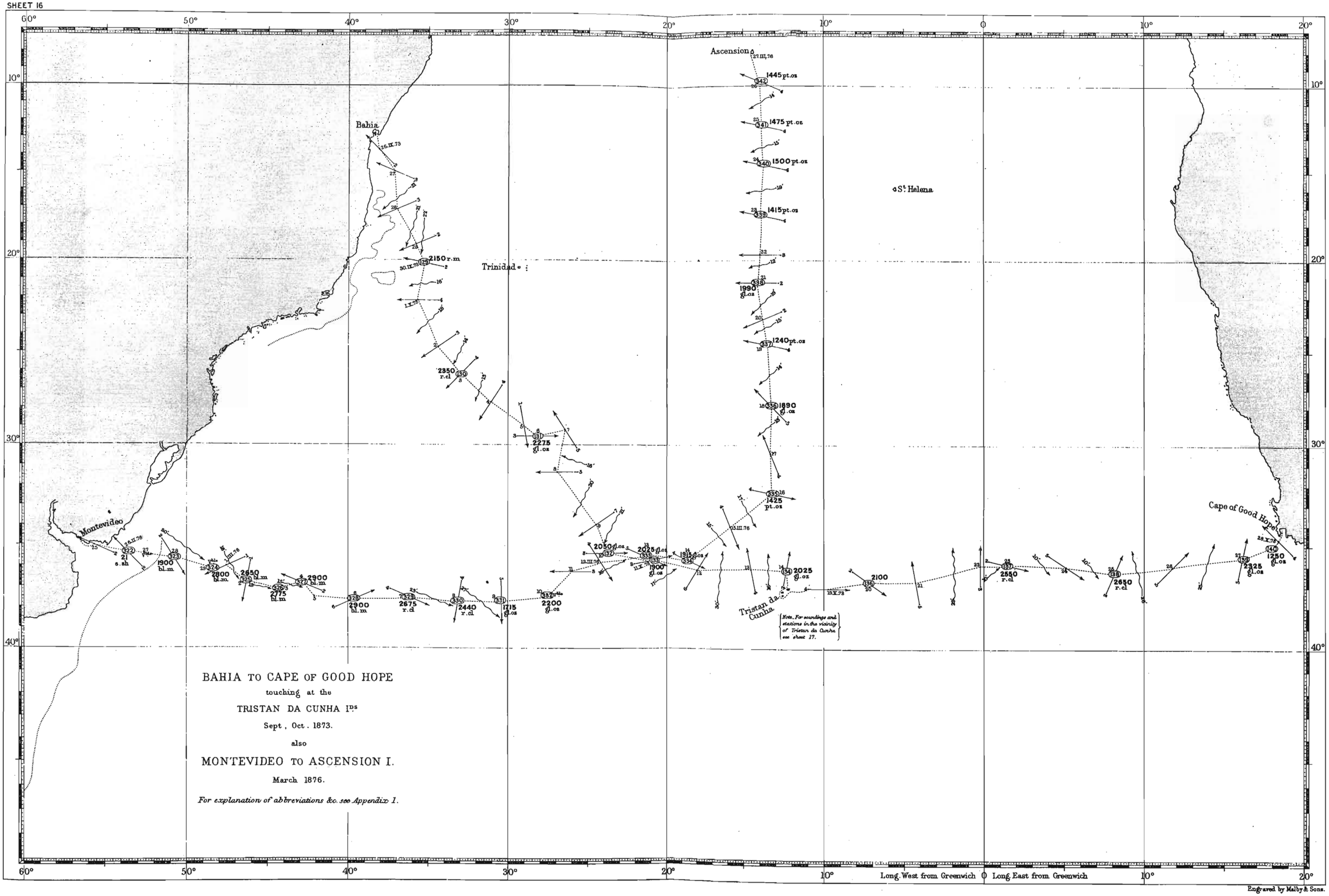
Tristan da Cunha Group.

On the 15th October, at 3 A.M., the ship proceeded towards Tristan Island, and at daylight the three islands of the group were seen. At 8 A.M. the ship was anchored in 19 fathoms in Falmouth Bay, and parties landed, with a view of exploring the island and obtaining observations; but as the weather looked threatening in the afternoon, and a swell got up, it was considered inadvisable to risk remaining at anchor, and the ship left Falmouth Bay proceeding towards Inaccessible Island, with the view of landing on it should the prognostication of bad weather prove incorrect. This was accomplished, for on the 16th, the wind being light and the sea smooth, exploring parties were landed, and the ship steamed round Inaccessible Island, obtaining soundings and dredgings, and finally anchoring on its northeast side for the night. On the morning of the 17th October the vessel left Inaccessible Island for Nightingale Island, and the day was devoted to fixing its position, and surveying and sounding its coast; but dusk coming on before a suitable anchorage could be found, the ship remained under weigh during the night of the 17th, and the 18th was devoted to sounding and dredging between Nightingale and Tristan Islands, the vessel finally leaving the group for the Cape of Good Hope at 6 P.M. on the 18th (see Sheet 17).

During the four days' stay the wind varied from N.W. through W. and S. to S.E., the force never exceeding 5, and being frequently 1. The weather was cloudy and the sea moderate. The temperature of the surface water was on an average from 2° to 3° higher than that of the air, the maximum temperature in the shade registered being 56°, the minimum 46°, and the mean 51°; whilst the mean temperature of the surface water was 53°·6. The air was dry and invigorating, the relative humidity averaging 77.

The islands known as the Tristan da Cunha group (three in number) were originally discovered by the Portuguese about 1506, who named the largest "Tristan da Cunha" (since contracted to Tristan) Island. The Dutch appear to have described them in 1643, but M. d'Etchevery, in "L'Etoile du Matin," appears to have been the first to land on them in 1767. He named the western island "Inaccessible," and the southern "Nightingale"; and anchored off, and landed on, both Nightingale and Tristan Islands. Since that date many of H.M. ships, as well as merchant vessels, have touched here; but it was not until they were visited by Captain Denham, H.M.S. "Herald," in 1852, that their exact geographical position was known; and even in 1873, the precise position and

SHEET 16



BAHIA TO CAPE OF GOOD HOPE

touching at the

TRISTAN DA CUNHA Ips

Sept, Oct. 1873.

also

MONTEVIDEO TO ASCENSION I.

March 1876.

For explanation of abbreviations &c. see Appendix 1.

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extent of the two smaller islands had not been ascertained. As the Challenger completed the exploration of the group, it appears desirable to give an exact account of it here, compiled partly from old publications[1] and partly from these more recent observations.

Tristan Island, the northernmost, largest, and highest island of the group, has a nearly circular form, with the apex 7640 feet above the level of the sea in its middle; in fact, if a circle with a radius of $3\frac{1}{2}$ miles be described, using the summit of the island as a centre, the circumference of the circle will be found to touch the salient points all

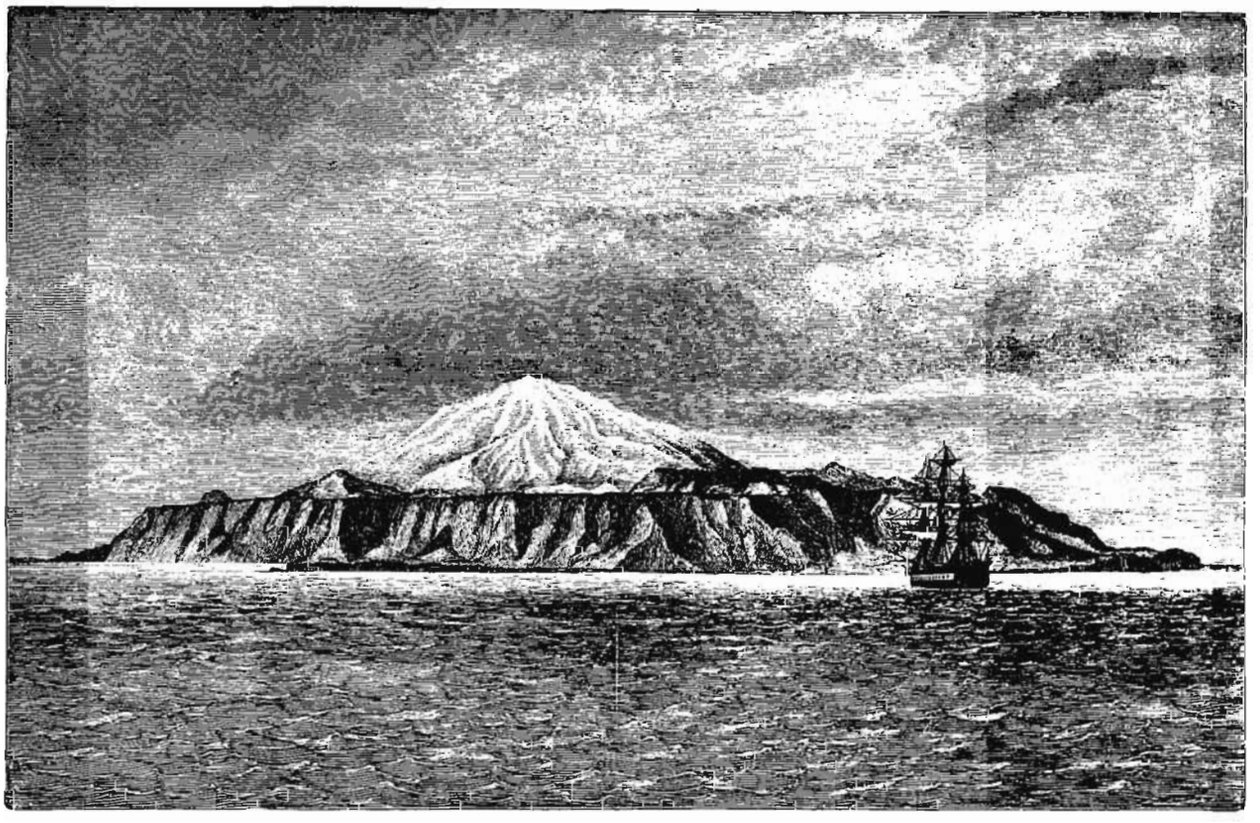


FIG. 98.—The Island of Tristan da Cunha.

round, except in one part, viz., in the eastern quadrant, where the coast will be found to project half a mile beyond the circumference.

Precipitous cliffs, 1000 to 2000 feet in height, rise directly from the sea everywhere, except in the northwest quadrant, where there is, in front of the cliffs, an irregular flat, 100 to 200 feet above the sea level, $2\frac{1}{2}$ miles in length and half a mile in breadth. From the top of the high cliffs the island has the appearance of rising gradually on all

[1] *Nautical Magazine*, vols. iii., iv., viii., xxii. (1853), xxv. (1856), xxxi. (1862); Morrell's Voyage of the "Antarctic"; Account of Tristan da Cunha, by the Rev. W. F. Taylor, 1856; Voyage of H.M.S. "Galatea," 1867; Parliamentary Papers, 1876; and Documents in the Hydrographic Department.

sides to the apex, but does not really do so, as the slope from the peak, besides being divided by numerous ravines, has on it several small extinct craters. The peak has, so far as is known, never yet been ascended by any one except the sure-footed islanders, although it has been occasionally attempted by others, notably by Lieutenant Rich in 1816 and Commander Nolloth in 1856. It is said to terminate in a cone, consisting of black and deep red lava ashes, in the centre of which is an extinct crater, nearly circular, a quarter of a mile in diameter, now partially filled with fresh water, the depth of which has not been ascertained. There is a depression on one side of the cone, probably the effect of an eruption. In several of the small craters there are also lakes or ponds of fresh water, and some lodes of stiff yellow clay fit for brick making.

It appears curious that the lake in the crater on the summit should not be frozen, as the peak is seldom free from snow; and Lieutenant Rich, in his partial ascent in 1816, found that the thermometer registered 33° in the sun, in the middle of the day, in September.

The geographical position of Tristan, long in doubt, was satisfactorily ascertained by Captain Denham in H.M.S. "Herald." The summit is in lat. 37° 5′ 50″ S., long. 12° 16′ 40″ W., and Herald Point, the N.W. angle of the island, an eligible position for obtaining observations, is in lat. 37° 2′ 45″ S., long. 12° 18′ 30″ W.; and here one cannot but refer to the general accuracy of some of the old navigators, especially to the pains taken by some of them to ascertain the position of islands and shores, for Mr. Lewis Fitzmaurice—of H.M.S. "Semiramis," Captain Richardson—remained on shore here, in March 1813, four days taking observations, and made the lat. 37° 5′ S., long. 12° 11′ W., variation 9° 51′ W.; and Captain Wauchope, of H.M.S. "Eurydice," in November 1817, when at anchor 1 mile N.N.E. of the Cascade, made the position of his ship lat. 37° 1′ S., long., by mean of 20 lunars, 12° 1′ W., and by chronometer, 12° 23′ W.

Rising abruptly from the sea as Tristan does, except in one small portion of its circumference, its coast may fitly be described as ironbound. Vessels may approach it to within a mile, or even closer, with perfect safety so far as depth of water is concerned, for the soundings deepen quickly to 100 fathoms, so much so, that boats fishing at anchor in 20 fathoms not infrequently swing into depths exceeding 100 fathoms. Small beaches at the foot of deep ravines afford, with certain winds, landings here and there all round the island, but the adventurous seaman who endeavours thus to explore the coast line will find himself confined entirely to the strip of pebbly ground on which he stands, for the precipitous nature of the cliffs prevents his mounting to the higher land or walking along the base, the only exception being on the strip of comparatively level ground on the northwest side, where the landing is good in all but northerly winds, and from here the highlands may be reached and explored. All round the coast, and in some cases extending a considerable distance from it, grow large quantities of Kelp.

SHEET 17

SOUNDINGS AND STATIONS

in the vicinity of the

TRISTAN DA CUNHA Ids

For explanation of abbreviations &c. see Appendix 1.

TRISTAN I.
(7640 ft.)

360 (135) 15.IX.73
volcanic sand

(135 g) 550
hard ground

18.IX.73 (135 f) 1100
hard ground

(135 e) 1000
hard ground (shells, gravel)

(135 b) 465
hard ground (shells, gravel)

75 (135 a)
hard ground (shells, gravel)

75
65
15
16.IX.73
52
65
84
hard ground (shells, gravel)
90
90
58
90
hard ground (shells, gravel)

Inaccessible I.
(1840 ft.)

190
72 (135 d)
150
200
(135 c) 110
52
190
210
70 17.IX.73

Nightingale I.
(1100 ft.)

13° Long. West from Greenwich

Engraved by Malby & Sons

Tristan, like the other islands of the group, was, when first discovered, uninhabited. Its first inhabitant was Captain John Patten of the ship "Industry" of Philadelphia, who landed with a part of his crew in August 1790, and remained on shore until April 1791, collecting seal skins, in which he was very successful, shipping in that time no less than 5600 for the China market. At that time there were goats on the island, but how they got there is unknown; most probably they were landed by a passing vessel, but it is quite possible that they may have swum ashore from a wreck, for Captain Patten saw the remains of different wreck, such as the bowsprit and mast of a cutter, several spars, some of which were worm eaten, some iron hoops and other pieces of iron, but no remains or traces of huts or habitations. If they were landed purposely it seems strange that there should be no record of the fact.

From 1790 Tristan Island appears to have been deserted until about 1810, when three men landed and took possession of the island, intending to remain some few years there for the seal and sea elephant fisheries, and trusting to be able to dispose of their labours to passing vessels. By a singular and curious edict, Jonathan Lambert, an American, one of the three men, declared himself, on the 4th February 1811, the sovereign proprietor of the group, and set to work to clear the land on the northwest side of Tristan, planting about 50 acres with various kinds of seed, some of which were sent to him by the American minister at Rio Janeiro, but although some of the seeds sprang up and the settlement appeared prosperous, Lambert shortly after abandoned his possessions, leaving only one man behind, viz., Thomas Currie, a native of Leghorn, who had landed in December 1810.

In November 1814 Currie was joined by a Spaniard, Bastiano Poncho Comilla, a native of Mahon, but there appears to be no record of the vessel from which he landed. At this time there were numerous flocks of goats on the island and some wild pigs, but by whom these latter animals were landed does not appear.

Such is a short account of the history of the island to the time it was taken possession of by Great Britain.

In 1816, after the Emperor Napoleon had been incarcerated in St. Helena, it was deemed advisable to send a guard to Tristan, to prevent its being made a base of operations against the former island. Accordingly Rear-Admiral Sir Pultney Malcolm, K.C.B., despatched a frigate to take possession of the group and to land a detachment. On the 14th August 1816, Captain Festing, of H.M.S. "Falmouth," arrived at Tristan Island, and proceeding on shore annexed the islands to Great Britain with all the requisite formalities, and constituted, by Sir Pultney's orders, Lieutenant David Rich, R.N., as the first Commandant. The only people on the island were Thomas Currie and Bastiano Comilla.

On the 15th August 1816, the "Falmouth" landed a lieutenant of marines, four midshipmen, and thirteen men under the orders of Lieutenant Rich. This detachment

remained until the 28th November of the same year, when they were relieved by Captain Josiah Cloete of the 21st Regiment of Dragoons, and some troops from the Cape of Good Hope. Captain Cloete then succeeded Lieutenant Rich, as Commandant, and remained until the settlement was finally abandoned by the British Government in November 1817. During his four months' stay on shore Lieutenant Rich kept a journal, from which the following interesting particulars have been extracted :—

The "Falmouth" remained five days in the vicinity of the group, landing stores, provisions, and other necessaries for the men on shore; and during her stay Captain Festing, with a laudable anxiety to explore Tristan Island, started in a gig to pull round it, and the master of the ship sounded out the anchorage, which he named Falmouth Bay, a name which it has since retained, although the original name appears to have been Reception Bay. Captain Festing was unfortunate in his weather, for at 2 P.M. on the day he started, the wind and sea had become strong enough to necessitate his return to his ship, and they increased so rapidly as to threaten the total loss of the boat. After struggling against these adverse circumstances for some hours, Captain Festing perceived that the only chance of safety for his exhausted crew was to endeavour to land, and in this he succeeded at 10 P.M., but not without his boat being capsized, and stove against the rocks, and his crew receiving a considerable number of bruises before they extricated themselves from the surf. Captain Festing and his boat's crew remained in a very unpleasant position on the rocks for two days, living on Penguins, before they could be rescued, for the sea and wind were sufficient to force the "Falmouth" to slip from her anchors to avoid being driven on shore. Fortunately he had means of making a fire with flint and steel, and plenty of Tussock Grass around him to burn, so that they were able to cook their food.

After the "Falmouth" left the group, Lieutenant Rich employed his men in regular working parties, in cutting wood and building huts, in catching fish, in killing and boiling down Sea Elephants for oil, and curing their skins to make caps and moccasins, and in preparing a large piece of ground for the reception of vegetables and cereals.

The fishing parties were always successful; they fished with hook and line from a boat at anchor. The party cutting wood and building the huts met with some difficulties owing to the smallness of the trees, there being only one species of tree on the islands (*Phylica nitida*), the wood of which is weak and small. After the first hut was built and the stores removed into it, they found that continuous rain for a day made their thatch of Tussock Grass so heavy that it bent the uprights on which the roof rested, consequently they had to begin their work over again, and build smaller huts, which they floored with staves of casks and other materials.

The agricultural party cleared a large patch of ground, and planted some wheat, potatoes, and a large quantity of cabbages, in addition to the ground already under cultivation by Thomas Currie, who had grown a considerable number of potatoes, cabbages, and carrots, which had a most healthy appearance.

Two attempts were made by Lieutenant Rich to cross the mountain ranges, but they both failed, as the rugged nature of the ground rendered it necessary to pass the nights on the hills; and he found it so cold and damp, that without some shelter he considered it unadvisable to pass more than one night away from the tents, and the difficulty of transport prevented his taking a tent with him, besides which the clouds hanging over the mountain envelop it in fog, so that there is great danger of losing the way. A few goats and numbers of wild pigs were seen by Lieutenant Rich in these mountain excursions; but their capture was difficult, owing to their frequenting the least accessible parts of the island.

From a register kept during Lieutenant Rich's stay, it appears that from the 15th to the 31st August 1816 the mean temperature was 56° and the extremes 82° and 42°. On 14 of the 17 days rain fell, on 5 days gales of wind or strong breezes blew, landing was safe in Falmouth Bay on 13 days, and the direction of the wind was S.W. for 7 days, W. 5 days, N.W. 2 days, E. 1 day, and variable 2 days.

During September 1816 the mean temperature was 55° and the extremes 80° and 40°. Rain fell on 25 days, and strong breezes or gales were registered on 15 days. On 16 days the landing was safe, and the direction of the wind was S.W. for 17 days, N.W. 4 days, N.E. 2 days, N. 1 day, E. 1 day, W. 1 day, and variable 4 days.

During October 1816 the mean temperature was 58°, the extremes being 80° and 47°. Rain fell on 17 days, and strong winds or gales were registered on 13 days. Landing was safe on 17 days, and the direction of the wind was N.W. for 9 days, S.W. 7 days, W. 4 days, N.E. 2 days, N. 1 day, S.E. 1 day, and variable 7 days. From the 1st to the 27th November 1816 the mean temperature was 56° and the extremes 74° and 43°. Rain fell on 16 days, and strong winds or gales were registered on 12 days. Landing was safe on 17 days, and the direction of the wind was S.W. for 8 days, N.W. 5 days, W. 4 days, E. 1 day, S. 1 day, and variable 8 days. The temperature was registered four times a day—at sunrise, 8 A.M., noon, and sunset; occasionally also at 2 P.M. The register of the landing refers to the beach in Falmouth Bay.

During Lieutenant Rich's period of command only two vessels were sighted from the island before the "Falmouth" came to take them off on the 26th November 1816, having on board a detachment of troops, under the command of Captain Cloete, amongst whom were several men of the Royal Artillery skilled in various trades. The detachment, about 100 in number, was accompanied by 17 women, wives of the soldiers, and was well provided with horses, cattle, sheep, poultry, and pigs.

The "Falmouth" having landed the troops, embarked Lieutenant Rich and his party, and left Captain Cloete as Commandant or Governor of this military colony. The troops only remained in occupation of the island for a year, for, finding by the reports of the various men of war who visited the group that its want of shelter for ships, and the difficulty of communicating with the shore, rendered it almost impossible to make any island

of this group a base of operations for facilitating the escape of the Emperor from St. Helena, the Government determined to withdraw the garrison, and leave the islands once more in the occupation of sea birds and seals. Consequently two vessels were despatched to bring off the troops and their baggage, viz., the sloop "Julia," Captain Jenkin Jones, and the frigate "Eurydice," Captain Wauchope.

The "Julia" arrived at the island first, anchored in Falmouth Bay, and commenced receiving stores; but on the night of October 2nd, 1817, whilst at anchor, a heavy swell set in about midnight from the northward, and drove her on shore, when fifty-five out of her crew of ninety-five perished. The captain, it appears, was on shore, not having gone off to his ship in the evening; and it is reported that neither he nor any of the troops knew of this sad catastrophe until one or two of the men who were fortunate enough to escape drowning ran up the bank and told them; which, if true, does not say much for the vigilance of the sentries on the island. The "Julia" had visited the island on a previous occasion in December 1816, and had then anchored rather too close to the shore; but it must be borne in mind that, until her loss, it was not known that the first warning of a northerly gale is a heavy surf setting in during a calm, and that even when the gale is at its height its force is not much felt at the settlement, owing to the influence of the high perpendicular cliffs immediately to leeward of the anchorage.

A month after the loss of the "Julia," the "Eurydice" arrived, anchored in Falmouth Bay (4th November), and commenced embarking stores and luggage. On the night of the 5th, however, Captain Wauchope, taking warning by the sad fate of the "Julia," slipped his cable at 10.30 P.M. at the beginning of an easterly wind, and it was fortunate for him he did so, for until the 18th he was unable to return to the bay and complete the embarkation of the troops and their baggage, being engaged for thirteen days in battling against strong breezes, gales, and dirty rainy weather.

On the 18th, however, the "Eurydice" was enabled to return to the anchorage, and having completed the embarkation by 2 P.M. on the 19th, left the bay just as another northerly wind commenced; even then it was not found possible to hoist in the boats before making sail, but this was put off until the safety of the ship was secured.

Captain Wauchope, whose careful and laborious operations in obtaining the temperature of the sea at considerable depths have been rescued from oblivion by Professor Prestwich, F.R.S.,[1] made careful observations on the weather. He was the first to point out that, owing to the peculiar formation of the coast, a northerly gale is not felt at the anchorage, but that the swell setting in with resistless violence would certainly cause the loss of any sailing vessel that might be caught at anchor in Falmouth Bay; and this statement has since been confirmed by the settlers, who say that north and northwest winds are not felt at the settlement, but southwest winds are exceedingly violent and destructive. Captain Wauchope also says in one of his reports, "that in fine weather nothing

[1] *Phil. Trans.*, vol. clxv. p. 595, 1875.

can be more beautiful or picturesque than Tristan, with its lofty peak covered with snow, the sea as smooth as the stillest lake, just rippling against the fine volcanic black sand on the beach, and a cascade of the purest water falling over a cliff directly into the sea; but it must not be forgotten that in the course of an hour this calm and placid scene may be rendered one of the most terrific in nature, and prove in an unmistakable way the power of the ocean, for in that short time the beach, so lately covered with fine sand, has forced up on it immense stones, which, tossed against one another by the surf, create a noise resembling thunder, and so quickly are these large stones cast up that a fortnight after the wreck of the 'Julia' she was almost entirely buried beneath them."[1]

When Captain Cloete received orders to abandon the settlement, and return with his men to the Cape of Good Hope, one of his soldiers, Corporal William Glass, in charge of the detachment of the Royal Artillery, asked, and received, permission to remain on the island with his wife and family. He persuaded two other men, John Nankivall and Samuel Burnell, both natives of Plymouth, to join him, and form a kind of partnership, in which he was to be the principal. One of the officers drew up a form of agreement between the three men, which they signed, and in November 1817, after the departure of the troops, these three men, with Glass's wife and two children, remained for some considerable time the only inhabitants of the group.

From 1817 to the present time Tristan Island has always been occupied either by the original settlers, their descendants, or other people, who from time to time have become fascinated by the primitive life of this interesting community. To the time of his death, which happened in 1853, Corporal Glass, who appears to have been a man of some education, considerable industry, mild temper, and strong religious principles, was considered the chief of the settlement, and was commonly designated as the Governor by the other residents, who invariably bowed to his decisions. In 1849, previous to the death of Glass, a gentleman interested in the welfare of this remote colony, remitted to the Society for the Propagation of the Gospel a sum of £1000, to be expended in providing the inhabitants of Tristan Island with a resident clergyman for five years, who would fulfil the office of teacher as well as minister. The Society selected the Rev. W. F. Taylor for the task, and he reached the island in 1851, and remained there until 1857, when he left for the Cape of Good Hope in H.M.S. "Geyser," and took with him forty-five of the inhabitants, who thought they could better themselves in that colony. After the death of Corporal Glass, the Rev. Mr. Taylor was, of course, considered the chief of the settlement until his departure, since which time a man named Peter Green has been acknowledged as such.

For the first three years of its existence this little colony had few communications with the outer world; they lived very happily together, Mrs. Glass attending to the dairy and other such suitable work, and the three men looking after the cattle and sheep, and

[1] M.S. Report in Hydrographic Department of Admiralty.

cultivating the ground. In December 1820, the colony received an addition to its number, for a small sloop, the "Sarah," being wrecked there in that month, three of her men resolved to remain on the island, and in June 1821, three additional men were landed by H.M.S. "Satellite." In July 1821, the "Blenden Hall" was wrecked on Inaccessible Island, and in November of that year some of the crew managed to cross over to Tristan and make known the fact to Glass, who immediately started to the relief of the shipwrecked men, and succeeded in transporting them all to his own island, where they were treated with the utmost kindness and consideration, and from whence they were eventually taken to the Cape of Good Hope by the barque "Susanna" and the brig "Narina," but not without leaving behind them a welcome addition to the colony, for one of the crew having fallen in love with a servant maid on the voyage, the two married, and settled on the island, thus providing Mrs. Glass with a companion of her own sex.

After the wreck of the "Blenden Hall," the colonists became ambitious of possessing a small vessel of their own, in which they might carry their surplus produce to the Cape of Good Hope, and bring back such necessaries as could more easily be purchased than grown or manufactured on their own island. They accordingly bought a small schooner for £700, which they paid from the produce of the cargoes they sent to Cape Town; but the vessel was, unfortunately, totally lost through carelessness in Table Bay in 1823, since which time the inhabitants of Tristan Island have entirely depended on passing vessels for their communication with the outer world.

Before the schooner was wrecked she had brought four new settlers to the island, including a woman and a middle-aged doctor suffering from dipsomania, whose friends thought that a residence in Tristan might cure him. These constituted, with the original settlers and their descendants, the inhabitants when the island was visited by the "Berwick" in 1823. The doctor, however, soon got tired of his enforced sobriety, and managed to leave the island before he had been there twelve months, and some of the other men also became wearied of their primitive mode of life, and left, so that in 1824 the population was reduced to four men, two women, and the children. In this year, however, they received an accession to their number, for a gentleman, named Earle, a naturalist and artist, who landed to explore the island whilst the ship in which he was a passenger was lying off for the purpose of receiving supplies, was accidentally left behind, owing to the wind suddenly increasing to such a degree that the ship was obliged to leave the group; he remained at the settlement eight months before he could obtain a passage in a passing vessel, and, like a good fellow making the best of his circumstances, acted as parson and schoolmaster during his enforced residence.

In 1826 there were seven men and two women besides children on the island. Seeing that the five unmarried men were in want of wives, a Captain Anim made a bargain with them by which he bound himself to proceed to St. Helena and endeavour to procure five women who should return with him to Tristan in search of

husbands. In April 1827 he brought the women, and they were married to the five bachelors of the settlement, bringing the total number of families up to seven, and these were the residents when the group was visited and described by Captain Morrell of the "Antarctic."

In 1828 American whalers first began to visit the neighbourhood of the Tristan da Cunha group in search of spoil, and they have continued to do so more or less ever since. Requiring, as they do, a constant supply of fresh meat and vegetables, and having always on board surplus quantities of flour, coffee, tea, sugar, &c., a brisk trade ensued between their crews and the islanders, which reached its maximum in 1840, and has since gradually declined, for the whales, harassed by the attacks of the numerous ships employed in their capture, have gradually departed to localities less easy of access, and, naturally, the ships have endeavoured to follow them.

The visits of these whaling vessels were of considerable benefit to the colony, for not only did they bring news of what was going on in the world, but they afforded opportunities to the boys (descendants of the original settlers) of occasionally taking a cruise, thus becoming acquainted with other communities, and working off the natural wish of most young men to wander for a time; they also supplied opportunities of marriage to the young women, of which some took advantage; and, above all, by reminding the inhabitants that, did they feel discontented with their simple mode of life, an opportunity of escaping from it was frequently to be had for the asking, made them year by year less inclined to sacrifice their numerous comforts to enter the race of life amongst communities less bound together by ties of interest and consanguinity than themselves.

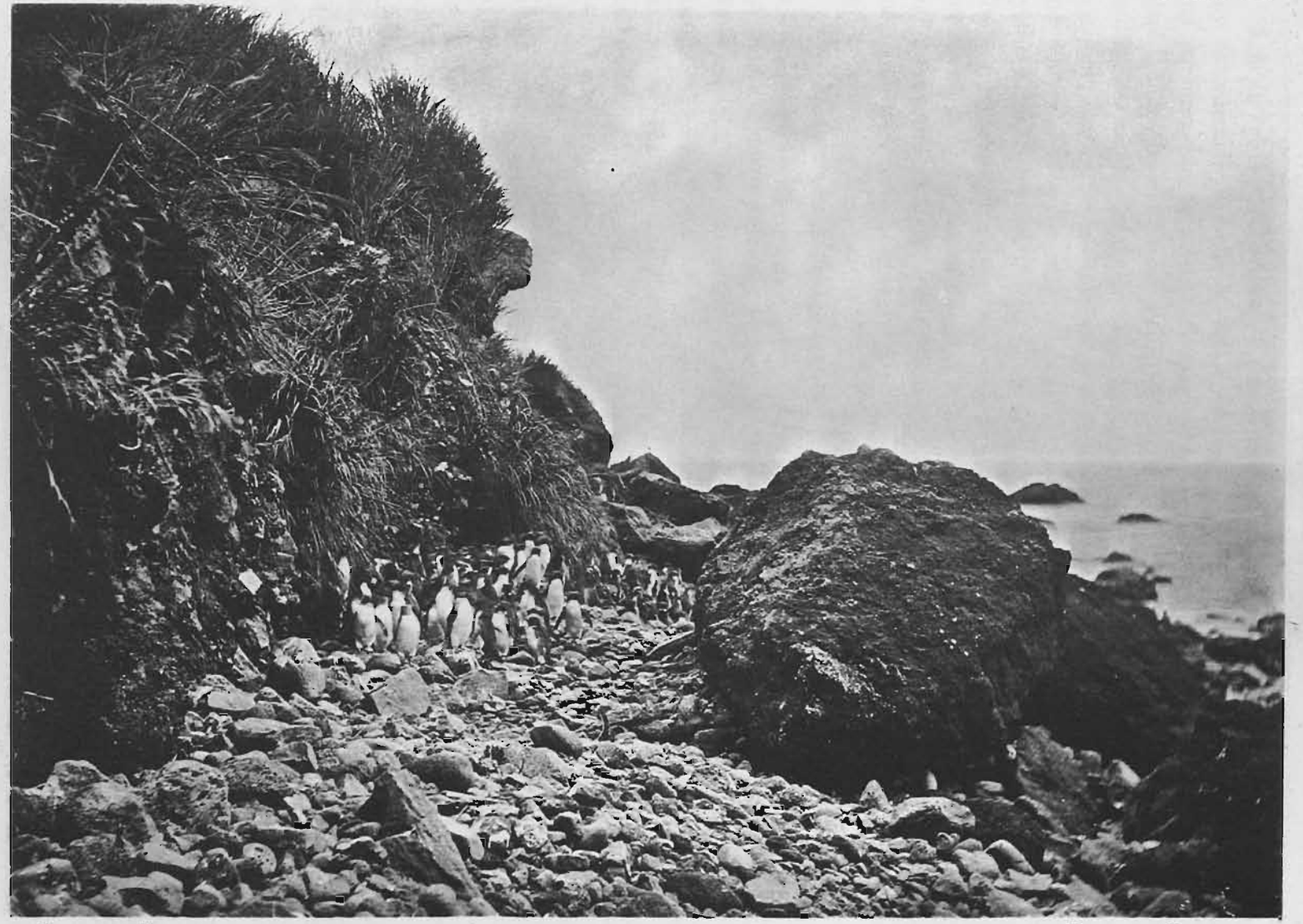
How the inhabitants of this remote dependency of the British Crown have prospered can be better seen by referring to the following table of statistics than by any description. Their flocks and herds have increased after supplying all their wants, and their vegetable produce has always been greater than the consumption, while their food and cooking have been described, by those visitors who have enjoyed their hospitality, as most excellent. The table gives the names of the ships whose captains have made reports on the state of the group, the date of their visit, the number of inhabitants, the produce of the island, and a column has been added showing in what publication these reports appear *in extenso*, so that reference can be made to them should it be necessary to ascertain exactly what was said of the settlement at any particular date.

The occasional decrease in the number of the inhabitants shown by this table is due to emigration, and not to disease or death. The residents are remarkably healthy and vigorous, and invariably decline to receive a medicine chest.

From all the ships mentioned in the following table a description of the settlement, more or less diffuse, has been given, from which an excellent idea of the condition of the island can be gathered.

Date.	Ship's Name.	Captain's Name.	Number of Inhabitants.				Live Stock on Island.	Vegetables on Island.	Remarks.
			Men.	Women.	Children.	Total.			
1817	When abandoned by troops.		3	1	2	6	Cattle, sheep, pigs, goats, poultry	Potatoes, cabbages, carrots	Narrative of Rev. Mr Taylor, published by S. P. G. in 1856.
1823	Berwick	Jeffery	22	3	–	25	Cattle, sheep, pigs, goats	Potatoes, cabbages, &c.	Findlay's Directory for South Atlantic Ocean.
1829	Antarctic	Morrell	7 families				Cattle, pigs, goats, rabbits, poultry	Potatoes, cabbages, beetroot, parsnips, carrots, onions, pumpkins	Butter, cheese, eggs, and milk also offered for barter; peach and apple trees. Morrell's Voyage.
1833	Diana and Mary	...	6	6	28	40	... ...	... ...	Findlay's Directory for South Atlantic.
1835	Wellington	Liddell	–	–	–	41	50 cattle, 75 sheep, pigs and poultry.	... ...	Naut. Mag., 1836.
1852	H.M.S. Herald	Denham	–	–	–	85	Cattle, sheep, pigs, poultry	Plenty, but names not mentioned	Eggs, butter, and milk; peach and apple trees. Naut. Mag., vol. xxii., 1853.
1856	H.M.S. Frolic	Nolloth	–	–	–	71	200 cattle, 300 sheep, pigs, poultry, goats	Potatoes	Peach and apple trees. Naut. Mag., vol. xxv., 1856.
1862	H.M.S. Cyclops	Pullen	6	11	19	36	Cattle, sheep, fowls, ducks, pigs	Potatoes, cabbages, onions	Apples and peach trees. Naut. Mag., vol. xxxi., 1862.
1867	H.M.S. Galatea	Duke of Edinburgh	–	–	–	53	500 cattle, 200 sheep, fowls; no goats	Potatoes, parsnips	Strawberries. The Cruise of H.M.S. "Galatea."
1873	H.M.S. Challenger	Nares	–	–	–	84	600 cattle, 600 sheep, fowls, geese, pigs	Potatoes, and other vegetables	15 houses; beef 4d. per pound, potatoes 4s. per bushel, eggs, milk. Personal observations.
1875	Sappho	Digby	–	–	–	85	Cattle, sheep, pigs, poultry	Potatoes, and other vegetables	Parliamentary Papers, 1876.
1875	Diamond	Bosanquet	15	18	52	85	Cattle, sheep, pigs, poultry	Vegetables only mentioned	Do., do.

[1] It is very unlikely that peach or apple trees, if planted, would grow to any size, or the fruit ripen. The subsequent writers who mention these trees have probably copied Morrell.



HORSBURGH, EDINBURGH. PERMANENT PHOTOTYPE.

PENGUIN ROOKERY, INACCESSIBLE ISLAND.

Life at Tristan is by no means without its advantages, since it does not necessitate any considerable amount of labour. Vegetables, such as potatoes, cabbages, carrots, and parsnips, can be raised in considerable quantities, but the fields in which they are planted must be small and walled all round to protect them from the wind; fish can readily be caught in almost any quantity; fur seals, though scarce, are occasionally captured; the cattle provide meat, milk, butter, and cheese. There were between 500 and 600 head of cattle, and about as many sheep, on the island when it was visited by the Expedition; but the cattle are often lost in the very cold weather from exposure. The sea birds provide large numbers of eggs; passing vessels exchange flour, coffee, sugar, and other articles of luxury, for the surplus produce of the island, mainly potatoes and meat; and, in short, the settlers on this remote spot are not badly off. The wild goats and pigs have been entirely killed off, and the wild rabbits, formerly numerous, appear to be now quite extinct.

The character of the inhabitants stands deservedly high; they have invariably assisted, to the best of their ability, all shipwrecked persons, and they also fed, and provided for the wants of, forty prisoners landed by the "Shenandoah" during the American Civil War, although they naturally enough remonstrated against such a sudden influx of visitors. This high character appears to be in a great measure due to the judicious example of the late Corporal Glass, who was much respected by the Rev. Mr. Taylor and by all the captains of vessels touching at the island. The Rev. Mr. Taylor also always spoke in the highest terms of the moral character of the community, and said he failed to trace a vice amongst them. Since his departure, and probably owing to the want of such a man as Glass to set them an example, the inhabitants appear to have deteriorated slightly from this high standard. Captain Pullen of H.M.S. "Cyclops" states that when he visited the island in 1862, some of them were decidedly excited by liquor towards evening.

The houses forming the village, fifteen in number, are built very solidly of huge rectangular blocks, cut out of a soft red tufa, fitted together without mortar (see Pl. IX.), the walls being about 8 feet high and 3 feet thick; the roofs are raftered with wood obtained from American vessels, and then thatched with Tussock Grass, a most excellent material which outlasts the rafters. Small gardens surround the cottages, walled in to shelter them from the violent southwest winds, and roses and other flowers are successfully cultivated.

There can be no doubt that the habitation of Tristan Island is of immense advantage to the sailor, and it would be a great pity were the island ever to be abandoned. Many shipwrecked crews have been hospitably received by the settlers, and their wants supplied without any recompense being required. Should this group be made a dependency of the British crown, a resident clergyman or schoolmaster might be appointed to act as Governor.

With respect to men-of-war calling, there need be no apprehension of danger. Gales of wind are, of course, common at all seasons, but the islanders can nearly always communicate with ships if they stand close in, and now-a-days, with steam ever at command, there is no chance of a vessel sharing the "Julia's" fate. One precaution should, however, always be taken by vessels anchoring—steam should invariably be kept up, and the cable ready for slipping at a moment's warning.

The cliffs of the main island show a very regular stratification, and are composed throughout of a series of beds lying nearly horizontally, but dipping slightly towards the shores, at least they appear to do so east and west of the anchorage. The beds, which are conspicuously marked, are alternately of hard basalt and looser scoriaceous lava, with occasional beds of a red tufa. The whole section is traversed by numerous dikes, mostly

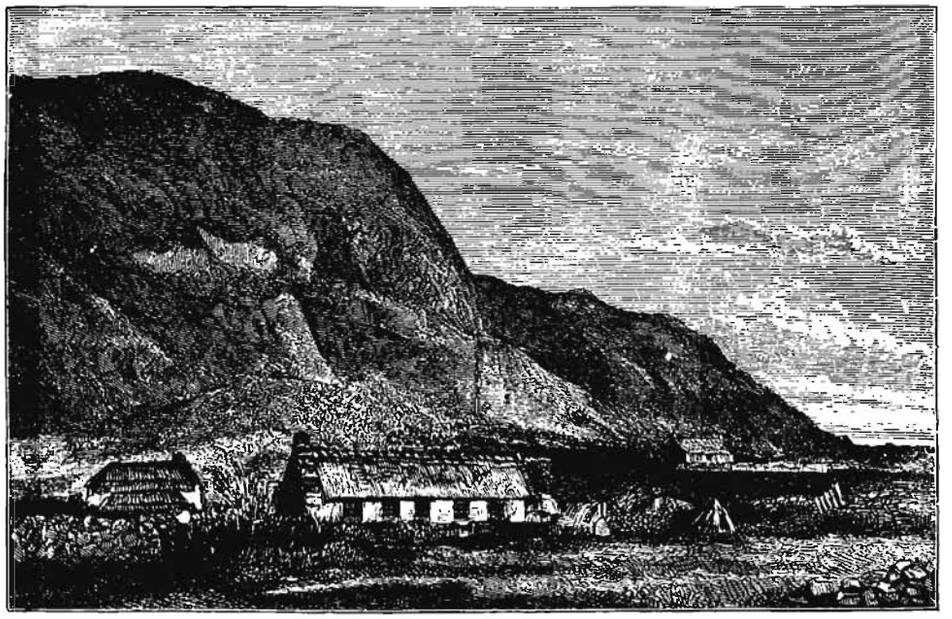


FIG. 99.—Settlement of "Edinburgh," Tristan da Cunha. (*From a Photograph.*)

vertical and usually narrow in appearance, and is not unlike that exposed in the Grand Cural at Madeira. The rock specimens collected were large grained felspathic basalts sometime bordered with layers of black basaltic glass (sideromelan) passing to palagonite, basaltic tufa, augite-andesite, pyroxenite, and amphibolic andesite containing sanidine.

Streams, or rather cascades, which come dashing down to the sea during the constant heavy rains, have eaten their way into the cliffs, and their beds form conspicuous features in the view as narrow gullies, descending the rocks in a series of irregular steps. At the foot of the cliffs, immediately opposite the anchorage, are débris slopes and irregular rocky and sandy ground, forming a narrow strip of low shore land.

The settlement lies on a broader and more even stretch of low land which extends

westwards (see fig. 99). At the margin of this lower tract a small low secondary cliff has been formed by the waves. Steep slopes of débris lead to the settlement above from the cliffs, here and there broken into ledges and deep gullies, by which ascent to the summit is easy. At the landing-place the beach is formed of black volcanic sand, but elsewhere in the neighbourhood, of coarse basaltic boulders.

The cliffs have a scanty covering of green, derived mainly from grasses, sedges, mosses, and ferns, with darker patches of the peculiar trees of the island (*Phylica nitida*), and the Crowberry (*Empetrum nigrum*, var. *rubrum*); these dark patches become more and more marked towards the summit. Conspicuous patches of bright green are formed under the cliffs at the foot of the water-courses by a Dock (*Rumex frutescens*). Further, dotted about amongst the other herbage, are rounded tufts of pale bluish-green, consisting of the tall reed-like Tussock Grass (*Spartina arundinacea*), which is peculiar to the Tristan da Cunha group, St. Paul and Amsterdam Islands. On nearer inspection the damp foot of the cliff is found to be covered with Mosses and Liverworts, which latter form, in favourable situations, continuous green sheets covering the earth beneath the grass. Many Ferns were collected; *Asplenium obtusatum*, growing in the clefts of the rocks, just as does our home *Asplenium marinum*, and *Lomaria alpina* growing abundantly under the cliffs.[1] The *Lomaria* plants, where situated on stony slopes, and comparatively starved, were all provided with fertile fronds, whilst when growing in rich vegetable mould, they were commonly without fructification. The commonest flowering plants under the cliffs are Wild Celery (*Apium australe*)—a plant abundant here, in Tierra del Fuego, and in the Falkland Islands,—the Crowberry (*Empetrum nigrum*, var. *rubrum*), the common Sow-thistle (*Sonchus oleraceus*), a cosmopolitan weed,—and a plant with strongly scented leaves (*Chenopodium tomentosum*), called "tea" by the islanders, and used as such, a decoction of the leaves being drunk with milk and sugar. Creeping amongst the damp moss is the narrow-leaved plant with small bright red berries (*Nertera depressa*), so common in English conservatories.

The streams running down the cliffs, which vary from violent dashing cascades in rain time, to narrow rills fed only by the melting of the snow above in dry weather, were small at the time of the ship's visit; the water soaks into the banks of sand at the foot of the cliffs and on the shores, and is mostly lost, but in some places reappears in the shape of shallow freshwater ponds close to the sea beach. The water of the streams had a temperature of 50°, whilst that of the ponds was higher, 54°. The temperature of the lower regions of the island is no doubt constantly reduced by the descent of the cold water from the snow far above; in the gully above the settlement, shrubs of *Phylica nitida* commence at about 400 feet elevation. The trees in this locality have all been cut down for firewood, but there is still plenty of wood on the island. *Phylica nitida* is a species found in the Tristan da Cunha group, Gough Island, and in the far-off island of Amsterdam, 3000 miles distant; as well as in Bourbon, Mauritius, and perhaps Mada-

[1] For detailed list, see Bot. Chall. Exp., part iii. pp. 162-170, 1884.

gascar. The genus belongs to the natural order of the Buckthorns (Rhamnaceæ), and other species occur at the Cape of Good Hope, but they are low and shrubby. The foliage of the tree is of a dark glossy green, with the under sides of the narrow almost needle-like leaves white and downy, hence the tree, which in habit is very like a Yew, presents as a whole a mixture of glaucous grey and dark olive green shades; it bears berries of about the size of sweet-peas, which are eaten by the Finch living on the islands. The constant heavy gales do not permit the tree to grow erect; the trunk is usually procumbent at its origin for several feet, and then rises again, often at a right angle, and is always more or less twisted or gnarled. In sheltered places, as under the cliffs on the northeast of Inaccessible Island, the tree is as high as 25 feet, but it is not nearly so high on the summit of the island, though the trunks are said there to reach a length of 30 feet or more. The largest trunk seen was about a foot in diameter, but they are said to grow to 18 inches. The wood of the tree is brittle, and when exposed, rapidly decays, but is serviceable when dried carefully with the bark on. The German settlers on Inaccessible Island used it even for handles to their axes and other tools.

Inaccessible Island, next in size to Tristan, and the most westerly of the group, receives its name from its appearance; and certainly this name seems most applicable when the island is viewed from a distance of 2 or 3 miles. A nearer approach, however, discloses the fact that beaches exist, here and there, at the foot of the almost perpendicular cliffs, all around the island, and on the northeast and northwest sides these beaches are occasionally so wide as to afford space for building purposes, or pitching tents; and from two points where the cliffs are somewhat broken it is possible, by the aid of the Tussock Grass, which grows on every available spot, to climb to the undulating table top of the island.

Inaccessible Island is quadrilateral in shape, the sides being nearly equal, each about 2 miles in length, and the angles pointing in the direction of the cardinal points of the compass. Its highest point, on the west side, is 1840 feet above the level of the sea; from here it slopes irregularly towards the coast, terminating on all sides in precipitous cliffs averaging 1100 feet in height. On the south point is a remarkable rocky cone 1140 feet, and on the southwestern side another cone 690 feet, in height, but separated from the cliffs by V-shaped chasms, apparently the effect of rain. Separated from the south point by a channel, a cable wide, is a pyramidal rock 60 feet in height, close to which is a smaller rock only 3 feet above the level of the sea, and off the southwest coast of the island are three detached rocks over which the sea is constantly breaking. On the southeast side is a conical rock 230 feet in height, just off the coast, and a cable off the east point is a rock 3 feet above the level of the sea. On the northeast side of the island are two waterfalls, the easternmost being the larger and more conspicuous (see fig. 100), and off a point in the centre of the northeast coast is a rock 2

feet above the level of the sea, half a cable from the beach. The position of this rock is lat. 37° 17′ 50″ S., long. 12° 42′ 10″ W. The northwest coast has no rocks off it above water, but there are rocky shelving points projecting from the beach, which extends the whole length of this side of the island.

FIG. 100.—Waterfall, Inaccessible Island. (*From a Photograph.*)

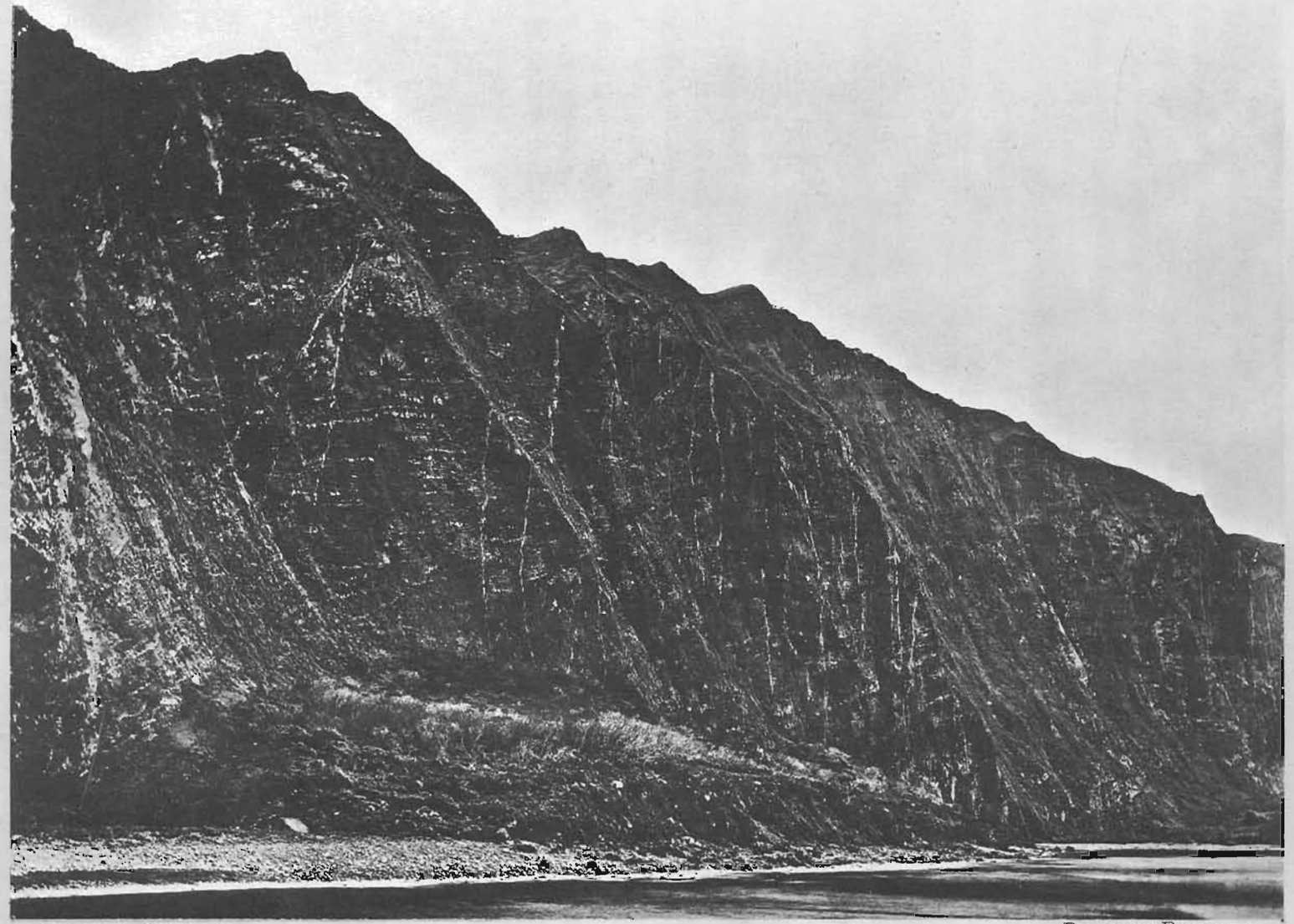
Between Inaccessible and Tristan Islands is a perfectly safe channel, 20 miles across. Soundings of from 50 to 90 fathoms were obtained at distances of from 1 to 2 miles round Inaccessible Island. Kelp was observed growing on the northeast side,

extending to a distance of half a mile from the coast. Owing to the detached rocks on the southwest coast extending to a distance of nearly three quarters of a mile, the island should not be approached on this side within 2 or 2½ miles; but on the other sides 1 mile is a safe distance in a steam vessel, and anchorage can be obtained off the 2 feet rock on the northeast coast, but no sailing vessel should use it.

The island was surveyed by placing a boat in position off the east point; the Challenger then steamed round obtaining soundings and angles. At every sounding the ship was stopped, and at a given signal her masthead angle taken by the officer in the boat, the bearing of the boat being taken on board (as well as the angles) whilst the ship was stationary.

Captain Richardson, of H.M.S. "Semiramis," was the first, as far as there is any record, to effect a landing on Inaccessible Island, when in 1813 he visited the group and explored the three islands. The forbidding aspect of Inaccessible has prevented any attempt to settle on it, and it appears to have been rarely visited until the "Blenden Hall" was wrecked there in 1821. Since that time, however, a boat from Tristan has gone over nearly every year. The crew and passengers of the "Blenden Hall" remained on the island nearly six months before they were rescued; they must, therefore, be considered its first inhabitants. This ship, bound to Bombay from London, was lost on the 23rd July 1821. It appears that her captain wished to sight the group to verify his chronometer, and stood towards the land, notwithstanding the unfavourable state of the weather, which was thick, with a considerable swell and light breeze. At about 9 A.M. kelp was reported and he tried to tack, but owing to the light wind missed stays, and before he could get his boats ahead to tow, breakers were reported, and then high land was seen through the mist. The boats had no power to tow the ship against the swell, and, failing to anchor, the vessel was drifted on shore, and soon broke up, but not until all the crew and passengers, with the exception of two men, had been safely landed. Some sails thrown up on the beach enabled them to erect tents; the Sea Elephants and other Seals, Penguins, and numerous sea birds supplied them with an ample quantity of food, which though unpalatable is sufficiently nourishing, and as water is plentiful, they were better off than most people who have the misfortune to be wrecked. After being three months on shore, a boat was constructed with the aid of some surgical instruments, from the remains of the wreck, in which six men started for Tristan. Bad weather drifted them away from the group, and they were picked up by a passing vessel, whose captain, it appears, was not humane enough to return to Inaccessible to take off the castaways. By the 8th November those left on Inaccessible Island had succeeded in constructing a second boat, which reached Tristan in safety. Corporal Glass, directly he heard of the wreck, started immediately to their relief, and succeeded in transporting them all to his own island, from whence they were taken by passing vessels to the Cape of Good Hope.

Corporal Glass, in view of the probability of other vessels being lost on Inaccessible



HORSBURGH, EDINBURGH. PERMANENT PHOTOTYPE.

SEA CLIFF, INACCESSIBLE ISLAND

Island, landed on it, shortly after the wreck of the "Bienden Hall," some goats and pigs; the progeny of the latter still flourish on the plateau above the cliffs of the island, but as they live almost entirely on sea birds and their eggs, their flesh has a peculiar fishy flavour, and is very unpalatable, so much so that the men in the Challenger could not eat it.

From 1822 Inaccessible remained deserted until the 27th November 1871, when two Germans (brothers), named Frederic and Gustav Stoltenkoff, landed there for the purpose of collecting sealskins, and remained on the island until taken off by the Challenger in October 1873, after a residence of nearly two years.[1]

As the vessel lay off Inaccessible Island, the Penguins were to be heard screaming all night on shore and about the ship, and when parties of them passed by, they left vivid phosphorescent tracks behind them as they dived through the water alongside. In the morning the island was in full view, and presented on this side a range of abrupt cliffs, of much the same structure as those of Tristan, viz., successive layers of basalt, traversed by vertical or oblique dikes, mostly narrow vertical ones. At the foot of the cliffs are some very steep débris slopes, extending in one place a long way up the cliff, but not so as to render the ascent possible (see Pl. VIII.). In front of these stretches a strip of narrow uneven ground, formed of large detached rocks and detritus from the cliffs above, which terminates seawards in a beach of black boulders and large pebbles. In one place, where the cliff is somewhat lower than elsewhere, there is a waterfall, which at the time of the visit was scantily supplied with water, but, from the marks left by it on the rocks and vegetation, it evidently attains much greater dimensions in rainy weather. The cascade pours right down from the high cliff above into a dark pool of peaty water on the beach below. The rocks about its course are covered with mosses and green incrusting plants. The face of the cliff generally is sprinkled over with green, the vegetation consisting principally of Tussock Grass (*Spartina arundinacea*), Wild Celery (*Apium australe*), Sow-thistle (*Sonchus oleraceus*), Dock (*Rumex frutescens*), a small Sedge (*Carex insularis*), and Ferns; with dark green patches of *Phylica nitida* on the débris slopes and ledges.

Amongst the grass are several patches or small coppices of *Phylica nitida* trees, which keep the ground beneath them free from Tussock, it being covered instead with a thick growth of Sedges, Ferns, and Mosses, forming an elastic carpet on the dark peaty soil. Amongst the moss creeps *Nertera depressa*, with its bright red berries, and the *Potentilla*-like *Acæna sanguisorbæ* grows here and there, together with the "tea-plant" of the islanders. The stems and branches of the *Phylica* trees are covered with lichens in tufts and variously coloured crusts, and the branches of the trees meeting above these little islands, as it were, in the seas of tall grass, afford most pleasant shady retreats, which

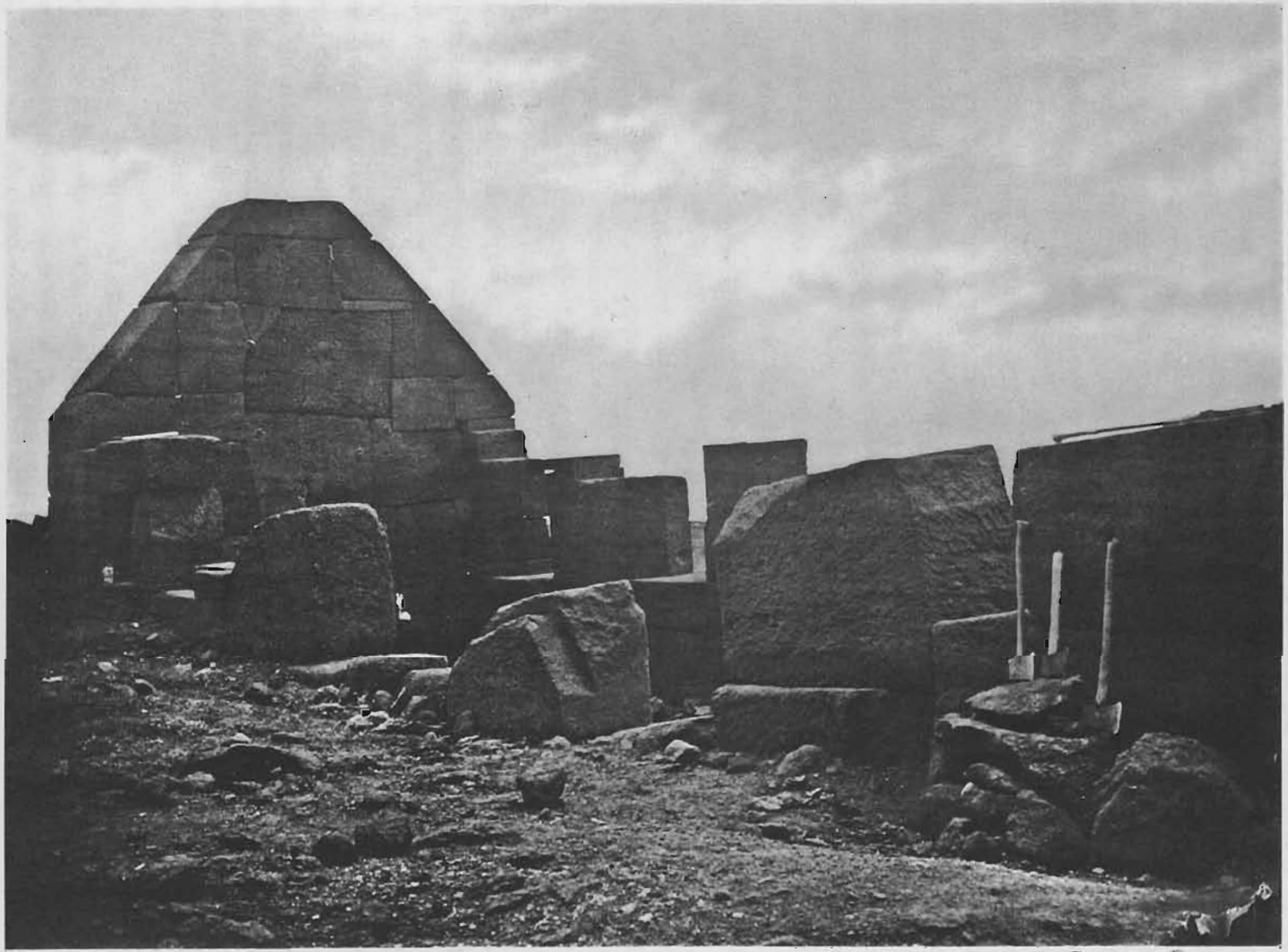
[1] Two Years on Inaccessible Island, by R. R. Richards, Esq., R.N., *Cape Monthly Magazine*, Cape Town, J. C. Juta 1873.

seem a perfect paradise after the terrible struggle and fight through the Penguin rookery, which it is necessary to endure in order to reach them.

In landing it was necessary to pass through a broad belt of water, covered with the floating leaves of the wonderful seaweed already referred to, *Macrocystis pyrifera*, termed "Kelp" by seamen, which here, as at Tristan and Nightingale Islands, forms a sort of zone around the greater part of the island, and which was afterwards met with in great abundance at Kerguelen Island.

As the shore was approached, a shoal of what looked like extremely active very small Porpoises or Dolphins was seen moving through the water. They showed black above and white beneath, and came along in a drove of fifty or more, from the sea towards the shore at a rapid pace, by a series of successive leaps out of the water and splashes into it again, describing short curves in the air, taking headers out of the water and headers into it. They landed on the black stony beach, and there struggled and jumped up amongst the boulders, and revealed themselves as wet and dripping Penguins. It would have been impossible for any one previously unacquainted with them to have believed the animals to be birds, had he seen them only thus in rapid motion in the water.

The beach was bounded along its whole stretch at the landing place by a dense growth of Tussock, a stout, coarse, reed-like grass, growing in large clumps, which have at their bases large masses of hard woody matter, formed of the bottom of old stems and the roots. In Penguin rookeries, the grass covers wide tracts with a dense growth like that of a field of standing corn, but denser and higher, the grass reaching high over a man's head. The Falkland Island "Tussock" (*Dactylis cæspitosa*) is of a different genus, but it has a similar habit. In the Tristan group there is a sort of mutual-benefit-alliance between the Penguins and the Tussock. The millions of Penguins sheltering and nesting amongst the grass, saturate the soil on which it grows with the strongest manure, and the grass thus stimulated grows high and thick, and shelters the birds from wind and rain, and enemies, such as the predatory Gulls. On the beach were to be seen various groups of Penguins, coming from or going to the sea. There is only one species of Penguin in the Tristan group (*Eudyptes chrysocome*). The birds stand about a foot and a half high, and are covered, as are all Penguins, with a thick coating of closely set feathers. They are slaty grey on the back and head, snow white on the whole front, and from each side of the head a tuft of sulphur yellow plumes projects backwards. The tufts lie close to the head when the bird is swimming or diving, but they are erected when it is on shore, and then almost seem, by their varied posture, to be used in the expression of emotions, such as inquisitiveness and anger. The bill of the Penguin is bright red, and very strong and sharp at the point, as the legs of the various exploring parties testified before the day was over; the iris is also red, and remarkably sensitive to light. When one of the birds was standing in the zoological laboratory on board the ship, with one side of its head turned towards the port, and the other away from the



HORSBURGH, EDINBURGH. PERMANENT PHOTOTYPE.

HOUSE-BUILDING, TRISTAN-DA-CUNHA.

light, the pupil on the one side was contracted almost to a speck, whilst that on the other was widely dilated. The birds are subject to great variations in the amount of light they use for vision, since they feed at sea by night as well as by day. It seems remarkable that there should be only one species of Penguin at the Tristan da Cunha group, since in most localities several species occur together. It would seem probable that a species of Jackass Penguin (*Spheniscus*) should occur on the islands, since one species (*Spheniscus magellanicus*) occurs at the Falkland Islands and Fuegia, and another (*Spheniscus demersus*) at the Cape of Good Hope, intermediate between which two points Tristan da Cunha lies. The connection between these two widely-separated *Sphenisci* is wanting; perhaps it once existed at the Tristan group, but has perished. Most of the droves of Penguins made for one landing place, where the beach surface was covered with a coating of dirt from their feet, forming a broad track, leading to a lane in the tall grass about a yard wide at the bottom, and quite bare, with a smoothly beaten black roadway; this was the entrance to the main street of this part of the "rookery," for so these Penguin establishments are called. Other smaller roads led at intervals into the rookery from the nests near its border, but the main street was used by the majority of the birds. The birds took little notice of their visitors, allowing them to stand close by, and even to form them into a group for the photographer. A very successful photograph of a group of the birds standing near one of the entrances into the forest of Tussock forming the rookery is reproduced in Pl. VII. This kind of Penguin is called by the whalers and sealers "rockhopper," from its curious mode of progression. The birds hop from rock to rock with both feet placed together, like men jumping in sacks, but they scarcely ever miss their footing. When chased, they blundered and fell amongst the stones, struggling their best to make off.

Immediately on entering the main street of the rookery the explorer is as if in a maze, and cannot see in the least where he is going. Various lateral streets lead off on each side from the main road, and are often at their mouths as big as it; moreover, the road sometimes divides for a little and joins again, hence it is the easiest thing in the world to loose the way, and this is quite certain to occur to persons inexperienced in Penguin rookeries. The Germans who acted as guides, accustomed to pass through the place constantly for two years, were perfectly at home in the rookery, and knew every street and turning. It is impossible to conceive the discomfort of traversing a big rookery, hap-hazard, or "across country" as one may say. A plunge is made into one of the lanes in the tall grass, which at once shuts out the surroundings from view. You tread on a slimy black damp soil composed of the birds' dung. The stench is overpowering, the yelling of the birds most annoying and discordant. You lose the path, or perhaps are bent from the first in making direct for some spot on the other side of the rookery. In the path only a few droves of Penguins, on their way to and from the water, are encountered, and these stampede out of your way

into the side valleys. The instant you leave the road you are on the actual breeding ground. The nests are placed so thickly that you cannot help treading on eggs and young birds at almost every step. A parent bird sits on each nest with its sharp beak erect and open, ready to bite, yelling savagely "caa, caa, urr, urr," its red eyes gleaming and its plumes at half-cock, quivering with rage. No sooner are your legs within reach than they are furiously bitten, often by two or three birds at once: that is if you have not got on strong leather gaiters, as on the first occasion of visiting a rookery you probably have not. At first you try to avoid the nests, but soon find that impossible; then maddened almost, by the pain, stench, and noise, you have recourse to brute force. Thump, thump, goes your stick, and at each blow down goes a bird. Thud, thud, is heard from the men behind as they kick the birds right and left off the nests, and so you go on for a bit,

FIG. 101.—Penguins at home.

thump, smash, whack, and thud, "caa, caa, urr, urr," and the path behind you is strewed with the dead and dying and bleeding. But you make miserably slow progress, and worried to death, at last resort to the expedient of stampeding as far as your breath will carry you. You put down your head and make a rush through the grass, treading on old and young hap-hazard, and rushing on before they have time to bite. The air is close in the rookery and the sun hot above, and out of breath, and perspiring with running you come across a mass of rock fallen from the cliff above, and sticking up in the ground; this you hail as "a city of refuge." You hammer off it hurriedly half a dozen Penguins who are sunning themselves there, and are on the look-out, then mounting on the top take out your handkerchief to wipe away the perspiration and rest a while, to see in what direction you have been going, how far you have got, and in what direction you are to make the next plunge. Then when you are refreshed, you make another rush, and so on. If you stand quite still, so long as your foot is not actually on the top of a nest of eggs or young, the Penguins soon cease biting at you and

yelling. One must cross the rookeries in order to explore the island at all, and collect the plants, or survey the coast from the heights. These Penguins make a nest which is simply a shallow depression in the black dirt, scantily lined with a few bits of grass or not lined at all. They lay two greenish white eggs about as big as duck eggs, and both male and female incubate.

After passing through the rookery, one of the small coppices already described was entered. Hopping and fluttering about amongst the trees and herbage were numbers of a small Finch and a Thrush, but no other land birds were seen. The Finch (*Nesospiza acunhæ*), a genus peculiar to the Tristan da Cunha group, looks very like a Green Finch, and is about the same size. The Thrush (*Nesocichla eremita*), a genus also peculiar to

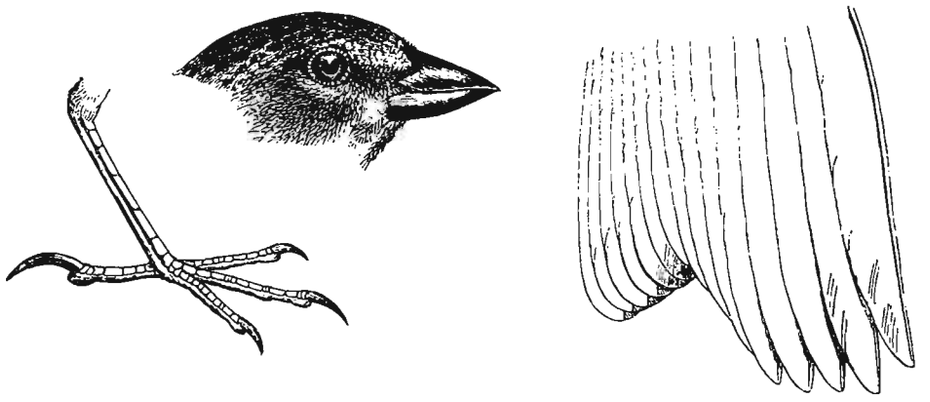


FIG. 102.—Head, foot, and wing of *Nesospiza acunhæ*, Cabanis.

this group, looks like a very dark-coloured Song Thrush, but it is peculiar for its remarkably strong and acutely ridged bill. The bird feeds especially on the

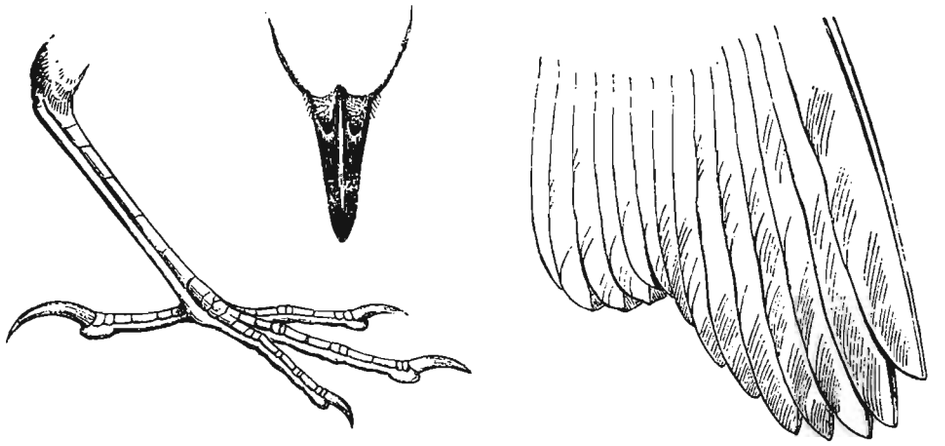


FIG. 103.—Head, foot, and wing of *Nesocichla eremita*, Gould.

berries of *Nertera*, but is also fond of picking the bones of the victims of the predatory Gull (*Stercorarius antarcticus*). The Finch eats the fruit of the *Phylica*, and seems to have become extinct in Tristan Island itself. Dr. v. Willemoes Suhm was told that the

Tristan people had tried to introduce the bird into their island without success. The only other land bird of the group, a kind of Water Hen (*Gallinula nesiotis*), which is found also on the higher plateau at Tristan Island, and is described by the inhabitants as scarcely able to fly, was not met with. Only very few inhabit the low land under the cliffs at Inaccessible Island, and the exploring parties were unable to land at the only place from which the higher main plateau of the island is to be reached. The Germans said that the Inaccessible Island bird is much smaller than *Gallinula nesiotis*, and differs from it in having finer legs and a longer beak. This is, however, hardly probable, since the Tristan species occurs at Gough Island.

Sitting on the tree tops with the Thrushes were numerous Noddies, of the same two species as those of St. Paul's Rocks. It was strange to see birds which one had met with on the equator living in common with Boobies, here mingling with antarctic forms. The Noddy, however, ranges far north also, occasionally even to Ireland. The whole of the peaty ground underneath the trees in the *Phylica* woods is bored in all directions with the holes of smaller sea birds, called by the Germans "night birds," a *Prion* and a *Puffinus*. These burrows are about the size of large rats' holes, and they traverse the ground everywhere, twisting and turning, and undermining the surface so that it gives way at almost every step.

The rocks of Inaccessible Island are felspathic basalt (some specimens of this basalt have porphyritic augite), dolerite, augite-andesite, sideromelan, and palagonite.

Nightingale Island, the smallest and southernmost island of the group, consists of one large and two small islets, with several rocks immediately adjacent to the coast, and, unlike Tristan and Inaccessible Islands, rises in low cliffs, from the top of which the land slopes upwards, terminating in two peaks, one of which (1100 feet high) is rugged and steep, whilst the other (960 feet high) slopes gently towards the coast all round, except immediately to the southward, where its descent is precipitous. Nightingale Island is one mile long east and west, and three quarters of a mile wide; the other two islets lie to the northward of Nightingale, and are each a third of a mile in length and a sixth in breadth; they were named by the Challenger, "Stoltenkoff" and "Middle" Islands; Stoltenkoff, the farthest from Nightingale, being 325 feet high, with a flat top, and Middle Island 150 feet high, with an undulating top.

Nightingale Island was first landed on by M. d'Etchevery in 1767, who anchored his vessel "l'Etoile du Matin" off it in 33 fathoms, with the centre of the island W.S.W. He described Stoltenkoff Island as having the appearance of a ruined fort, a description which holds good to the present day. Nightingale Island has, so far as is known, never been inhabited, although it has been visited frequently for the purpose of shooting Seals, numbers of which used to frequent the caves hollowed out in its low cliffs; but the reckless manner in which the Seals were slaughtered caused them to desert this breeding place,

so that visits to Nightingale Island have of late years much diminished in frequency. The same small tree and Tussock Grass found on Tristan and Inaccessible Islands grow here, and the island is also frequented by the same birds. Water was not so plentiful as on the other two islands, and goats have not been landed, a subject of much regret, as they would certainly flourish. The island was surveyed in a somewhat similar manner to Inaccessible. An officer was stationed on the summit of Middle Island, who took the bearing of the ship and her masthead angle, at given signals, viz., when the ship was stationary, sounding and obtaining observations. The day being fortunately less cloudy than usual, sights for longitude, latitude, and true bearings were obtained, and angles to the summits of the various salient points on Inaccessible and Tristan Islands, by which the correct relative positions of the three islands of the group with regard to each other were ascertained. The observation spot, the summit of Middle Island, was found to be in lat. 37° 25′ 50″ S., long. 12° 29′ 45″ W.

Between Inaccessible and Nightingale Islands there is a perfectly safe passage, 10 miles in width, in which a sounding of 465 fathoms was obtained by the Challenger; and between Nightingale and Tristan Islands there are depths of 1000 fathoms and upwards.

Landing at Nightingale can easily be effected in moderate weather on the rocks at its northeast point; here, as in all the other islands of the group, a belt of kelp prevents the swell from breaking, and the boat rises and falls alongside the cliffs without danger, if care be taken to cast a line over some projecting knobs to prevent the surging backwards and forwards, which is certain to be experienced in all cases where the sea runs along the side of a cliff. There are no beaches on Nightingale Island.

The whole of the lower land of the island, and all but the steepest slopes of the high land and its actual summits, are covered with a dense growth of Tussock, which occupies also even the ledges and short slopes between the bare perpendicular rocks of the Peak. The lower ridge is covered with the grass on all except its very summit, where, amongst huge irregularly piled boulders of basalt, grow the same ferns as are found on Inaccessible Island, and *Phylica nitida* trees. The summit of the higher ridge appears to have a similar vegetation, the Tussock ceasing there. In the sea of tall grass, clothing the wide main valley of the island on its south side, are patches of *Phylica* trees, growing in many places thickly together as at Inaccessible Island, with a similar vegetation devoid of Tussock beneath them. The appearance of the tall grass, when seen from a distance, is most deceptive; as the island was viewed from the deck of the ship about a quarter of a mile off, a green coating of grass was seen, coming everywhere down to the verge of the wave-wash on the rocks, and stretching up comparatively easy looking slopes towards the peaks. The grass gave no impression of its height and impenetrability. On closer inspection, however, the real state of the case might be inferred, for there was plainly visible a dark sinuous line leading from the sea right inland through the thickest of the

Tussock. This was a great Penguin road, for the whole place was one vast Penguin rookery, and the grass that looked like turf was higher than a man.

The rocks of Nightingale Island are augite-andesite passing to amphibolic andesite and tufa of the same rocks. The caves in the low cliffs are so numerous as to form a striking feature in the appearance of the island as it is approached, and indicate an elevation of the island; they are not apparent, however, at Inaccessible or Tristan Islands. The caves, with the sloping ledges leading up to them, are frequented, as was said, by Fur Seals. Four years before the visit of the Expedition, 1400 seals had been killed on the island by one ship's crew. Seals were very much scarcer in 1873, but the

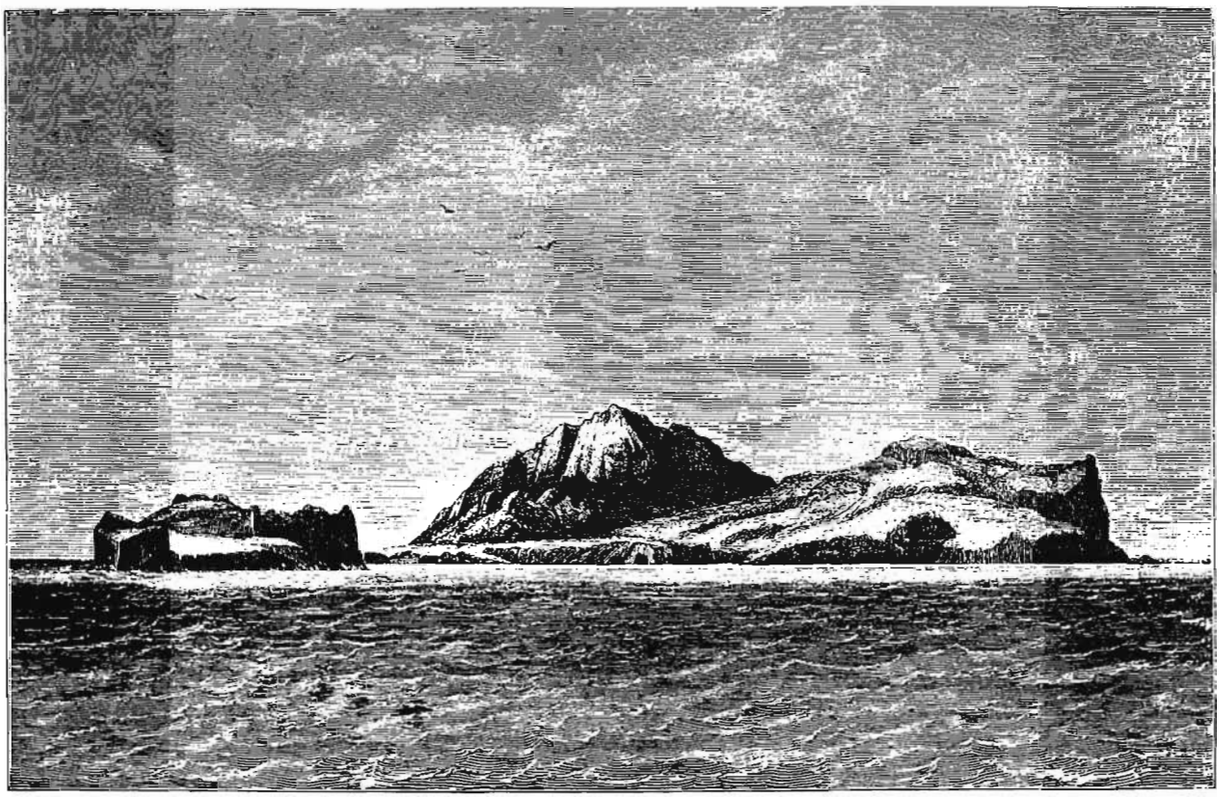


FIG. 104.—Nightingale Island from the North.

island was visited regularly once a year by the Tristan people, as was also Inaccessible Island. The Germans only killed seven Seals at Inaccessible Island during their stay, but the Tristan people killed forty there in December 1872.

At the entrance to the rookery the hard rock was actually polished, and had its irregularities smoothed off where the feet of the birds had worn it down at the commencement of the street. No doubt the Diatom skeletons present in the food and dung of the Penguins, and always abundant in the mud of their rookeries, adhering to their dirty feet, act as polishing powder and assist the wearing process. The street did

not open by a single definite mouth towards the sea, but split up into numerous channels leading down to a number of easy tracks through the rocks. A little way in there was a clear open track 6 feet wide, and in places as much as 8 or 10 feet in width. On each side narrow alleys led nearly at right angles to the rows of nests with which the whole space on either side of the main street was taken up.

Amongst the Penguins here were numerous nests of the Yellow-billed Albatross, *Diomedea chlororhyncha*, Gmelin,[1] called by the Tristan people "Mollymauk," variously spelt in books, Molly Hawk, Mollymoy, Mollymoc, Mallymoke. It is, as

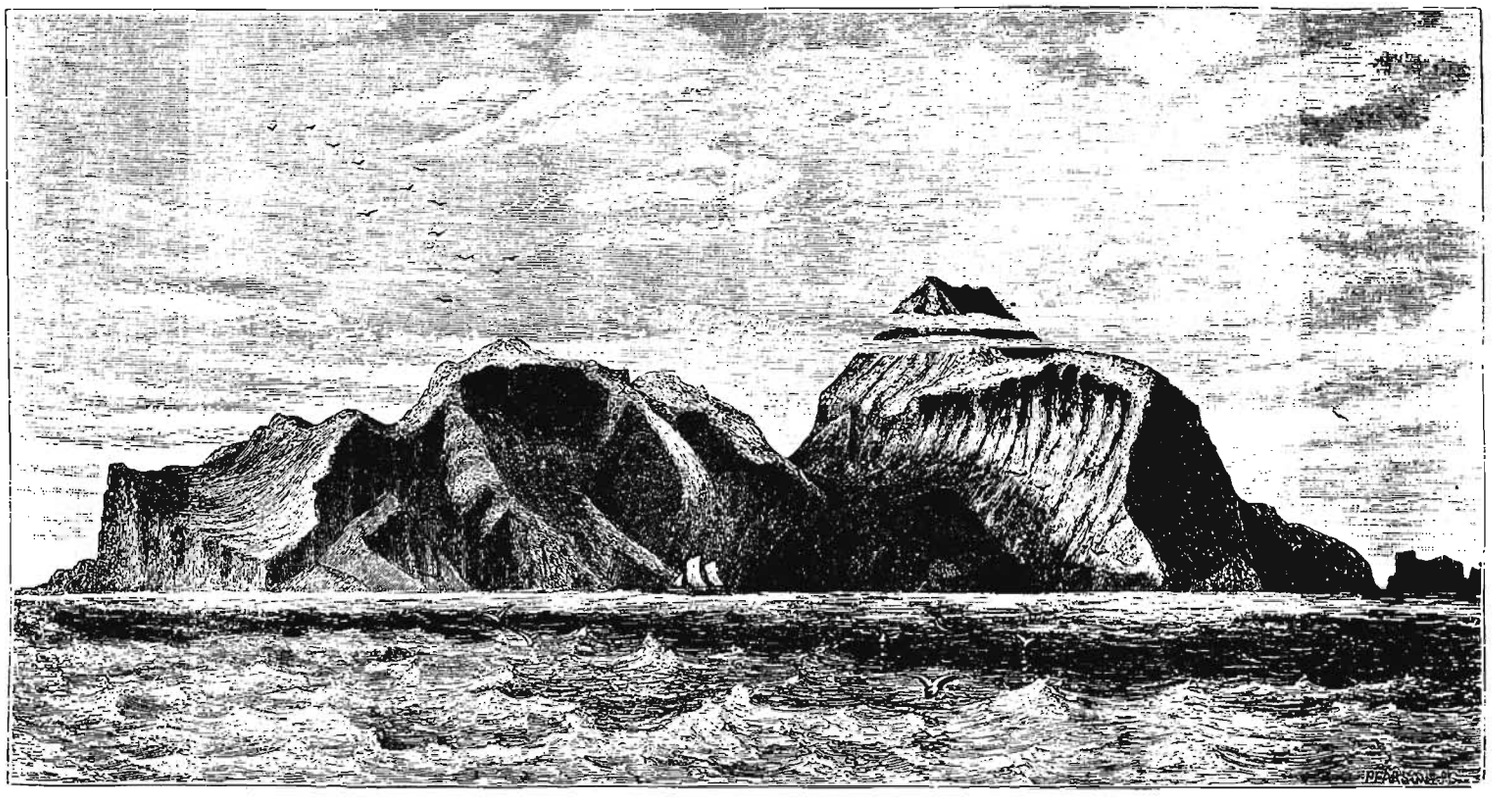


FIG. 105.—Nightingale Island from the South.

are most of the sealers' names in the south, a name originally given to one of the Arctic birds, in this case to the Fulmar, and then transferred to the Antarctic forms from some supposed or real resemblance. The Mollymauk is an albatross about the size of a goose, head, throat, and under part pure white, the wings grey, and the bill black with a yellow streak on the top and with a bright yellow edge to the gape, which extends right back under the eye, and shows out conspicuously on the side of the head (it is not thus shown in Gould's coloured figures). The birds are extremely handsome. They take up their abode in separate pairs anywhere in the rookery, or under the trees where there are no

[1] This is called *Thalassiarche culminata* in Mr. W. A. Forbes' Report on the Tubinares, Zool. Chall. Exp., part. xi., 1882.

Penguins, which latter situation they seem to prefer. They make a neat and round cylindrical nest, which stands up from the ground, of tufts of grass, clay, and sedge. There is a shallow concavity on the top for the bird to sit on, and the edge overhangs somewhat, the old bird undermining it, as the Germans said, during incubation, by pecking away the turf of which it is made. One nest measured was 14 inches in diameter and 10 inches in height. The nests when deserted and grass-grown make most convenient seats. The birds lay a single egg about the size of a goose's, or somewhat larger, but elongate, with one end larger than the other, as are all Albatross' eggs. The birds when approached sit quietly on their nests or stand by them, and never attempt to fly; indeed they seem, when thus bent on nesting, to have almost forgotten the use of their wings. Captain Carmichael, in his account of Tristan da Cunha, relates how he threw one of the birds over a cliff and saw it fall like a stone without attempting to flap; and yet these birds will soar after a ship over the sea as cleverly as any other Albatross; indeed, the same peculiarity occurs in the case of the large Albatross when nesting. When bullied with a stick or handled on the nests, the birds snap their bills rapidly together with a defiant air, but they may be pushed or poked off with great ease. Usually a pair is to be seen at each nest, and then, by standing near a short time, one may see a curious courtship going on. The male stretches out his neck, erects his wings and feathers a little, and utters a series of high-pitched rapidly repeated sounds, not unlike a shrill laugh; as he does this he puts his head close up against that of the female. Then the female stretches her neck straight up, and turning up her beak utters a similar sound, and rubs bills with the male again. The same manœuvre is constantly repeated. The Albatrosses sometimes make their nests in the very middle of a Penguin road, but the two kinds of birds live perfectly happily together. No fighting was observed, though, small as the Penguins are, they could evidently drive out the Mollymauks if they wished. The ground of the rookery is bored in all directions by the holes of Prions and Petrels, which thus live under the Penguins. Their holes were not so numerous in the rookery at Inaccessible Island as here. The holes add immensely to the difficulties of traversing a rookery, since as one is making a rush, the ground is apt to give way, and give one a fall into the black filthy mud amongst a host of furious birds.

Besides the Mollymauks and Petrels, one or two pairs of Skuas (*Stercorarius antarcticus*) had nests on a few mounds of earth in the rookery. How these mounds came there it is difficult to explain.

The rookery had evidently once been larger than at the time of the visit, since a good part of the tall grass then not occupied by birds, had old deserted nests amongst it; probably the number of birds varies considerably each season. It is a remarkable fact that the Penguins are migratory. They leave Inaccessible Island, the Germans said, in the middle of April, after moulting, and return, the males in the last week of July, the females about August 12th; and it is improbable that the Germans could have

been mistaken. Whither can they go, and by what means can they find their way back? The question with regard to birds that fly is difficult enough, but it may always be supposed that they steer their course by landmarks seen at great distances from great heights, or that they follow definite lines of land. In the present case the birds can have absolutely no landmarks, since from sea level Tristan da Cunha is not visible from any great distance; the birds cannot move through the water with anything approaching the velocity of birds of flight; they have, however, the advantage of a constant presence of food. The question of the aquatic migration of Penguins and Seals seems a special one, and presents difficulties quite different from that of the migration of birds of flight. The Penguins certainly do not go to the Cape of Good Hope nor to St. Helena.

Although there is little fresh water on Nightingale Island, one pond was observed in the rookery, but the water was undrinkable. In a cave near the landing-place also, there was a scanty trickling spring of excellent water filling a small basin; water enough to keep three or four persons alive might be got here. On a small open patch in the centre of the rookery, free from Tussock, was found a bed of a yellow-flowered Composite plant, which has since been determined as a new species of *Cotula* (*Cotula moseleyi*), as far as yet known peculiar to Nightingale Island. A representative of the genus (*Cotula* [*Leptinella*] *plumosa*) is, however, abundant in Kerguelen Island and in the Antarctic region generally.

With the exception of the Journal and Meteorological Register of Lieutenant Rich, for the four months he was Commandant of the garrison in 1816, no regular record of the weather has been kept at the Tristan group of islands. This is much to be regretted, for, lying as these islands do far south in the Atlantic, in the immediate track of vessels bound to Australia and the Cape of Good Hope, and midway between that Cape and Cape Horn, a register of the weather here would be of the utmost importance, and the Rev. W. F. Taylor would have conferred a great boon on seamen had he devoted a small portion of his time, during his five years' residence at Tristan, to keeping a daily record of meteorological phenomena.

From the description of some of the more intelligent of the inhabitants of Tristan Island, and from the remarks of vessels visiting the group and cruising in its vicinity, more especially from the notes of some of the captains of H.M. ships in the early part of this century, a fair idea can be given of the average state of the weather throughout the year.

The prevailing winds are westerly, strong breezes being the rule, and light winds or calms the exceptions. In the winter months the wind is usually northward of west, and in the summer months southward. August, September, and October are the worst months of the year, and it is then no unusual thing for gales to continue for a fortnight at a stretch. December to March is the fine season; and in January and February rollers are frequent, so that landing is sometimes impossible. Easterly gales are rare, but are

occasionally experienced at all seasons. North and northwest gales are not felt much at the settlement, as the wind is then blowing directly against the face of the cliffs at the back, but with these winds there is a heavy surf in Falmouth Bay; the southwest wind sweeping fairly across the level strip is most destructive, and has been known to unroof the houses, solidly built as they are. The climate is mild, the temperature averaging 68° in summer, and 55° in winter, occasionally falling to 40°. Rain is frequent; in fact, situated as these islands are, and rising as they do to a height of over 7000 feet, it would be extraordinary if rain were not frequent, as clouds almost continuously cover the higher parts of the land. Hail and snow fall occasionally, but rarely, and the sky is usually cloudy, but the air is not excessively humid. Little is known about the movements of the barometer in the locality; the islanders possess an instrument, but do not record its readings. Captain Wauchope states that during his stay in H.M.S "Eurydice" in the vicinity of the group, the pressure varied from 29·75 to 30·35 in the months of October and November 1817; but he could form no opinion as to the future condition of the weather from the height of the barometric column. During the four days' visit of the Challenger in 1873, the pressure was unusually great, the mercurial column varying from 30·605 to 30·233 inches, and the weather, though cloudy, was on the whole fine, the wind being light. That the climate is very healthy is beyond a doubt, for the inhabitants do not appear to suffer much from sickness; Lieutenant Rich says that they all suffered from inordinate appetites.

The time of high water, at full and change, is given by Lieutenant Rich as at 2 hours with a rise and fall of 8 feet. Captain Nolloth, in his visit in 1856, made it, high water, full and change, at 12 hours, rise and fall 4 feet, and the islanders state that it never exceeds that amount. No register has, however, been kept; and it would be exceedingly difficult to erect a tide pole in a sufficiently sheltered position, although, could it be done, a record here would be of decided scientific value.

There appear to be some discrepancies in the various accounts given as to the tidal stream or current. Some of the old navigators say that they observed a regular east and west going stream when at anchor in Falmouth Bay. Others say the current always sets to the northeast; whilst the islanders assert that inshore the stream changes, but that outside the current is always northeasterly. Against this assertion, however, must be placed the fact, that Captain John Patten found a great deal of driftwood on the east coast of the island and none on the west side in 1790. Captain Nolloth was, however, told that a sofa was made on the island from a log of wood (mahogany) that grounded on the west coast of Tristan Island, and says, that at the time of his visit, there was a tree thickly covered with barnacles on "the sea side." This latter observation is, however, rather obscure, as it is difficult to tell which is not a sea side at Tristan. The current experienced by the Challenger whilst in the vicinity had certainly a northeasterly tendency, but it is of greater force westward than eastward of the group.

A collection of the terrestrial Invertebrata of this group was made, which has not yet been entirely worked out, but up to the present time it has yielded the following:—Mollusca,[1] *Balea* (*Tristania*) *ventricosa*, Gray, and *Balea* (*Tristania*) *tristensis*, Gray, previously known to inhabit these islands, and in addition *Limax canariensis*, d'Orb., *Limax gagates*, Drap., *Helix* (*Hyalinia*) *exulata*, Smith.

Coleoptera,[2] *Lancetes varius*, Fabr., *Cercyon littorale*, Gyll., *Quedius fulgidus*, Fabr., *Palæchthus glabratus*, Waterhouse, *Palæchthus cossonoides*, Waterhouse, and *Pentarthrum carmichaeli*, Waterhouse. Rev. O. P. Cambridge has recognised the following spiders from the collection:—*Tegenaria derhamii*, Scop., *Steatoda versuta*, Bl., *Linyphia leprosa*, Ohl. (European species, the two last British), from Tristan Island, and *Theridion* sp.? (allied to *Theridion formosum*, Clk., a widely-spread European species), *Steatoda versuta*, Bl., *Neriene* sp.? (probably new, but scarcely in good enough condition for description), from Inaccessible Island. In addition to these Dr. v. W. Suhm notes in his diary:—"*Julus* and *Scolopendra* common everywhere; two specimens of a bug underneath the bark of trees in Inaccessible Island, and a small whitish Cicad, Nightingale Island. A Noctuid from Nightingale Island, also seen on Inaccessible Island; caterpillars, probably of a *Vanessa* (?), Microlepidoptera. *Musca* sp.; a *Culex*-like animal was seen but not obtained; *Pulex* parasitic in the nests of Penguins and Albatrosses on Nightingale Island. A Thysanurid was found on a dead Puffin. No Orthoptera nor Hymenoptera were found. *Oniscus*, *Gammarus* everywhere under stones, as also *Lumbricus*."

Many hauls of the dredge and trawl were taken around and between the islands of the Tristan da Cunha group in depths from 60 to 1100 fathoms. There was generally a coarse shelly bottom, composed of fragments of Polyzoa, Lamellibranch and Gasteropod shells, Brachiopods, Echinoderms, Pteropods, *Serpulæ*, and a few pelagic and other Foraminifera. The mineral fragments were exclusively of volcanic origin. A large number of animals of all groups came up in the trawl and dredge: Primnoas, Gorgonias, Caryophyllias, Hydroids, Sponges, Starfish, and Molluscs; altogether a mass of material much like what is found in shallower water off the coast of Great Britain.

The Cephalopoda.—On the return of the Expedition to England the collection of Cephalopoda was sent to Professor Huxley, who hoped to be able to prepare a Report on the whole of this group. In 1882, owing to the many demands on his time, Professor Huxley decided to limit his Report to the genus *Spirula*, and the remainder of the collection was handed over to Mr. W. E. Hoyle for examination, who writes as follows:—

"Regarded as a whole, the collection of Cephalopoda is quite as remarkable for its deficiencies as for the types represented in it. It might have been expected

[1] Smith, E. A., *Proc. Zool. Soc. Lond.*, pp. 278, 279, 1884.

[2] Waterhouse, C. O., *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xiii. pp. 276–279, 1884.

that on a voyage, during which careful and systematic use was made of the surface-net. pelagic forms would have been captured in large numbers. Such, however, was not the case; the genus *Tremoctopus*, for instance, was preserved on only four occasions, *Ommastrephes* on five, *Onychia* on six, and *Cranchia* on three or four.[1] Mr. Murray informs me that this is to be accounted for by the astonishing activity of these animals, which is so great that they were only captured when the vessel was sailing rapidly, a condition in general unfavourable to the use of the tow-net.

"Professor Steenstrup has divided both the Octopod and Decapod Cephalopoda into two groups, *littorales* and *pelagici*, and as in so many other divisions of the animal kingdom, while pelagic forms belong to but few species, each of which has a wide range of distribution, littoral genera are represented by very many species, each confined within a narrow area.

"The latter portion of this statement was well illustrated by the genus *Octopus;* of which almost every resting-place of the Expedition seems to have furnished a distinct type: about twelve of which belong to species hitherto undescribed. The littoral habits of this type are most clearly demonstrated, for out of twenty-eight species collected, sixteen came, not from dredging stations, but from the shore collections; and of those obtained by the dredge or trawl, only two were found in depths exceeding 500 fathoms, and there is, of course, no conclusive proof that these were actually brought up from the depth reached by the dredge.

"Indeed the difficulty of deciding whether the dredge really captured at the bottom the animals eventually found in it, or whether they became entangled in it during its upward or downward progress, was felt to be extremely great in the case of the Cephalopoda, for only in one or two instances were such structural peculiarities found as appeared to demonstrate that the animals were really abyssal in their mode of life.

"Many very interesting species of *Sepia* were captured; some of which have been hitherto known only by their shells. All the specimens of this genus brought home by the Challenger Expedition (including some ten new species) were obtained between Stations 163 and 232, that is to say, during the cruise from the eastern coast of Australia through the Malay Archipelago to Japan; a strong confirmation of the fact that the Indo-Pacific region is beyond all question the metropolis of this genus, for out of some thirty species previously known, no less than twelve are from this portion of the globe, although it has been much less explored than many others.

"Among pelagic Cephalopods very noteworthy additions have been made to the genus *Cirroteuthis*, which has hitherto been represented only by comparatively few specimens from the coast of Greenland, the largest being one in the Copenhagen Museum, which does not exceed 18 inches in extreme length. During the cruise in the Southern

[1] *Cranchia* was very frequently obtained in the surface-nets, but, like many other common surface forms, was not always preserved.—J. M.

Ocean, however, a very fine new species (*Cirroteuthis magna*), measuring between 2 and 3 feet, was dredged from a depth of 1375 fathoms at Station 146. Unfortunately it was not so well preserved as to be fit for minute anatomical examination, but the form of the dorsal cartilage, which is elongated transversely instead of longitudinally, is quite sufficient to establish its specific distinctness from the typical *Cirroteuthis müller*i.

"Two other specimens, each representing a distinct species (*Cirroteuthis pacifica* and *Cirroteuthis meangensis*), together with a fragmentary and a young animal, were found at different points in the Pacific Ocean.

"One of the most remarkable forms in the collection is apparently somewhat allied to this genus; it is a small creature obtained on the surface in the neighbourhood of the Kermadec Islands, which has been named *Amphitretus pelagicus* (see fig. 106). It differs, however, from all Cephalopods hitherto known in that the mantle is firmly united to the

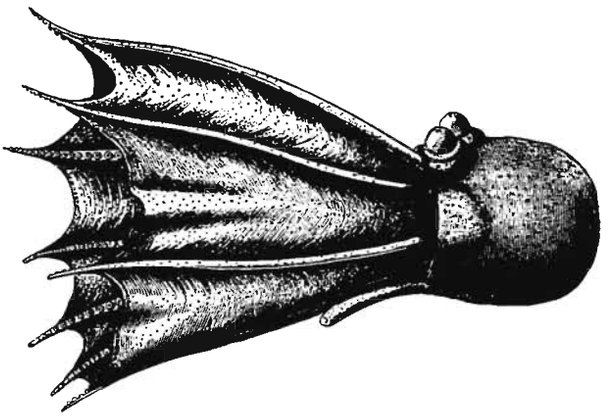


FIG. 106.—*Amphitretus pelagicus*, n. gen. et sp.; somewhat enlarged.

siphon, leaving two openings into the branchial cavity, one on either side, immediately below the eyes, which are closely approximated on the dorsal surface. The arrangement of the suckers in a single row, and the webbing of the arms, almost as far as their extremities, are points of resemblance to *Cirroteuthis*, but the cirri characteristic of this latter genus are wanting.

"In the South Atlantic (Station 126) there was found in the dredge a curious gelatinous specimen, of pale yellowish-grey colour, with red chromatophores. The body is prismatic, the dorsal surface being flat and the ventral rising into a median rounded ridge. The eyes are prominent, and situated about midway between the extremities of the arms and the posterior end of the body (see fig. 107). It seems desirable to make this the type of a new genus, and the name *Japetella prismatica* is given to it. Resembling this last in the consistency of the body and some other characters, and possibly congeneric with it, is another form represented by a single specimen from the surface of the Pacific,

north of Papua (*Japetella diaphana*). The genus *Bolitæna*, Stp., is perhaps the nearest ally of these two forms, but its differences from them are many and important.

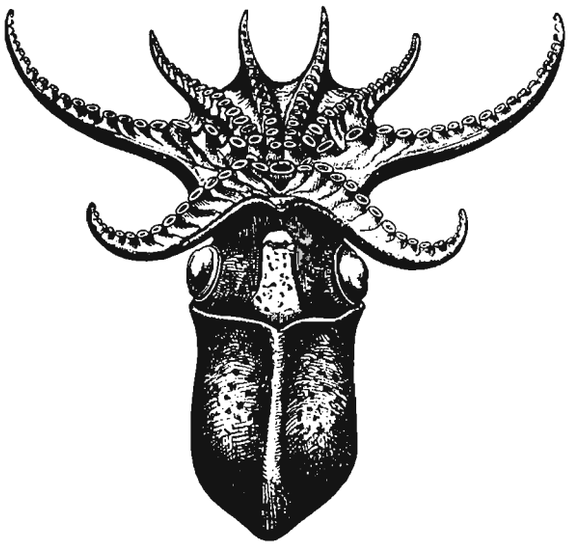


FIG. 107.—*Japetella prismatica*, n. gen. et sp.; natural size.

"The genus *Eledone* furnished two new species, both characterised by a short stumpy contour and by arms webbed half-way to the extremities; one was obtained near the Antarctic Circle, depth 1950 fathoms, the other in the South Atlantic (Station 320) from a depth of 600 fathoms; while some portions of a large Octopod, which were picked up on the surface of the North Atlantic, beyond all reasonable doubt once formed part of an individual of the curious *Alloposus mollis*, Verrill.

"The Decapoda yielded, on the whole, fewer striking novelties than the Octopoda. One of the most curious is a small creature from the Southern Ocean, which has been called *Bathyteuthis abyssicola* (see fig. 108); it measures about 5 cm. in length excluding the tentacles; the body is subcylindrical, tapering to a blunt point behind, where are situated two small rounded fins. The head is broad, with prominent eyes, and there is a very large oral membrane provided with suckers. The arms are very short, the longest not quite reaching 1 cm., and the suckers are minute and arranged biserially; the tentacles about equal the body in length, and have no clubs, but gradually taper to a point armed with numerous very small suckers like those of many *Sepiæ*. The funnel is provided with a valve, and the pen resembles that of *Ommastrephes*.

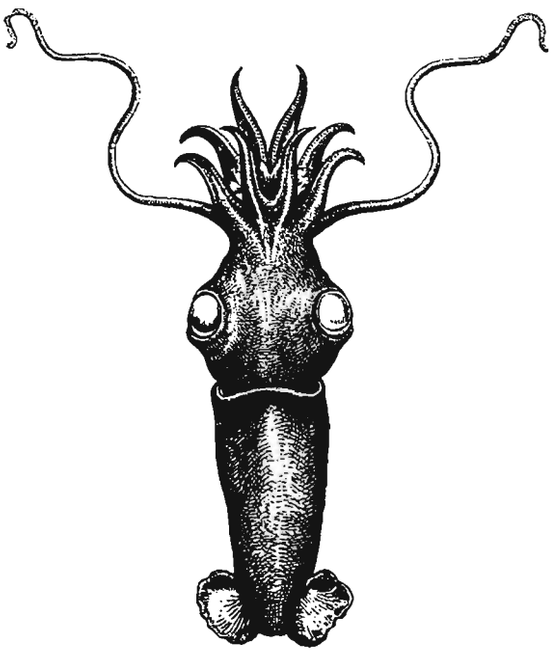


FIG. 108.—*Bathyteuthis abyssicola*, n. gen. et sp.; natural size.

"The structure of this form seems to adapt it for life at great depths, and to justify the belief that it really came from the depth reached by the dredge (1600 fathoms); the small fins are in marked contrast to those of pelagic species, while the small suckers and delicate tentacles are equally little

fitted for raptorial purposes; but, on the other hand, the large circumoral lip would seem well suited for collecting nutritive matters from an oozy bottom.

"A new genus has also been erected for the reception of another interesting Decapod, *Promachoteuthis megaptera*, which has a rounded body not much longer than the head; two large fins are attached to the body for fully half its length, and united with each other to some extent behind it, their combined breadth exceeding the length of the body. The head is small, as are also the eyes, which are scarcely at all prominent. The longest (lateral) arms are slightly longer than the body, and bear two rows of globular suckers, with lateral apertures, recalling those of *Sepiola* and *Rossia*. The tentacles have unfortunately lost their extremities; but they are very stout, and about half as long again as the arms (see fig. 109). The single specimen comes from Station 237 (North Pacific), perhaps from 1875 fathoms, but more probably from the surface.

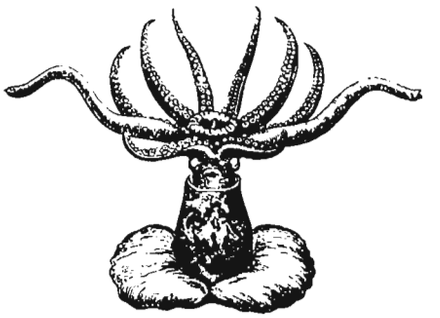


FIG. 109.—*Promachoteuthis megaptera*, n. gen. et sp.; natural size.

"A rare, if not new, form was dredged on the *Hyalonema*-ground south of Japan, in 345 fathoms (Station 232); it is generically, if not specifically, identical with *Calliteuthis reversa*, Verrill, hitherto known only from the eastern coast of North America, of which *Loligopsis ocellata*, Owen, is possibly only a synonym.

"A type somewhat allied to this, and apparently intermediate between it and the genus *Histioteuthis*, was obtained in the South Atlantic (Station 333); the web is very small in comparison with that of this genus, not extending quite half way to the tips of the arms. In the present state of our knowledge it seems impossible to refer this form to any type hitherto described, and the name *Histiopsis atlantica* is therefore given to it, although it is possible that other Cephalopods will be discovered which will bring it into closer relation with known forms.

"Among the Challenger collection is also one mutilated individual of *Taonius hyperboreus*, Stp., a genus hitherto known only from examples in the Copenhagen Museum;[1] there are also two medium sized specimens and a small one which appear to be referable to the same genus. It is remarkable that many of the most interesting specimens are mere fragments; among others may be mentioned part of a tentacle of *Mastigoteuthis agassizii*, Verrill, which was found adhering to the dredge rope, and numerous pieces of a long gelatinous pen, taken from the stomach of a shark; these latter seem to resemble nothing hitherto known so nearly as the pen of *Chiroteuthis lacertosa*, Verrill,[2] though if this determination be correct that species must sometimes attain a length of several feet.

[1] The specimen which Verrill figures (*Trans. Connect. Acad.*, vol. v. p. 302, pl. xxvii. figs. 1, 2, 1882) is certainly not *Taonius hyperboreus*, Stp.; I hope elsewhere to adduce arguments for believing it to be *Taonius pavo* (Les.).

[2] *Ibid.*, p. 408, pl. lvi. figs. 1 *a*, *a'*, *a''*, 1881.

"Specimens of *Nautilus pompilius* and *Spirula australis* were obtained, and will be alluded to in connection with their respective captures.

"Such is a very brief notice of the more interesting and remarkable Cephalopoda obtained during the cruise; those who require more detailed information are referred to the forthcoming memoir upon the group in the series of zoological reports. The collection is not lacking in novelties, though it has by no means fulfilled the expectations of those who hoped that forms hitherto known only as fossils would be brought home among the spoils. One of the naturalists tells us that 'even to the last every Cuttle-fish which came up in our deep-sea net was squeezed to see if it had a Belemnite's bone in its back;'[1] but no such precious discovery was made, and our knowledge of the anatomy of these interesting animals must still be gleaned piecemeal from exceptionally well-preserved fossil specimens."

Tristan da Cunha Group to the Cape of Good Hope.

On the 18th October, at 6 P.M., the Challenger left the Tristan da Cunha group for the Cape of Good Hope.

On the 28th October, at daylight, the land in the vicinity of False Bay was observed, and having obtained a sounding and some temperature observations, the ship proceeded to Simon's Bay, arriving and mooring there at 3.20 P.M.

During the passage the wind was variable from north round west to south and southeast, occasionally shifting suddenly, and its strength was as unsteady as its direction, but on no occasion did it exceed a moderate gale in force. The weather was cloudy and squally, with passing showers. On the 23rd, at 5 P.M., a large mass of seaweed was passed 700 miles from Tristan Island.

Between Tristan Island and the Cape of Good Hope five soundings, five serial temperature soundings, and two dredgings were obtained (see Sheet 16).

The dredging on the 20th October, at Station 136, was on hard ground, for the sounding rod brought up only a fragment of manganese, and the dredge caught at the bottom directly it was attempted to drag it along, giving much trouble and anxiety. In heaving in, the line parted, but, owing to the smartness of the man attending the stopper, the end was caught and spliced again, so that the dredge was saved. It came up empty, the nature of the bottom being evidently unfavourable for such work.

The depths increased gradually from 2100 fathoms at a distance of 200 miles from Tristan, to 2600 fathoms 500 miles west of the Cape of Good Hope, from whence they diminished to 2325 fathoms at a distance of 130 miles from the Cape, and afterwards gradually to the edge of the 100 fathom bank (see Diagram 6).

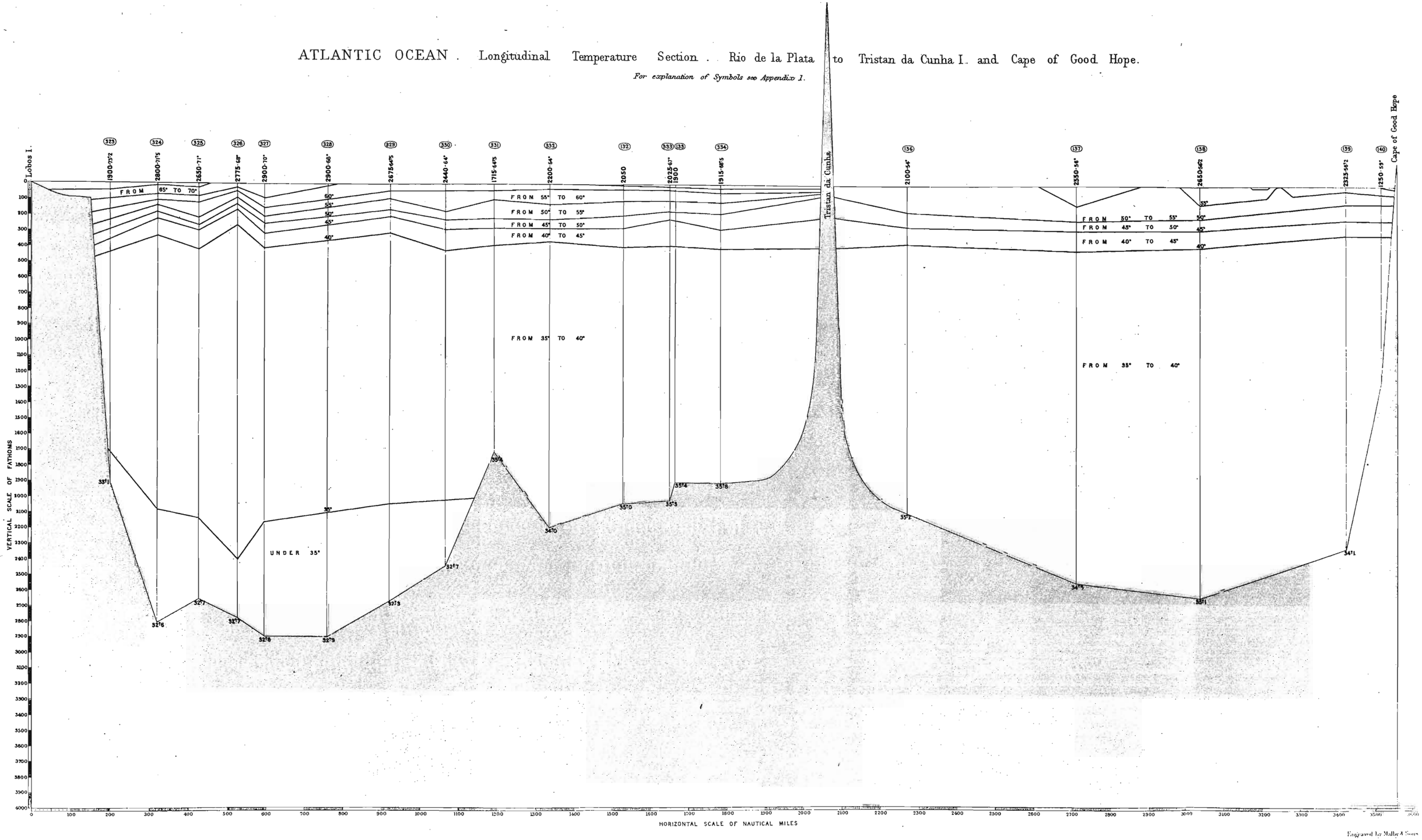
The temperature of the surface water varied from 53° at the Tristan group to 59° at

[1] Moseley, Notes by a Naturalist on the Challenger, p. 586, London, 1879.

DIAGRAM 6

ATLANTIC OCEAN . Longitudinal Temperature Section . . Rio de la Plata to Tristan da Cunha I. and Cape of Good Hope.

For explanation of Symbols see Appendix 1.



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the Cape, but the alteration was by no means gradual, for on one day it varied more than 5°; and as these variations did not take place on those days which were bright and sunny, it was concluded that they were due to the Agulhas Current.

On the 28th, at 7 A.M., a series of temperatures at intervals of 10 fathoms down to 100 fathoms was taken. At noon on the same day a second series was taken 15 nautical miles to the southwest of the Cape of Good Hope, and it was found that in the interval the ship had passed into the loop of the Agulhas Current, which curls round the Cape close to the land. The contrast between the two series is remarkable.

A Series of Temperature Observations taken just before, and one taken immediately after, entering the Agulhas Current, October 28th, 1873.

Depth.	7 A.M.	Noon.
Surface.	58°·2	62°·0
10 fathoms.	58·5	62·8
20 ,,	58.0	62·2
30 ,,	58·0	61·5
40 ,,	56·8	60·5
50 ,,	54·5	58·5
60 ,,	54·2	57·0
70 ,,	52·9	56·0
80 ,,	52·9	55·0
90 ,,	53·0	54·0
100 ,,	52·9	51·8

The temperature of the air likewise rose perceptibly, the thermometer in the shade indicating at noon 58°·8, nearly three degrees above the average of the same hour during the previous week.

The temperature of the bottom water varied from 35°·2 to 34°·2, the lowest result being obtained at 2325 fathoms 130 miles west of the Cape.

The serial temperatures showed that the isotherm of 40° occupied a mean depth of 370 fathoms, varying from 320 to 400 fathoms, the maximum depth being in the centre of the section, and the minimum at the Cape. The isotherms of 45° and 50° indicated this peculiarity in a still more marked degree, for they may be said to be bow-shaped. The isotherm of 55° was irregular (see Diagram 6).

No observations for current could be obtained, except in the ordinary way, viz., by difference between the dead reckoning and observed position of the ship.

On the 20th October, at Station 136, the velocity of the wind was on an average 14 miles per hour.

Between the Tristan plateau and the south of Africa, there is a wide and deep depression, where depths of 2550 and 2650 fathoms were obtained. The deposits at these depths contained 35 and 26 per cent. of carbonate of lime, consisting of pelagic Foraminifera and their broken parts. The mineral particles were rather abundant, making up 50 per cent. of the whole deposit at the greater depth, and consisted of rounded and angular fragments of quartz, orthoclase, hornblende, tourmaline, and augite. These mineral fragments, some of which were fully one millimetre in diameter, indicate that these soundings are within the area which is occasionally affected with Antarctic ice. The two soundings in 2325 and 1250 fathoms contained 47 and 50 per cent. of carbonate of lime; the mineral particles seldom exceeded 0·07 mm. in diameter, and consisted of quartz, glauconite, felspar, augite, and magnetite. About 5 per cent. of these deposits were made up of Radiolarians, Diatoms, and Sponge spicules.

A dredging at 2100 fathoms, near the edge of the Tristan plateau, was unproductive, the bottom appearing to be hard or rocky. A trawling in 2550 fathoms yielded two small Starfish, a bivalve Mollusc, and a few Crustaceans.

The tow-nets did not yield such a variety of forms as in the sections across the tropical portions of the Atlantic.

The Holothurioidea.—Dr. Hjalmar Théel, of Upsala, gives the following summary of his Report on the Holothurioidea collected by the Expedition, the first part of which has been published:—[1]

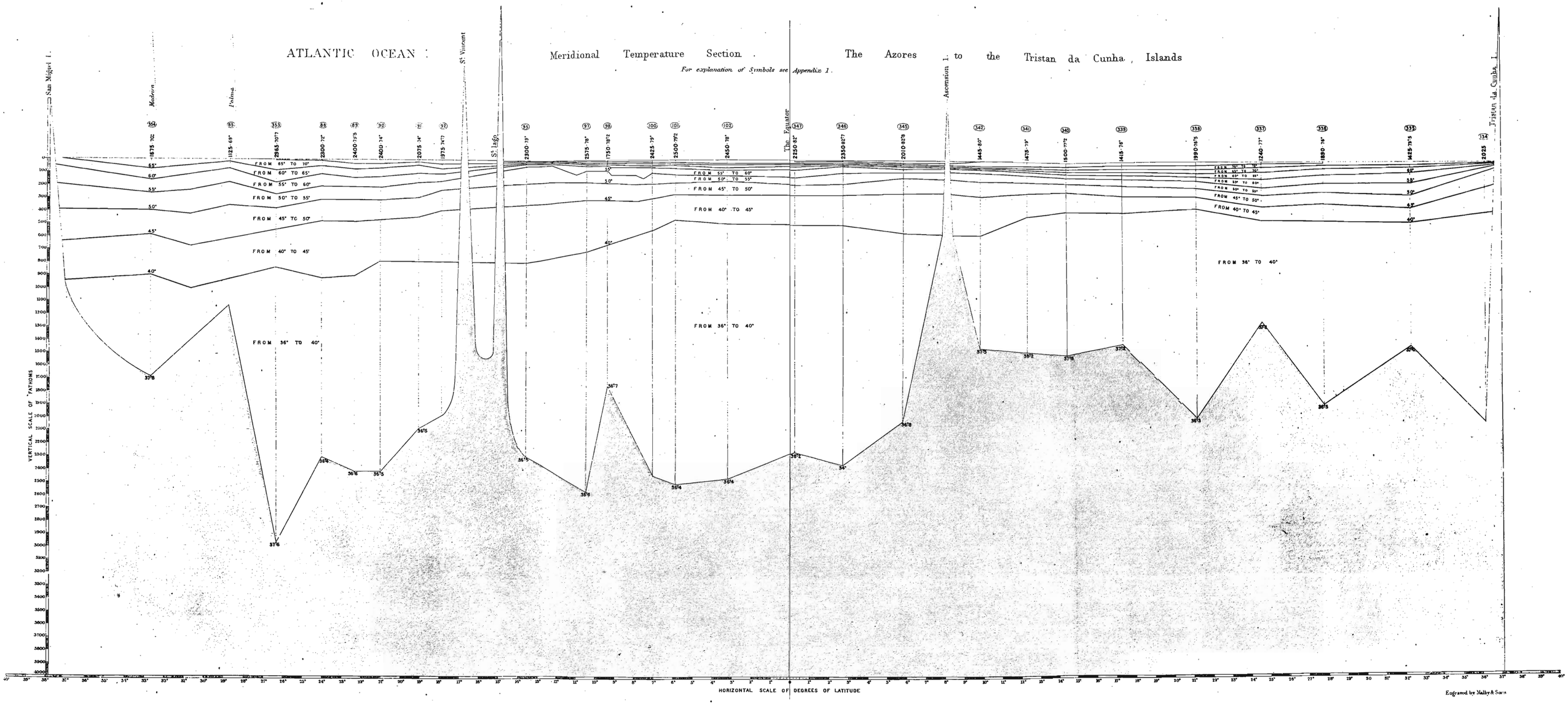
"The Holothurians are very widely distributed in the sea, and representatives of them are found from the shores down to the greatest depths all over the bottom of the ocean. Before the Challenger Expedition set out, our knowledge was limited almost exclusively to such forms as live on, or in the neighbourhood of, the shores; but from the investigations of the Expedition, not only has our knowledge of the shallow water forms been considerably increased, but the obscurity which involved the abyssal fauna has been greatly dispelled. It seems to be a fact that only a comparatively small number of Holothurians nearly related to the true shallow water forms are met with in the deep sea. The majority of Holothurians dredged from the bottom of the ocean present such important peculiarities, and differ so strikingly from the shallow water forms, that it has been necessary to arrange them in a new order, Elasipoda, equivalent to the orders Apoda and Pedata, already known. This summary is intended to show how far our knowledge of the Holothurians has been increased by the Challenger Expedition, which

[1] Report on the Holothurioidea,—the Elasipoda, by Hjalmar Théel, Zool. Chall. Exp., part xiii., 1881.

DIAGRAM 7

ATLANTIC OCEAN : Meridional Temperature Section . The Azores to the Tristan da Cunha , Islands

For explanation of Symbols see Appendix 1.



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will best be done by briefly pointing out the peculiarities in the external and internal organisation of the Elasipoda. The shallow water Holothurians have not been at all overlooked, for a large collection of such forms was brought home from different localities; but these Holothurians, being mostly already known, are not of sufficient interest to deserve mention here. However, to give an idea of what the Challenger Expedition has done with regard to the shallow water forms, it may be noted that a great number of new species has been dredged, previously known species have been found in many new localities, and several interesting biological observations made.

"Only three Elasipoda were previously known, viz., *Elpidia glacialis*, *Kolga hyalina*, and *Irpa abyssicola*, all obtained from the North Atlantic Ocean and the Arctic Sea; but the Challenger Expedition has so far extended our knowledge of this peculiar group of animals, that no less than fifty-two species and three varieties, divided into nineteen genera, have been described.[1] Only eight of these species were found at depths less than 1000 fathoms—not a single one from a depth less than 50 fathoms—the remainder being

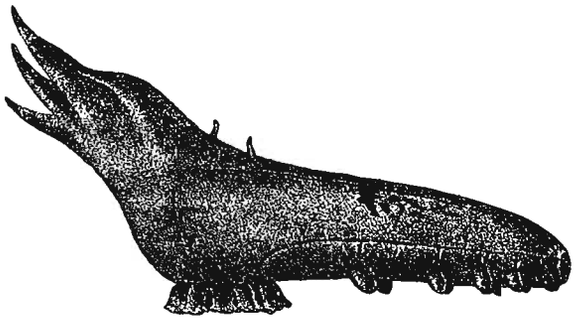

FIG. 110.—*Peniagone wyvillii*, Théel.

obtained from depths exceeding 1000 fathoms. The greatest depth at which any living Holothurid has been obtained is 2900 fathoms. The Elasipoda are distributed throughout all seas, especially *Oneirophanta mutabilis*, which is almost cosmopolitan. Therefore there seems to be every reason for the opinion that the Elasipoda are highly characteristic of the deep-sea fauna, for, as above pointed out, this order is almost unrepresented in the shallow water fauna, and, besides, presents forms perhaps the most aberrant met with in any group of deep-sea animals. With regard to their geographical distribution, the peculiar fact may be noted that some species are obtained from very distant localities. Thus, for instance, *Elpidia glacialis* occurs in the North Atlantic Ocean and the Arctic Sea, but was also obtained by the Challenger Expedition at Station 160, south of Australia, and *Lætmogone violacea* was first dredged by the same Expedition close to Sydney, and lately it has been found in great abundance by the 'Knight Errant,' between the Færöe Islands and the coast of Scotland.

"Thus the Elasipoda represent the deep-sea forms among the Holothurioidea, while

[1] Zool. Chall. Exp., part xiii., 1881.

the Apoda and Pedata, of course with several exceptions, belong to the shores. The more important peculiarities in the organisation of the Holothurioidea, especially of the Elasipoda, may now be pointed out.

"It is known that a large majority of the so-called shallow water forms, viz., the Apoda and most of the Dendrochirotæ, have a cylindrical or fusiform body, the former destitute of all pedicels and processes, the latter provided with small cylindrical pedicels, either irregularly scattered all over the body or arranged in rows along the ambulacra. Consequently, no clear distinction between the dorsal and ventral surfaces is here marked out. In the rest of the Dendrochirotæ and the Aspidochirotæ, on the contrary, more or less clearly marked dorsal and ventral surfaces are present, carrying processes or pedicels scattered or in rows.

"A glance at the figures given in this account, and representing types of the three families into which the Elasipoda are divided, will clearly show that they are characterised by a ventral and dorsal surface, distinctly marked the one from the other, and, in general, by the bilateral symmetry of the body,—characters which they have in common with the Aspidochirotæ and part of the Dendrochirotæ; but above all, by the unusual symmetry in the arrangement of the pedicels and processes. The following peculiarities cannot be too clearly expressed as characterising the Elasipoda:—The ambulacral appendages of the ventral surface alone are intended for locomotion, these being in the typical Elasipoda particularly large, and arranged in a single row on each side of the body; and the locomotor organs of the one side are accurately opposed to those of the other side, so as to form distinct pairs, almost recalling the legs of an insect or the locomotor organs of one of the Polychæta. As a rule the locomotor organs of the Elasipoda are not to be compared with such true pedicels as are common in other Holothurids, but are rather to be regarded as processes or 'ambulacral papillæ.'

"These locomotor organs show the most evident tendency to appear in fixed places and in a fixed number in every species of the more typical Elasipoda, and their number is often limited, as, for instance, in *Elpidia glacialis*, which has always four pairs of pedicels, *Scotoplanes globosa*, which has seven pairs, &c.

"The dorsal appendages are so modified as to perform functions far different from those of the ventral appendages. These dorsal appendages, like the ventral ones, have a tendency to become definite in number, so that every species may have a certain number situated in certain fixed positions on the back.

"From the size of the pedicels and their incapability of extension, and from the fact that the pedicels mostly lack a terminal plate, and sometimes even a sucking disk, the Elasipoda seem to be unable to move in the same manner as most of the Echinoderms, by attaching the suckers to surrounding bodies. Besides, their often firm external skeleton, and the shortness of their body-form, probably prevent them from moving by the extension and contraction of their bodies. From the size of the pedicels and their

arrangement in pairs, it seems most probable that they use them in the same manner as the more highly organised animals commonly do their limbs. Besides, there is no doubt that these animals, with their large and powerful pedicels, are able to move more rapidly and to dig easily into the soft ooze or clay of the bottom of the deep sea.

"What is the use of the very large and characteristic processes or lobes situated on the dorsal surface? The correct answer to this question is very difficult to give, but many things—especially the unusual abundance of nerves in them—seem to prove that they perform the function of tactile organs. There is much reason to believe that these organs are particularly suited to bring the animals into relation with surrounding bodies.

"The tentacles, like those in the Aspidochirotæ, are so slightly modified as to constitute

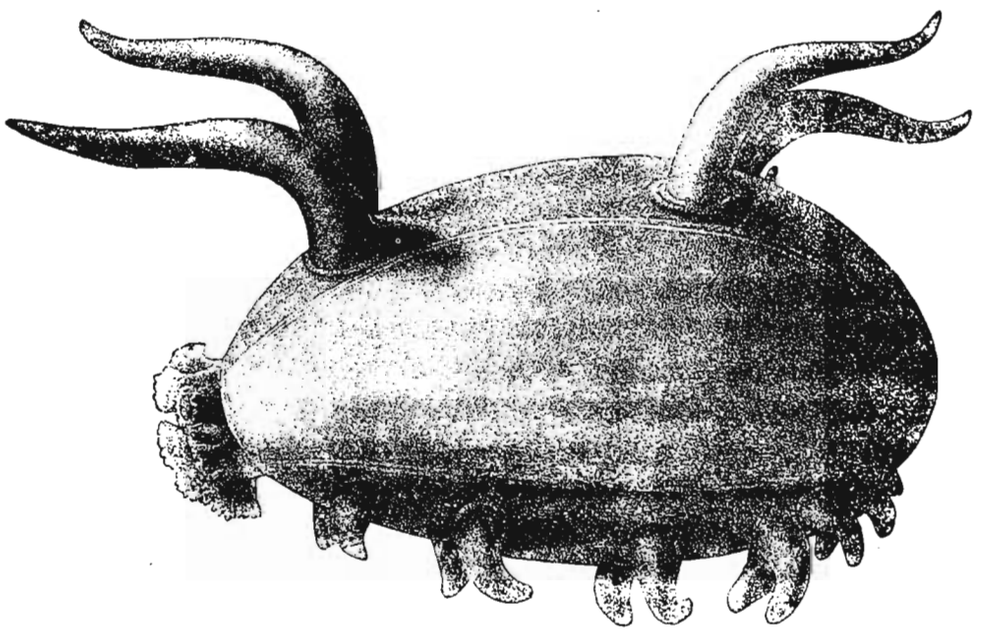

FIG. 111.—*Scotoplanes globosa*, Théel.

a disk with some larger or smaller processes, supported by a stem; thus, their shape in general proves that they do not perform the function of prehensile organs in the same manner as, for instance, those in the Dendrochirotæ, which use their thread-like branched tentacles to collect the proper food, and to bring it into the mouth. It seems most probable that the Elasipoda move along the bottom of the ocean with the mouth open, thus perpetually filling the alimentary canal with Globigerina ooze, Diatom ooze, clay or mud, in which operation the tentacles assist. The whole alimentary canal, from mouth to anus, is always filled up and highly distended by such matters, of which only a small portion can be used as food, while the rest must be pressed out through the posterior aperture at the same time as new materials are taken in.

"It is an already well known fact that the various tissues composing the body

of the Echinoderms secrete calcareous matters which take a distinct form, and that the perisome especially possesses this secreting function in a very high degree. Even in the very early stages of development, the Echinoderms are characterised by possessing calcareous deposits, which almost always take the form of simple or branched spicules, which, as the larvæ grow larger, change their form and become more or less complicated. Thus it is a fact that many of the fully-developed shallow water Holothurians have their body-wall supported by plates, crowns, anchors &c., and that their calcareous ring, which is often very firmly constructed, is made up of a solid calcareous network. It is of importance to note that the Elasipoda, with few exceptions, present a singular resemblance to the larval forms as to their calcareous deposits in the perisome as well as in the ring surrounding the gullet, these deposits having been arrested at a very low degree of development.

"The water-vascular system is very well developed in the Elasipoda, and has sometimes a more complicated conformation than is met with in the pedate shallow water Holothurians, their ampullæ, which are sometimes branched, having attained a very considerable size and being enclosed within the perisome. All the manuals of invertebrate zoology indicate, as an important character distinguishing the Holothurians from the rest of the Echinoderms, that the water-vascular system in the former communicates with the interior of the peritoneal cavity by the madreporic canal, while in other Echinoderms the same canal opens into an exterior madreporic tubercle, thus placing the ambulacral system in direct communication with the surrounding medium. This character must now be omitted, since it has been observed that many of the Elasipoda are remarkable in having the water-vascular system in persistent communication with the exterior, and that too not only by one pore but sometimes by a great number of pores crowded closely together, so as to form a kind of external madreporic tubercle. The larvæ of the Apoda and Pedata have the madreporic canal in communication with the surrounding medium by an opening on the dorsal surface; but eventually this canal looses its connection with the exterior, so that it hangs loosely in the peritoneal cavity of the adult animal. Thus the Elasipoda, even in this respect, obviously resemble the larval state of other Echinoderms.

"The respiratory trees are present in all the Pedata and in some of the Apoda, but in most of the latter the respiratory trees are supplied with "ciliated cups." The true function of these peculiar organs is unknown, though it seems probable that they subserve an excretory function. The Elasipoda seem to be devoid of every trace of these organs. Many authors seem to attach so much importance to the respiratory trees, that two orders have been founded, Pneumonophora and Apneumona, on the presence or absence of these organs. For my own part, I think that the presence or absence of ambulacral appendages—that is to say, a more or less complicated ambulacral system—is of far greater systematic importance, considering that the water-vascular system is one

of the most characteristic peculiarities of the Echinoderms in general, and doubtless plays a much greater rôle in their life.

"With regard to the sensory organs of the Elasipoda, it is very remarkable that auditory organs in the shape of small sacs, with a greater or smaller number of otoliths, are often very abundantly developed, while no traces of eyes are apparent, and that these organs are in connection not only with the nerve ring but also with the two lateral ventral nerve stems. Possibly the well-developed auditory organs, together with the tactile organs, viz., the dorsal processes, can to some extent supply the want of eyes. With good reason it may be asked why many species are so richly provided with auditory organs—some species have fifty sacs or more—while other forms are totally devoid of them. As is well known, only a few shallow water Holothurians are furnished with auditory vesicles, but these have always their place at the nerve-ring.

"In the Elasipoda, as in the majority of the Holothurioidea, the sexes are distinct. The embryo of the Echinoderms commonly leaves the egg in a condition very different from the adult state, and their larvæ live under conditions totally different from those under which the adult passes its existence. Thus, while the adult animal moves slowly along the floor of the bottom, the larvæ are found living on the surface of the sea, carried about by winds and currents, until they have reached that stage in their evolution, when it becomes necessary for their existence and further development to retire to the shores or the bottom of the sea. In some Echinoderms the embryo passes into the adult condition without any free larval stage, which seems to be the case with several shallow water Holothurians, and doubtless even with the Elasipoda. If these latter were subject to a more complicated metamorphosis, it is most probable that their larvæ would not be able to live at the surface of the sea, but keep close to the floor of the ocean. It may be stated here that during the Challenger Expedition some particularly inter-

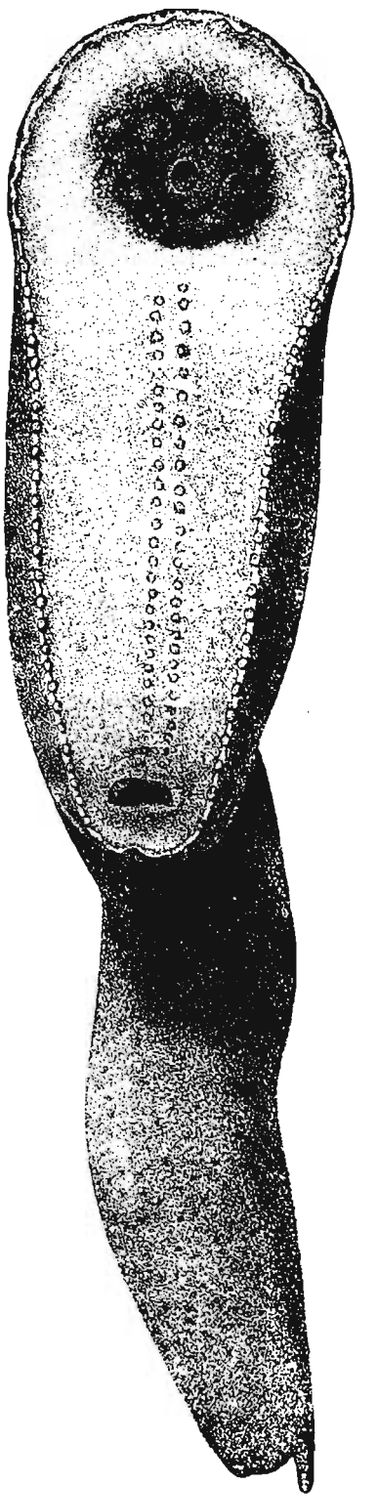

FIG. 112.—*Psychropotes longicauda*, Théel.

esting observations were made concerning the development of some shallow water Holothurians, viz., *Cladodactyla crocea* (Lesson), from Stanley Harbour, and *Psolus ephippifer*, from Corinthian Harbour in Heard Island (see pp. 379–384). In the females of the former the young were closely packed and adhering to the dorsal pedicels, while in the latter the embryos were developed within a kind of marsupium, situated on the dorsal surface and formed by its calcareous plates. There can be little doubt that the eggs are impregnated either in the ovarium or immediately after their extrusion, and that the free larval stage is omitted.

"Though the remains of Echinodermata are found abundantly as fossils, our knowledge of the fossil Holothurians is very unsatisfactory. Only a few calcareous spicules, believed to belong to Holothurians, occur in the Mesozoic rocks; but it must be remembered that these deposits are very fragmentary and difficult to refer to any distinct genus or species. However, some anchors, wheels, and other deposits are found, which seem to prove that the Apoda are older than the Pedata; but, as above mentioned, our knowledge is too incomplete to decide the question. No fossil remains of the Elasipoda have been detected, but nevertheless the opinion that the order is very old seems justified, and from the fact that it has retained more peculiarities characteristic of the larvæ of the Holothurians than the Apoda and Pedata, it seems to follow that it does not bear any direct genetic relation to the present representatives of these two orders.

"Thus I have endeavoured to give in a few words an account of this peculiar group of Holothurians, which passes its existence in the great depths at the floor of the ocean. Those readers who wish to get a clearer view of the different forms and their organisation, are referred to the Report"[1]

The Cape of Good Hope.

The Challenger remained moored in Simon's Bay from the 28th October till the 2nd December, when she proceeded to Table Bay. After a stay of ten days at Table Bay the ship returned to Simon's Bay till the 17th December. At Simon's Bay the ship was refitted, a deck house built for the convenience of the Naturalists, and the necessary stores taken on board for the Antarctic trip.

The Governor of Cape Colony, Sir Henry Barclay, and the inhabitants received the Expedition with great hospitality, and many receptions and entertainments were given in honour of the visit to Cape Town. Several excursions were arranged to enable the members of the Expedition to see the interior of the country, and to make collections. It was not, however, the practice to make any extensive collections at places like the Cape Colony, where the Botany and Zoology were well known.

[1] Zool. Chall. Exp., part xiii., 1881.

Some crania of Bushmen were procured at the Cape, and along with them several stone implements, shaped into lance heads, and a large perforated stone ball. A description of the skulls has been given by Professor Turner in his Report on the Human Crania.[1] He found them to possess the mesaticephalic and orthognathous proportions characteristic of this race.

The zoological and other specimens collected during the year 1873 were carefully packed, catalogued, and landed in sixty-one large cases in the dockyard for transmission to England.

Captain Nares remarks as follows on the temperature observations at the Cape:[2]—

"Our observations indicate that the broad and comparatively sluggish 'South Atlantic drift current,' running to the eastward before the continuous westerly winds, accumulates its water against the west coast of Africa, raising the level of the sea sufficiently to prevent the Agulhas current continuing its course, and swallows or diverts nearly the whole of it; a very small portion escaping to the northward round the Cape during the southerly winds, intermixing with the colder water of the drift current, which also throws out an offshoot to the northward, as it strikes against and meets the African coast and Agulhas stream. Great variations in temperature may naturally be looked for when two such oppositely constituted currents meet and intermingle. It is well known at the Cape that the warm current seldom extends as far to the north as Table Bay, the water there being much colder than in Simon's Bay.

"During our stay the wind was blowing nearly continuously from the southeast, and the temperature of the sea in Simon's Bay was from 62° to 64°, the same temperature, and therefore water derived from the same source, as we found outside close to the land. But on one occasion during a northwesterly gale this warm water was driven out of Simon's Bay, being replaced in about six hours by water of a temperature of 51°; and this applies, not only to the surface water, but to that at the depth of nine fathoms, in which water the ship was anchored, and to which the observations extended. The current usually circles round the bay from Cape Agulhas to Cape Point; on this occasion, whilst the water was gradually cooling, a current was circling round the bay in the opposite direction, running to the eastward from Cape Point towards Cape Agulhas. From this I can only conclude that during northwesterly gales the pressure of the wind is sufficient to overpower and drive the narrow branch or horn of the Agulhas current, which at other times is found touching the Cape, to the southward, with the rest of the stream. Immediately the pressure from the northwesterly wind was withdrawn the water in Simon's Bay gradually increased in temperature, indicating the return of the warm Agulhas stream. It is remarkable that the surface water of a temperature of 51° found in Simon's Bay during the northwesterly gale was colder than that found at any Station to the westward

[1] Zool. Chall. Exp., part xxix., 1884.

[2] Report to the Hydrographer, December 1873.

during our run across, except at a depth of 50 fathoms; the lowest surface temperature being 54°. Immediately previous to our arrival there had been few southerly winds, afterwards they blew with great regularity for a fortnight, and if they extended any distance southwest of the Cape colder water might naturally be looked for."

Peripatus.—During the stay at the Cape, one of the most important of the zoological discoveries of the voyage was made by Mr. Moseley, namely, that of the affinities of a remarkable animal well known to naturalists under the name of *Peripatus*, believed at the time to be a peculiar and aberrant form of earthworm. The uncertainty and misapprehension as to its affinities had arisen from the fact that it had never been examined by any professed naturalist in the fresh condition, but was only known from specimens preserved in spirit. Professor Moseley writes :—

"The animal has the appearance of a black caterpillar, the largest specimens being more than 3 inches in length, but the majority smaller. A pair of simple horn-like antennæ projects from the head, which is provided with a single pair of small simple eyes. Beneath the head is an opening surrounded by plicated lips, leading into a space which may be termed the præoral cavity. Within this cavity lie a pair of muscular organs each

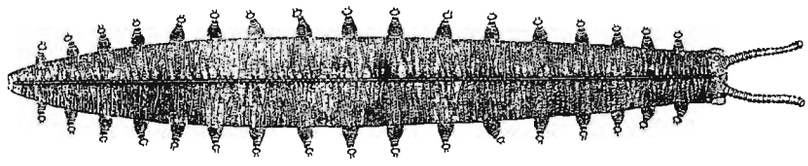

FIG. 113.—*Peripatus capensis;* viewed from the dorsal surface (after Balfour).

bearing two stout horny jaws behind which is situated the mouth. The animal has seventeen pairs of short conical feet, provided each with a pair of hooked claws. The skin is soft and flexible, and not provided with any chitinous rings.

"The animal breathes air by means of tracheal tubes like those of insects, but these, instead of opening to the exterior by a small number of apertures,—'stigmata' arranged at the sides of the body in a regular manner as in all other animals provided with tracheæ,—are much less highly specialised. The apertures are in *Peripatus* scattered more or less irregularly over the greater part of the surface of the skin. In the freshly killed animal the tracheæ, being distended with air, are readily seen, whereas in specimens which have been steeped in spirit, and in which the air is absent, they are almost invisible.

"The sexes are distinct in *Peripatus capensis*. The males are much smaller and fewer in number than the females. The females are viviparous, and the process of development of the young shows that the horny jaws of the animal are the slightly modified claws of

a pair of limbs turned inwards over the mouth as development proceeds, in fact 'foot-jaws' as in other Arthropoda. In many points of internal anatomy *Peripatus* proves itself to be a most archaic form, and the early stages in the development of the egg have been shown by Balfour [1] and Sedgwick [2] to be of a most remarkable character. It is probable that we have existing in *Peripatus* a form nearly allied to the ancestral progenitors of all insects, and that the condition of the tracheæ in *Peripatus* represents an early stage in the history of the development of these organs which was passed through by the ancestors of all forms respiring by means of tracheæ. The tracheæ were probably developed in the first tracheate animals out of skin glands scattered all over the body. In the higher forms they have become restricted to certain definite positions by the action of natural selection.

"That *Peripatus* is a very ancient form is proved by its wide and peculiar geographical distribution. Species of the genus occur at the Cape of Good Hope, in Australia, New Zealand, in Chili, in British Guiana, in the Isthmus of Panama and its neighbourhood, and in the West Indies.

"The animal is provided with a pair of large glands, secreting a viscid fluid, which

FIG. 114.—A right leg of *Peripatus capensis*; viewed from the anterior surface (after Balfour).

FIG. 115.—A left leg of *Peripatus capensis*; viewed from the inner surface (after Balfour).

it has the power of projecting from two papillæ placed one on either side of the mouth. When it is irritated it discharges this fluid with great force and rapidity in fine thread-like jets, which form a sort of network in front of the animal, resembling a spider's web with the dew upon it, and appears as if by magic, so instantaneously is it emitted.

"The viscid substance, which is not irritant when placed on the tongue, is excessively tenacious like bird lime, and the jets of it are apparently used, not only for defence, but also to procure small insects for prey.

[1] *Quart. Journ. Micr. Sci.*, N.S., vol. xix. pp. 431–433, 1879.

[2] *Ibid.*, vol. xxiii. pp. 213–259, 1883.

"The animal is nocturnal in its habits. Its gait is exactly like that of a caterpillar, the feet moving in pairs and the body being entirely supported on them. During the day time it is to be found coiled up in hollows in decayed wood."

The Cetacea.—During the stay of the ship at Cape Town, the skull of an adult *Mesoplodon layardi*, without the lower jaw, and the end of the rostrum with the corresponding part of the lower jaw and the two mandibular teeth of a second specimen, were collected by Mr. Moseley, and the same gentleman subsequently procured, at the head of Port Sussex, on the west coast of East Falkland Island, the skeleton of a young example of the same animal. At a later stage of the voyage, whilst the ship was in New Zealand, a skull of *Ziphius cavirostris* and some of the bones of the Humpback and Right Whales of the southern seas were presented by the Colonial Museum, Wellington. These specimens were reported on at some length by Professor Turner,[1] and his Report may be referred to for the anatomical details, including the microscopic structure of the teeth both of *Mesoplodon layardi* and *Mesoplodon sowerbyi*. It may be sufficient to state in this place that although a specimen of *Mesoplodon layardi* had previously been procured at the Cape, and other specimens at the Chatham Islands, New Zealand, and Australia, the discovery of a skeleton in the Falkland Islands, which Professor Turner determined to be an immature example of that Cetacean, has extended the geographical range of this animal considerably to the westward. No specimen has up to this time been obtained to the north of the equator.

The skull of the *Ziphius cavirostris* had been marked *Epiodon chathamiensis* by the authorities of the Colonial Museum, but the comparison which Professor Turner has made of this skull with an undoubted specimen of *Ziphius cavirostris* from Shetland, in the Anatomical Museum of the University of Edinburgh, has satisfied him that differences do not exist between them sufficient to justify him in classifying them as distinct species. He considers that the present state of knowledge of this Cetacean strengthens the statement which he had made in a memoir on *Ziphius cavirostris*, published in 1872[2] that certain exotic as well as European crania, which had up to that time been described, were examples of that species, and that the geographical distribution of this animal is equal to that of the sperm whale.

The Chitonidæ.—Professor A. C. Haddon, who is preparing a short Report on the small collection of Chitons made during the Expedition, has sent the following note :—

"The number of specimens of Chitons collected by the Challenger Expedition was small, considering the frequency and wide distribution of the group. This is to be accounted for by the fact that the majority of Chitons are strictly littoral in

[1] Report on the Bones of Cetacea, Zool. Chall. Exp., part iv., 1880.

[2] *Trans. Roy. Soc. Edin.*, vol. xxvi. pp. 759–780, 1872.

their habit, and the Challenger Expedition occupied itself mainly with deep-sea dredging. About eighty specimens were collected, which are referable to some twenty-eight species, of which four were previously undescribed, and two are described in the late Dr. P. P. Carpenter's MS.

"The distribution of the shore Chitons is now fairly well known. The specimens collected by the Expedition present us with no new features of interest, and, unfortunately, an insufficient number was collected to give instructive series.

"Three species of Chitonellidæ were collected, viz., *Cryptoplax striatus*, Lam., *Chitonellus fasciatus*, Quoy and Gaim., and *Chitonellus oculatus*, Quoy and Gaim. There has been much confusion concerning this last species, chiefly owing to the fact of Reeve describing a *Cryptoplax striatus* under that name. Quoy and Gaimard's description is sufficiently lucid, but unfortunately they only figure the under surface and one separate valve. It is therefore very satisfactory to be able to restore this beautiful lost species.

"The deep-sea Chitons belong mostly to the genus *Leptochiton*. The following is a list of the species collected by the Expedition of that genus.

	Station	Date.	Depth. faths.	Latitude.	Longitude.	Nature of Bottom.	Bottom temp.
Leptochiton alveolus, Sars, .	241	June 23, 1875	2300	35° 41′ N.	157° 42′ E.	Red clay.	35°·1
Leptochiton alveolus, Sars, .	205	Nov. 13, 1874	1050	16° 42′ N.	119° 22′ E.	Blue mud.	57°·0
Leptochiton, n. sp., . . .	149c	Jan. 19, 1874	60	49° 32′ S.	70° 0′ E.	Volcanic mud.	...
Leptochiton, n. sp., . . .	310	Jan. 10, 1876	400	51° 27′ S.	74° 3′ W.	Blue mud.	46°·5
Leptochiton, n. sp., . . .	145A	Dec. 27, 1873	310	46° 41′ S.	38° 10′ E.	Volcanic sand.	...

"It is interesting to find that the only really deep-sea captures both belong to the same species, *Leptochiton alveolus*, Sars. The following localities have been recorded for this species:—

"Bergen, Lofoten, Finmark, 150 to 300 fathoms (Sars).

"Gulf of St. Lawrence, off Cape Rosier, 220 fathoms (Whiteaves).

"Gulf of Maine, 150 fathoms (U.S. Fish Commission, 1872, Dall).

"East Coast of United States, 'ranges northwards along the American coast, beyond New England waters,' 99½ to 640 fathoms (Verrill).

"North Pacific (P. P. Carpenter, MS.).

"This species has thus hitherto only been recorded from Scandinavia (150 to 300 fathoms) and the northeast coast of North America in the region swept by the Arctic currents (99 to 640 fathoms). Carpenter's MS. locality is very vague. W. H. Dall has described a very closely allied species, if indeed it be really distinct, *Leptochiton*

belknapi, from the North Pacific, lat. 53° 8′ N., long. 171° 19′ W., 1006 fathoms, black sand and shells, bottom temperature 35°·5 F. We are now in a position to state that *Leptochiton alveolus* is found in the North Pacific at great depths as far south as lat. 16° 42′ N.

"*Placiphora setiger*, King, was found at a depth of 345 fathoms, blue mud, bottom temperature 46°, Station 306A; and *Euplaciphora simplex*, Carp. MS., was collected on the shore, and dredged from 110 fathoms at Tristan da Cunha."