MEMOIRS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT

HARVARD COLLEGE.

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V.

GENERAL REPORT OF THE EXPEDITION.

By ALEXANDER AGASSIZ.

WITH NINETY-SIX PLATES,

AND EIGHT FIGURES IN THE TEXT.

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INTRODUCTION.

The U. S. Fish Commission Steamer "Albatross" was, with the consent of the President, placed at my disposal by Secretary Cortelyou of the Bureau of Commerce and Labor, at the suggestion of the Hon. Geo. M. Bowers, Commissioner of Fisheries.

The area selected for this cruise of the "Albatross" included the vast tract of the Eastern Pacific south of the Panamic region, explored by her in 1891. This area was crossed by lines from the Galapagos to Aguja Point (Pl. 1), thence in a southwesterly direction, then to Callao. From Callao we ran to Easter Island, then to the Galapagos, next to Manga Reva, and finally to Acapulco, where our exploration ended, after having steamed from Panama over a distance of more than 13,000 miles.

From Acapulco the "Albatross" ran to San Diego, where the collections were shipped to the Fish Commission, to be distributed to the specialists who have kindly undertaken to work up the material collected during her cruise.

The collections made during the present expedition will give ample material for extensive monographs on the holothurians, the siliceous sponges, the cephalopods, the jelly-fishes, the pelagic crustaceans, worms, and fishes of the Eastern Pacific, as well as on the bottom deposits and on the radiolarians and dinoflagellates, diatoms, and other protozoans collected by the tow-nets. Small collections of plants were made at Easter Island and Manga Reva which may throw some light on the origin and distribution of the flora of the Eastern Pacific.[1]

With one exception, the lines we ran were all well within the steaming range of the "Albatross," so that the work laid out was satisfactorily carried on. Our last line, however, from Manga Reva to Acapulco, while practicable under ordinary circumstances, proved beyond the capacity of

[1] A brief account of the progress of the expedition was sent to the Hon. Geo. M. Bowers from Callao, from the Galapagos, and from Acapulco. These letters were published in the American Journal of Science for February, April, and May, 1905, and were reprinted in the Bull. M. C. Z., Vol. XLVI, No. 4, April, 1905.

the "Albatross." Our progress, which was excellent during the first days of our journey after leaving Manga Reva, soon became greatly impeded by head winds in the region where we ought to have been in the full swing of the southeasterly trades. This led us to abandon with great reluctance all idea of further work when in the equatorial belt of currents; to give up our proposed visit to Clipperton, and, on account of our limited coal supply, to make for Acapulco, merely sounding every morning. This was a great disappointment, as we had every reason to expect to be able to spend some time in the western region of the equatorial currents belt, and settle more conclusively than we have been able to do the question of their influence upon the richness of the fauna living on the bottom in their track, far from continental shores or insular areas.

We were most fortunate in our arrangements for our coal supply. It was a somewhat risky undertaking to provide coal at the Galapagos, Easter Island, and Manga Reva. But, thanks to the interest of Messrs. Burns, Philp & Co. in our behalf, their contracts to supply us with coal were carried out most punctually. Their failure to meet us either at Easter Island or Manga Reva would have been disastrous, as neither of these islands are visited more than once a year.

We hoped to be docked at Callao, but, owing to the prolonged occupation of the dock by a disabled steamer and the uncertainty of its becoming free within reasonable time, we decided to proceed without further delay to Easter Island and continue the expedition without docking.

But little is known of the hydrography of the area we explored, but few soundings are recorded from that area of the Eastern Pacific before the present expedition of the "Albatross;" one to the N. W. of Callao by the Italian S. "Vittor Pisani"[1] in 1882, three by the Cable S. "Silverton" in 1893,[2] and four by the U. S. S. "Alaska."[3] A few deep-sea soundings eastward of the Paumotus, to the meridian of 91° 31′ W., are all taken by H. M. S. "Alert" in 1878–80. I do not include the long list of soundings taken by the steamers of the Central and South American Telegraph Company along the west coast of South America. They are all within very moderate distance of the coast, and bear mainly upon the configuration of the submarine western slope of South America.

1	11° 4′ S.	80° 33′ W.	2729	fathoms.
2	10° 14′ S.	79° 29′ W.	1267	fathoms.
	10° 47′	79° 3′	1115	fathoms.
	11° 16′	78° 4′	1169	fathoms.
3	11° 14′ S.	78° 59′ W.	2107	fathoms.
	11° 52′	78° 39′	2017	fathoms.
	11° 51′	78° 54′	3368	fathoms.
	11° 53′	76° 9′	3164	fathoms.

The greatest interest attached to this exploration, there is no other oceanic region situated at so great a distance from a continental area and interrupted by so few islands. The eastern tropical Pacific extends south from a line between Acapulco and the Galapagos, and to Cape San Francisco as a northern boundary, to a distance of over 3000 miles as far as the latitude of Manga Reva, Easter Island, and a point north of Valparaiso; and the distance of Manga Reva from the South American coast is fully 3500 miles, with nothing to break this vast expanse of water.

The investigation of this region promised interesting results and valuable data regarding the extension of an abyssal oceanic fauna far from shore and its dependence upon the pelagic food carried by the great oceanic currents.

The "Albatross," under command of Lieut.-Commander L. M. Garrett, U. S. N., left San Francisco on the 6th of October and arrived at Panama the 22d. On her way along the coast Professor C. A. Kofoid took advantage of the opportunity for making surface hauls with the tow-nets, as well as vertical hauls, generally to a depth of 300 fathoms. A large amount of pelagic material was thus collected, not at a great distance from the coast, however. Off Mariato Point the "Albatross" made two hauls in the vicinity of the stations where in 1891 she found "modern green sand," in 555 and 782 fathoms.[1] It was interesting to find the green sand again, as the specimens collected in 1891 were lost in transit to Washington. I was fortunate in having as assistant for this trip Professor Kofoid, who has had great experience in studying the Protozoa both in fresh water and at sea. He was given charge of the collection of Radiolarians and Diatoms, and of other minute pelagic organisms; and he will prepare a report on the results of that branch of the expedition.

It will be interesting to compare the pelagic fauna at intermediate depths collected along the coast from San Francisco to Panama with that of the Eastern Pacific. A glance at the preliminary records of that line shows the great abundance along the continental area of the embryos of littoral types of Echinoderms, of Lamellibranchs, Gasteropods, Acalephs, Crustacea, Fishes, and others mixed with Dinoflagellates, Radiolarians, Tintinnids, Globigerinæ, and pelagic types of Copepods, Amphipods, Tunicates, Ostracods, Annelids, Sagittæ, Pteropods, Cephalopods, Acalephs, and Fishes. The oceanic lines were marked for the total absence of littoral embryos.

[1] Stations 3357, 3358, Bull. M. C. Z. XXIII, No. 1, p. 5, 1892.

At Panama the "Albatross" was coaled and provisioned at once; on my arrival there on the 1st of November I found her ready for sea, and on the 2d we left for Mariato Point to make a few additional trawl hauls in the region of the green sand. In both the hauls made off Mariato Point green sand was found, but not in the quantity obtained in 1891. These were the only trawl hauls made in the Panamic District north of the Galapagos.

The changes made in the working apparatus of the "Albatross" under the superintendence of Lieutenant Franklin Swift, U. S. N., proved most satisfactory. The alterations in the main drum and the device for preventing the piling of the wire on the surging drum and the accompanying shock have greatly reduced the risk of breaking the wire rope when trawling at great depths. The wire rope proved an excellent piece of workmanship, and worked admirably in the comparatively deep water in which most of our trawling was done. A new dredging boom was also installed, and everything relating to the equipment of the "Albatross" was carefully overhauled before her departure.

Lieut.-Commander L. M. Garrett was indefatigable in his interest for the expedition; the officers and crew were devoted to their work; and the members of the scientific staff carried out most faithfully their duties of preparing and preserving the collections made.

I have to thank specially for assistance and advice, during the equipping of the "Albatross" for her voyage, Captain Z. L. Tanner, U. S. N.; the late Admiral Sir Joseph Wharton, R. N.; Mr. Richard Rathbun, assistant secretary of the Smithsonian; Mr. J. W. Littlehales for copies of the report of Commander B. F. Day, U. S. N., of the "Mohican," on Easter Island, and for the corrections made on the chart of the island by the officers of the "Mohican;" the managing director of the Telegraph Construction and Maintenance Company, and Mr. Lucas, the engineer of the company, for advice regarding his automatic sounding-machine; Mr. Jas. A. Scrymser, the president, and Mr. Kingsford, the manager, of the Central and South American Telegraph Company; the managing director, and Mr. A. Birrell the manager, of the Pacific Steam Navigation Company; Messrs. Burns, Philp and Co., of Sydney; Messrs. W. R. Grace and Co., of Callao; Captain Pillsbury of the Bureau of Navigation; the Panama R. R. Company; the late Secretary Hay, who was kind enough to obtain through our embassies at London, Paris, Mexico, Lima, Santiago, Ecuador, and Panama, letters from the governments to whom they were accredited recommending the "Albatross" to the good-will of the officials of the ports we intended to visit. Nothing could have been more cordial than our reception at the points where we coaled. I may also mention the assistance given us by Mr. C. Cooper, the manager of the Easter Island Company, during our visit to that island, and the cordial reception given the "Albatross" while at Manga Reva by the governor, Dr. Fernand Cassiau.

Finally my thanks are due to the officers in charge of the Bureau of Fisheries at Washington for their attention to all the details called for by the fitting out of the "Albatross."

NEWPORT, R. I., November, 1905.

LIST OF THE OFFICERS OF THE UNITED STATES STEAMER "ALBATROSS."

Lieut.-Commander . .	L. M. GARRETT, U. S. N., *Commanding.*
Lieutenant	W. J. MANION, U. S. N., *Executive Officer and Navigator.*
Boatswain	JOHN MAHONEY, U. S. N.
Boatswain	LOUIS M. SOPP, U. S. N.
Acting Boatswain . .	F. W. METTERS, U. S. N.
Past Assistant Surgeon	JOSEPH C. THOMPSON, U. S. N.
Assistant Paymaster .	E. H. COPE, U. S. N.
Warrant Machinist . .	CHARLES CRATER, U. S. N.
General Assistant . .	L. M. TONGUE, U. S. F. C.

SCIENTIFIC STAFF.

C. A. KOFOID, *Assistant.*
H. B. BIGELOW, *Assistant.*
F. M. CHAMBERLAIN, *Naturalist, U. S. F. C.*
M. WESTERGREN, *Artist.*

"ALBATROSS" EASTERN TROPICAL PACIFIC EXPEDITION.

GENERAL REPORT.

HYDROGRAPHY.

Plates 1–12.

During this expedition we sounded every day while at sea, and developed very fairly the contour of that part of the Eastern Pacific which lies to the south and west of the line from Cape San Francisco to the Galapagos and of a line from the Galapagos to Acapulco, limiting an area occupied by the "Albatross" in 1891. The area developed by us is included by a line over 3200 miles in length from Acapulco to Manga Reva, and the area north of a line from Manga Reva to Easter Island and from Easter Island to Callao.

During our voyage one hundred and sixty soundings were taken with the Lucas sounding-machine. The bathymetrical chart of the "Albatross" expedition of 1891[1] was somewhat modified by the northern soundings of our present expedition on the lines Manga Reva to Acapulco, Manga Reva to the Galapagos, and Easter Island to the Galapagos. The soundings affected the 2000-fathom line off the Galapagos Plateau, and off the Mexican coast (Pl. 1).

The soundings of the area we surveyed in the Eastern Pacific are comparatively shallow. With the exception of the area to the westward and southwestward of Callao, the soundings generally varied from 1800 to 2300 fathoms, while off Callao and in the direction of Easter Island are found a number of soundings varying from 2000 to over 3000 fathoms (Pl. 1).

Following our lines as they developed after leaving Panama, we made a straight line of soundings (Pl. 1) from Mariato Point towards Chatham Island in the Galapagos (Pl. 4), intersecting the ring of soundings we made northeast of the Islands in 1891.[2] The deepest point of the line (1900

[1] Pl. III, Bull. M. C. Z. Vol. XXIII, No. 1, Feb., 1892.   [2] Ibid.

fathoms) was found about 100 miles southwest of Mariato Point. The depth then continued to show about 1700 fathoms for nearly 200 miles, and shoaled very gradually to 1418 fathoms about 80 miles from Chatham Island. From this point it sloped quite rapidly, the 1000-fathom line being not more than 60 miles from Chatham Island. We ran a short line south of Hood Island, and found a somewhat steeper slope to that face of the Galapagos, reaching over 1700 fathoms in a distance of less than 50 miles; the bottom then remained comparatively flat, attaining a depth of 2000 fathoms about 100 miles farther south. This depth we carried eastward on a line to Aguja Point (Pl. 7). When half-way, the soundings had increased to over 2200 fathoms, and remained near that depth to within 60 miles of the coast, when the depth rapidly shoaled. From Aguja Point we ran a line of soundings to the southwest, to a point about 675 miles west of Callao (Pl. 6, fig. *1*); on this line the depth gradually increased from 2200 fathoms, 100 miles off the Point, to nearly 2500 fathoms. On running east to Callao (Pl. 9), the depth soon increased to about 2600 fathoms, and at a distance of about 80 miles off Callao we dropped into the Milne-Edwards Deep and found a depth of over 3200 fathoms. We spent a couple of days in developing this Deep, making soundings of 1490, 2845, 458, 1949, 2338, and 3120 fathoms; showing a great irregularity of the bottom within a comparatively limited area of less than 60 miles in diameter.

The soundings taken to the south of the Galapagos (Pls. 4, 5), developed the outline of the 1500-fathom curve as well as that of the 2000-fathom line to the south and west, showing that the latter enclosed a very much larger area (Pl. 1) than had been inferred from the soundings taken in 1891. Our soundings also showed that the Guatemala Basin was enclosed by the 2000-fathom line, forming a large elliptical area to the west of the Mexican and Guatemalan coast (Pl. 1).

The soundings we made to the eastward from the Galapagos to the South American coast (Pls. 7–9, Pl. 10, fig. *1*), and to the westward of Callao, as well as on the line from Callao to Easter Island, all indicate a gradual deepening to the eastward, to form the northern part of a basin I have called the Bowers Basin (Pl. 1), and which is independent of what has been called on the "Challenger" Charts the Buchan Basin, with greatest depths of 2400 to over 2700 fathoms, and passing at several points near the coast to Milne-Edwards Deep, Haeckel Deep, Krümmel Deep, Bartholomew Deep, and Richards Deep, some of them with a depth of over 4000 fathoms.

It is difficult from the absence of soundings between the southernmost lines of the "Albatross" and those of the "Challenger" in the latitude of Valparaiso to fix any limit to the Buchan Basin. For this reason I have merely kept the legend without attempting to define its boundaries.

The line from Callao to Easter Island (Pl. 10, fig. *1*), passes through Milne-Edwards Deep, which is separated from the southern part of Bowers Basin having a depth of over 2700 fathoms, by a ridge of about 2500 fathoms.

The slope of that line rises very gradually from 2400 fathoms to the 2000-fathom line, forming the eastern flank of the plateau enclosing Sala y Gomez and Easter Island. The latter, the larger island, rises more suddenly from a much smaller plateau than the one of which the small rocky islet of Sala y Gomez is the visible area (Pl. 1), the 1500-fathom line extending nearly half-way from Sala y Gomez to Easter Island and within a short distance of Easter Island connecting Sala y Gomez and Easter Island. On the ridge we found 1142 fathoms near Sala y Gomez, and 1696 fathoms half-way between that point and Easter Island. The ridge rises rapidly from about 2000 fathoms, the general oceanic depth within about 100 miles, to over 1100 fathoms within a comparatively short distance from both Sala y Gomez and Easter Island.

The plateau connecting Sala y Gomez and Easter Island forms a marked spur on the southeast point of the Albatross Plateau (Pl. 1).

The two lines centering at Easter Island (Pls. 4, 10, fig. *1*), developed the eastern edge of the Albatross Plateau (Pls. 5, 6, fig. *1*, 9, 11, 12), indicated on the "Challenger" bathymetrical charts, on the strength of a few soundings reaching from Callao in a northwesterly direction and of a couple of soundings on the 20th degree of latitude. It is surprising that with the few soundings known at the time the "Challenger" charts were published so accurate a sketch of the Albatross Plateau should have been made, and still more interesting that the plateau should have been called the "Albatross" Plateau, and be developed by the "Albatross" nearly thirty years later.

The "Albatross" Plateau is the most interesting bathymetrical feature of the Eastern Pacific (Pls. 5, 6, fig. *1*, 9, 11, 12). It is a triangular area (Pl. 1), indicated by the 2000-fathom line pointing towards the Galapagos, with a base starting from Easter Island almost reaching Manga Reva.

According to the "Challenger" bathymetrical chart (Pl. 1 B), the Juan Fernandez Plateau connects with the Albatross Plateau and forms the southern limit separating Buchan Basin from Barker Basin south of the Juan

Fernandez Plateau. I hesitate to accept this interpretation of the few shallower soundings taken by the "Challenger" more than six hundred miles south of the 2000-fathom line defining the Easter Island and Sala y Gomez Plateau.

The Albatross Plateau, as developed by the "Albatross" (Pls. 9, 11), separates the Bowers and Buchan Basins from the great basin to the north-west. The eastern slope indicated by the 2000-fathom line gradually falls into deeper water as we pass towards the South American coast, while the western slope passes into deep water in the direction of Grey's Deep and of the Moser Basin and Moser Deep (Pl. 1). The Galapagos Plateau is separated from the Albatross Plateau by a wide channel of more than 300 miles, with a probable greatest depth of nearly 2300 fathoms.

Our line from Easter Island to the Galapagos (Pl. 12) shows a wonderfully level tract, varying in depth only from 2020 to 2265 fathoms in a distance of nearly 2000 miles.

On our line, Galapagos to Manga Reva, we developed the western extension of the Albatross Plateau (Pl. 5), and found it varying in depth from 1900 to somewhat less than 2300 fathoms in a distance of nearly 3000 miles; about half-way from the Galapagos to Manga Reva we came upon a ridge of about 200 miles in length with a depth of 1700 to 1055 fathoms, dropping rapidly to the south to over 1900 fathoms. I propose to call this elevation Garrett Ridge (Pls. 1, 5).

Our line from Manga Reva to Acapulco (Pl. 12) shows the gradual slope of the western extension of the Albatross Plateau towards the great basin of the Eastern Pacific. This line is almost level; in a distance of 3200 miles the depth varies only about 400 fathoms. The great area traversed by the "Albatross" was practically *mare incognitum.* Three soundings in latitude 20° S., towards the Paumotus, and five soundings in a north-westerly trend from Callao to Grey's Deep (Pl. 8) are all the depths that were previously known of this great expanse of water. The existence of a great plateau dividing Bowers Basin along the South American coast from Grey and Moser Basins (Pls. 1, 9, 11) to the west is most interesting. It recalls the division of the Southern Atlantic into an Eastern and Western Basin by a central connecting ridge, the "Challenger" Ridge.

The existence of a sounding of 2554 fathoms near the equator in longitude 110° W., would seem to indicate a small basin disconnected from Grey's Deep and Moser Basin. How far west towards these basins that extension reaches, no soundings indicate as yet. It is interesting to note that along the Mexican coast there are a number of deep disconnected basins lying close to the shore, just as there are a number of disconnected deeps close along the South American coast, extending from off Callao to off Caldera, Chili, opposite high volcanoes or elevated chains of mountains. These basins and a great part of the steep Mexican continental shelf form a deep channel, separating in places the oceanic slope from the steep continental slope. The steepness of the continental shelf is especially well seen off Acapulco and Manzanilla. One of the small basins along the Mexican coast, with 2661 fathoms, lies off Sebastian Viscaino Bay; a second south of Tres Marias with 2395 fathoms; another with more than 2900 fathoms is to the west of Manzanilla Bay; a third to the southeast of Acapulco has about the same depth, and a fourth with 2500 fathoms is off San José, Guatemala. Our last soundings off Acapulco, about 29 miles south of the lighthouse, in 2494 fathoms, showed the western extension of one of these deep holes lying to the east of Acapulco. These small basins off the west coast, close to the shore, at the foot of a steep continental slope, are in great contrast to the wide continental shelves of Yucatan and Florida, which characterize the east coast of Central America and the east coast of the United States from Florida to the Banks of Newfoundland.

CHARACTER OF THE BOTTOM OF THE EASTERN TROPICAL PACIFIC.

Plate 3.

The bottom of the area explored by the "Albatross" in 1891 is covered by green and brown mud mixed with masses of decayed and decaying vegetable matter. South of this area we come upon the great tracts of the Eastern Pacific the bottom of which is covered by manganese nodules. The extent of this tract is shown in Plate 3, where are given the northern and eastern limits of the manganese nodules as well as its southern limit extending from Easter Island to Manga Reva. From the northern extremity of Moser Basin the line forming the northern limit of the manganese nodules runs in a southeasterly direction to about 100° W. Long., and 5° south of the equator where it runs nearly due east off Aguja Point, its eastern line then runs south, parallel to the South American coast. The southern limit of the nodules as here given (Pl. 3) is probably not its southernmost limit, as the "Challenger" obtained manganese nodules a long way south in the latitude of Valparaiso; but nothing is known of the character of the bottom on the area intervening between the lines of the "Albatross" and "Challenger." The western and northern and eastern limits of the Radiolarian ooze (Pl. 3) indicate a great tract partly covering the area of manganese nodules.

To the west of the Radiolarian ooze area lies a great tract of Globigerina ooze; it is east of the Marquesas and of the Paumotus and extends north some way into Moser Basin (Pl. 3).

Diatoms are found in a very wide belt reaching from the equator to nearly the general latitude of 15° S., in some localities south and west of Aguja Point, as well as others. Close to the South American coast they occur in sufficient quantities to have formed silicious earth.

It will be noted that the belt where diatoms occur is entirely within the influence of the western and northern set of the Humboldt current, and that while diatoms are found in great abundance in an area near the equator, yet they have undoubtedly been brought north by the Humboldt current from more southern latitudes than those explored by the "Albatross," and have been spread westward by the prevailing southeast trades of the belt where they are found (Pl. 4).

BOTTOM FAUNA OF THE EASTERN TROPICAL PACIFIC.

Plate 3[c].

Hauls of the trawl made off the Galapagos and at the western extremity of our lines off Aguja Point brought us within the area of the manganese nodules, with its Radiolarian ooze mud, Cetacean earbones, and beaks of Cephalopods; nothing could stand the damaging work of these nodules in grinding to pieces all the animal life the trawl may have obtained (Pl. 3). Down to a depth of 2200 fathoms or so the bottom was constituted of Globigerina ooze, its character being more or less hidden when near the coast by the amount of detrital matter and terrigenous deposits which have drifted out to sea.

North of the Galapagos, as in the 1891 expedition,[1] we found vegetable matter at nearly all the stations, and between the Galapagos and Callao such material was not uncommon in the trawl.

Beyond the line of 2200 fathoms dead radiolarians become quite abun-

[1] Bull. M. C. Z. XXIII, No. I, p. 11, 1892.

dant on the bottom, as well as in the mud of the manganese nodules, though among the nodules it was not uncommon to find an occasional Biloculina. Many of the dead radiolarians found on the bottom were obtained from the guts of Salpæ swimming near the surface or within the 300-fathom line in the tow-nets sent to that depth. The same is the case with many of the Dinoflagellata which have been considered as deep-sea types.

North of Callao our trawls brought up from the bottom many interesting fishes, among which I may mention Bathypteroïs, Ipnops, Sternoptyx, Nemichthys, Alepocephalus, Macrurans, Brotulids, Cyclothone, Melamphaës, and a few bat fishes, all, thus far, described by Mr. Garman from the 1891 expedition. I may mention also a Chimæra, different from the Chili species.

Among the Crustacea were Lithodes, Munidopsis, a number of Macrurans, many Schizopods, large Pycnogonids, and several species of Scalpellum, all well-known species of the 1891 expedition; we found a few Molluscs, and a few interesting genera of Tubicolous Annelids, among them Hyalicæna. Compared to the 1891 expedition, few starfishes and brittle stars were obtained, and still fewer sea urchins, only one species of Aceste and one of Aërope, a new species of Asthenosoma and Homolampas, in marked contrast to the numerous Echini collected in the Panamic Basin in 1891. We obtained, however, a magnificent collection of Holothurians, nearly every species occurring in the Panamic Basin being found in numbers in our track south of the Galapagos, in the wake of the great Chili-Peruvian current, and at considerable depths. On one occasion, at Station 4647, in 2005 fathoms, we obtained no less than sixteen species of Holothurians, among them brilliantly colored Benthodytes, Psychropotes, Scotoplanes, Euphronides, and the like. At Station 4670, in 3209 fathoms, we obtained six species of Holothurians. At Station 4672, in 2845 fathoms, we obtained also very many specimens of three species of Ankyroderma, a large Deima, two species of Scotoplanes, two of Psychropotes, with a number of young stages of that genus, repeating thus the experience of the "Challenger," which found Holothurians at great depth in abundance, not only in the number of specimens but also of species, though the "Challenger" did not in any locality obtain as many as we did at Station 4647. Mr. Westergren made a number of sketches of the species which were not obtained in the 1891 expedition. We also collected in the trawl a number of deep-sea Actinians, Stephanactis, Actinauge, none different, however, from genera previously found in the Panamic district. We obtained only a few Pennatulids, Gorgonians, and Antipathes, and a very considerable number of silicious sponges, usually associated with the Holothurians found in deep water in the track of the Peruvian current. In the track of the current, at not too great distances from the coast, we invariably brought up, even from very considerable depths, sticks and twigs and fragments of vegetable matter. On two ocasions we brought up in the trawl specimens of Octacnemus. The trawl had been working at 2235 and 2222 fathoms. Both Moseley and Herdman described this interesting Ascidian as attached to the bottom by a small peduncle. While the presence of the peduncle cannot be denied, yet its attachment, if attached at all, must be of the slightest, its transparent, slightly translucent body, with its eight large lobes, suggesting rather a pelagic type than a sedentary form. Octacnemus was discovered by the "Challenger" west of Valparaiso.

In the "Albatross" Tropical Pacific expedition (1899–1900) Octacnemus was obtained in the tow-net from less than 150 fathoms at station 15 Lat. 4° 35′ N., Long. 136° 54′ W., about 600 miles north of the Marquesas. The "Albatross" also collected in 1883, on her way from New York to San Francisco, specimens of Octacnemus, off Port Otway, Patagonia, in 1050 fathoms. They were described and figured by Mr. M. M. Metcalf,[1] showing that the individuals are not solitary but are attached to one another in a linear series by means of a slender stolon. It is possible that they were attached to some solid object or normally lived upon the bottom.

In the stomach of one of the specimens of Octacnemus was found a species of Tanais. Of this Dr. Hansen says: The species is certainly new, and the specimen well enough preserved so that it can be described. All the species of Tanaidacea, some curious males perhaps excepted, live on the bottom, some species rather near the shore, and many forms at considerable or great depths. This is of interest in the present case, because it would serve to show that the Octacnemus has taken the animal on the bottom and that it therefore goes down to the depth recorded — 2222 fathoms. But as this locality is comparatively near shore and in the track of the disturbances due to the Humboldt current, it is not safe to assume that the Octacnemus lived at that depth, as it is also known to live within 150 fathoms of the surface in other localities.

On our way from Callao to Easter Island in the early part of December,

[1] Octacnemus patagoniensis. Spengel, Zool. Jahrb. Abth. f. Anat. u. Ontol., Bd. 13. Pl. 40, fig. *80*, p. 572, 1900.

as far as 90° west longitude, we remained in the Humboldt current, as we could readily see from the character of the temperature serials and from the amount of pelagic life we obtained from both the surface and the intermediate hauls. This current also affected the bottom fauna, which was fairly rich, even as far as 800 miles from the shore, while we remained within the limits of the northern current (Pl. 3^c). As soon as we ran outside of this the character of the surface fauna changed; it became less and less abundant as we made our way to Easter Island, the western half of the line from Callao becoming gradually barren. This current also affected the deep-sea fauna to such an extent that towards Easter Island, at a distance of 1200 to 1400 miles from the South American continent, our trawl hauls were absolutely barren (Pl. 3^c); the bottom of the greater part of the line was covered with manganese nodules on which were found attached a few insignificant silicious sponges, an occasional ophiuran, and a few brachiopods or diminutive worm tubes, the same bottom continuing to Sala y Gomez and between there and Easter Island.

The southern part of our line from Easter Island to the Galapagos shows all the features characteristic of the western part of the line from Callao to Easter Island; like the latter, as far as the 12th degree of southern latitude, it proved comparatively barren, the bottom consisting of manganese nodules to within about 250 miles of the Galapagos (Pl. 3^c). The pelagic and intermediate fauna from Easter Island to 12° south latitude was very poor, and the serial temperatures show that we were outside and to the westward of the great Humboldt current. But near the 12th degree of southern latitude a sudden change took place; the pelagic and intermediate fauna became quite abundant again and soon fully as rich as at any time in the Humboldt current. There was also a marked change in the temperature of the water as indicated by the serials, showing that from the 12th degree of southern latitude to the Galapagos we were cutting across the western part of the Humboldt current (Pls. 3$''$, 4).

The presence of diatoms in all parts of the Humboldt current, which we crossed from south of Callao to the equator at the Galapagos and west towards Clipperton, shows how far the track of a great oceanic current can be traced, not only by its temperature but also by the pelagic life within or near it (Pl. 3). When once in the warm westerly equatorial current, the diatoms disappear and the bottom samples show only surface radiolarians and globigerinæ.

As we passed south from the Galapagos and gradually drew out of the influence of the western current, we entered the same barren region we passed through to the eastward when going to and from Easter Island. By the time we reached latitude 15° S., the hauls became quite poor; this barren bottom district extended to within a short distance of Manga Reva; corresponding to it we found a most meagre pelagic fauna, both at the surface and down to 300 fathoms — so poor that it could afford but little food to the few species, if any, living on the bottom in that region (Pl. 3°).

The samples of the bottom obtained by the soundings taken by the expedition or gathered in the mud-bag and in the trawl indicate that an immense area of the bottom of the Eastern Pacific is covered with manganese nodules, and that they play an important part in determining the character of the bottom, not only in the area covered by this expedition but also in other oceanic regions; the Eastern Pacific area of manganese nodules probably extends to the northwest of our lines to join the stations where manganese nodules were found by the "Albatross" in 1899 in the Moser Basin, on the line San Francisco to Marquesas (Pl. 3).

This area may also extend south of our lines, Callao to Easter Island, and join the line west of Valparaiso where the "Challenger" obtained manganese nodules at many stations. I do not mean to imply that manganese nodules are present to the exclusion of radiolarians and of globigerinæ. It is probable that the layer of nodules is partly covered by them, and by the thick, sticky, dark chocolate-colored mud which is found wherever manganese nodules occur.

On the northern part of the line, Galapagos (Wreck Bay) to Manga Reva, we did but little work beyond sounding, as we were likely to duplicate our former work to the eastward. The fourth day out, in latitude 5° S., we began a series of trawl hauls, surface hauls, and intermediate towings from the surface to 300 fathoms. In the northern part of the line to Manga Reva the hauls were remarkably rich as long as we remained within the influence of the western extension of the Humboldt current, and as long as there dropped from the surface masses of the radiolarians, diatoms, and globigerinæ living in the upper waters. Some of the hauls were remarkable for the number of deep-sea Holothurians and silicious sponges. Among the former I may mention a huge Psychropotes, 55 cm. long, and another a large Benthodytes which was viviparous.

As we passed south and gradually drew out of the influence of the western current, we entered the same barren region we passed through to the eastward when going to and from Easter Island. By the time we reached latitude 15° S., the hauls became quite poor; this barren bottom district extended to within a short distance of Manga Reva; corresponding to it we found a most meagre pelagic fauna, both at the surface and down to 300 fathoms — so poor that it could afford but little food to the few species, if any, living on the bottom in that region.

The extensive barren area of the Eastern Pacific is situated a considerable distance from land. It is bounded on the north by the curve indicating the position of $-h$ on Pl. 3′, it is out of the track of great oceanic currents. Similar but less extensive barren tracts have been indicated by the trawling of the "Albatross Tropical Pacific Expedition," and by those of the "Challenger" in the Central Pacific, and in the line from the Paumotus to Valparaiso. All these areas are at a distance from land where no food comes from telluric sources owing to the steep continental slopes of the adjoining continents.

We left Port Rikitea for Acapulco on the 4th of February to anchor off Aka-Maru; on the 5th we left our anchorage, sounded off the east face of Manga Reva, and took photographs of the islands from characteristic points.

On our way north from Manga Reva to Acapulco we did not begin to trawl or tow until warned by the contents of the surface-nets that the surface was becoming richer in animal and vegetable life (Pl. 3) and also by indications of the surface temperatures showing that we had reached the southern edge of the cold western equatorial current (Pl. 3″). A little north of 10°, south latitude, we made our first trawl haul and deep tow, and found a very rich fauna down to the 300-fathom line, recalling the pelagic fauna of the northern extremity of the eastern lines and fully as rich. On trawling we found, as we expected a very rich bottom fauna.

Among the animals brought up in the trawl there were some superb Hyalonemas, silicious sponges, Benthodytes and other deep-sea Holothurians, fine specimens of Freyella, and some large Ophiurans. This haul is interesting as showing that in the track of a great current, carrying an abundance of food, we may find at a very considerable depth (2422 fathoms) an abundant fauna even at very great distances from continental lands. We were, at this station (4740), about 2140 miles from Acapulco, 1200 miles from Manga Reva, 1700 miles from the Galapagos, and about 900 miles from the Marquesas.

Another haul made under the equator near the northern edge of the cold current in 2320 fathoms gave us the same results. The pelagic fauna was very abundant, the surface teemed with radiolarians, diatoms, and globigerinæ, and swarmed with invertebrates. The trawl contained a superb collection of bottom species of Holothurians, Brisinga, Hyalonema, and Neusina; Professor F. E. Schulze has shown these to be a new type of Rhizopod which he has called the Xenophyophora,[1] and on this occasion we brought up the only stalked crinoid collected during this expedition — parts of the stem of two specimens of Rhizocrinus, of which, unfortunately, the arms were wanting.

PELAGIC AND INTERMEDIATE DEPTHS FAUNA.

Plate 3C.

In the Panamic Basin to the northward of the Galapagos we occupied ten stations with the tow-nets, hauling both at the surface and at 300 fathoms, and vertically from that depth; we also continued this pelagic work at nearly all the stations from the Galapagos to Callao.

When off Chatham Island we began to trawl, and used the tow-nets regularly, occupying twenty stations as far as Callao. The nets were in charge of Mr. F. M. Chamberlain. The pelagic collections, as a whole, are remarkably rich. They are especially noteworthy for the great variety and number of pelagic fishes obtained inside the 300-fathom line at a considerable distance from shore — from 300 to 650 miles. Many of these fishes had been considered as true deep-sea fishes, to be obtained only in the trawl when dredging between 1000 and 1500 fathoms or more. On one occasion the tow-net brought up from 300 fathoms, the depth being 1752 fathoms, no less than 12 species of fishes; of some species of Myctophum we obtained 18 specimens; of another, 37; of a third, 45; in all, nearly 150 specimens. On other occasions it was not uncommon to obtain 8 or 10 species, and from 50 to 100 specimens. Among the most interesting types of fishes obtained in the tow-net I may mention Plagusiæ, Leptocephalus, and, as coming from less than 300 fathoms, Stylophthalmus and Dissoma, both of which Chun considers as deep-sea fishes, found in depths of 600 to 4000 meters; also a species of Eurypharynx obtained for the first time in the Pacific. Stylophthalmus I had caught in the tow-net in 1900, during the Tropical Pacific

[1] Valdivia Ex., Vol. XI, 1905.

expedition of the "Albatross," in depths of less than 300 fathoms. In the lines we ran across the great northerly current which sweeps along the coasts of Peru and Chili and is deflected westward at the easterly corner of the Galapagos Islands, we obtained with the tow-nets an unusually rich pelagic fauna at depths less than 300 fathoms (Pl. 3[c]). We collected a number of Schizopods, among them many beautifully colored Gnathophausiæ, Willemoesia, Eryonicus, Glyptocrangus, and pelagic Macrurans; huge, brilliant-red Copepods, as well as many other species of blue, gray, mottled, and banded Copepods. Euphausiæ, Saphirinæ, Phyllosoma, Thysanopoda, Lucifer, and Sergestes were abundant in many of our hauls. Many species of Amphipods were collected, Hyperids without number, especially where the surface hauls were made among masses of Salpæ, which, on several occasions, formed a jelly of Tunicates. Several species of Phronimæ also occurred constantly in the tow-nets. Sagittæ were very numerous, a large orange species being noteworthy. Several species of Tomopteris, some of large size and brilliantly colored, violet or carmine with yellow flappers, and two species of Pelagonemerteans and other pelagic Nemerteans. Two species of orange-colored Ostracods were also common, one having a carapace with a long spiny appendage. We obtained several species of pelagic Cephalopods, Cranchia and Taonis among them, and one with telescopic eyes. Two species of Doliolum also occurred, but they were never as abundant as the Salpæ, two species of which often constituted the whole contents of the tow-net. Appendiculariæ often swarmed and Pyrosomæ were occasionally found.

In the surface and deeper tows we procured also a number of Acalephs. We have collected more than 150 species of Medusæ and Siphonophores, many of which have been figured by Mr. Bigelow, differing from those of the 1891 expedition. Atollæ and other deep-sea Medusæ were common within the 300-fathom line.

Characteristic genera of the Humboldt current, both off the coast of Peru and on the line Easter Island to the Galapagos, are Atolla, Periphylla (once), Nauphanta, Æginura, Crossota, Colobonema, Halicreas, Haliscera, Aequorea, Rhegmatodes, Cunina, Solmissus, Pegantha, and a new genus closely allied to Ptychogena; among Siphonophores, Athorybia, Crystallodes, Vogtia, Physophora, Porpita; and among Ctenophores, Cestum, Beroë, Mertensia, and Eucharis. There were many genera of very general distribution over the whole area, especially Liriope, Geryonia, Rhopalonema, Solmaris, Aglaura, Æginella, Cytæis, Diphyopsis, Diphyes, Praya, Galeolaria, Rhizophysa, Cymba, Bassia, and very numerous monogastric forms, as Ursæa, Eudoxia, Eudoxella, Aglaisma, and Agalmid larvæ. In the barren area south and west of the Humboldt current few forms were taken except Liriope, Rhopalonema, Aglaura, Pelagia, Tiara, Cytæis, Diphyopsis, Porpema, Sphæronectes, and one specimen of Stephanomia. Off the coast of Mexico we took Velella, Porpita, Physalia, Cestum, and Cunina, and in Acapulco Harbor a large number of Leptoline forms, among them Zanclea, Pennaria, Ectopleura, Cytæis, Limnorea, Willia, Bougainvillia, Stomotoca, Phortis, Eucheilota, Oceania, besides Rhopalonema, Cunina, Ocyroë, Mnemiopsis and Agalma and Diphyes. A few Sertularians were brought up in the trawl.

The Salpæ guts gave us, in addition to the finer tow-nets, immense collections of radiolarians, diatoms, and dinoflagellata, many of which have been considered to live at great depth and upon the bottom. It is most interesting to note the number of diatoms found in this tropical region. They have usually been considered as characteristic of more temperate and colder regions. On several occasions the surface waters were greatly discolored by their presence, and the extent of their influence on the bottom deposits is shown by the discovery of a number of localities where the bottom samples at depths from 1490 to 2845 fathoms, in the track of the great Peruvian current, formed a true infusorial earth.

The tow-nets also contained many species of Limacina, Spirialis, Atlanta, Cavolina, Hyala, Cymbulia, Styliola, Cleodora, Tiedemannia, Clio, and the like. On one occasion the mass of the pelagic hauls consisted entirely of small brown Copepods, the contents of the tow-nets looking like sago soup. Another time Sagittæ, Salpæ, Doliolum, and Liriope, all most transparent forms, formed the bulk of the tow-net's catch. Again another time, Firoloides, Cymbulia, and Carinaria constituted the bulk of the haul. At other times Euphausiæ and Schizopods constituted the mass of our catch. These catches, coming on successive days, or interrupted with hauls of more than mediocre quality, show how hopeless it is at sea to make any quantitative analysis of the pelagic fauna and flora at any one station within the influence of such a great oceanic current as the Chili and Peruvian stream.

We came across such huge masses of pelagic surface animals at Station 4647 consisting mainly of Cytæis.

At Stations 4650 and 4660 and Stations 4709, 4720, a large Salpa species and Doliolum constituted nearly the whole of the catch.

Euphausiæ with other Schizopods and Hyperids and Amphipods constituted the mass of pelagic animals at Stations 4654 and 4676.

Acalephs, mainly Liriope and Glossocodon, filled the nets at Station 4671.

At Station 4743 Crystallodes swarmed with a few other Acalephs and Siphonophores.

At Stations 4712, 4715 a surface haul contained mainly transparent types: Sagitta, Doliolum, Pteropods.

Halobates were quite common at the stations where the swarms of pelagic animals occurred. A large Tornaria with rows of feathery vibratile cilia was also not uncommon on such occasions.

When coming across such masses of Salpæ, of Cytæis, or Cymbulia or swarms of other pelagic animals as to make a thick soup of the water and its contents, one cannot fail to be struck with the huge quantity of minute pelagic organisms which must be devoured by these larger pelagic animals. An excellent example of this is the instance given of the contents of the guts of Salpæ, at Stations 4650, 4660, and 4709. They contained among other Diatoms: Planktoniella, Rhizosolenia, Coscinodiscus, Asteromphalus, and Synedra, many Dinoflagellates such as Ceratium, Peridinium, Steiniella, and a great number of Radiolarians:

Acanthonia	Collosphæra	Coelodendrum
Acanthochiasma	Ellipsostylus	Dorotaspidæ
Acanthometron	Hexalonche	Acantharia
Zygacantha	Diploconus	Lithocampe
Acanthostaurus	Haliomma	Aulosphæra
Quadrilonche	Coronidium	
Astrolophus	Rhopalastrum	

Between Panama and the Galapagos and from the Galapagos to Callao we found very commonly in our tow-nets, from 300 fathoms, Tuscarora, Tuscarusa, Aulosphæra, and others. In depths of 300 fathoms to the surface, the tow-net was rich in Tintinnidæ, either dead or moribund Planktoniellæ, and Dinoflagellata. Among these were species of Ceratium, of Peridinidæ, Gonyaulax, Phalacroma, Pyrocystis, Cyttarocylis, Undella, and Dictyocysta. On the surface Planktoniella sol predominates, with Asteromphalus, Biddulphia, and Thalassiothrix. Among the Dinoflagellata we obtained species of Ceratium, of Peridinium, and species of other Peridinidæ; among the Protozoa were a number of Sticholonche; among the Acantharia were especially to be noticed Acanthometron, Acanthostaurus, Amphilonche. Collozoum, Thalassicola, and a number of Chirospira murrayana and a few species of Challengeridæ were frequently found.

It is impossible at present to indicate the geographical distribution of the Diatoms, Dinoflagellates, Tintinnids and Radiolarians thus far collected in our pelagic hauls. The same genera of these groups are constantly occurring at very distant points and their distribution seems mainly characterized by the association of varying numbers of specimens of the same genera and species. But undoubtedly a closer tabulation of the species of these groups may lead to a general conception of their geographical distribution over the area of the Pacific explored by the "Albatross."

The principal genera of Diatoms met with are Coscinodiscus, Asteromphalus, Planktoniella, Rhizosolenia, Synedra, Gossleriella, Eucampia, Thalassiothrix, Biddulphia, Euodia.

Of the Tintinnids: Tintinnus, Undella, Dictyocysta, Amphorella, Cyttarocylis, Codonella, Porœca are the principal genera found.

Coccoliths, Coccospheres, and Rhadospheres, occurred in the whole area explored by the "Albatross." Noctiluca and Pyrocystis were not uncommon. Challengeridae, Challengeron, Tuscaroridae and Tuscarusa were obtained in nets sent down to 150 and 300 fathoms, and from the surface. Trichodesmium, Halosphæra, and other pelagic Algae were most common.

Among the Radiolarians the following genera have been noted, many of which have been described as living at great depths while in reality they are only the dead carcasses of types living at the surface or close to it and gradually falling to the bottom :

Collozoum		Rhopalastrum	Cyrtophormis
Belonozoum		Conchidium	Lithostrobus
Cenosphæra		Litholophus	Lithomitra
Ethmosphæra		Acanthonia	Eucyrtidium
Odontosphæra		Acanthostaurus	Lithocampe
Chœnicosphæra	Species described by Haeckel as found in 2500 fathoms in Central Pacific.	Belonostaurus	Aulactinium
Siphonosphæra		Zygostaurus	Aulocantha
Trypanosphæra		Amphibelone	Sagosphæra
Solenosphæra		Perispyris	Aulosphæra
Hexastylus		Nephrospyris	Cannosphæra
Hexacontium		Litharachnium	Challengeron
Echinomma		Carpocanistrum	Challengeria
Cromyomma		Cornutella	Cadium
Pityomma		Tripocyrtis	Medusetta
Ellipsostylus		Lychnocanium	Euphysetta
Stylatractus		Carpocanium	Circoporus
Spongocore		Sethoconus	Tuscarora
Porodiscus		Dictyoceras	Tuscarusa
Euchitonia		Theocalyptra	Tuscaridium

Of the Dinoflagellates the following were recognized.

Pyrocystis	Ceratium	Ceratocorys
Exuviaella	Gonyaulax	Phalacroma
Prorocentrum	Goniodoma	Dinophysis
Glenodinium	Diplopsalis	Amphisolenia
Ptychodiscus	Peridinium	Ornithocercus
Pyrophacus	Podolampas	Histoneis
Steiniella	Blepharocysta	Citharistes
Protoceratium	Oxytoxum	Cladopyxis

The great changes of temperature which took place at some localities in the layers of the water between 50 and 300 fathoms are most striking, and show what a disturbing element the great mass of cold water flowing north must be in the equatorial regions of the Panamic district to the south and to the north of the Galapagos (Pls. 3^a; 4, fig. 2; 6, fig. 2; 10, fig. 2). South of the Galapagos the western flow of the Humboldt current must be nearly 800 miles wide, and of about the same width when running parallel to the South American coast.

The range of temperatures between 30 fathoms and 150 fathoms is at some points as great as 21° (Pl. 4, fig. 2). Such extremes cannot fail to affect the distribution of the pelagic fauna, and may account for the mass of dead material often collected in the intermediate tows at depths of less than 300 fathoms, when the range becomes as great as 28°. Such a range of temperature is far greater than that of the isocrhymic lines which separate coast faunal divisions. A preliminary examination of the contents of the nets from 800 fathoms shows nothing which had not been obtained in lesser depths of from 300 to 150 fathoms from the surface. These nets coming from 800 fathoms, as at Station 4517,* contained a mass of dead and moribund material collected on its way to the bottom. A lot of Copepods came up, fully 65 per cent of which were dead. Of the Dinoflagellata, most of them had no chlorophyll, and of the Radiolarians many were the skeletons of surface colonial forms. At Station 4697 at 300 fathoms to the surface more than one-third of the contents of the net was dead.

At 800 fathoms at Station 4701, of the Copepods in the net, 25 per cent were dead, and of the Radiolarians, 70 per cent.

From 800 fathoms at Station 4715, a great deal of dead material and débris was collected, mainly of Diatoms and Dinoflagellates.

From the same depth, at Station 4717, many dead Globigerinæ were obtained, and 25 to 30 per cent of the Copepods collected were dead.

From 800 fathoms at Station 4728 many of the Copepods, Diatoms, and Radiolarians brought up in the net were dead.

From 800 fathoms at Station 4732, the net sent down on the serial line contained a great deal of dead and moribund stuff.

At 300 fathoms at Station 4736 a great many dead Diatoms, Copepods, Radiolarians, Globigerinæ, and Dinoflagellates were found.

The poor hauls made after leaving Easter Island, and composed of dead and moribund and battered stuff, occur beyond the limits of the Humboldt stream, where the pelagic fauna gets no food; it is dying and dropping to the bottom.

At Station 4710, in a surface haul, much débris of Diatoms, Dinoflagellates, Tintinnids, and Radiolarians was obtained.

At Station 4721, though still in the current, the Diatoms in the fine nets had greatly diminished in number.

The next Station, 4722, is still poorer in Diatoms, and at Station 4725 about half-way to Manga Reva very few Diatoms were collected.

In the Eastern Tropical Pacific area, Globigerinæ increase in number in the warmer water. This is very marked on the way from the Galapagos to Manga Reva.

At Station 4679, we met in the warmer waters representative tropical forms of Dinoflagellates, forms not seen since leaving the Galapagos: Goniodoma, Gonyaulax, Phalacroma, Histoneis, Ornithocercus, Ceratocorys, Dinophysis; among Radiolarians: Trypanosphæra, Conchidium, Cornutella, Choenicosphæra. The abyssal fauna, as we entered the Humboldt current going north from the Galapagos, gradually became richer in spite of the bottom being covered with manganese nodules.

The distribution of the pelagic and bottom fauna can be seen at a glance on Plate 3C. The curves drawn show in a general way the area over which the pelagic fauna is rich, poor, or barren. The northern limit of the rich pelagic fauna (1) runs somewhat north of the equator from Long. 120° W. and nearly parallel with it as far as the northern Galapagos Islands; thence it runs in a northeasterly direction to a point south of Mariato Point.

The southern limit of the rich pelagic fauna (1) coincides with that of the rich trawl hauls. It runs east to Long. 105° W., makes a bend to the south, crossing the 100° W. Long. at about Lat. 15° S., and then trends in a southeasterly direction, crossing Lat. 20° S. at Long. 90° W. The southern limit of the poor pelagic hauls begins off the eastern face of the Paumotus running east, somewhat north and south of Lat. 20° S. to about 95° W. Long., when it runs off in a southeasterly direction. South of the southern limit of (2) the pelagic fauna is barren; its southern limit begins off Manga Reva, running eastward and passing somewhat north of Easter Island and Sala y Gomez.

The southern limit of the rich trawling is found at the latitude of the Marquesas, about in Long. 125° W., running in an easterly direction to Long. 100° W., Lat. 7° S., when the curve takes a bend and runs in a southeasterly direction to Lat. 20° S., Long. 80° W. The northern limit of the poor trawl hauls extends almost to the southern limit of the rich trawl hauls. It forms a regular curve from off the east face of the Paumotus, cutting Long. 100° W. at 10° S. Lat., and thence curves in an easterly and southeasterly direction, cutting Lat. 20° S. at about 84° W. Long. The whole of the bottom area of that part of the Eastern Pacific is barren of animal life and forms a great desert on which but little animal life is found and upon which drop the dead carcasses of a poor pelagic area; while the belt of the rich bottom trawling is in a region where the bottom fauna is abundantly supplied with the remains of a rich pelagic fauna.

No line is shown as the northern limit of the rich trawl hauls, as in the Panamic district to the north of the northern limit of the rich pelagic fauna the bottom fauna was found to be uniformly rich from the equator as far as the coast line.

The area situated between the northern limit of the rich pelagic fauna (1) and the southern limit of the rich trawl hauls corresponds to the rich belt of the pelagic fauna which is swept north by the Humboldt current and then westward towards the Marquesas and Moser Basin.

SERIAL TEMPERATURES.[1]

Plates 3^a, 4–12.

All stations marked * are hydrographic stations.

The serial temperature stations occupied on the lines between the Galapagos to Aguja Point, southwest from Aguja Point to the western edge of the Humboldt current and east to Callao, as well as on the lines from Callao

[1] The stations at which serial temperatures were taken are marked *t* on Plate 1. For position of stations see Plate 2.

to Easter Island, Easter Island to the Galapagos, and Galapagos to Manga Reva, developed the course and width of the Humboldt current, while the line from Manga Reva indicated its western extension and the position of the equatorial current to the west of the Galapagos. The temperature conditions of the Panamic district were observed by the "Albatross" in her expedition of 1891, and were noted in my general sketch of the cruise.[1]

Beginning with a line running in a northwesterly direction from Aguja Point (Pl. 7) towards the Galapagos, we find at 50 fathoms, at the three eastern stations, a nearly uniform temperature, varying between 57°.8 and 58°.8, while at a western station the temperature at that depth was 62°.5. The belt of 60° begins at about 25 fathoms near the coast and widens to 75 fathoms towards the west. At 100 fathoms the temperature is between 54°.9 at the western station and 57°.5 near the coast, and the belt of water adjoining the coast maintains its greater temperature to a depth of 800 fathoms, the cold belt of 38° and 40° rising as we go west. Yet the surface temperature is colder towards Aguja Point. It is 64° at Station 4652, 67° at Station 4651, rising to 71°, 71°.5, 72°, 75°.2, 77°, and reaching 78°.5 as we proceed westward from Station 4652 to Stations 4649, 4647, 4646, 4523*, and 4539*. Between Station 4651 and Stations 4647 and 4713 the rapid fall of temperature from the surface to 50 fathoms is very striking, falling from 67° to 58°.8; 71° to 57°.8; 71°.5 to 58°.6; 75°.2 to 62°.9, or varying between 8°.2 and 13°.2 (Pl. 6, fig. *2*).

In a section from Aguja Point in a southwesterly direction (Pl. 6, fig. *1*) from Station 4655 to Stations 4662, 4701, the surface temperature gradually rises as we pass westward. Near the coast it is 65° at Station 4654, 67° at Station 4655, 70° at Station 4658, 69° and 69°.4 at Stations 4660 and 4662, and it rises to 74°.7 at Station 4701. The temperature curves of 60°, 50°, 40° and 38° are at about the same depths as those of the more northern line.

A line about west of Callao to Station 4535*, nearly 2750 miles from Callao, shows the same increase in surface temperature (Pl. 9). At Stations 4509* and 4670, about 80 miles from the coast at the western edge of Milne-Edwards Deep, it is 67°; it has risen to 69° at Station 4666, to 69°.4 at 780 miles from the coast, at Station 4662, to 72°.7 at Station 4707, to 76°.7 at Station 4724 on the Albatross plateau, and to 80° at Station 4535*. The body of water having a temperature above 38° is larger north at Aguja Point

[1] General sketch of the expedition of the "Albatross" from February to May, 1891, Bull. Mus. Comp. Zool. XXIII, No. 1, p. 12.

than south off Callao. Off the former locality the curves of 38°, 40°, 50°, and 60° are near the coast at 850, 650, 250, and 30 fathoms. Off Callao they are at 700, 550, 150, and 40 fathoms. That is, the cold water extends from 150 to 100 fathoms nearer the surface off Callao than at Aguja Point.

In the line from Callao to Easter Island (Pl. 10, fig. *1*) we begin near the coast at Station 4509* with a surface temperature of 67°; between this station and Station 4676, the surface temperature varies rapidly, passing to 65° then 70° and 69° at the last station. At Station 4681 it has risen to 70°, again rising further west to 70°.6, 72°, 73°, 74°, at Stations 4683, 4685, 4687, 4689, 4691, dropping to 73° and 71° near Sala y Gomez and between it and Easter Island, when it rises again to 74°[1] at Stations 4512*, 4693, 4513*.

At the stations which are nearly on the 20° S. Lat. (Pl. 11), the surface temperature of 70°.6 at Station 4683 gradually increases as we go west to 73°, 75°, 81°.5, and 81° at Stations 4685, 4699, 4737, and 4532*.

The rapidity with which the temperature of the Humboldt current drops from the surface to a very moderate depth is shown in Plates 4, fig. *2*; 6, fig. *2*; 10, fig. *2*. At Station 4713, south of the Galapagos, the temperature at 15 fathoms is about the same as at the surface — 75°.2. It has fallen 1° at 30 fathoms, it has dropped nearly 12° at 50 fathoms, and 6° more at 75 fathoms, and has fallen to 54°.9 at 100 fathoms, a difference in 100 fathoms of 20°.3.

At Station 4651 off Aguja Point near the coast, about in the same latitude as that of Station 4713, the surface temperature of 67° has only dropped to 57°.5 at the depth of 100 fathoms, the body of water between the surface and 75 fathoms being colder.

At Station 4683 on 20° S. Lat., at a greater distance from land, the surface temperature is 70°.6, and at 125 fathoms is still over 62° (62°.5), the water off the western edge of the Humboldt current being much warmer to a depth of 125 fathoms than that in the Humboldt current itself.

At Station 4685, a little more to the south and west than Station 4683, the body of water down to 200 fathoms is as a whole warmer than at the stations to the eastward.

Taking a section in a northwesterly direction from Callao (Pl. 8), we note the same increase of surface temperature as we go west.

At Station 4670, on the western edge of Milne-Edwards Deep, the tem-

[1] A current runs north to south between Sala y Gomez and Easter Island.

perature is 67°. It becomes 70° at Station 4658, 75°.3 at Station 4711, and 79° at Station 4540*, about 2400 miles northwest of Callao, the temperature of the body of water between the surface and 500 fathoms gradually rising from 59°.7 to 67°.6 at 50 fathoms, from 54°.1 to 65°.3 at 100 fathoms, from 48°.9 to 52°.9 at 200 fathoms, from 44°.6 to 46°.7 at 300 fathoms, and from 42 to 44°.1 at 400 fathoms. At 600 fathoms the temperature of the same stations differs only 0°.2. It is 39°.4 at the eastern and western stations.

Taking the sections running in a general way from the north to the south, the line from Callao to Easter Island and that from Aguja Point in a southwesterly direction have been described. On the line from the Galapagos to Easter Island (Pl. 4, fig. *1*) the surface temperature varies from 74° to 75° as far south as Station 4705, where the surface temperature becomes 72°. This remains the surface temperature as far south as Station 4703, where it is 73°, it rises to 74°.7 at Station 4701, gradually rising to 75° towards Easter Island, where it drops to 72°. At Station 4707 we have a warmer body of water between 300 fathoms and the surface than at the stations to the south and north of it. The Humboldt current probably extends as far as the 12° of southern latitude. On the line from the Galapagos to Manga Reva (Pl. 5), the surface temperature rises and falls from 76° at the Galapagos to 75° at Station 4722; from that point, going south and west, it rises gradually to 81°.5 at Station 4736, and again drops to 80° at Station 4524* and to 77° at Manga Reva; thus passing across the colder water of the Humboldt current, which, south of the Galapagos, must be about 800 miles wide, to warmer waters. South towards Manga Reva, at 400 fathoms, the temperature is colder near Manga Reva (41°.7) than near the Galapagos (44°.1); the same is the case at 300 fathoms. But at 200 fathoms the temperature of that depth, while falling from 52°.9, at Station 4718, to 50°.3 at Station 4721, and to 48°.5 at Station 4724, rises again south of it, at Station 4728, to 50°.1, and continues to rise to 51°.9, 55°.4 and 56°.7 as we go south and west at Stations 4732, 4736, 4739, to drop again to 53°.5 at Manga Reva, at 225 fathoms.

A similar condition of temperature exists at the 200-fathom line. At 100 fathoms the temperature is higher near the Galapagos, at Station 4714; it falls from 65°.3 to 55°.7 at Station 4721, to rise to 64°.5 at Station 4724, and gradually rises to 67°.6 at Station 4729, to 70°.5 at Station 4732, to 71°.7 at Station 4736, and to fall to 68°.5 at Station 4739 near Manga Reva.

The water of the western part of the line as a whole being warmer than the eastern part, the intrusion of a large body of cold water between Station 4721 and Station 4717, between 50 and 200 fathoms, is a marked feature of the northern end of the line Galapagos to Manga Reva.

Only two serial temperatures were taken at Stations 4740 and 4742 on the line Manga Reva to Acapulco (Pl. 12). To the eastward on the line, Galapagos to Manga Reva we took a number of serial temperatures, passing from the colder water of the Humboldt current to the warmer waters south towards Manga Reva. The temperatures at 200 fathoms are nearly identical. North, a great change in temperature takes place between 25 and 200 fathoms, where there is a difference of 24°. South the belt of warm water extends 100 fathoms, a great change occurring between 100 and 200 fathoms, a drop of 16°. The serial temperatures taken at the southern and northern edges of the cold current on the line Manga Reva to Acapulco agreed well with those taken in the same current to the east.

Station 4725, which is in the same latitude as 4740, shows a difference (colder) of 4° at the surface, of 5° at 50 fathoms, of 2° at 100 fathoms, and of 0°.3 at 200 fathoms.

Station 4714 which is a little to the south of the western Station 4742, shows a difference (colder) of 2° at the surface, 3°.4 at 50 fathoms, 11°.1 at 100 fathoms, 1°.4 at 200 fathoms, while at 300 and 400 fathoms the western station is colder, 1°.2 at 300 fathoms, and 1°.6 at 400 fathoms. At 800 the temperature is 39°.4 at both stations.

It may not be out of place to correlate the temperature results obtained south of the Panamic region with those obtained in the Panamic district by the "Albatross" in 1891.[1]

A transverse section of the Mexican current from Mariato Point to Cocos Island shows the existence of a cold current running north parallel to the coast: the northern extension of a branch of the Humboldt current. This is pushed to the east by the Mexican branch of the California current and also by the easterly equatorial set. The latter is deflected to the westward and becomes a part of the westerly equatorial current flowing well north of the eastern set which flows by the Galapagos in the oceanic basin between them and Acapulco as far as Lat. 12° N., while in the oceanic valley separating Galera Point and the Galapagos there is a wide current of cold water flowing north towards the Bay of Panama.

[1] Bull. M. C. Z. XXIII, No. 1, p. 12, 1902.

RECORD OF SERIAL TEMPERATURES.

Station.	Temperature.		At Fathoms								At Bottom.	Depth in Fathoms.
	Of the Air.	At the Surface.	25	50	100	200	300	400	600	800		
	° F.	°	°	°	°	°	°	°	°	°	°	
4647	72	71.5		58.6	56.4	50.4	45	42.6	39.9	37.8	35.5	2005
4649	71	71	62.9	57.8	55.6	50.3	45.1	42.8	39.8	39	35.5	2235
4651	68	67	61	58.8	57.5	51.3	48.2	44.4	40.6	39.5	35.5	2222
			5 f.	10 f.	20 f.	30 f.	40 f.	50 f.	75 f.	100 f.		
4651	68	67	67	61.5	60.6	59.9	. . .	58.7	57.9	57.1	35.5	2222
4662	70	69.4	69.1	59.3	53.5	49.7	46.2	42.5	39.4	37.4	35.3	2439
4666	68	69	67	58.5	55.3	50.6	45.3	43.2	39.3	37.3	35.1	2600
4670	68	67	63.8	59.7	54.1	48.9	44.6	42	39.4	38.1	35.5	3209
4676	70	69.5	65.7	64.4	53.4	49.4	44.8	42	31.9	37.3	35.5	2714
4681	68	70.3	68.5	67.8	61.3	49.1	43.8	41.8	39.1	37.3	35.5	2395
					75 f.	100 f.	125 f.	150 f.	175 f.	200 f.		
4683	72	70.6	69	68.5	68.4	62.7	62.5	52.3	50.4	50.6	35.8	2385
4685	80	72.5	68.6	67.7	64.8	49.2	42.7	41.1	38.7	37.2	35.4	2205
4689	81	74	70.1	68.8	64.4	51	44.1	41.4	38.3	37	35.5	2185
4517*	75	74.6	73 6	68.8	67	56.2	53.2	41.6	38.6	36.8	35.5	1723
4701	75	74.7	72.6	69.9	68.5	50.4	43.5	41.3	39	37.2	35.5	2265
4707	73	72.7	72.5	69.8	56.7	49.2	45.1	42.2	39.1	37.3	35.8	2120
4711	74	75.3	73.8	59.5	54.9	51.1	45.6	43.4	39.2	37.4	35.8	2240
			15 f.	30 f.	50 f.	75 f.	100 f.	125 f.	150 f.			
4713	77	75.2	75.2	74.1	62.5	56.3	54.9	54.4	53.8	. . .	35.8	2191
4715	77	74.7	70.6	62.7	56.7	51.6	47.9	43.8	40.4	38.2	. . .	1743
4717	81	76.2	76.5	66.7	65.3	52.9	46.7	44.1	39.4	37.9	35.8	2153
4721	79	75.7	76	73.1	55.7	50.3	46.3	42.7	39.2	37.3	. . .	2084
4724	79	76.7	76.6	73.8	64.5	48.5	45.3	42.4	39	37.3	35.8	1841
4728	80	78.7	78.7	74.2	67.6	50.1	44.4	42.4	39.1	37.4	36.5	1055
4732	80	81	77.3	73.6	70.5	51.9	44.4	42.3	39.3	37.4	35.1	2012
4736	81	81.1	79.6	74.7	71.7	55.4	44.1	41.2	38.9	37.3	34.8	2289
4739	81	79.7	79.5	74.7	68.5	56.7	44.6	41.7	39.3	37.4	34.9	2042
4740	81	80.7	80.6	78.7	66.5	48.8	45	41.9	39.1	37.4	34.2	2422
4742	78	77.4	75.8	70.1	56.2	51.5	45.5	42.5	39.4	37.8	34.3	2320

* Hydrographic station.

The existence of these large bodies of warm water in the western and central area of the Panamic region is well shown by the temperature sections (Pls. VIII, IX), Bull. M. C. Z. XXIII. No.1. The confusion existing in the currents north of the Galapagos due to the flow of the cold Humboldt current between the southeastern islands of the Galapagos is easily traced in Plates X–XII of the Report of the 1891 expedition.

As we go southwest of Cocos the body of water becomes warmer, but again becomes colder to the south of Malpelo and still colder to the eastward under the influence of the eastern branch of the Humboldt current. Near Galera Point we find the same extremes of temperature in a small bathymetrical range: 20° in less than 50 fathoms.

SURFACE TEMPERATURES.[1]

Plate 3″.

On Plate 3″ are found the curves of temperatures characteristic of the Eastern Pacific from November to March. The heavy lines indicate temperatures of 65°, 70°, 75°, and 80°. As the surface temperatures are known only along the lines run by the "Albatross," they are of course not simultaneous observations. A glance at Plate 3″ shows the two great warm areas above 80°. One south of the equator, east of the Marquesas and the Paumotus; this is somewhat pear-shaped, while the corresponding warm area, nearly in the same position north of the equator, is elongated in shape and extends east almost to 100° W. Long. A smaller warm area, bounded by the 80° curve, runs parallel in a general way to the trend of the Central American and Mexican coast. Within this area are smaller areas of greater degree of temperature. The effect of the southeast trades in pushing westward a large body of warm water close to the equator, and with a temperature between 75° and 79°, is well shown on Plate 3″.

A huge body of water, with a temperature of between 75° and 80°, occupies the greater part of the Eastern Pacific. Next come the warm areas over 80°. A mass of water, with a surface temperature between 70° and 75°, extends from Lat. 20° S. and about Long. 94° W., to Long. 110° W., and runs north to the latitude of the Galapagos in the west, when the 75° line runs east toward the coast of Ecuador. The eastern face of this belt runs north to the latitude of Aguja Point, when it runs in a northeasterly direc-

[1] For record of surface temperatures see List of Stations pp. 37–50.

tion towards Cape San Francisco. In this area, south of the equator and southwest of the Galapagos, lies a small, isolated, elliptical area, having a temperature of 77°, and one of 75° near Easter Island running in a northeasterly direction. An area of cold water exists between the 65° and 70° curve, extending from 20° of southern latitude to the equator, where the curves meet across the ridge off Cape San Francisco. The coldest water of this area is immediately west of the South American coast. It will be noted that, owing to the mass of cold water between 65° and 70° which is forcing its way north, the belts of temperature are not continuous either in the colder area or in the adjoining somewhat warmer area having a temperature between 70° and 75°. Belts of warm and colder water alternate with one another, forming thus a most singular set of longer or shorter temperature lines running from south to north. It is only outside of the 75° curve line that the temperature lines assume any regularity and limit definite areas. The surface temperature of the Eastern Pacific is nowhere below 77° north of the equator, with the exception of a very narrow strip north of the Galapagos, where the temperature falls to 75°. South of the equator, on the contrary, east of about 110° W. Long. to the South American coast, the surface of this great body of water is nowhere higher than 75°, and gradually becomes colder as we go east, reaching its minimum of 65° immediately off the South American coast. While west of the 75° curve the temperature gradually rises toward the warm area enclosed by the 80° curve, which lies to eastward of the Paumotus.

The warm areas north and south of the equator are separated by a wide belt in which the surface temperatûre does not fall below 79°. The warm shore belt (of 80°) is off the Mexican coast, separated from the northern equatorial warm belt of 80° by surface water of 79°, but between the former and the 75° curve, which extends eastward nearly on the line of the equator, the surface temperatures gradually fall from 80° to 75° passing south.

SPECIFIC GRAVITIES.

Plate 3^b.

On Plate 3^b the specific gravity is indicated merely by the decimal numbers; to avoid confusion, instead of being given as 1.0252 or 1.0260, it is given only as 252 or 260 etc., etc. . . . ; the 1.0 should be prefixed to each record. The heavy lines on Pl. 3^b indicate the specific gravities of 1.0240, 1.0245, 1.0250, 1.0255, 1.0260.

Mr. F. M. Chamberlain made two daily observations of the density of the water, and found the same discrepancies between our observations and those of 1891, and those given by the "Challenger" and in the Atlas of the Pacific Ocean published by the German Naval Observatory. Whenever we took a serial temperature, he also determined the density at 800 fathoms.

The observations made in 1891 were not sufficiently numerous to enable me to draw the curves of densities in the Panamic district and connect them with the observations taken during the present cruise. They varied so rapidly from station to station as to indicate great difference in densities in belts of water separating adjoining stations. This rendered it impracticable to sketch out a chart of the densities of the Panamic region from the confused data available.

From the effect of the prevailing southeasterly trades and the northerly set of the Humboldt current off the South American continent the lines of equal gravity are frequently separated by narrow belts of different gravities. This is well shown on Pl. 3^b, in the area between the curves of 1.0250 and of 1.0255 off the coast of Peru, as far north as Aguja Point and half-way from Callao to Easter Island.

This confusion becomes still greater in the Panamic district north of the equator and to the east of the line run by the "Albatross" from Mariato Point to the Galapagos. The densities increase in a southwesterly direction from Acapulco, from 1.0240 to 1.0245, 1.0250, 1.0255, and 1.0260. These lines are about 600 miles apart, and all trend in a southeasterly direction. The area of greatest specific gravity is enclosed by the 1.0260 line which runs from a point north of the Marquesas to about 300 miles northeast of Easter Island, where the line forms a loop and runs towards Manga Reva about half-way between Easter Island and the equator. The 1.0255 line coming from Moser Basin runs east and then, forming a sharp elbow, south, about parallel with the South American coast line. The 1.0250 curve runs in a general way about parallel with the 1.0255 and 1.0260 curves and makes a sharp angle off Aguja Point and runs south in loops about parallel to the coast off Callao. Towards Acapulco only parts of the 1.0240 and 1.0245 curves are indicated parallel to the 1.0250 line. On the line from the Galapagos to Acapulco an area of greater density is indicated, with a specific gravity of 1.0256. This area crosses the belt of hot water with a temperature of 78° to 80° lying to the west of Cocos Island and extending westward to the Moser Basin.

RECORD OF SPECIFIC GRAVITIES.

Date. 1904.	Time of Day.	Station.	Latitude North.	Longitude West.	Depth.	Temperature by Attached Thermometer	Specific Gravity Reduced to 15° C.	REMARKS.
			° ′	° ′		°		
Oct. 19	7 P.M.	4615	9–07	85–11	Surface	80	1.0221	
20	9.30 "	4619	7–15	82–08	do.	78	1.0218	
21	8.45 "	4624	6–58	80–46	do.	80	1.0212	
28	4 "	Panama Bay			do.	83	1.0207	
Nov. 2	7 "	4627	7–21.3	79–55.8	do.	81.5	1.0204	
4	9 "	4634	4–35.4	83–32.3	do.	77	1.0235	
			South.					
6	1 "	4639	0–04	87–39.5	do.	76	1.0234	
6	8 "	4640	0–39.4	88–11	do.	75	1.0234	
7	8 "	4644	2–13.3	89–42.2	do.	72	1.0243	
8	8 A.M.	4645	3–37.6	89–43.1	do.	70	1.0255	
8	8 P.M.	4646	4–01.6	89–16.3	do.	70	1.0254	
9	8 A.M.	4647	4–33	87–42.5	do.	70	1.0252	
9	8 P.M.	4648	4–43	87–07.5	do.	71	1 0253	
10	8 A.M.	4649	5–17	85–19.5	do.	70	1.0254	
10	2 P.M.	4649	5–17	85–19.5	800 fathoms	39.5	1.0247	
10	8 "	4650	5–21	84–39	Surface	71	1.0254	
11	8 A.M.	4651	5–41.7	82–59.7	do.	66	1.0251	
11	3 P.M.	4651	5–41.7	82–59.7	800 fathoms	40.1	1.0246	
11	8 "	4652	5–44.7	82–39.5	Surface	66	1.0250	
12	12 M.	4653	5–47	81–24	do.	62.5	1.0250	
12	8 P.M.	4655	5–57.5	80–50	do.	65	1.0250	
13	8 A.M.	4656	6–54.6	83–34.3	do.	69	1.0250	
13	8 P.M.	4657	7–12.5	84–09	do.	69	1.0253	
14	9 A.M.	4658	8–29.5	85–35.6	do.	70	1.0253	
14	8 P.M.	4659	8–54.5	86–05.5	do.	70	1.0253	
15	8 A.M.	4660	9–55.6	87–30	do.	69	1.0252	
15	8 P.M.	4661	10–17	88–02	do.	69	1.0256	
16	8 A.M.	4662	11–13.8	89–35	do.	69	1.0254	
16	2 P.M.	4662	11–13.8	89–35	800 fathoms	38	1.0244	
16	8 "	4663	11–20.3	88–55.2	Surface	69	1.0254	
17	8 A.M.	4664	11–30.3	87–19	do.	68	1.0253	
17	8 P.M.	4665	11–45	86–05.2	do.	67	1.0250	
18	8 A.M.	4666	11–55.5	84–20.3	do.	67	1.0253	
18	2.20 P.M.	4666	11–55.5	84–20.3	800 fathoms	38	1.0248	
18	8 "	4667	11–59.5	83–40.4	Surface	68.5	1.0252	
19	8 A.M.	4668	12–09.3	81–45.2	do.	67	1.0252	
19	8 P.M.	4669	12–12.7	80–25.6	do.	67	1.0249	
20	8 A.M.	4670	12–08.7	79–02.4	do.	66	1.0248	
20	3 P.M.	4670	12–08.7	79–02.4	800 fathoms	38.7	1.0246	
20	8 "	4671	12–06.9	78–28.2	Surface	66	1.0250	
21	8 A.M.	4672	13–11.6	78–18.3	do.	66	1.0250	
21	8 P.M.	4673	12–30.5	77–49.4	do.	66	1.0250	Specimen taken a short distance beyond station.
22	8 A.M.	4509	12–26.6	78–34.5	do.	68	1.0250	
22	8 P.M.	4675	12–54	78–33	do.	68	1 0249	
23	8 A.M.	Callao Bay			do.	68	1.0250	
23	8 P.M.	" "			do.	60	1 0248	
Dec. 4	8 A.M.	....	13–08.5	78–59	do.	69	1.0252	
4	8 P.M.	4510 *	13–18.2	80–13	do.	70	1.0250	
5	8 A.M.	4676	14–28.9	81–24	do.	69	1.0250	
5	3 P.M.	4676	14–28.9	81–24	800 fathoms	37.3	1.0244	
5	8 "	4677	14–37.5	81–41	Surface	68	1.0250	
6	8 A.M.	4511 *	15–39	83–27.4	do.	69	1.0252	
6	8 P.M.	4678	16–31.2	85–03.8	do.	68	1.0252	
7	8 A.M.	4679	17–26.1	86–46.5	do.	62	1.0252	
7	8 P.M.	4680	17–55	87–42	do.	69	1.0252	
8	8 A.M.	4681	18–47.1	89–26	do.	68	1.0254	
8	2 P.M.	4681	18–47.1	89–26	800 fathoms	37.3	1.0246	
8	8 "	4682	19–07.6	90–10.6	Surface	69	1.0256	
9	8 A.M.	4683	20–02.1	91–52.5	do.	70	1.0253	
9	10 "	4683	20–02.4	91–52.5	200 fathoms	50.6	1.0244	
10	8 "	4685	21–36.2	94–56	Surface	72	1.0257	
10	10 "	4685	21–36.2	94–56	800 fathoms	37.2	1.0248	
10	8 P.M.	4686	22–01.3	95–50.5	Surface	71	1.0255	

* Hydrographic station.

RECORD OF SPECIFIC GRAVITIES. — *Continued.*

Date. 1904.	Time of Day.		Station.	Latitude South.	Longitude West.	Depth.	Temperature by Attached Thermometer.	Specific Gravity Reduced to 15° C.	Remarks.
				° ′	° ′				
Dec. 12	8	A.M.	4689	24–05	100–20	Surface	72	1.0257	
12	10	"	4689	24–05	100–20	800 fathoms	37	1.0247	
12	8	P.M.	4690	24–45.8	101–46.2	Surface	73	1.0258	
13	8	A.M.	4691	25–28.7	103–30.8	do.	73	1.0258	
13	8	P.M.	4692	25–40.3	104–01.4	do.	72	1.0257	
14	8	A.M.	4512 *	26–17.3	105–25.2	do.	71.5	1.0256	
14	8	P.M.	. . . .	26–37.5	106–29.4	do.	71	1.0256	
15	8	A.M.	. . . .	26–53	108–00	do.	72	1.0257	
15	8	P.M.	Cook Bay, Easter Island			do.	73	1.0257	
16	8	A.M.	La Pérouse Bay, Easter Isl.			do.	74	1.0258	
17	8	P.M.	Cook Bay, Easter Isl.			do.	74	1.0260	
22	9	A.M.	"	"	"	do.	72	1.0259	
22	3	P.M.	4517 *	26–50.9	109–12.5	800 fathoms	36.8	1.0248	
22	8	"	4694	26–31	108–57.3	Surface	72	1.0258	
23	8	A.M.	4695	25–20.2	107–43.7	do.	74	1.0258	
23	8	P.M.	4696	24–40.3	107–05.3	do.	74	1.0259	
24	8	A.M.	4697	23–27.2	105–59.6	do.	75	1.0260	
24	8	P.M.	4698	22–50.4	105–31.7	do.	75	1.0259	
25	8	A.M.	4699	21–39.5	104–29.8	do.	75	1.0257	
25	8	P.M.	4700	20–28.8	103–26.3	do.	74	1.0259	
26	8	A.M.	4701	19–10.8	102–24.4	do.	72	1.0259	
26	2	P.M.	4701	19–10.8	102–24.4	800 fathoms	37.2	1.0247	
26	8	"	4702	18–39.5	102–00	Surface	73	1.0259	
27	8	A.M.	4703	17–18.6	100–52.3	do.	73	1.0259	
27	8	P.M.	4704	16–55.3	100–24.6	do.	73	1.0259	
28	8	A.M.	4705	15–05.3	99–19	do.	72	1.0258	
28	8	P.M.	4706	14–18.7	98–15.8	do.	72	1.0256	
29	8	A.M.	4707	12–33.2	97–42	do.	72	1.0257	
29	10	"	4707	12–33.2	97–42	800 fathoms	37.3	1.0248	
29	8	P.M.	4708	11–40	96–55	Surface	72	1.0256	
30	8	A.M.	4709	10–15.2	95–40.8	do.	72	1.0255	
30	8	P.M.	4710	9–30.5	95–08.3	do.	74	1.0255	
31	8	A.M.	4711	7–47.5	94–05.5	do.	75	1.0256	
31	10	"	4711	7–47.5	94–05.5	800 fathoms	37.4	1.0247	
31	8	P.M.	4712	7–05	93–35.5	Surface	74	1.0252	
1905.									
Jan. 1	8	A.M.	4713	5–35.3	92–21.6	Surface	73	1.0251	
1	9	"	4713	5–35.3	92–21.6	150 fathoms	53.8	1.0250	
1	8	P.M.	4714	4–19	91–28.5	Surface	75	1.0252	
2	8	A.M.	4715	2–40.4	90–19.3	do.	75	1.0251	
2	9.30	"	4715	2–40.4	90–19.3	800 fathoms	38.2	1.0246	
2	8	P.M.	4716	2–18.5	90–02.6	Surface	75	1.0250	
3	8	A.M.	. . . .	1–16.3	89–35.7	do.	75	1.0252	
3	8	P.M.	Wreck Bay, Chatham Isl.			do.	74	1.0254	
11	11	A.M.	. . . .	2–22.9	92–47	do.	76	1.0252	
11	8	P.M.	. . . .	2–57.8	93–55	do.	76	1.0251	
12	8	A.M.	4523 *	3–34	95–35.1	do.	77	1.0252	
12	8	P.M.	. . . .	3–49.7	96–05.5	do.	75	1.0257	
13	8	A.M.	4717	5–10	98–56	do.	76	1.0252	
13	10	"	4717	5–10	98–56	800 fathoms	37.9	1.0250	
13	8	P.M.	4718	5–32.4	99–32.2	Surface	76	1.0256	
14	8	A.M.	4719	6–29.5	101–16.8	do.	75.5	1.0251	
14	8	P.M.	4720	7–13.3	102–31.5	do.	75	1.0252	
15	8	A.M.	4721	8–07.5	104–10.5	do.	75	1.0254	
15	10	"	4721	8–07.5	104–10.5	800 fathoms	37.3	1.0248	
15	8	P.M.	. . . .	8–35	104–57.2	Surface	75	1.0256	
16	8	A.M.	4722	9–31	106–30.5	do.	75	1.0254	
16	8	P.M.	4723	10–14.3	107–45.5	do.	76	1.0255	
17	8	A.M.	4724	11–13.4	109–39	do.	77	1.0254	
17	9.30	"	4724	11–13.4	109–39	800 fathoms	37.3	1.0250	
17	8	P.M.	4725	11–38.3	110–05	Surface	76	1.0255	
18	8	A.M.	4726	12–30.1	110–42.2	do.	78	1.0256	
18	8	P.M.	4727	13–00.3	112–44.9	do.	77	1.0258	
19	8	A.M.	4728	13–47.5	114–21.6	do.	77	1.0256	

* Hydrographic station.

RECORD OF SPECIFIC GRAVITIES. — *Continued.*

Date. 1905.	Time of Day.		Station.	Latitude South.	Longitude West.	Depth.	Temperature by Attached Thermometer	Specific Gravity reduced to 15° C.	Remarks.
				° ′	° ′		°		
Jan. 19	9.30	A.M.	4728	13–47.5	114–21.6	800 fathoms	37.4	1.0248	
19	8	P.M.	4729	14–15	115–13	Surface	78	1.0260	
20	8	A.M.	4730	15–06.2	116–37.7	do.	79	1.0259	
20	8	P.M.	4731	15–47.2	118–22.5	do.	79.5	1.0259	
21	8	A.M.	4732	16–32.5	119–59	do.	81	1.0258	
21	9	A.M.	4732	16–32.5	119–59	800 fathoms	37.4	1.0248	
21	8	P.M.	4733	16–57.4	120–48	Surface	80.5	1.0260	
22	8	A.M.	4734	17–36	122–35.6	do.	81	1 0259	
22	8	P.M.	4735	18–16	123–34.4	do.	81	1.0259	
23	8	A.M.	4736	19–00.4	125–05.4	do.	81	1.0258	
23	9.30	A.M.	4736	19–00.4	125–05.4	800 fathoms	37.3	1.0248	
23	8	P.M.	. . .	19–15	125–41.4	Surface	81	1.0260	
24	8	A.M.	4737	19–57.5	127–03	do.	81.5	1.0261	
24	8	P.M.	4738	20–26.5	128–30.2	do.	81	1.0259	
25	8	A.M	4524 *	21–03	130–10.3	do.	80.5	1.0259	
25	8	P.M.	4525 *	21–36.1	131–35.3	do.	79	1.0258	
26	8	A.M.	4739	22–11.1	133–21	do.	79	1.0259	
26	9	A M.	4739	22–11.1	133–21	800 fathoms	37.4	1.0246	
26	8	P.M.	. . .	22–26.2	133–52	Surface	79	1.0257	
27	8	A.M.	4526 *	22–55.3	134–48.6	do.	78	1.0253	About 20 minutes' run beyond station.
27	8	P.M.	Off Rikitea, Manga Reva			do.	78	1.0252	
Feb. 5	8	A.M.	Outer Harbor, Manga Reva			do.	77	1.0259	
5	8	P.M.	. . .	22–15	134–09.6	do.	77.5	1.0259	
6	8	A.M.	4531*	21–04.5	133–01.2	do.	79	1.0260	
6	8	P.M.	. . .	19–49.2	131–57.7	do.	79	1.0261	
7	8	A.M.	4532 *	18–29.4	130–15.8	do.	81	1.0261	
7	8	P.M.	. . .	17–27.2	129–48	do.	82	1.0261	
8	8	A.M.	4533 *	16–20.3	128–46	do.	82	1.0261	
8	8	P.M.	. . .	15–10	127–49.8	do.	81.5	1.0262	
9	8	A.M.	4534*	13–51	126–53.1	do.	82	1.0261	
9	8	P.M.	. . .	12–39.5	125–58.3	do.	81.5	1.0259	
10	8	A.M.	4535*	11–20	125–01.3	do.	80	1.0258	
10	8	P.M.	. . .	10–17.4	124–14.4	do.	80	1.0258	
11	8	A.M.	4740	9–02.1	123–20.1	do.	81	1.0257	
11	9.30	A.M.	4740	9–02.1	123–20.1	800 fathoms	37.4	1.0248	
11	8	P.M.	4741	8–29	122–56	Surface	80	1.0254	
12	8	A.M.	4536*	7–10.3	122–13.2	do.	80	1.0256	
12	8	P.M.	. . .	5–56.6	121–30	do.	79	1.0252	
13	8	A.M.	4537*	4–50.5	120–45.7	do.	79	1.0254	
13	8	P.M.	. . .	3–37.3	119–54.9	do.	79	1.0251	
14	8	A.M.	4538*	2–14	118–55.1	do.	79	1.0253	
14	8	P.M.	. . .	1–19.2	118–05	do.	78.5	1.0257	
				North.					
15	8	A.M.	4742	0–03.4	117–15.8	Surface	77	1.0251	
15	4	P.M.	4742	0–03.4	117–15.8	800 fathoms	37.8	1.0248	
15	8	P.M.	4743	0–21.3	117–02.6	Surface	78	1.0251	
16	8	A.M.	4539*	1–35	116–38	do.	78.5	1.0247	
16	8	P.M.	. . .	2–45	115–55.6	do.	79	1.0247	
17	8	A.M.	4540*	3–25.6	115–05.4	do.	79	1.0248	
17	8	P.M.	. . .	4–29	114–00	do.	80	1.0248	
18	8	A.M.	4541*	4–55	112–27	do.	80	1.0247	
18	8	P.M.	. . .	6–01	111–33	do.	80	1.0248	
19	8	A.M.	4542*	7–08 7	110–45.3	do.	80	1.0247	
19	8	P.M.	. . .	8–02.2	109–40	do.	79.5	1.0243	
20	8	A.M.	4543*	8–52.2	108–54	do.	79.5	1.0240	
20	8	P.M.	. . .	9–46.2	107–52	do.	80	1.0244	
21	8	A.M.	4544*	10–38	106–47.6	do.	80	1.0240	
21	8	P.M.	. . .	11–34	105–42.5	do.	79	1.0245	
22	8	A.M.	4545*	12–42.5	104–45	do.	79	1.0242	
22	8	P.M.	. . .	13–56.3	103–28.2	do.	80	1.0242	
23	8	A.M.	4546*	14–50	103–31	do.	81	1.0240	
23	8	P.M.	. . .	15–43.6	100–30	do.	82	1.0240	
24	8	A.M.	. . .	16–39	99–53.9	do.	82	1.0240	
Mar. 2	4	P.M.	. . .	Acapulo, Mexico		do.	81.5	1.0243	

* Hydrographic station.

SPECIFIC GRAVITIES OF THE PANAMIC REGION.

Date.	Time of Day.	Station.	Latitude North.	Longitude West.	Depth.	Temperature by attached Thermometer.	Specific Gravity reduced to 15° C.
1891.			° ′ ″	° ′ ″	Fathoms.	°	
Feb. 18	12 M.	Panama, U. S. C.	. . .	. . .	Surface	74	1.025480
23	12 M.	. . . .	7 07 00	80 43 00	do.	76	1.025480
23	7 P.M.	. . . .	7 09 30	81 05 30	do.	83	1.024880
23	do.	. . . .	7 09 30	81 05 30	25	68.4	1.025280
23	do.	. . . .	7 09 30	81 05 30	50	65.9	1.025680
23	do.	. . . .	7 09 30	81 05 30	100	58.5	1.026080
23	do.	. . . .	7 09 30	81 05 30	200	52.9	1.026280
23	do.	. . . .	7 09 30	81 05 30	300	44.9	1 026280
23	do.	. . . .	7 09 30	81 05 30	400	48.7	1.026280
23	do.	. . . .	7 09 30	81 05 30	546	40.1	1.026480
23	12 P.M.	. . . .	6 59 30	81 15 00	Surface	81	1 025280
24	9 A.M.	. . . .	6 35 00	81 44 00	do.	83	1.023880
24	do.	. . . .	6 35 00	81 44 00	25	74.4	1.024692
24	do.	. . . .	6 35 00	81 44 00	50	76	1.025892
24	do.	. . . .	6 35 00	81 44 00	100	. . .	1.026092
24	do.	. . . .	6 35 00	81 44 00	200	51.8	1.026092
24	do.	. . . .	6 35 00	81 44 00	300	46	1.026292
24	do.	. . . .	6 35 00	81 44 00	400	43	1.026092
24	do.	. . . .	6 35 00	81 44 00	500	41	1.026092
24	do.	. . . .	6 35 00	81 44 00	600	. . .	1 026092
24	6 P.M.	. . . .	6 17 00	82 05 00	Surface	83	1.024092
24	12 P.M.	. . . .	6 16 00	82 23 00	do.	83	1.024092
25	6 A.M.	. . . .	6 10 00	83 06 00	do.	82	1 023892
25	do.	. . . .	6 10 00	83 06 00	25	76.9	1.025092
25	do.	. . . .	6 10 00	83 06 00	50	59	1 025292
25	do.	. . . .	6 10 00	83 06 00	100	55.7	1.025692
25	do.	. . . .	6 10 00	83 06 00	200	50.5	1.026092
25	do.	. . . .	6 10 00	83 06 00	300	46.8	1.026292
25	do.	. . . .	6 10 00	83 06 00	400	43.6	1 026292
25	do.	. . . .	6 10 00	83 06 00	500	41.9	1.026292
25	do.	. . . .	6 10 00	83 06 00	600	40.2	1.026292
25	do.	. . . .	6 10 00	83 06 00	700	38.3	1.026292
25	do.	. . . .	6 10 00	83 06 00	800	38.9	1.026292
25	do.	. . . .	6 10 00	83 06 00	900	37.5	1.026492
25	do.	. . . .	6 10 00	83 06 00	1,000	36.5	1.026692
25	12 M.	. . . .	6 11 00	83 16 30	Surface	84	1.024092
25	6 P.M.	. . . .	6 05 00	83 55 00	do.	84	1.023892
26	6 A.M.	. . . .	5 56 00	85 10 30	do.	84	1.023906
26	do.	. . . .	5 56 00	85 10 30	50	. . .	1.025706
26	do.	. . . .	5 56 00	85 10 30	100	55.8	1.026106
26	do.	. . . .	5 56 00	85 10 30	200	51.3	1.026106
26	do.	. . . .	5 56 00	85 10 30	300	46.7	1.026306
26	do.	. . . .	5 56 00	85 10 30	400	. . .	1.026100
26	6 A.M.	. . . .	5 56 00	85 10 30	500	49.3	1.026100
26	do.	. . . .	5 56 00	85 10 30	600	. . .	1.026100
26	do.	. . . .	5 56 00	85 10 30	700	39.1	1.026100
26	do.	. . . .	5 56 00	85 10 30	800	. . .	1.026300
26	do.	. . . .	5 56 00	85 10 30	900	37.3	1.026300
26	do.	. . . .	5 56 00	85 10 30	1,000	36 8	1.026300
26	12 M.	. . . .	5 51 00	85 23 30	Surface	83	1.023920
26	6 P.M.	. . . .	5 50 00	85 41 00	do.	84	1.023720
27	6 A.M.	. . . .	5 30 00	86 08 30	do.	81	1.024080
27	do.	. . . .	5 30 00	86 08 30	25	76.4	1.024680
27	do.	. . . .	5 30 00	86 08 30	50	58.9	1.025480
27	do.	. . . .	5 30 00	86 08 30	150	54.4	1.025680
27	do.	. . . .	5 30 00	86 08 30	250	48.8	1.025880
27	do.	. . . .	5 30 00	86 08 30	350	44.9	1.025880
27	do.	. . . .	5 30 00	86 08 30	450	42.8	1.025880
27	do.	. . . .	5 30 00	86 08 30	550	41	1.025880
27	do.	. . . .	5 30 00	86 08 30	650	. . .	1.026080
27	do.	. . . .	5 30 00	86 08 30	900	38	1.026280
27	12 M.	. . . .	5 30 00	86 23 00	Surface	85	1.023780
27	6 P.M.	. . . .	5 30 00	86 45 00	do.	84	1.023780
27	do.	. . . .	5 30 00	86 45 00	25	73.7	1.023980
27	do.	. . . .	5 30 00	86 45 00	50	58.9	1.025280
27	do.	. . . .	5 30 00	86 45 00	100	55.8	1.025480

SPECIFIC GRAVITIES OF THE PANAMIC REGION. — *Continued.*

Date.	Time of Day.	Station.	Latitude North.	Longitude West.	Depth.	Temperature by attached Thermometer.	Specific Gravity reduced to 15° C.
1891.			° ′ ″	° ′ ″	Fathoms.	°	
Feb. 27	do.	. . . .	5 30 00	86 45 00	200	50.9	1.025680
27	do.	. . . .	5 30 00	86 45 00	300	45.9	1.025680
27	do.	. . . .	5 30 00	86 45 00	400	44.7	1.025880
27	do.	. . . .	5 30 00	86 45 00	500	41.5	1.025880
27	6 P.M.	. . . .	5 30 00	86 45 00	600	40.4	1.025880
27	do.	. . . .	5 30 00	86 45 00	700	38.8	1.026080
28	12 M.	. . . .	5 33 20	86 58 20	Surface	84	1.023780
28	6 P.M.	. . . .	5 32 45	86 51 30	do.	84	1.023780
Mar. 1	12 M.	. . . .	5 11 00	86 40 00	do.	83	1.023740
1	6 P.M.	. . . .	4 49 00	86 11 20	do.	82	1.023740
2	12 M.	. . . .	4 01 00	84 55 00	do.	82	1.024340
2	6 P.M.	. . . .	3 50 00	84 45 00	do.	81	1.024340
3	12 M.	. . . .	2 32 00	83 55 00	do.	80	1.024340
3	6 P.M.	. . . .	2 33 00	83 29 00	do.	80	1.024740
3	12 P.M.	. . . .	2 34 30	83 03 00	do.	79	1.024940
4	6 A.M.	. . . .	2 34 00	82 29 00	do.	77	1.025340
4	12 M.	. . . .	2 49 00	82 23 30	do.	78	1.025140
4	6 P.M.	. . . .	3 09 00	82 10 30	do.	77	1.025140
4	12 P.M.	. . . .	3 30 00	81 57 30	do.	77	1.025140
5	6 A.M.	. . . .	3 50 00	81 44 20	do.	77	1.024940
5	12 M.	Malpelo Island	. . .	. . .	do.	78	1.025140
5	6 P.M.	. . . .	4 03 00	81 31 00	do.	78	1.025140
5	12 P.M.	. . . .	4 30 00	81 12 00	do.	77	1.025340
6	7 A.M.	. . . .	4 56 00	80 52 30	do.	77	1.025140
6	12 M.	. . . .	4 58 30	80 52 00	do.	77	1.025140
6	6 P.M.	. . . .	5 08 30	80 34 00	do.	77	1.025340
6	12 P.M.	. . . .	5 29 00	80 16 00	do.	76	1.025340
7	6 A.M.	. . . .	5 48 00	79 58 00	do.	75	1.025340
7	12 M.	. . . .	6 19 20	79 37 40	do.	76	1.025340
7	6 P.M.	. . . .	6 40 00	79 25 30	do.	75	1.025906
7	12 P.M.	. . . .	6 59 00	79 13 00	do.	75	1.026106
8	6 A.M.	. . . .	7 21 00	79 02 00	do.	74	1.026106
8	12 M.	. . . .	7 26 00	79 07 00	do.	74	1.026106
8	7 P.M.	. . . .	7 40 00	79 17 50	do.	74	1.026106
9	12 M.	. . . .	7 00 00	79 55 00	do.	73	1.026106
10	do.	. . . .	7 13 30	79 39 00	do.	73	1.026106
11	do.	. . . .	7 29 00	78 43 30	do.	70	1.026306
20	6 P.M.	. . . .	8 34 00	79 35 00	do.	75	1.026106
20	12 P.M.	. . . .	7 42 00	79 52 00	do.	73	1.026306
21	6 A.M.	. . . .	6 50 00	80 09 00	do.	74	1.026106
21	12 M.	. . . .	5 56 10	80 28 00	do.	74	1.026106
21	6 P.M.	. . . .	5 13 00	80 32 00	do.	75	1.025906
21	12 P.M.	. . . .	4 32 00	80 30 00	do.	75	1.025706
22	6 A.M.	. . . .	3 51 00	80 28 30	do.	78	1.025706
22	12 M.	. . . .	3 00 30	80 30 30	do.	79	1.025506
22	6 P.M.	. . . .	2 31 00	80 24 00	do.	80	1.025506
22	12 P.M.	. . . .	2 02 00	80 19 00	do.	80	1.025506
23	6 A.M.	. . . .	1 33 00	80 12 00	do.	79	1.025406
23	12 M.	. . . .	1 07 30	80 05 00	do.	80	1.025406
23	6 P.M.	. . . .	1 05 00	80 21 00	do.	84	1.025406
23	12 P.M.	. . . .	1 05 30	80 37 00	do.	80	1.025206
24	6 A.M.	. . . .	1 04 00	80 53 00	do.	80	1.025206
24	12 M.	. . . .	1 04 30	81 14 30	do.	82	1.025506
24	6 P.M.	. . . .	0 56 30	81 40 00	do.	84	1.025506
24	12 P.M.	. . . .	0 47 00	82 06 00	do.	80	1.025506
25	6 A.M.	. . . .	0 41 00	82 32 00	do.	81	1.025706
25	12 M.	. . . .	0 31 00	82 59 00	do.	82	1.025506
25	6 P.M.	. . . .	0 19 00	83 20 00	do.	82	1.025506
25	12 P.M.	. . . .	0 07 00	83 56 00	do.	82	1.025306
			South.				
26	6 A.M.	. . . .	0 05 00	84 23 00	do.	81	1.025306
26	12 M.	. . . .	0 18 00	85 03 00	do.	83	1.024706
26	6 P.M.	. . . .	0 23 00	85 34 00	do.	83	1.024506
26	12 P.M.	. . . .	0 27 00	86 05 00	do.	82	1.024706
27	6 A.M.	. . . .	0 35 00	86 36 00	do.	83	1.024706
27	12 M.	. . . .	0 40 00	87 06 30	do.	82	1.024506

SPECIFIC GRAVITIES OF THE PANAMIC REGION. — *Continued.*

Date.	Time of Day.	Station.	Latitude South.	Longitude West.	Depth	Temperature by attached Thermometer.	Specific Gravity reduced to 15° C.
1891			° ′ ″	° ′ ″	Fathoms		
Mar. 27	6 P.M.	. . . .	0 45 00	87 40 00	do.	83	1.024906
27	12 P.M.	. . . .	0 51 00	88 14 00	do.	82	1.024906
28	6 A.M.	Off Chatham Island	. . .	. . .	do.	82	1 024906
28	12 M.	. . . .	1 01 00	89 22 00	do.	82	1.024906
29	12 M.	Wreck Bay	. . .	. . .	do.	81	1.025706
April 1	12 M.	Charles Island	. . .	. . .	do.	80	1.025306
2	12 M.	Duncan Island	. . .	. . .	do.	81	1.025306
2	6 P.M.	Indefatigable Island	. . .	. . .	do.	82	1.025106
3	12 M.	. . . .	0 01 00	90 23 00	Surface	81	1.524906
			North.				
4	12 M.	. . . .	1 05 00	91 17 00	do.	82	1.025106
4	6 P.M.	. . . .	1 23 00	91 30 00	do.	82	1.025106
4	12 P.M.	. . . .	1 51 00	91 43 00	do.	81	1.025292
5	6 A.M.	. . . .	2 14 00	91 56 00	do.	82	1.025192
5	12 M.	. . . .	2 39 00	92 09 00	do.	83	1.025292
5	6 P.M.	. . . .	3 17 00	92 31 00	do.	84	1.025492
5	12 P.M.	. . . .	3 55 00	92 51 00	do.	83	1.025692
6	6 A.M.	. . . .	4 34 00	93 14 00	do.	82	1.025692
6	12 M.	. . . .	5 13 00	93 35 00	do.	83	1.026092
6	6 P.M.	. . . .	5 53 00	94 03 00	do	82	1.026092
7	6 A.M.	. . . .	7 10 00	94 59 00	do.	81	1.026092
7	12 M.	. . . .	7 54 00	95 27 00	do.	82	1.025692
7	6 P.M.	. . . .	8 31 00	95 43 00	do.	81	1.025492
7	12 P.M.	. . . .	9 08 00	95 59 00	do.	82	1.025492
8	6 A.M.	. . . .	9 45 00	96 15 00	do.	82	1.025492
8	12 M.	. . . .	10 23 00	96 30 30	do.	83	1.025292
8	6 P.M.	. . . .	10 58 00	96 44 00	do.	83	1.025292
8	12 P.M.	. . . .	11 33 00	96 58 00	do.	82	1.025292
9	6 A.M.	. . . .	12 08 00	97 12 00	do.	81	1.025292
9	12 M.	. . . .	12 45 00	97 26 00	do.	83	1.025492
9	6 P.M.	. . . .	13 33 30	97 57 30	do.	83	1.025492
9	12 P.M.	. . . .	14 09 00	98 18 00	do.	83	1.025492
10	8 A.M.	. . . .	14 46 00	98 40 00	do.	82	1.025692
10	6 P.M.	. . . .	15 28 00	98 19 00	do.	84	1.025692
10	12 P.M.	. . . .	15 49 00	98 09 00	do.	82	1.025892
11	6 A.M.	. . . .	16 10 00	97 58 00	do.	80	1.025892
11	12 M.	. . . .	16 32 00	97 48 40	do.	82	1.025892
15	6 P.M.	. . . .	16 50 00	100 20 00	do.	80	1.025767
15	12 P.M.	. . . .	17 05 00	100 58 00	do.	80	1.025820
16	6 A.M.	. . . .	17 20 00	101 34 00	do.	78	1.025820
16	12 M.	. . . .	17 43 00	102 19 30	do.	80	1.025620
16	6 P.M.	. . . .	18 12 00	102 58 00	do.	80	1.025620
16	12 P.M.	. . . .	18 41 00	103 37 00	do.	76	1.025620
17	6 A.M.	. . . .	19 10 00	104 16 00	do.	77	1.025620
17	12 M.	. . . .	19 44 40	104 56 30	do.	74	1.025620
17	6 P.M.	. . . .	20 02 00	105 17 00	do.	72	1.025620
18	6 A.M.	. . . .	20 46 00	105 59 00	do.	74	1.025620
18	12 M.	. . . .	21 07 30	106 21 30	do.	75	1.026020
19	12 M.	. . . .	22 58 00	107 20 00	do.	73	1.025820
20	12 M.	. . . .	24 20 30	108 34 30	do.	71	1.025420
21	12 M.	. . . .	25 33 00	109 50 00	do.	71	1.025620
22	12 M.	. . . .	26 58 00	110 49 30	do.	71	1.026020
23	12 M.	Guaymas, Mexico	. . .	. . .	do.	71	1.026220
24	12 M.	. . . .	27 33 00	110 02 00	do.	71	1.026220
25	12 M.	. . . .	25 06 00	109 51 00	do.	72	1.025620
26	12 M.	. . . .	23 07 00	110 08 00	do.	65	1.025420
27	12 M.	. . . .	24 41 30	112 16 30	do.	62	1.025020
28	12 M.	. . . .	26 40 00	114 06 30	do.	64	1.025020
29	12 M.	. . . .	28 51 30	115 06 30	do.	57	1.024820
30	12 M.	. . . .	30 44 30	116 13 45	do.	57	1.025020
May 2	12 M.	San Diego, Cal.	. . .	. . .	do.	65	1.024820
3	12 M.	. . . .	33 55 40	118 54 20	do.	60	1.025020
4	12 M.	. . . .	35 49 30	121 36 00	do.	58	1.025020

RECORD OF AIR TEMPERATURES IN FAHRENHEIT DEGREES.

Date.	7 A.M.	Noon.	6 P.M.	Mean.	Minimum for 24 Hours.	Date.	7 A.M.	Noon.	6 P.M.	Mean.	Minimum for 24 Hours.
1904.	°	°	°	°	°	1905.	°	°	°	°	°
Nov. 2	78	85	84	81	77	Jan. 1	76	80	79	77^1	74
3	78	85	80	80^1	78	2	75	80	77	76^3	75
4	81	81	78	79^1	77	3	75	82	78	77^1	74
5	77	79	76	76^3	75	4	76	81	81	78^1	75
6	73	77	74	74^1	73	5	75	82	82	78^1	74
7	74	75	72	73	71	6	76	80	77	76^3	74
8	71	72	72	71^1	70	7	75	79	80	77	74
9	71	74	72	72	71	8	75	82	79	77^2	74
10	71	73	72	71^1	69	9	75	83	82	78^3	75
11	68	74	71	70	67	10	76	82	78	78	76
12	65	67	67	65^3	64	11	76	82	76	77^1	75
13	69	74	70	70	67	12	78	82	77	78^1	76
14	70	76	72	71^3	69	13	77	83	78	78^2	76
15	70	72	69	70	69	14	77	80	77	77^2	76
16	69	72	69	69^2	68	15	76	82	77	77^2	75
17	67	72	69	68^3	67	16	78	87	79	79^3	75
18	68	72	69	69	67	17	82	80	78	79	76
19	67	72	70	69	67	18	79	80	80	78^3	76
20	67	68	68	67^1	66	19	78	82	80	79^2	78
21	66	72	78	70^2	66	20	81	85	81	81^1	78
22	67	69	69	67^2	65	21	84	80	79	80^1	78
23	65	71	69	67^1	64	22	85	89	82	83^3	79
24	64	73	68	66^3	62	23	84	86	81	82^3	80
25	64	76	68	67	60	24	89	88	84	85^1	80
26	65	76	69	68^3	65	25	78	82	78	78^2	76
27	68	73	69	68^3	65	26	80	83	80	80^1	78
28	66	78	68	69^1	65	27	78	76	81	77^3	76
29	66	78	71	69^3	64	28	76	80	77	76^3	74
30	65	79	72	70^1	65	29	79	84	84	80^3	76
Dec. 1	68	78	72	71	66	30	79	85	84	81	76
2	67	75	72	69^3	65	31	75	82	83	78^2	74
3	67	74	69	68^3	65	Feb. 1	75	81	82	78	74
4	70	77	71	71^3	69	2	75	81	76	76^2	74
5	71	74	69	70^2	68	3	79	82	77	78^1	75
6	71	70	68	69	67	4	80	79	80	78^1	74
7	68	74	69	69^2	67	5	75	78	85	78	74
8	66	70	69	67^3	66	6	79	81	82	79^2	76
9	68	75	73	70^2	66	7	81	81	86	80^2	74
10	74	74	74	72^2	68	8	82	86	86	83^3	81
11	79	78	74	75	69	9	82	85	87	83^2	80
12	75	82	75	75^2	70	10	82	84	85	82^3	80
13	74	82	74	75^2	72	11	80	84	85	81^3	78
14	71	76	72	72^2	71	12	81	84	83	82	80
15	79	81	78	77	70	13	80	82	82	81	80
16	72	75	75	73^1	71	14	80	82	81	80	77
17	74	79	79	76	72	15	78	81	82	79^1	76
18	73	80	85	77	70	16	78	83	80	79^3	78
19	74	80	78	75^2	70	17	79	84	83	81^1	79
20	69	73	72	70^1	67	18	80	85	82	81^3	80
21	69	75	72	70^3	67	19	80	84	82	81^2	80
22	71	76	77	73^1	69	20	81	84	84	82^1	80
23	74	80	77	75^2	71	21	82	84	82	82	80
24	76	80	76	76^3	75	22	81	85	84	82^2	80
25	75	79	81	77^1	74	23	78	86	84	81^1	77
26	74	80	79	76^2	73	24	77	88	80	80^2	77
27	72	78	75	74^1	72						
28	73	76	74	73^2	71						
29	73	78	78	75^1	72						
30	70	77	79	74	70						
31	74	85	83	78^3	73						

WINDS.

Plate 3^d.

The daily direction of the winds is indicated on Pl. 3^d, the arrows showing the direction, and the number of barbs the strength of the wind according to the Beaufort scale.

From Panama to the Galapagos we encountered during the first days of November southwesterly winds for the first half of the distance, and then southeasterly winds as far as the islands, and the same southeasterly trades from the Galapagos to Aguja Point, and in our line to the southwest of the Point as well as from that point to Callao, the southeasterly trades extending on the line, Callao to Easter Island, to about 17° S. latitude and 85° W. longitude. From that point to Sala y Gomez the winds were from the northeast. At Easter Island we found them variable during our stay during the middle of December.

From Easter Island to latitude 19° S. we encountered westerly and northeasterly winds; from that point northward to the Galapagos we met southeasterly and easterly trades. From the Galapagos towards Manga Reva the same easterly and southeasterly trades flanked us as far as 10° S. latitude. The winds then became northeast almost to Manga Reva, where they were southwesterly.

From Manga Reva towards Acapulco we encountered, north of 20° S. latitude, northerly winds for about 500 miles. The winds then became easterly or southeasterly to nearly 3° N., where we struck strong northeast trades to within 250 miles off Acapulco, where we met light northwesterly winds.

From Panama to the Galapagos, from the Galapagos to Aguja Point, on the line to the southwest of this point, and thence to Callao, and from Callao about a third of the distance to Easter Island, the set was usually in the direction of the wind. Though near the shore the current was in a northeasterly direction, and from latitude 20° S. as far as Sala y Gomez the set was strong in a northeasterly direction.

On the line from Easter Island to the Galapagos there was a strong southeasterly set as far as latitude 15° S. Then the set was in the direction of the wind to the northwest as far as the Galapagos. It became variable in the vicinity of the Galapagos.

From the Galapagos half-way to Manga Reva the set was in the direction of the southeast trades to the northwest. The remaining distance there was a strong northeasterly set changing to northwest near Manga Reva.

From Manga Reva to Acapulco there is a southeasterly set as far north as latitude 10° S. Then the set is northwest as far as 5° N., where it becomes southwest until within the influence of the Mexican coast winds off Acapulco.

RECORD OF PELAGIC STATIONS OF THE UNITED STATES FISH COMMISSION STEAMER "ALBATROSS" BETWEEN SAN FRANCISCO, CAL., AND PANAMA DURING OCTOBER, 1904.

Serial Number.	Date.	Time.	Position. Lat. North.	Position. Long. West.	Temperature at Surface.	Depth in Fathoms at nearest Sounding.	Time in Minutes.	Distance from Land.	Remarks.
U.S F.C.	1904.	h. m.	° ′	° ′	°		h. m.	miles.	
4567	Oct. 6	1 30 P.M.	37 25	122 26	60–63	28	3 30	4.25	Pump filter No. 20 silk started at 10 A.M. at 37° 50′ N. and 122° 30′ W.
4568	" 6	5 30 P.M.	36 45	122 02	60–63	486	4 00	10.0	Pump filter. Started at 1.30 P.M. at 37° 25′ N., and 122° 26′ W.
4569	" 6–7	6 00 A.M.	34 45	120 15	60–63	38	12 30	11.5	Pump filter No. 20. Started at 5.30 P.M., Oct. 6, at 36° 45′ N., and 122° 02′ W.
4570	" 7	9 00 A.M.	34 20	120 20	63–64	187	3 00	6.8	Pump filter. Started at 6 A.M. at 34° 45′ N., and 120° 15′ W.
4571	" 7	4 23 P.M.	33 40	119 35	71	825	18 00	18.3	Surface haul
	" "								Vertical haul. Started at 3.04 P.M.
4572	" 7	5 30 P.M.	33 30	119 25	64–66	899	8 30	13.4	Pump filter. Started at 9 A.M. at 34° 20′ N. and 120° 20′ W.
4573	" 7–8	7 00 A.M.	31 35	118 10	64–67	1076	13 30	62.6	Pump filter. Started at 5.30 P.M. at 33° 30′ N., and 119° 25′ W.
4574	" 8	3 45 P.M.	30 35	117 15	69	330	42 00	69.3	Vertical hauls.
4575	" 8	5 30 P.M.	30 15	117 10	67–70	1466	10 30	56	Pump filter.
4576	" 8	8 51 P.M.	29 52	116 56	69	1466	21 00	55.2	Surface haul.
4577	" 8–9	7 00 A.M.	28 25	115 55	66–70	1279	13 30	17.3	Pump filter at 5.30 P.M., Oct. 8, at 30° 15′ N. and 117° 10′ W.
4578	" 9	7 00 P.M.	27 02	114 40	70–71	543	12 00	14.4	Pump filter. Started at 7.00 A.M. at 28° 25′ N., and 115° 55′ W.
4579	" 9–10	7 00 A.M.	25 20	113 13	70–72	75	12 00	45	Pump filter. Started at 7.00 P.M., Oct. 9, at 27° 02′ N. and 114° 40′ W.
4580	" 10	11 20 A.M.	24 55	112 45	76	19	20 00	14.4	Vertical hauls.
4581	" 10	7 00 P.M.	24 15	111 52	72–77	40	12 00	5.1	Pump filter. Started at 7 A.M. at 25° 20′ W. and 113° 13′ N.
4582	" 10–11	7 00 A.M.	23 12	110 32	77–82	323	12 00	19.5	Pump filter No. 20. Started at 24° 15′ N. and 111° 52′ W.
4583	" 11	10 30 A.M.	22 45	110 5	83	1048	23 00	8.2	Vertical hauls.
4584	" 11	7 00 P.M.	22 05	109 10	81–87	1624	12 00	62.3	Pump filter. Started at 7 A.M. at 23° 12′ and 110° 32′ W.
4585	" 11–12	7 00 A.M.	21 00	107 37	80–83	1747	12 00	64.3	Pump filter. Started at 7 P.M., Oct. 11, at 22° 05′ N. and 109° 10′ W.
4586	" 12	7 30 P.M.	19 52	106 22	83	1923	9 30	28.7	Pump filter. Started at 10 A.M. at 20° 42′ N. and 107° 25′ W.
4587	" 12	10 30 A.M.	20 42	107 25	82	1885	24 00	58	Vertical hauls.
4588	" 12	8 50 P.M.	19 52	106 22	81–83	1923	20 00	28.6	Surface haul.
4589	" 12–13	10 30 A.M.	18 50	104 50	82–83	1038	13 00	21.8	Pump filter. Started at 19° 52′ N. and 106° 22′ W. at 7.30 P.M., Oct. 12.
4590	" 13	10 40 A.M.	18 50	104 50	82–83	1038	22 00	21 8	Vertical hauls.
4591	" 13	7 00 P.M.	18 20	103 40	83–87	30	8 30	4.5	Pump filter No. 20. Started at 10.30 A.M. at 18° 50′ N. and 104° 50′ W.
4592	" 13	7 51 P.M.	18 20	103 40	84	30	24 00	4.5	Surface hauls.
4593	" 14	7 00 A.M.	17 25	101 50	82–85	627	12 00	19.0	Pump filter. Started at 7.00 P.M., Oct. 13, at 18° 20′ N. and 104° 40′ W.

RECORD OF PELAGIC STATIONS ETC., — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperature at Surface.	Depth in Fathoms at nearest Sounding.	Time in Minutes.	Distance from Land.	Remarks.
			Lat. North.	Long. West.					
U.S.F.C.	1904.	h. m.	° ′	° ′	°		h. m.	miles.	
4594	" 14	10 30 A.M.	17 20	101 32	84	627	30 00	16.0	Vertical hauls.
4595	" 14	7 00 A.M.	16 47	100 27	84–85	838	9 00	14.4	Pump filter. Started at 10 A.M. at 17° 26′ N. and 101° 32′ W.
4596	" 14	7 24 P.M.	16 47	100 27	84	838	24 00	14.4	Surface haul.
4597	" 15	7 00 A.M.	16 10	98 37	81–84	30	12 00	7.1	Pump filter. Started at 7 P.M., Oct. 14, at 16° 47′ N. and 100° 27′ W.
4598	" 15	10 35 A.M.	15 58	98 13	84	99	30 00	4.5	Surface haul.
4599	" 15	7 00 P.M.	15 36	97 00	80–85	160	12 00	5.3	Pump filter. Started at 7.00 A.M. at 16° 10′ N. and 98° 37′ W.
4600	" 15	7 25 P.M.	15 36	97 00	82	160	25 00	5.3	Surface haul. Started at 7.00 P.M.
4601	" 16	7 00 A.M.	14 58	95 17	81–83	120	12 00	61.2	Pump filter. Started at 7.00 P.M. Oct. 15, at 15° 36′ N. and 97° 00′ W.
4602	" 16	7 00 P.M.	13 37	93 52	79–82	2166	12 00	103.2	Pump filter. Started at 7.00 A.M. at 14° 58′ N. and 95° 17′ W.
4603	" 17	7 30 A.M.	12 30	92 30	81–83	2166	12 30	110.0	Pump filter. Started at 7.00 P.M., Oct. 16, at 13° 37′ N., and 93° 52′ W.
4604	" 17	11 30 A.M.	12 21	92 13	84	2166	30 00	110.1	Surface haul.
4605	" 17	1 30 P.M.	12 21	92 13	85	2166	30 00	110.1	Vertical hauls. Started at 1 P.M.
4606	" 17	7 00 P.M.	12 00	91 30	81–83	2500	11 30	116.0	Pump filter No. 20. Started at 7.30 A.M. at 12° 30′ N., and 92° 30′ W.
4607	" 17	7 22 P.M.	12 00	91 30	83	2500	22 00	116.0	Surface haul.
4608	" 18	8 00 A.M.	11 15	89 48	82–83	2052	13 00	130.4	Pump filter. Started at 7 P.M., Oct. 17, at 12° 00′ N. and 91° 30′ W.
4609	" 18	10 30 A.M.	11 05	89 35	81	1970	30 00	132.2	Vertical hauls.
4610	" 18	7 00 P.M.	10 33	88 30	78–83	1792	11 00	135.0	Pump filter. Started at 8.00 A.M. at 11° 15′ N., and 89° 48′ W.
4611	" 18	7 23 P.M.	10 33	88 30	78	1792	23 00	135.0	Surface haul.
4612	" 19	7 00 A.M.	9 50	86 40	78–80	1833	12 00	66.7	Pump filter. Started at 7.00 P.M., Oct. 18th, at 10° 33′ N., and 88° 30′ W.
4613	" 19	10 30 A.M.	9 45	86 20	80	1833	30 00	54.4	Vertical hauls. Started at 10 A.M.
4614	" 19	7 00 P.M.	9 7	85 11	79–82	1708	12 00	26.2	Pump filter. 9° 50′ N. and 86° 40′ W.
4615	" 19	7 20 P.M.	9 7	85 11	80	1708	20 00	26.2	Surface haul. Started at 7 P.M.
4616	" 20	7 00 A.M.	8 10	83 33	79–80	956	12 00	17.2	Pump filter. Started at 7 P.M., Oct. 19, at 9° 7′ N. and 85° 11′ W.
4617	" 20	4 25 P.M.	7 45	82 25	78	1185	25 00	10	Vertical haul. Started at 4.00 P.M.
4618	" 20	7 00 P.M.	7 15	82 8	77–80	792	12 00	12.8	Pump filter. Started at 7.00 A.M., at 9° 7′ N., and 82° 11′ W.
4619	" 20	7 20 P.M.	7 15	82 8	79	792	20 00	12.8	Surface haul. Started at 7.00 P.M.
4620	" 21	8 00 A.M.	6 45	81 47	78–79	782	13 00	27	Pump filter. Started at 7.00 P.M., Oct. 20, at 7° 15′ N., and 82° 8′ W.
4621	" 21	10 26 A.M.	6 36	81 44	79	581	36 00	36.4	Vertical haul.
4622	" 21	12 50 P.M.	6 31	81 44	81	581	74 00	40.8	Vertical haul.
4623	" 21	7 00 P.M.	6 58	80 46	78–81	592	11 00	12.8	Pump filter. Started at 8 A.M., at 6° 45′ N. and 81° 47′ W.
4624	" 21	7 30 P.M.	6 58	80 46	79	592	30 00	12.8	Surface haul.
4625	" 22	7 00 A.M.	8 00	79 33	79–80	75	12 00	37.6	Pump filter. Started at 7 P.M., Oct. 21., at 6° 58′ N., and 80° 46′ W.
4626	" 22	7 00 P.M.	8 55	79 32	80–84	5	12 00	0.7	Pump filter. Started at 7 A.M. at 8° 00′ N., and 79° 33′ W.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS OCCUPIED BY THE UNITED STATES FISH COMMISSION STEAMER "ALBATROSS" IN THE EASTERN TROPICAL PACIFIC FROM NOVEMBER, 1904, TO MARCH, 1905.

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude North.	Longitude West.	Surface.	Bottom.			
	1904.	h. m.	° ′	° ′	°	°			
			4627–4640 Panama to Galapagos Islands.						
4627	Nov. 2	7 P.M.	7 21.3	79 55.8	81.5	. . .	. .	. . . . .	Surface haul.
4628	" 2	9 P.M.	7 15	80 5 5	80–83	. . .	. .	. . . . .	Pump filter.
4629	" 3	8† A.M.	6 52	81 42.5	81	40.5	556	gn. S., lrge. glob.	Pump filter. Trawling for the green sand collected in 1891.
4630	" 3	8 A.M.	6 53	81 42.5	81				
4631	" 3	1 P.M.	6 26	81 49	82	38.0	774	gn. S.	Pump filter. Trawling for the green sand collected in 1891.
4632	" 3	8‡ P.M.	5 48.5	82 16.3	79–83	. . .	. .	. . . . .	Pump filter.
4504*	" 3	10 P.M.	5 36	82 28	80	36.4	1885	fine gn. M.	
4633	" 4	8 A.M.	4 40	83 24.4	79–80	. . .	. .	. . . . .	Pump filter.
4634	" 4	10 30 A.M.	4 35.4	83 32.3	80	35.9	1729	. . . . .	Trawl. Towed at 300 fathoms.
4635	" 4	8 P.M.	3 52.5	84 14.3	79	. . .	. .	. . . . .	Surface haul; pump filter.
4505*	" 5	3 A.M.	3 11.6	84 57.4	78	36.4	1705	gn. M., glob.	
4636	" 5	8 A.M.	2 44.5	85 23.5	78	. . .	. .	. . . . .	Pump filter.§
4637	" 5	9 P.M.	1 31	86 32	76	no record	1541	sml. & lrge. glob., lt. gn. glob. Oz.	Globigerinae similar to those found in pump filter on surface (8 A.M.). Thermometer did not trip. Towed at 300 fathoms and vertical haul to surface.
4638	" 6	7 A.M.	0 27	87 13	75	no record	1450	lt. gn. glob. Oz.	Thermometer did not trip. At Stn. 4638 also made a surface haul and towed with open net at 300 fathoms and vertically to surface. Pump filter.
			Latitude South.						
4639	" 6	1 P.M.	0 4	87 39.5	76	35.4	1418	lt. gy. glob. Oz., br. M.	Surface haul poor.
4506*	" 6	5 P.M.	0 21	87 57.5	75	no record	1433	gy. glob. Oz., br. M.	
4640	" 6	8 P.M.	0 39.4	88 11	75	37.4	1061	no sample	Pump filter, and extraordinarily rich surface haul, with a large number of pelagic fishes.

* Hydrographic Stations where soundings alone were made. See Note, page 50.

† Stations occupied at 8 A.M. are usually trawling stations at which temperature serials were also taken and intermediate tows at 300 fathoms and to the surface.

‡ At 8 P.M. a surface haul was usually made daily.

§ When not mentioned to the contrary, the pump filter was run each day.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position. Latitude South.	Position. Longitude West.	Temperatures. Surface.	Temperatures. Bottom.	Depth in Fathoms.	Character of Bottom.	Remarks.
	1904.	h. m.	° ′	° ′	°	°			
4641–4644 Southeast Face of Galapagos Islands.									
4641	Nov. 7	8 A.M.	1 34.4	89 30.2	74	39.5	633	lt. gy. glob. Oz.	Trawl haul, 10 miles from Hood Island, Galapagos.
4642	" 7	10 30 A.M.	1 30.5	89 35	74	48.6	300	brk. Sh. & glob.	5 miles from southeast end of Hood Island; Tangles.
4643	" 7	1 30 P.M.	1 28.7	89 48.5	74	67.2	100	brk. Sh. & glob.	About 4½ miles southwest by south from the west end of Hood; Tangles and Trawl.
4644	" 7	8 30 P.M.	2 13.3	89 42.2	72	35.4	1752	fine lt. gy. glob. Oz.	Surface haul with many fishes; pump filter.
4645–4651 Galapagos to Aguja Point.									
4645	Nov. 8	8 00 A.M.	3 37.6	89 43.1	70	36.0	1955	fine lt. gy. glob. Oz.	Trawl came up empty. (Pump filter.)
4646	" 8	7 00 P.M.	4 1.6	89 16.3	72	35.4	2058	fine lt. gy. glob. Oz. and br. M.	Towed 20 minutes with open net at 300 fathoms and vertically to surface.
4647	" 9	8 00 A.M.	4 33	87 42.5	70	35.5	2005	very lt. gy. glob. Oz.; large glob., br. M.	Trawl, magnificent haul of Holothurians, open net tow to surface from 800 fathoms.
4648	" 9	7 00 P.M.	4 43	87 7.5	71	. . .	. .	. . . . .	Surface haul and towed 20 minutes at 300 fathoms and vertically to surface. Swarm of Cytæis on surface.
4649	" 10	8 00 A.M.	5 17	85 19.5	70	35.4	2235	stky. gy. M., very few glob.	Trawl haul. Octacnemus in the trawl. Pump filter. Open net tow from 800 fathoms to surface.
4650	" 10	7 00 P.M.	5 22	84 39	71	. . .	. .	. . . . .	Surface haul; mass of Salpae; towed 20 minutes at 300 fathoms and up to surface.
4651	" 11	8 00 A.M.	5 41.7	82 59.7	66	35.4	2222	stky. fine gy. S.; trace of shore M.	Trawl, fine lot of silicious sponges; net towed open at 800 fathoms and to surface.
4652	" 11	7 00 P.M.	5 44.7	82 39.5	66	. . .	. .	. . . . .	Surface haul. Towed 20 min. at 400 fathoms and to surface. Towed 20 min. at 200 fathoms and to surface (Dissoma). Towed 20 min. at 100 fathoms and to surface.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position. Latitude South.	Position. Longitude West.	Temperatures. Surface.	Temperatures. Bottom.	Depth in Fathoms.	Character of Bottom.	Remarks.
	1904.	h. m.	° ′	° ′	°				
4507*	Nov. 12	7 00 A.M.	5 43.6	81 43.8	64	34.9	2312	fine stky. blue M., shore M., Pumice.	Trawl, much vegetable matter 17 miles from land, Nonuna Pt.
4653	" 12	10 27 A.M.	5 47	81 24	65	41.3	536	dk. br. gy. shr. M., many Diatoms.	Trawl.
4508*	" 12	1 00 P.M.	5 46.5	81 26.9	65	38.5	685	dk. gn. shore M.	
4654	" 12	1 50 P.M.	5 46	81 31.9	65	37.3	1036	dk.br.M.,veg.Mat., many Diatoms.	Trawl.
4655–4661. Line from Aguja Point towards the outer Western Edge of the Chili-Peruvian Stream.									
4655	Nov. 12	7 P.M.	5 57.5	80 50	65	. . .	. .	. . . . .	Surface haul. Towed at 400 fathoms, 20 min. and to surface; Pump filter
4656	" 13	8 A.M.	6 54.6	83 34.3	69	35.2	2222	fine gn. M. mxd. with gy. Qz., min. part. Sponge spic., many Diatoms.	Trawl; Octacnemus in trawl.
4657	" 13	7 00 P.M.	7 12.5	84 9	69	. . .	. .	. . . . .	Surface haul. Towed at 300 fathoms and vertically to surface.
4658	" 14	8 00 A.M.	8 29.5	85 35.6	70	35.3	2370	fine gn. M., Mang. nod.; Rad. Oz.	Trawl full of Manganese nodules 3 to 5″ in diameter. Sharks' teeth. Cetacean earbones. Towed with Tanner closing net at 300 fathoms 20 minutes, failed to close.
4659	" 14	7 00 P.M.	8 54.5	86 5.5	69	. . .	. .	. . . . .	Surface haul and towed 20 min. at 300 fathoms and vertically to surface.
4660	" 15	8 00 A.M.	9 55.6	87 30	69	35.4	2425	fine br. M.; Mang. nod.; Rad., a few Diatoms; Sponge spic.	Trawl, pump filter.
4661	" 15	7 00 P.M.	10 17	88 2	69	. . .	. .	. . . . .	Surface haul. Salpa soup. Towed at 300 fathoms, 20 min. and to surface.
4662–4669. From the Western Part of the Peruvian Current to the Western Edge of Milne-Edwards Deep.									
4662	Nov. 16	8 00 A.M.	11 13.8	89 35	69	35.2	2439	br. Rad. Oz., Mang. nod.	Pump filter; towed net at 800 fathoms and to surface.
4663	" 16	7 00 P.M.	11 20.3	88 55.2	69	. . .	. .	. . . . .	Pump filter, surface haul; Salpa soup. Towed at 300 and to surface. Yellow Pelagonemertes.

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude.	Surface.	Bottom.			
	1904.	h. m.	° ′	° ′	°	°			
4664	Nov. 17	8 00 A.M.	11 30.3	87 19	68	. . .	. .	. . . . .	Pump filter, surface haul, towed at 300 fathoms and to surface, Tanner closing net at 400 fathoms.
4665	" 17	7 00 P.M.	11 45	86 5.2	68	. . .	. .	. . . . .	Surface haul, poor tow at 300 and vertical to surface. Pump filter.
4666	" 18	8 00 A.M.	11 55.5	84 20.3	67	34.9	2600	lt. gy. Oz., floc. débris, few Mang. nod., Cetacean ear-bones.	Trawl, angular fragments of rocks. Pump filter.
4667	" 18	7 00 P.M.	11 59.5	83 40.4	68	. . .	. .	. . . . .	Surface haul. Towed at 300 fathoms and to surface.
4668	" 19	8 00 A.M.	12 9.3	81 45.2	67	no record	2620	fine gy. Oz., few Diatoms & Rad., glob.	Tanner net towed at 300 fathoms 20 minutes.
4669	" 19	7 00 P.M.	12 12.7	80 25.6	67	. . .	. .	. . . . .	Surface haul. Tow at 300 fathoms and to surface. Pelagonemertes.
4670–4675 from the Western Edge of Milne-Edwards Deep off Callao.									
4670	Nov. 20	8 00 A.M.	12 8.7	79 2.4	66	35.4	3209	sft. lt. br. M.	Trawl. Serial temp. and towed net at 800 fathoms to surface.
4671	" 20	7 00 P.M.	12 6.9	78 28.2	66	35.4	1490	fine gn. clay; infus. earth full of Diatoms.	Water of late discolored by Diatoms. Surface haul and tow at 300 fathoms to surface. Pump filter.
4672	" 21	7 00 A.M.	13 11.6	78 18.3	65	35.2	2845	similar to above	Trawl. Fine haul of Holothurians. Tanner net tow at 400. Pump filter.
4673	" 21	7 00 P.M.	12 30.5	77 49.4	67	42.5	458	rky.	Surface haul, and tow at 300 fms.
4509*	" 22	7 00 A.M.	12 26.6	78 34.5	67	35.2	1949	fine dk. gn. M., many Diatoms.	Pump filter.
4674	" 22	9 00 A.M.	12 14.4	78 43.4	68	35.1	2338	fine dk. gn. M., Sponge spic.; few Diat. & few Rad., Diat. Oz. in mud-bag.	Large angular fragments of rock in trawl.
4675	" 22	7 00 P.M.	12 54.0	78 33.0	68	no record	3120	fn. dk. gn. M., floc. organic matter, Diat. débris, Silicious infus. earth.	Surface haul tow at 300 fathoms and to surface.

* Hydrographic Station.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position. Latitude South.	Position. Longitude West.	Temperatures. Surface.	Temperatures. Bottom.	Depth in Fathoms.	Character of Bottom.	Remarks.
	1904.	h. m.	° ′	° ′	°	°			
1510*–1514* 4676–4693 Callao to Easter Island.									
4510*	Dec. 4	7 00 P.M.	13 48.2	80 13.0	70	35.2	2543	fine lt. gy. clay Oz.; floc. mat.; few Rad., Sponge spic.; Diat. Oz.	
4676	" 5	8 00 A.M.	14 28.9	81 24	69	35.4	2714	fine dk. br. Oz., Diat. Rad. Mang. nod.	Pump filter every A.M. at 8. Lost trawl frame and bag; serial temp. and tow at 300 fms.
4677	" 5	7 00 P.M.	14 37.5	81 41	68	. . .	. .	. . . . .	Poor surface haul.
4511*	" 6	8 00 A.M.	15 39	83 27.4	69	35.2	2620	lt. br. Rad. Oz.; Rad. filled with M., no Diat.	
4678	" 6	7 30 P.M.	16 31.2	85 3.8	68	. . .	. .	. . . . .	Surface haul very poor.
4679	" 7	8 00 A.M.	17 26.4	86 46.5	69	35.3	2485	lt. br. stky. Oz., Sponge spic., few Rad. or glob.	Tow at 300 fathoms. Water has been a most intense ultramarine to-day.
4680	" 7	7 00 P.M.	17 55	87 42	68	. . .	. .	. . . . .	Very little in tangles. Very fine surface haul. Cymbulia soup.
4681	" 8	8 00 A.M.	18 47.1	89 26	68	35.4	2395	choc. br. clay, Mang. nod., few glob., few Rad.	Tow at 300 fathoms, serial temp.; trawl came back torn to pieces; a few manganese nodules left in bag; must have been too heavy a load.
4682	" 8	7 30 P.M.	19 7.6	90 10.6	69	. . .	. .	. . . . .	Surface haul; Cymbulia soup again.
4683	" 9	8 00 A.M.	20 2.4	91 52.5	70	35.2	2385	dk. choc. col. clay, no Diat., very few glob. Mang. nod.	Serial temp., tow at 300 fathoms.
4684	" 9	8 00 A.M.	20 40.3	93 19.2	71	. . .	. .	. . . . .	Poor surface haul.
4685	" 10	8 00 A.M.	21 36.2	94 56	72	35.3	2205	few Rad., a gd. many glob., dk. br. clay, no Diat., Orbulinae partly decomposed.	Tow at 300 fathoms and to surface; very poor haul. Serial temperature. Trawl haul; small trawl came up with $1\frac{1}{2}$ tons of manganese nodules, very little animal life.
4686	" 10	8 00 P.M.	22 2.2	95 52	71	. . .	. .	. . . . .	Very poor surface haul.
4687	" 11	8 00 A.M.	22 49.5	97 30.6	73	35.4	2184	dk. choc. col. clay, few more glob., few Rad., very few Sponge spic.	Tow at 300 fathoms, very poor. Tow at 2125 fathoms; nothing not taken before; very little in net, not more than in 300 fms. haul. Surface haul very poor here, out of current. 1260 miles from Callao and 500 from Sala y Gomez.

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude West.	Surface.	Bottom.			
	1904.	h. m.	° ′	° ′	°	°			
4688	Dec. 11	8 00 A.M.	23 17.2	98 37.5	72	...	..		Surface haul very poor.
4689	" 12	8 00 A.M.	24 5	100 20	72	35.4	2185	dk. br. choc. clay, mrkd. incr. in glob., few Rad.	Tow at 300 fathoms, extremely poor haul. Serial temperatures.
4690	" 12	8 00 P.M.	24 45	101 45	73	...	..	.....	Surface haul extremely poor.
4691	" 13	8 00 A.M.	25 27.3	103 29.3	73	35.3	1939	lt. yl. br. glob. Oz., few Rad., Sponge spic.	Tow at 300 fathoms; very poorest haul of all; trawl came up torn, with lot of angular fragments of volcanic rocks, pumice, and manganese nodules.
4692	" 13	8 00 P.M.	25 40.4	104 1.3	72	...	..	.....	Nothing in surface haul.
4512*	" 14	8 00 A.M.	26 17.3	105 25.2	71	36.4	885	rky.	Off Sala y Gomez. Did not dare to trawl.
4693	" 14	11 00 A.M.	26 30.1	105 45.2	73	35.4	1142	rky., fine glob. from mudbag of trawl. Lava rk. & Mang. nod.	Sharks' teeth and cetacean earbones in trawl.
4513*	" 15	2 00 A.M.	26 50	107 30	71	35.4	1696	rky., no bot. spec.	
4514*	" 15	1 00 P.M.	27 1.6	108 56	74	35.4	1552	yl. clay, Mang. nod., few glob. & Rad.	Anchored in Cook Bay, Easter Id., 5.30 P.M.
4515*–4518* 4694–4716 Easter Island to Chatham Island, Galapagos.									
4515*	Dec. 22	11 00 A.M.	26 58.7	109 20.3	72	35.5	1145	fine vol. S., few glob., Sponge spic.	5 miles off N. Pt. of Easter Id.
4516*	" 22	12 30 P.M.	26 54.8	109 16.4	74	35.4	1627	fine vol. S., Obsidian fgt., many glob.	10 miles off N. Pt. of Easter Id.
4517*	" 22	1 30 P.M.	26 50.9	109 12.5	74	35.4	1723	lt. br. Oz., many glob. Orbulina, a few Rad., vol. part.	15 miles off N. Pt. of Easter Id.; serial temperatures.
4518*	" 22	3 30 P.M.	26 47.3	109 9.3	75	35.3	1770	fine lt. br. Oz., many lrge. & sml. glob., Sponge spic., few Rad.	20 miles, off Easter Id., too rough to trawl.
4694	" 22	8 00 P.M.	26 34	108 57.3	72	...	..	.....	Surface haul fair; very many Radiolarian colonies.
4695	" 23	8 00 A.M.	25 22.4	107 45	74	...	2020	in mudbag fine lt. br. Oz., very many glob., few Rad.	Lost thermom. and 90 fms. wire. Trawl haul, very little in bag. Manganese nodules, sharks' teeth.
4696	" 23	8 00 P.M.	24 40.3	107 5.3	74	...	..	.....	Very poor surface haul.
4697	" 24	8 00 A.M.	23 24.4	106 2.2	75	35.5	2188	dk. br. choc. clay, few Rad., very few glob., fine min. part.	Tow at 300 very poor. Trawl tripped, probably from load of manganese nodules.
4698	" 24	8 00 P.M.	22 50.4	105 31.7	75	...	..	.....	Wretchedly poor surface haul.

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude West.	Surface.	Bottom.			
	1904.	h. m.	° ′	° ′	°	°			
4699	Dec. 25	8 00 A.M.	21 39.5	104 29.8	75	35.5	2168	dk. br. choc. clay, very few Rad., arenaceous Foram.	Tow at 300 fathoms; very poor haul.
4700	" 25	8 00 P.M.	20 28.8	103 26.3	74	. . .	. .	. . . . .	Surface haul, very marked improvement in catch; getting into trade wind region.
4701	" 26	8 00 A.M.	19 11.5	102 24	72	35.3	2265	dk. br. choc. clay, sharks' teeth, earbones, Mang. nod., very few glob. & Rad.	Tow 300 fathoms; very much better haul, more like those half way from Callao to Easter Id., poor trawl haul, bottom still very barren. Serial temperatures.
4702	" 26	8 00 P.M.	18 39.5	102	73	. . .	. .	. . . . .	Surface haul very poor, some increase in the fine stuff in the water.
4703	" 27	8 00 A.M.	17 18.6	100 52.3	73	35.3	2228	dk. choc. col. Oz., some glob.	Tow at 300 fathoms, hauls continue poor, a few more Copepods. Trawl obtained nothing; barren bottom.
4704	" 27	8 00 P.M.	16 55.3	100 24.6	73	. . .	. .	. . . .	Surface haul quite good.
4705	" 28	8 00 A.M.	15 5.3	99 19	72	35.3	2031	very lt. gy. yl. glob. Oz., some Diat. & very many Rad.	Tow at 300 fathoms and to surface, excellent haul; are in the western edge of the Humboldt current. Brought up very little in the trawl.
4706	" 28	8 00 P.M.	14 18.7	98 45.8	72	. . .	. .	. . . . .	Very fair surface haul.
4707	" 29	8 00 A.M.	12 33.2	97 42	72	35.3	2120	dk. choc. br. Oz., very many glob. & Rad. & Coscinod.	Tow at 300 fathoms, excellent haul.
4708	" 29	8 00 P.M.	11 40	96 55	72	. . .	. .	. . . . .	Very good surface haul.
4709	" 30	8 00 A.M.	10 15.2	95 40.8	72	35.3	2035	lt. gy. glob. Oz., very many Rad. & Diat.	Fair haul towing at 300 fathoms. Trawl tripped, but good trawl haul in bag. Earbones, sharks' teeth, and Manganese nodules.
4710	" 30	8 00 P.M.	9 30.5	95 8.3	74	. . .	. .	. . . . .	Surface haul. Salpa soup.
4711	" 31	8 00 A.M.	7 47.5	94 5.5	75	35.3	2240	lt. gy. glob. Oz., with many Rad & Diat. all dead.	Tow at 300 fathoms, very good haul. Ring trawl sent to tow at bottom. Brought up large load of Manganese nodules and a few sharks' teeth and earbones.
4712	" 31	8 00 P.M.	7 5	93 35.5	74	. . .	. .	. . . . .	Fair surface haul.
4713	1905 Jan. 1	8 00 A.M.	5 35.3	92 21.6	73	35.3	2191	lt. br. glob. Oz. at top of cylind., lt. gy. glob. below, few glob. at top, many Rad., few Diatoms.	Serial temperatures. Tow at 300 fathoms, good haul.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude West.	Surface.	Bottom.			
	1905.	h. m.	° ′	° ′	°	°			
4714	Jan. 1	8 00 P.M.	4 19	91 28.5	75	. . .	. .	. . . . .	Surface haul, fair catch.
4715	" 2	8 00 A.M.	2 40.4	90 19.3	75	failed to register	1743	lt. gy. glob. Oz., many Diat. and many Rad.	Serial temperatures, at base of rim of rise of the Galapagos. Splendid haul at 300 fathoms.
4716	" 2	8 00 A.M.	2 18.5	90 2.6	75	. . .	. .	. . . . .	Trawl, fair haul. Surface haul excellent about 55 miles from Hood Island, Galapagos. Anchored Wreck Bay, Chatham Island, Galapagos January 3 at 11 A.M.
4519*–4526* 4717–4739 GALAPAGOS TO MANGA REVA.									
4519*	Jan. 10	7 00 P.M.	1 31	91 4	76	35.5	1385	hard.	40 miles from abeam P. O. Bay, Charles Island, Galapagos.
4520*	" 11	12 06 A.M.	1 46.8	91 36	74	35.5	1815	gy. glob. Oz., very many Rad. & Diat.	About 75 miles from last station, on course to Manga Reva.
4521*	" 11	8 00 A.M.	2 14.3	92 29.9	75	failed to trip	1871	glob. Oz. as at St. 4520.*	About 143 miles from Charles Island.
4522*	" 11	4 00 P.M.	2 42.4	93 30	77	35.4	1924	lt. gy. glob. Oz., gt. many Rad. and Diatoms.	Pump filter collected on this line at 8 A. M. daily.
4523*	" 12	8 00 A.M.	3 34	95 35.4	77	35.3	2031	wh. glob. Oz., very many Rad. & Diat.	
4717	" 13	8 00 A.M.	5 10	98 56	75	35.2	2153	red br. glob. Oz., glob. much brok. up, many Diat. & many Rad. filled with blk. min. part.	Tow at 300 fathoms, very fine haul. Trawl excellent catch. Serial temperatures.
4718	" 13	8 00 P.M.	5 32.4	99 32.2	76	. . .	. .	. . . . .	Excellent surface haul.
4719	" 14	8 00 A.M.	6 29.8	101 16.8	75	Th. failed to reg.	2285	Red clay, cup cut Mang. nod., no glob. or Rad.	Excellent haul 300 fms. to surface; did not dare to trawl, mang nodules.
4720	" 14	7 30 P.M.	7 13.3	102 31.5	76	. . .	. .	. . . . .	Surface haul, Salpa soup.
4721	" 15	8 00 A.M.	8 7.5	104 10.5	75	failed to reg.	2084	lt. br. glob. oz., Sponge spic., many Diat., few Rad.	Tow 300 fms. and up to surface; excellent trawl haul; temp. serial. Huge Psychropotes 55 cm. long.
4722	" 16	8 00 A.M.	9 31	106 30.5	75	35.1	1923	rky.	Good haul 300 fms. to surface.
4723	" 16	7 30 P.M.	10 14.3	107 45.5	76	. . .	. .	. . . . .	Fair surface haul.
4724	" 17	8 00 A.M.	11 13.4	109 39	79	35.1	1841	hrd., col. cup empty.	Tow at 300 fms. to surface; rather poor, serial temp., trawl came up empty.
4725	" 17	7 30 P.M.	11 38.3	110 5	77	. . .	. .	. . . . .	Poor surface haul.

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude West.	Surface.	Bottom.			
	1905.	h. m.	° ′	° ′	°	°			
4726	Jan. 18	8 00 A.M.	12 30.1	111 42.2	78	35.1	1700	choc. br. M. full of glob., aren. For. Sponge spic., few Diat. Coscin., few Rad.	About half way to Manga Reva from the Galapagos. *Garrett Ridge*; trawl came up empty.
4727	" 18	7 30 P.M.	13 03	112 44.9	77	. . .	. .	. . . . .	Fair surface haul.
4728	" 19	8 00 A.M.	13 47.5	114 21.6	77	35.8	1055	glob. S. pkd. hrd. in mudbag. Few Diat. & Rad.	Tow at 300 fms. to surface, trawl empty, mudbag full of glob. sand, temp. serial, *Garrett Ridge*.
4729	" 19	7 30 P.M.	14 15	115 13	78	. . .	. .	. . . . .	Rather poor surface haul.
4730	" 20	8 00 A.M.	15 7	117 1.2	79	35	1912	clasper did not close.	Tow at 300 fms. to surface, fair haul, dropped back to general level of oceanic plateau ("Albatross").
4731	" 20	7 30 P.M.	15 47.2	118 22.5	79.5	. . .	. .	. . . . .	Very poor surface haul.
4732	" 21	8 00 A.M.	16 32.5	119 59	79	34.8	2012	lt. gy. glob. Oz., sharks' teeth, and earbones, mang. nod., very few Diat. & Rad., Sponge spic.	Serial temperatures, tow at 300 fms. to surface, very poor; little in trawl.
4733	" 21	7 30 P.M.	16 57.4	120 48	80	. . .	. .	. . . . .	Fair surface haul.
4734	" 22	8 00 A.M.	17 36	122 35.6	81	34.9	2019	nothing in cup	Tow at 300 and up to surface, very poor haul.
4735	" 22	7 30 P.M.	18 16	123 34.4	81	. . .	. .	. . . . .	Surface haul very poor.
4736	" 23	8 00 A.M.	19 0.4	125 5.4	81	34.8	2289	dk. br. choc. M. full of glob., very few Rad., in trawl sharks' teeth, ear bones, pumice & Mang. slabs.	Tow at 300 and up to surface, very poor. Trawl frame badly twisted, net torn. Mudbag full of brown sticky mud.
4737	" 24	8 00 A.M.	19 57.5	127 20.3	81.5	34.8	2060	very little in clasper, dk. br. choc. M. full of glob.	Tow at 300 and up to surface, very poor haul. Towed Petersen closing net from 550 to 400, fathoms, nothing in net.
4738	" 24	7 30 P.M.	20 26.5	128 30.2	81	. . .	. .	. . . . .	Very poor surface haul.
4524*	" 25	8 00 A.M.	21 3	130 10.3	80	34.5	2197	dk. br. choc. M. glob., Mang., nod.	Too rough to work.
4525*	" 25	7 00 P.M.	21 36.1	131 35.3	80	34.8	2123	stky. red clay with glob., no Diat., very few Rad., fine min. part.	
4739	" 26	8 00 A.M.	22 11.1	133 21	79	34.9	2042	dk. gy. glob. Oz., no Diat., very few Rad. in mudbag, obsiddian like frag.; large & sml. Mang. nod.	Tow at 300 very poor haul, trawl tripped. Bag empty. Little in mudbag. Serial temp.

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude West.	Surface.	Bottom.			
	1905.	h. m.	° ′	° ′	°	°			
				Off East Face of Manga Reva.					
4526*	Jan. 27	6 45 A.M.	11 m. N. E. off Mt. Duff		78	34.6	2070	lt. br. glob. Oz.	Very steep off the group. No plateau here.
				4527*–4530* Taken on Leaving Manga Reva.					
4527*	Feb. 5		Reef flat about ¼ m. from the ship		77	53.5	225	coralline & wh. S.	Off Tekava.
4528*	" 5		Reef flat about ¼ m. from the ship		78	50.4	245	coralline S., brk. Sh. Pteropods, Nullip.	Off East Point of barrier reef.
4529*	" 5		Reef flat less than ¼ m. from ship		77	51.5	241	hard.	Off Vaitekeue.
4530*	" 5		About 3½ m. N. E. from last station		77.5	35.0	1394	coral S. & coralline.	
				4531*–4547* 4740–4743 Manga Reva to Acapulco.					
4531*	Feb. 6	8 00 A.M.	21 4.5	133 1.2	79	35.0	2225	rd. clay M., many min. part., very few glob., no Rad. or Diatoms.	Very little in the tubes.
4532*	" 7	8 00 A.M.	18 29.4	130 50.8	81	34.5	2319	dk. br. choc. M., few lrg. glob., Sponge spic., Mang. nod.	
4533*	" 8	8 00 A.M.	16 20.3	128 46	82	34.5	2194	same bot. as Stn. 4532*	Very little in claspers.
4534*	" 9	8 00 A.M.	13 51	126 53.5	82	34.6	2185	dk. gy. glob. Oz., lrg. glob., many blk. Mang. part. few crystals. Aren. Foram, Sponge spic., very few Rad.	Quantities in tow-nets begin to increase.
4535*	" 10	8 00 A.M.	11 20	125 1.3	80	34.5	2215	lt. gy. glob. Oz., very few blk. min. part, quite a no. of Rad., some Diat. & Coscinod. Euodia.	
4740	" 11	8 00 A.M.	9 2.1	123 20.1	81	34.2	2422	dk. gy. glob. Oz. lrg. glob., very few blk. min. part, very many dead Rad. belonging to the surface colonial types, lrge. no. of Diat. 10° from equator.	Excellent trawl haul, earbones, Manganese nodules. Superb sharks' teeth, very fair tow at 300 fathoms and up.

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude South.	Longitude West.	Surface.	Bottom.			
	1905.	h. m.	° ′	° ′	°	°			
4741	Feb. 11	7 30 P.M.	8 29.7	122 56	80	. . .	. .	. . . . .	Very fair surface haul: fine stuff in net very thick; haul resembles those of the northern part of Eastern lines.
4536*	" 12	8 00 A.M.	7 10.3	122 13.2	80	34.3	2380	nothing in tubes prob. looser glob. Oz. than yesterday.	
4537*	" 13	8 00 A.M.	4 50.5	120 45.7	79	34.3	2350	very lt. gy. fne. glob. Oz., few blk. min. part., gd. no. of Rad., some Diatoms, Coscinod.	
4538*	" 14	8 00 A.M.	2 14	118 55.1	79	34.3	2291	very fine lt. gy. glob., very many Rad. & Diatoms, Cosc. Euodia; few min. part.	
			North						
4742	" 15	8 00 A.M.	0 3.4	117 15.8	77	34.3	2320	very lt fine gy. glob. Oz., very few blk. min. part., much silicious débris; great many Rad. & Diat. Cosc. Euodia, Synedra; short silic. needles, some Silico-flagellates.	Tow at 300, very good haul. Trawl; superb haul: Rhizocrinus stems, viviparous Benthodytes. Strange egg cluster. Squid?
4743	" 15	7 30 P.M.	0 21.3	117 2.6	78	. . .	. .		Excellent surface haul.
4539*	" 16	8 00 A.M.	1 35	116 38	78.5	34.4	2189	tubes came up clean probably still less stky. glob. Oz., all washed out.	Physalia sailed by.
4540*	" 17	8 00 A.M.	3 25.6	115 5.4	79	34.4	2200	dk. gy. glob. Oz., lrg. glob., many blk. mang. part., many Rad. & Diatoms, few Cosc., Sponge spic.	Large Velella sailed by; from surface net: Appendiculariae, Pteropods, Copepods, Coscinodiscus Euodia, Synedra, Acantharian Radiolaria, Pyrocystis Ceratium Planktoniella; approaching westerly warm current.
4541*	" 18	8 00 A.M.	4 55	112 27	80	34.4	2174	dk. gy. glob Oz., lrg. glob., Rad. filled with blk. mud.	Diatoms have disappeared; are in warm western tropical current.
4542*	" 19	8 00 A.M.	7 8.7	110 45.3	80	34.5	2225	no sample in tubes.	
4543*	" 20	8 00 A.M.	8 52.2	108 54	79.5	34.7	2058	rd. cly. dk. choc. br. stky. M., few glob., many sm. blk. Mang. part., few Rad., Sponge spic., transp. min. cryst. mass of yel. floc. mat.	

* Hydrographic Stations.

RECORD OF DREDGING, TRAWLING, AND PELAGIC STATIONS. — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude North.	Longitude West.	Surface.	Bottom.			
	1905.	h. m.	° ′	° ′	°	°			
4544*	Feb. 21	8 00 A.M.	10 38	106 47.6	80	34.4	1955	stky. dk. choc. br. M., many blk. Mang. part.	
4545*	" 22	8 00 A.M.	12 42.5	104 45	79	34.9	1753	stky. dk. choc. br. M., blk. part. of Mang.	
4546*	" 23	8 00 A.M.	14 50	101 31	81	35.2	2050	stky. dk. choc. br. M., many blk. part. of Mang.	
4547*	" 24	4 00 A.M.	16 20.2	99 58.4	83	35.2	2474	shot brought back.	About 29 miles south of Acapulco Light; western extension of deep hole east of Acapulco. Last sounding.

* Hydrographic Stations.

NOTE. — Owing to an error in the records of the "Albatross," the Hydrographic numbers 4504* to 4547* are incorrect; they should be Nos. 4805* to 4847*. As a mass of pelagic material was labelled to correspond to these stations as originally recorded, it was found impossible to change the record, and to prevent confusion we can only call attention to the discrepancy.

THE GALAPAGOS.

Plates 50–56.

We arrived at Wreck Bay, Chatham Island, Galapagos (Pl. 51), on the third of January, where we found a schooner with a supply of coal. We reached Chatham Island towards the end of the dry season when everything is dried up; the vegetation seems dead with the exception of a few small wild cotton plants, weeds, cactus, and an occasional mimosa (Pls. 52, 54). The great gray slopes of the island (Pl. 50, figs. *1*, *2*), covered with dry brush and shrubs, presented fully as uninviting an aspect as when Darwin described them.[1]

ON THE WAY TO THE HACIENDA, CHATHAM ISLAND.

When the "Albatross" visited the Galapagos in March, 1891, everything was green, presenting a very marked contrast to its present desolate appearance.[2]

The volcanic boulders covering the surface are fully exposed to view during the dry season (Pls. 53, 56), while during the rainy season they are hidden by the thick growth of brush and bushes. Cactus do not flourish

[1] Darwin, C. Journal of Researches in Geology and Natural History, 1840, p. 454: —

"Nothing could be less inviting than the first appearance. A broken field of black basaltic lava is everywhere covered by a stunted brushwood, which shows little sign of life. . . . The thin woods, which cover the lower parts of all the islands, excepting where the lava has recently flowed, appear from a short distance quite leafless, like the deciduous trees of the northern hemisphere in winter. It was some time before I discovered that, not only almost every plant was in full leaf, but that the greater number were now in flower." (September 17, 1835.)

[2] General sketch of the Expedition of the "Albatross" from February to May 1891, p. 61, by A. Agassiz, Bull. M. C. Z. XXIII, No. 1, 1892.

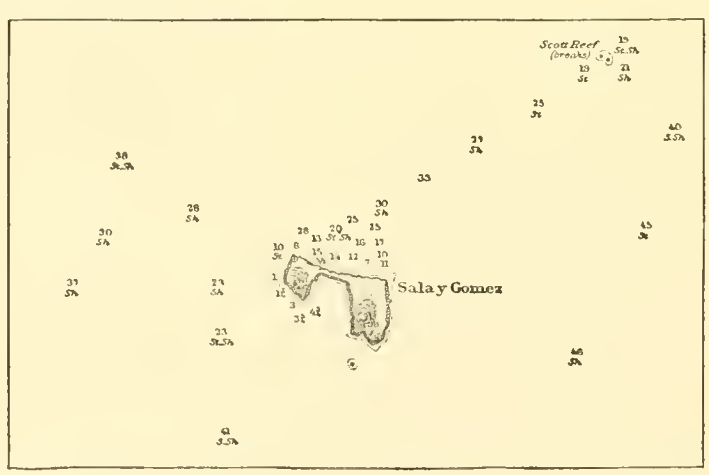
on the limestone plateau to the rear of the landing-place. Its vegetation consists mainly of mimosas and wild cotton plants (Pls. 52, 55, fig. *1*), while the cactus flourish among the decomposed volcanic boulders and attain a considerable height on some parts of the island, on the way to the hacienda (Pls. 53, 55, fig. *2*; 56).

Since our visit to Chatham Island in 1891, the contract laborers rose against Mr. Cobos, the former lessee of the island. He was killed during the rebellion. The Ecuadorian government now maintains a small garrison on the island, and Wreck Bay has become a port of entry.

SALA Y GOMEZ.

Plate 15.

The island is somewhat less than half a mile long, and about a fifth of a mile across its eastern part, which is rectangular and joined by a rocky narrow neck with a small western promontory of perhaps 50 feet in height (Pl. 15, fig. *2*). The southeastern point is nearly 80 feet high (Pl. 15, fig. *1*). The whole island appears to consist of dark brown volcanic rocks, deeply pitted and weather-worn into small rounded or mammary pinnacles or sharply weathered pinnacles, the sea breaking over the low parts of the island and the spray flying over the greater part. Judging from the soundings given in the Chilian surveys, the island must formerly have occupied a larger area than at present. Petrels, Gannets, and tropic birds were resting in numbers on different parts of the islet. A comparatively shallow area surrounds the island, and a mile to the northeast Scott's Reef is found, on which the sea breaks.



From H. O. Chart 1119. PLAN OF SALA Y GOMEZ. Scale 1 mile = 1''.50.

EASTER ISLAND.

Plates 13, 16–49^a.

The Chart of Easter Island (Pl. 13), is taken from the U. S. Hydrographic Chart No. 1119, which is based upon Chilian surveys made in 1870, with important additions and corrections by the U. S. S. "Mohican" in command of Commander B. F. Day, U. S. N., in 1886, during her visit to Easter Island on behalf of the Smithsonian. Before that time the island had been visited by a German gunboat, the "Hyäne," under Captain Lieutenant Geiseler[1] (1882).

To Paymaster Thomson, U. S. N., and Dr. Geo. H. Cooke, surgeon, U. S. N., of the "Mohican," we owe an excellent account of Easter Island fully illustrated.[2] At the time of the visit of the "Mohican" its officers were fortunate enough to find still at Easter Island Mr. A. A. Salmon, who had resided for many years on the island, and to whom much of the information obtained by Paymaster Thomson is due. Mr. Salmon was thoroughly familiar with the traditions, customs, and language of the natives, and to him we owe the preservation of some of the wooden tablets upon which are cut the written language giving us the traditions and legends of the Easter Islanders. Besides the translations of some tablets given by Paymaster Thomson (l. c. pp. 517–526), there is an important pamphlet on the "Île de Pâques," by Mgr. Janssen, Bishop of Axieri, published in Paris in 1893 from notes left by the bishop. giving among other things an account of the signs carved on the wooden tablets.

During the short time at our disposal I could not hope to add anything of importance to the knowledge of Easter Island beyond that published by the officers of the "Mohican," whose material was supplied by so able and competent a coadjutor as Mr. Salmon. I may add from my own impressions while on the spot that everything seems to point to the immediate ancestors of the present inhabitants as the workers who carved the stone images of the island.

One gets a general impression of the sudden collapse of all work on the island owing to some great catastrophe. The number of images left half finished in the quarries and workshops and in all stages of preparation imply a

[1] Die Oster Insel. Bericht von Kapitan-lieutenant Geiseler, Berlin, 1883. Captain Geiseler also owes the information regarding the natives contained in his pamphlet to Mr. Salmon.

[2] Report U. S. Nat. Museum for the year ending 1889 (June 30). 1891, Plates 13–60.

great activity suddenly come to an end: tools abandoned in all directions; images in all possible positions, ready to be transported to their final resting-place; images scattered all over the island on the way to their destination.

Some of the natives pretend that their great-great-grandfathers were cutters of images. In a volcanic island like Easter Island, with craters rising in all directions, it is not impossible that an eruption may have destroyed a great part of the large population which undoubtedly existed at one time on Easter Island. With the reduction of the population but little work may have been done after such a calamity, and the work of cutting images have been gradually given up. In 1860, the population previous to the time of the kidnapping by the Peruvians of a great number of the natives, was said to be 3000. It diminished very rapidly from that time. Ten years later there were only 900 inhabitants, and at the present time less than 150.

The traditions indicate one immigration from the mainland of South America, another from the Galapagos, and a third from the Paumotus. The last two localities do not seem very feasible in view of the direction of the prevailing winds in both cases. Boats would have to traverse in one case, 1500 miles against the trades, in the other, nearly 2000 miles, while from the east, about in the same latitude as Easter Island, the prevailing winds are favorable. Yet the natives of to-day are more closely allied to the inhabitants of the Paumotus and Society Islands than to any other natives.

In spite of the difficulties of the navigation eastward from the Paumotus to Easter Island, Mr. Salmon is of the opinion that the first inhabitants of Easter Island came from the Paumotus.

Skirting the northern coast of Easter Island one obtains an excellent idea of the character of that part of the island, which is also that of the rest of the island. Everywhere long slopes falling from La Pérouse Mountains (Pl. 21), or from the Blossom range (Pl. 22), the summits to the west of Cape O'Higgins (Puakatiki), or the slope of Rana Kao (Pl. 20, fig. 2) covered with tall bunchy grass growing between the blocks of lava scattered all over the surface, while on the sea face the projections of the slopes have been cut off into steep bluffs (Pls. 16, 19, 20, 29). Plate 16, fig. 2, shows a bluff to the west of Cape O'Higgins (Pl. 19, fig. 2), with three characteristic cones of denudation on the ridge of the slope running towards the summit of Puakatiki. Somewhat more to the westward is the rounded hill forming Rosalie Point, the outer slope of which has been weathered (Pl. 17) to form a small landing place in Ovahe Bay (Pl. 18, fig. *2*). To the west of La Pérouse Bay are irregular bluffs on the shore slope of the saddle separating La Pérouse Bay from Anakena Bay (Pl. 16, fig. *1*).

One of the many amphitheatres of the north shore is formed by the falling in of the volcanic tufa bluffs at the foot of Blossom Range to the west of Anakena Bay. Skirting the west coast, somewhat south of North Cape, we see the range of isolated rounded domes extending from Kotatake (Mount Powell) in a southeasterly direction towards Mounts Palmer and Orito (Pl. 20, fig. *1*). Mount Beechey is seen in the distance to the left.

From our anchorage in Cook Bay an excellent view is obtained of the western and northern slope of Rana Kao, with the steep bluff of the western rim of Rana Kao at Orongo forming the southwesterly extremity (Karikari Point) of Easter Island (Pl. 20, fig. *2*).

Rana Roroka is a small, low volcanic cone rising gently from the level of the great plain to the south of La Pérouse Bay, in the rear of Tongariki, Hanga Nui Bay (Pl. 13). Seen from the west (Pl. 26, fig. *1*) the rim of the crater is somewhat lower on that side, giving access to the crater through a gap on the southwest side of the rim. The eastern rim is a good deal higher than the western, and has a deep gap separating the northern from the southern part of the rim of the crater (Pl. 26, fig. *2*). The southeastern face is quite steep, with a talus reaching nearly half-way towards the gap on that side of the crater.

The low northern rim of the crater of Rana Roroka (Pls. 18, fig. *1*; 25), has a very moderate slope. The crater is filled by a large pool, the edges of which are overgrown with reeds and bulrushes. It is more open than the pool of the crater of Rana Kao, which is carpeted by a nearly solid bed of moss, reeds, and bulrushes, strong enough to allow cattle to walk over the greater part of the carpet of vegetation and to reach the small open pools of water scattered on its surface (Pls. 23, 24).

The highest point of Rana Roroka is not more than about 630 feet. The pass into the crater, but little above the level of the water in the crater, is about two-thirds that height. The slope of the crater is quite gentle.

Rana Kao is more than twice as high, 1327 feet. The path leading to the bottom of the crater (the level of the lake) is very steep. The lake is fully 700 feet below the highest point of Rana Kao, and is about a mile in circumference. There is a gap in the rim (Pl. 23) towards the south, and to the west; on the side where the stone houses of Orongo are found, Rana Kao is precipitous, the rim of the crater very narrow (Pl. 13).

Half-way up the gentle slope of Rana Kao, to the south of Mataveri, one gets an excellent panorama of Easter Island. Plate 21 gives the aspect of the western shore of the island, as seen looking north towards La Pérouse Mountain (Pl. 13), the highest point of the island. Plate 22 is a view of the central part of the island looking in a northeasterly direction from the northern slope of Rana Kao, towards the Blossom Range (Pl. 13). The surface of the island is everywhere covered with high tufts of coarse grass, as is shown in the foreground of Pls. 21 and 22, with blocks of black lava cropping out in all directions, as is also seen in the foreground in other views of the island (Pls. 18, fig. *2*; 26, 28, 31, 41, 42), and on the inner and outer slopes of Rana Roroka (Pls. 32–40).

Along parts of the coast on the northern side of the island the scattered lava blocks are larger and more numerous than towards the central part of the island. This is well seen on Plate 17, a part of the coast of La Pérouse Bay to the south of the landing-place on the small sandy beach in Ovahe Bay at the foot of Uremamore Point (Pls. 13; 18, fig. *2*).

At Easter Island we found our collier awaiting our arrival. We moved from Cook Bay to La Pérouse Bay to coal, as there was less swell there than in Cook Bay, where we could scarcely have gone alongside for this purpose.

Considerable shore collecting was done at Easter Island. We must have brought together at least thirty species of plants. The flora of Easter Island is very poor. There are neither trees nor native bushes. Not even the bushes which characterize the shore tracts of the most isolated coral reefs of the Pacific are found there; and yet some of the equatorial countercurrents must occasionally bring some flotsam to its shores. We collected a number of shore fishes, and made a small collection of the littoral fauna. The fishes have a decided Pacific look, and the few species of sea-urchins we came across are species having a wide distribution in the Pacific.

While coaling, we spent some time examining the prehistoric monuments which line the shores of Easter Island. During our stay at La Pérouse Bay we visited the platforms studding the coast of the bay, and made an excursion to the crater of Rana Roroka, where are situated the great quarries from which are cut the colossal images now scattered all over the island.

On our return to our anchorage at Cook Bay, we examined the platforms within easy reach of the settlement, and also the crater of Rana Kao, on the north rim of which, at Orongo, are a number of the stone houses built by the people who quarried the great stone images. At Orongo are also found sculptured rocks, but neither the sculptures nor the images show any artistic qualities, though the fitting of some of the cyclopean stones used in building the faces of the platforms indicates excellent and careful workmanship. To Mr. C. Cooper, manager of the Easter Island Company, we are indebted for assistance while visiting the points of interest of the island. He was indefatigable in his exertions in our behalf.

Red Tufa Crown, 3 Ft. High, 4 Ft. Diam. La Pérouse Bay.

We took a number of photographs during our stay, illustrating not only the prehistoric remains, but giving also an idea of the desolate aspect of Easter Island during the dry season.

Many of the images have fallen near the platforms upon which they were erected, or have been abandoned in different parts of the interior of the island while on their way from the quarries at Rana Roroka to the various platforms where they were to be erected. Near Rana Roroka, at Tongariki, is the largest platform on the island, about 450 feet in length with its wings, to the rear of which are fifteen huge images which have fallen from the pedestals upon which they once stood. The plain in the rear of the platform is crowded with stone houses, most of which are in ruins, and in the rear of the platform towards Rana Roroka the ground is one huge burying-place.

The eastern slope of Rana Kao is covered with fragments of obsidian. This is found at Mount Orito, a short distance to the east of Mataveri (Pl. 13). The red tufa of which the crowns of the images are cut is obtained from Mt. Teraai (Pl. 13) to the east of the Mission.

The fallen images once standing on the face of the great Tongariki platform are shown on Plate 29. One of the images is still left standing upon the lower part of its base, on the right of the Plate. These images are all broken or badly damaged. Large pieces of the red tufa crowns, more or less broken, are to be found among the mass of rubbish to the rear of the platform (Pl. 29). Two of them can be seen in the right of Plate 29 and one on the very left of the plate. The little islet of Marotiri to the west of Point Anataavanui (Pl. 13) is seen standing out beyond that promontory (Pl. 29.) Plate 30 shows the western extremity of the Tongariki platform, seen from the sea, with the base of one of the images still standing (Pl. 30, fig. *1*). The whole of the sea face of that part of the platform is built up of cyclopean stones fairly fitted together; Plate 30, fig. *2*, shows the greater part of the platform from the western end towards the eastern extremity.

On Plate 41 are seen fragments of the images found on our way between La Pérouse Bay and Rana Roroka, about half-way between the two localities, on the plain to the south of La Pérouse Bay. A short distance from the point where the fragments on Plate 41 were photographed, we found a very large broken image, with a comparatively short head, which must have been nearly forty feet in length (Pl. 42, fig. *2*). Another large image, broken in three pieces, was lying at the foot of Rana Roroka, near the southwest corner of the outer slope of the crater. Many other fragments of images of all sizes and states of preservation could be seen scattered on the plain to the west of Rana Roroka, as far as the eye could reach (Pl. 31). At the foot of the western face of the crater (Pl. 31) are seen a few images still standing, buried nearly to the chin; others have fallen over, and other broken ones are seen in the distance.

I have given views of the most characteristic and best preserved platforms found in the vicinity of La Pérouse Bay (Pls. 27, 28). They are not in as good a condition as that of Tongariki, but show the same essential features as do all the platforms in whatever part of the shore line they are found. The platforms near La Pérouse Bay are comparatively small and are not placed as close to the shore as those on the south shore of the island.

The platform figured on Plate 28 is about an eighth of a mile inland. The desert aspect of that part of the island is well shown in the background to the platform on Plate 28. Fragments of the images once raised on these platforms are found in their rear (Pl. 27, figs. *1*, *2*). At a little distance inland from one of the platforms a small red tufa crown was found. It was about four feet in diameter and three feet high, deeply grooved horizontally and vertically. See Fig. on p. 57.

A number of images are left standing on the outer slopes of Rana Roroka (Pls. 31–33), showing the heads in profile, in full face, or from the rear. These heads are not as large as the heads of the images figured on Plates 34–36, of which the head alone is more than 15 feet.

Paymaster William J. Thomson, U. S. N., to whom we owe such an excellent account of Easter Island,[1] states that the images on Easter Island were carefully counted, and shows a total of 550 images. Of these, he says, 40 are standing inside of the crater of Rana Roroka, and as many more outside, at the foot of the slope, where they were placed ready for removal to the different platforms. "The large majority of the images are lying near the platforms round the coast, all more or less mutilated."

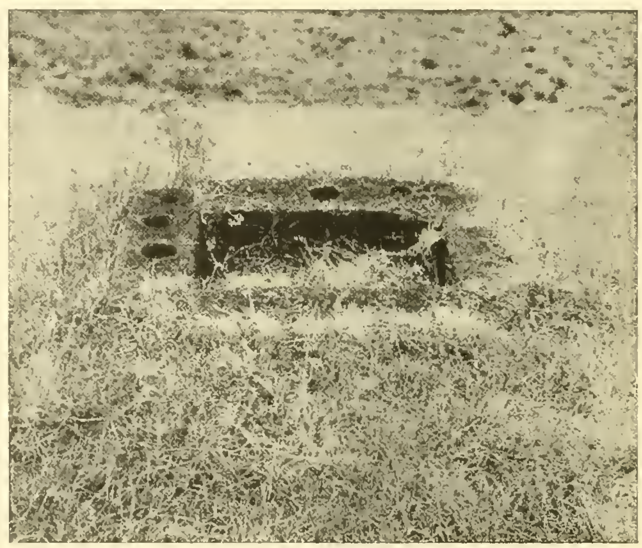
The images on Plate 31 are at the foot of the western slope of Rana Roroka; those on Plates 32 and 33 on the southeastern slope, and those on Plates 34 to 36[2] on the intermediate slope, facing somewhat in a southerly direction, at the foot of one of the lowest outside quarries or workshops. Many of these images are known by special names to the natives. They are cut from a conglomerate material easily worked with their rude stone hammers, but also readily disintegrated by weathering.

The quarries and workshops where the images were cut are found both in the interior and on the exterior slopes (Pls. 37–40) of the crater of Rana Roroka. On Plate 37 is shown part of the upper quarry and workshop of the interior slope of the crater with a number of images standing, and others fallen on different parts of the slope. On Plate 38 is shown a part of the lower quarry and workshop on the outer slope of the southeastern face of the crater. A large image is seen roughly cut out in the centre of the plate. Part of the upper quarry of the outer slope of the southeastern face of the

[1] Report of U. S. Natl. Museum for year ending 1889 (June). 1891.

[2] The image on Plate 35 is the same as that figured by Geiseler, l. c. Pl. 3.

crater is seen on Plate 40. The images are all in fragments and more or less disintegrated. One of the most interesting parts of the workshop near the base of the outer southern slope of the crater is that given on Plate 39, which gives a view of an unfinished image partly cut out of the face of the quarry. The face and the ventral part of the image alone is free from the surrounding rock, though the sides are partly cut away, leaving only a comparatively small area of the back to be freed and leave the image ready to be moved down the slope, and be transported to its destination.



KITCHEN OF HOUSE. WEST SLOPE OF RANA ROROKA.

There is very little variation in the aspect of the images (Pls. 31–37); the expression of the face is the same in all, the head is quite flattened, tapering towards the top, the brows are heavy, overhanging, the eyes indistinct, the nose is long, concave, pointed, slightly turned up, the nostrils are flaring, the lips are pouting, the upper lip is short, the lower lip is very thin, the chin is sharp, the neck short, the ears long and narrow, the cheekbones slightly prominent, the back of the neck curved in. When the arms are visible they are merely indicated as held close to the trunk. None of the images are finished below the hips.

On the southern slope of Rana Roroka we found remnants of the curbstones of houses such as have been figured by Paymaster Thomson on p. 502 of his Report on Easter Island. Such curbstones are found scattered over many parts of the island.[1]

[1] Such curbstones are figured by Geiseler, l. c. Pl. 4.

The tools used in carving the images are large stone hammers made out of hard lava rocks, and smaller tools of obsidian which must have been used for carving the wooden idols and cutting the wooden tablets.

The stone images seem to be of very different age. Those found scattered over the island are of coarser workmanship than those found at Rana Roroka, all of which have a more animated expression. The difference may perhaps be due to the longer weathering and exposure of the images dropped on the way to their respective platforms.

The older images distributed on the platforms have large square heads, fitted to carry the red tufa crowns, while the conical heads of the more recent images found at Rana Roroka seem to preclude their ornamentation with crowns.

At many points of the island are found ruins of extensive settlements, suggesting a former extensive population. On the west coast, west of Kotataki Mountain, the "Mohican" found the remains of stone houses, elliptical in shape, built of rough stones, with doorways facing the sea, with a niche at the rear end covered with loose stones forming an arch supported by a fairly shaped keystone. We found the remnants of such an elliptical house near the shore of La Pérouse Bay (Pl. 48, fig. *1*), and I have given on Pl. 49, fig. *2*, a figure of the arch of one of the niches with its keystone. Geiseler has given a restored figure (l. c. Pl. 5) of such an elliptical stone house, as well as sections of some of the stone houses at Orongo on the west face of Rana Kao (l. c. Pls. 9–11), showing the narrow passages leading into them. We also found the remnants of a stone house in the crater of Rana Kao, on the edge of the lake (Pl. 49). The ruins of similar extensive settlements of stone houses exist also at Tongariki and in the vicinity of the larger platforms all along the coast of Easter Island. But by far the most interesting settlement is that of Orongo on the western rim of Rana Kao. Sketch plans of the location of these stone houses on the sharp rim of the crater have been given by Paymaster Thomson (l. c. p. 479), and by Geiseler (l. c. Pl. 20).

On Pls. 45–48, fig. *2*, I have given views of the most characteristic and best preserved of the stone houses. Plate 45 shows a stone house with a double entrance. Plate 46 is a characteristic stone house with a single entrance. Plate 47 shows a stone house with two entrances widely separated, with a second house placed at right angles to the larger one. Plate 48, fig. *2*, is another large stone house with two entrances. The houses are all built of flat slabs laid dry. Similar but thicker slabs form the jambs of the entrances; these are frequently ornamented with rough carvings similar to those of the sculptured rocks beyond the stone houses.

The houses are more or less elliptical in outline, and are placed so as to abut against the face of the slope of the ground forming the rim of the crater. The roof is built up of slabs similar to those forming the face, and the roof is covered by sod to a thickness often of three to four feet.

Beyond the stone houses, on the very extremity of the narrowest part of the rim of the crater, where it forms the southern gap of Rana Kao, are found masses of huge, hard, volcanic rocks, on most of which are found very rude sculptures (Pls. 43, 44) greatly weathered; but we can still recognize carvings similar to the paintings of the stone houses and caverns, the mythical "meke meke" (Pl. 49[a]) being one of the most common of the carvings. Others are birds, fishes, distorted human faces, and indifferent, apparently meaningless, ornamentations.

The shores of Easter Island are riddled with caves. Many of them are quite extensive and have served as habitations to the image carvers. The roofs of the caves are often ornamented with rude painted figures (Pl. 49[a]), very similar to those found on the slabs covering the stone houses such as have been figured by Thomson (l. c. Pls. 19, 23) and by Geiseler (l. c. Pls. 7, 15–18). The cave from which the pictures on Plate 49[a] were taken is situated in a small indentation of the coast to the west of Mataveri, south of Hanga Piko landing-place. The cave at the landing of Ovahe Bay is not decorated, the cave being formed of conglomerate easily disintegrated, while the roof of the other cave consists of thin volcanic slabs.

Geiseler has given a number of rude cave paintings made by the natives to commemorate the advent of the whites (l. c. Pls. 8, 13, 14). These as well as the paintings found in the stone houses are all made with the coarse red pigment obtained in the red tufa quarries of Teraai.

MANGA REVA.

Plates 14, 57–91.

We arrived at Manga Reva on the 27th of January and found our collier awaiting our arrival.

While at anchor in Port Rikitea (Pls. 58, 62; 63, fig. 2), we examined Manga Reva (Pl. 14), the principal island of the Gambier group, from its central ridge on the pass leading from Rikitea to Kirimiro on the west side of Manga Reva, as well as from the pass leading to Taku. On both these passes we obtained excellent views of the encircling reef to the west, north, and east of the Gambier Islands (Pls. 63, fig. *1*, 66, 69–71). We could trace in the panorama before us the western reef extending in a northeasterly direction parallel to the general trend of Manga Reva Island for a distance of about five and a half miles (Pl. 69).

From the northern horn to nearly opposite Kirimiro Bay the barrier reef (Pl. 14) has only three small islets; it is narrow, of uniform width, about one-third of a mile, plainly defined, submerged in places, and forms the western boundary of a large northern bight with from 7 to 11 fathoms, dotted with numerous interior coral patches from a quarter of a mile to a mile in diameter or length. The southern part of the western barrier lagoon off Manga Reva is irregularly dotted with many small patches of reef, with an occasional deep hole of from 15 to 20 fathoms near Manga Reva Island. From the terminal islet of the western reef to the west of Kirimiro there are but few coral patches, indicating a reef which dips gradually in a distance of a mile to a deep channel of from 4 to 6 fathoms, which separates the northern and western reef from the great reef flat lying to the southwest of Tara-Vai. This flat has a width of nearly two miles, is about four and a half miles long, and is marked at its southwest extremity by a series of low islets arranged in a somewhat circular line, formed by three deep bays and spurs from the outer line of islets, as so frequently occurs on a wide reef flat in atolls of the Pacific.

This part of the reef is called Tokorua (Pl. 14). It shelves very gradually from $3\frac{1}{2}$ to 4 fathoms on the west face to 7, and connects with the plateau upon which stands Tara-Vai and Aga-kanitai. From Tokorua the reef extends in an indefinite narrow ridge eight miles long, with from 3 to 8 fathoms, in a southeasterly direction. The western edge is steep to, and the eastern face passes gradually into, the lagoon, which at that point has a general depth of 8 to 20 fathoms. The deepest part of this region is at the foot of Mount Mokoto, between it and Tara-Vai, though Tara-Vai is united with Manga Reva Island by a plateau varying in depth from $3\frac{1}{2}$ to $4\frac{1}{2}$ fathoms.

At the southeastern point of the reef it passes into a wide plateau with from 9 to 10 or 15 fathoms. This plateau is about nine miles wide southwest of Tekava (Pl. 14). That part of the atoll has not been well surveyed, so that the position of the reef flat has not been ascertained further west on that part of the east face; but the southeast passage indicates $5\frac{1}{2}$, 6, and $6\frac{1}{2}$ fathoms, where it probably marks the southwestern extension of the eastern barrier reef, separating the lagoon from the southern plateau to the south of the encircling reef.

The western face of Manga Reva and of Tara-Vai are indented by deep bays (Pl. 14), which are formed by spurs running from the central ridge of these islands (Pl. 63, fig. *1*), the remnants probably of small craters which flanked the large crater, of which Manga Reva forms the western rim and Au Kena is the remnant of the southeastern edge, the former extension of this rim being indicated by the spits uniting the base of Mount Duff with Au Kena; and by the projection of Au Kena towards the eastern outer barrier reef, and of the numerous patches of coral reef off the northeast point of Manga Reva towards the outer line of motus until they almost unite with the barrier reef.

CANOES IN PORT RIKITEA.

The western bays of Manga Reva Island are filled with fringing reefs which leave here and there a deeper pass to the shore (Pl. 14). The south face of the bluff at the foot of Mount Mokoto and Mount Duff is edged by a flourishing fringing reef, which extends nearly half a mile on the plateau at their base. The port of Rikitea is a reef harbor formed within the large fringing reef which occupies the whole of the southern bay of Manga Reva Island. The east face of Tara-Vai and part of the east and of the west face of Aga-kanitai are also fringed with reefs.

The islets and the islands of Aka-Maru, Mekiro, and Maka-pu are within a fringing reef flat which runs around the west and northern faces of Aka-Maru; Au Kena is also fringed by an extensive reef which runs out in a spit of more than half a mile in a northeasterly direction almost to the outer line of motus, which are nearly united with it by these irregular patches (Pl. 14). To the west of Au Kena a huge spit of two miles in length extends towards the base of Mount Duff and almost unites with the fringing reef off the cemetery, leaving a narrow, but deep pass for the entrance of ships into the inner harbor of Rikitea. There is only one to two and three-fourths fathoms of water on these two spits.

The depth of the basin within the area, bounded by Manga Reva and Au Kena and its connecting spit, with from 25 to 31 fathoms, would be naturally explained as being part of an ancient crater, as in Totoya in Fiji; its northeastern rim is also perhaps further indicated by the comparatively shallow flat of the lagoon, dotted with reef patches, to the west of the eastern barrier reef, with from 5 to 11 fathoms of water.

The principal islands of the group are in the central part of the lagoon (Pl. 14). The four larger islands are Manga Reva (Pls. 61, 62, 64), Tara-Vai (Pl. 65), Au Kena (Pl. 66, figs. *1*, *2*), and Aka-Maru (Pl. 67). Tara-Vai is flanked by Aga-kanitai and another islet to the west called Tepou-nui; Aka-Maru is flanked by Mekiro to the north, and by Maka-pu to the south. The southwest face of Aka-Maru (Pl. 67, fig. *1*) is an extinct crater, of which Maka-pu (Pl. 67, fig. *2*) forms the south rim. The main ridge of Tara-Vai is the edge of parts of three craters now opening to the west (Pl. 14). The four small volcanic islands in the southern part of the lagoon are isolated fragments, steep to, greatly weathered, and disintegrated (Pl. 68). No soundings exist to show their relation to the other islands of the group.

The soundings thus far made indicate in the southern part of the lagoon a depth of about 23 fathoms, with an occasional hole of from 38 to 40, and a gradual slope towards the outer sunken reef. To the south of the old crater of Manga Reva the general depth of the bank varies from 6 to 11 fathoms, with a deeper channel varying from 20 to 40 from southwest of Au Kena towards Tara-Vai. The lagoon seems to form a western basin where the depth varies from 10 to 20 fathoms. An eastern basin runs to the east of Au Kena and Aka-Maru, lying between them and the line of islets on the outer encircling reef. A similar, but shallower, basin exists off the northern end of Manga Reva, between it and the northern horn of the barrier reef, with from 7 to 11 fathoms. Its rim is formed by a ring of reef patches of varying size.

On two occasions we visited the outer encircling reef and examined the outer line of islets of the eastern face of the Gambier Islands (Pls. 78–91). The position of the islets as marked on the chart (Pl. 14) is not that of to-day, and the position of the reef flats is not accurate. The position of Tekava and Tauna (Pl. 72, fig. *2*) appears to be correct. Opposite Au Kena and in its extension, the east face of the encircling reef projects sharply to the east, forming an angular horn (Pl. 73, fig *1*), with one island south of the horn and the other north, running at sharp angles with it, so as to form a deep triangular bight opening westward to such an extent that when off

Manga Reva Island seen from Vaiatekeue.

the northern side of the horn we could see Tekava far to the westward of it. The second island is followed by a third and then by an island (Tarauru-roa) nearly two miles long; these islands are separated by small gaps. Then comes a larger island (Amou) followed by three small islands separated by deep gaps (Pl. 14).

At Vaiatekeue[1] (not the Vaiatekeua on the chart, which is north), the reef flat becomes quite narrow; it is hardly more than one hundred yards wide; the islets perhaps fifty. The northern islets are small and separated by long stretches of low shingle, and carry but little vegetation and very few cocoanut trees (Pl. 77). There are but few short sand beaches all the way from the northeastern to the eastern horn of the eastern face of the encircling reef of Manga Reva (Pls. 74–76). A regular dam of shingle from ten to fourteen feet high, on the top of which the usual coral reef

[1] Vaiatekeue is the islet on the encircling reef due east of Point Mata-iutea.

vegetation flourishes, extends along the outer face of the reef flat, which varies from fifty to one hundred and fifty yards in width, and is flanked at the base by low buttresses of modern elevated coral reef rock and of breccia in places, all more or less weather-beaten and honey-combed (Pls. 83–88).

The islets and their formation (Pl. 91) and their junction or division into larger or smaller islets, and the gaps which separate them (Pls. 79, 82, 83, 89), the mode of formation of the buttresses (Pls. 85, 86) of the planed-off, hard, nearly level, reef flat (Pls. 84, 86) of the coralline mounds of the outer edge (Pl. 84), all these differ in no way from what has been described in other barrier reef islands and atolls of the Pacific.

Native Hut on Outer Encircling Reef.

The beaches of the lagoon are steep (Pl. 81), and corals do not seem to thrive in those parts of the lagoon to which the sea does not have access or are at some distance from shore. This is well shown by the vigorous growth of corals in the fringing reef to the south of Mount Duff on the outer edges of the reef patches of Port Rikitea, and on the spits which connect Au Kena with Manga Reva, in contrast with those along the west face of the lagoon flats to the west of the eastern barrier reef.

There is a northeast horn of the eastern barrier reef in the extension of Manga Reva Island, forming the northern culmination of the central bight of the eastern face of the encircling reef (Pl. 14). From that point the reef flat runs westerly to form the northern horn about three miles north of Manga Reva Island. The position of the outer reef cannot be correct on the chart (H. O. No. 2024). On leaving Manga Reva we made three soundings close off the reef flat line of breakers — one off Tekava, at the most one-third of a mile from the reef, in 225 fathoms. Our position, plotted by tangents to the volcanic islands or by their summits, indicated in this case, on the chart, a distance of one and one-half miles. A second sounding of 245 fathoms off the eastern horn at less than one-half mile, indicated on chart No. 2024 a distance of two miles from the horn; and a sounding of 241 fathoms one-fourth of a mile off the point which we had visited (Vaiatekeue) indicated a distance of three-fourths of a mile on the chart.

The slope of the Gambier archipelago to the east is steep. On coming in sight of Manga Reva we sounded in 2070 fathoms at a distance of eleven miles from Mount Duff, that is, six miles from the outer edge of the reef, bearing southwest; and on coming out we sounded again half-way to that point at a distance of three and one-fourth miles from the breakers in 1394 fathoms.

One cannot fail to be struck with the similarity of the Manga Reva archipelago with the great atoll of Truk.[1] Darwin also called attention to this from a study of the charts. Yet, owing to the great size of Truk, no less than one hundred and twenty-five miles in circumference, and the great distance of the barrier reef from the encircled volcanic islands, the effect as one steams into Manga Reva is totally different from that produced by Truk. In the latter some of the islands, though large, and of the same height as those of Manga Reva, are much more scattered, and seem of comparatively small importance in the midst of the huge lagoon which surrounds them. The islets of the encircling reef of Truk are from eleven to fifteen miles distant from the encircled volcanic islands. In Manga Reva, which is only forty-five miles in circumference, after passing the small islands in the southern and open part of the lagoon when once off Maka-pu, we can fairly well take in the atoll as a whole (Pls. 14, 64–68). The westernmost island (Tara-Vai) is only five miles off; Manga Reva and Au Kena are about three, as are also the islets of the east face of the encircling reef; these distances, as you approach the entrance to Rikitea, are constantly growing less, so that when in the gap between Manga Reva Island and Au Kena, at the foot of Mount Duff, none of the larger islands are more than three miles off; and the islets of the eastern face of the barrier reef are seen to the northeast about four miles off. When on the summit of the central ridge of Manga Reva one can, in a radius of a little more than four miles, take in the whole

[1] See Plate 14 (B. A. Chart 1112) and compare it with B. A. Chart 982 or Plate 231 Mem. M. C. Z. Vol. xxxiii.

panorama of Manga Reva (Pls. 66, 69–71), and get an impression of the relations of its different parts far better than can be conveyed by the chart, for the whole of the visible part of the archipelago is included in a line drawn east and west, north of Maka-pu; south of that line the position of the southwestern reef can be traced only by the discoloration of the waters.

Manga Reva is an intermediate stage of erosion and denudation, between a lagoon archipelago such as Truk, and a barrier reef island like Vanikoro and other islands in the Society groups, such as Bora Bora,[1] Huaheine, Raiatea, Eimeo, in which the surrounding platform has comparatively little width and the barrier reef is close to the principal island and often becomes part of its fringing reef. Manga Reva is open to the south and to the west, Vanikoro to the east, while the volcanic islands of Truk are completely surrounded by the outer encircling reef, as are the Society Islands just mentioned, which have several wide passages into the lagoon through the wide barrier reef.

One is tempted to reconstruct the Gambier archipelago of former times, and to imagine it with a great central volcano, with a deep crater of more than 34 fathoms, of which Manga Reva and Au Kena are parts of the rim which once were connected from the southeast point of Manga Reva to Au Kena, and thence along the line of the outer islets to the northeast end of the former island. On the west face it was flanked by smaller craters extending to the western islets of the encircling reef, of which the bays of Taku, Kirimiro, and Rumaru, and the bays of the west side of Tara-Vai are the eastern ridges. There were probably also other secondary volcanoes, of which Aka-Maru and the islets of the south part of the lagoon are the remnants, the latter all being situated on the gentle slope of the southern part of the Manga Reva plateau; this may have been the southern slope of the principal volcano of the group, on the face of which have grown up the outer lines of the encircling reef and its islets.

The existence of a large central volcano would readily explain the depth of the lagoon in its different regions, as well as the great depth of the outer face of Manga Reva, depths showing slopes which are however no steeper nor more striking than the height and slopes of the southern part of Manga Reva (Pls. 58–62), or Tara-Vai (Pl. 65), of Aka-Maru (Pl. 67, fig. *1*), and of Maka-pu (Pl. 67, fig. *2*), supposing them to be extended into the sea.

[1] See A. Agassiz, The Coral Reefs of the Tropical Pacific, Plates 210 and 231.

Mount Mokoto (Pl. 61) and Mount Duff (Pls. 57–61) drop precipitously for more than one-third their height, and in less than a quarter of a mile fall from over 1300 feet to the level of the sea. Similar slopes are found along the volcanoes of Easter Island (Pl. 13) where there are no coral reefs. The edge of the crater of Rana Kao drops perpendicularly a height of nearly 1000 feet in less than one-eighth of a mile horizontal distance; and the eastern face of the crater of Rana Roroka rises vertically about 800 feet above the plain of Tongariki (Pl. 26).

CANEBRAKE.

It is interesting to note how poor is the flora of the Manga Reva archipelago as compared with that of the more western volcanic islands like the Marquesas and the Society Islands and some of the western elevated Paumotus.[1] In the Gambier archipelago the forests are reduced to a few patches extending along the small valleys of the slopes of the volcanic spurs (Pls. 58, 61, 62). I am informed that even in the thirties of the last century, when

[1] The vegetation on the islands of the outer encircling reefs consists of the usual Pacific reef-shrubs: Tournefortia, the "miki miki" (Pemphis acidula), the "Huhu" (Suriana maritima), Triumphetta procumbens, and the universal Scaevola königii exclusive of Pandanus, and cocoanut trees.

the missionaries first landed at Manga Reva, the forest trees, while more numerous, yet never attained the luxuriance of growth that they attain in the Society and Marquesas Islands. At the present day, with the exception of the forest patches just mentioned and a few trees which have been introduced for cultivation, the islands of the group are in great part thickly covered with a species of cane closely resembling that of our Southern states. The fauna of Manga Reva is also extremely poor. There are no mammals, and, with the exception of a "sandpiper," no indigenous birds. Sea birds are few in number, and in our trip in the Eastern Pacific we rarely had more than three or four birds accompanying us, usually tropic birds or gannets; often only one, and frequently none was visible for days. There are a few lizards on the islands, apparently of the same species as those in the Society Islands.

The illustrations of Manga Reva accompanying this Report (Pls. 57–91) have been taken to show the inner islands and the encircling reef as seen from the most important points of view in the interior of the Lagoon. A second set of views shows the inner islands of the Gambier group as seen from characteristic positions across the line of the outer encircling reef, while skirting it as close as practicable. A third set of views shows the details of the islets and beaches of the encircling reef, and characteristic views of the larger islands of the group. Entering through the southeast passage we see on the left (Pl. 68, fig. *1*) the islands of Maumi and Kamaka, and the island of Makaroa with its satellite Motu-teiko (Pl. 68, fig. *2*).

Steaming north we come on the right upon Maka-pu and beyond it can see the southern part of Manga Reva with its high peaks Mount Duff and Mokoto (Pl. 64, fig *1*). Plate 67, fig. *2*, gives a closer view of Maka-pu with Aka-Maru in the rear. After passing Maku-pu, Aka-Maru and the little island of Mekiro come into view (Pl. 67, fig. *1*). A view taken about halfway between Aka-Maru and the pass leading to Port Rikitea, shows more in detail than in Plate 64, fig. *1*, the southern part of Manga Reva with Mount Mokoto and Mount Duff (Pl. 64, fig. *2*). Coming abreast of the base of Mount Duff, Tara-Vai, and Aga-kanitai are seen to the southwest (Pl. 65, fig. *1*). From a point on the terrace at the base of Mount Duff is seen the southern part of Tara-Vai and Aga-kanitai disconnected from Tara-Vai (Pl. 65, fig. *2*).

From the channel leading into Port Rikitea, at the extremity of the spit to the west of Au Kena (Pl. 14), Mount Duff is seen in profile with its southern vertical face and slope to the northward (Pl. 57), towards the gap through which Mount Mokoto can be seen from Port Rikitea (Pl. 61). In Plate 58 the northern slope of Mount Duff is seen from our anchorage at Port Rikitea.

Plates 59 and 60 are two views of Mount Duff seen from the southeast, looking up to the summit from the top of the terrace which runs round the base of Mount Duff, and forms so conspicuous a landmark on the east face of the southern part of Manga Reva Island (Pl. 57).

The eastern side of the ridge of the northern extension of Manga Reva beyond Port Rikitea is shown in Plate 63, fig. *2*. A more detailed view of the eastern slope of Manga Reva north of the village is shown in Plate 62.

The crest of the ridge of the eastern extremity of Manga Reva and Mata-iutea Point are shown in Plates 70, 71. The western slope of Manga Reva as seen from the pass leading to Kirimiro is shown in Plate 69, fig. *1*, as far as Teaua-ua Point, and the crest of the ridge north of the pass, in Plate 69, fig. *2*. The outline of the western and northern encircling reef is seen in both the figures of Plate 69.

On the west face of Manga Reva, nearly opposite the southern termination of the western encircling reef, lies the bay of Gaatavake (Pl. 14), in the centre of which is the small island of Kotu-marei (Pl. 63). This deep bay is formed by the remnant of the rim of an extinct crater similar to those of the shallower bays to the north.

On Plate 66 are given views of the eastern inner islands as seen from Manga Reva. Au Kena is seen from the anchorage off Aka-Maru on Plate 66, fig. *1*. The same island is seen facing the northern side from the anchorage at Port Rikitea (Pl. 66, fig. *2*), and the gap between Aka-Maru and Au Kena is shown in Plate 66, fig. *3*. The encircling reef seen through the gap is not often clearly visible, as the outer islands are quite small.

The line of the western and northern encircling reefs, as seen from the pass leading to Kirimiro, are shown in Plate 69. In Plates 70 and 71 are shown such parts of the northeastern and eastern encircling reefs as are visible from the summit of the central ridge to the east of Taku, the southern continuations of which are indistinctly seen in Plate 66, figs. *1–3*.

We may now pass to views showing the aspect of the inner islands as seen on our way out from Manga Reva, across the encircling reef and its islets (Pl. 14). The inner islands of the southern part of the Gambier Islands as seen after rounding the southeast pass, are shown on Plate 72, fig. *1*. Aka-

Maru is the principal island on the right of the figure, with Maumi, Aka-Maru, and Makaroa on the left.

Plate 72, fig. *2*, shows Mount Duff in the centre as seen across Tauna, with Au Kena to the right of the figure, and Mekiro to the left. Moving north we look across the eastern horn of the eastern encircling reef north of Tekava Island (Pl. 73, fig. *1*).

Next we come upon the inner islands of the eastern part of the group Aka-Maru and Mekiro to the left, and Au Kena to the right of the figure (Pl. 73, fig. *2*), seen across the island to the north of Tauna. Another view of Au Kena and of Aka-Maru and Mekiro in the centre, somewhat more to the north, is seen through a gap between two islands to the south of Tarauru-roa (Pl. 74, fig. *2*).

When looking across the encircling reef east of Au Kena, the massif of Mount Duff and the eastern face of the greater part of the Island of Manga Reva are seen to the north of Au Kena (Pl. 74, fig. *1*). A very similar view is shown, looking across a barrier reef islet through the gap between Au Kena and Aka-Maru, with Mount Duff on the right (Pl. 75, fig. *1*).

Plate 75, fig. *2*, shows a view very similar to that of Plate 74, fig. *1*, from a point somewhat more to northward. A view very similar to that of Plate 75, fig. *2*, but somewhat more to the north of Au Kena, is shown in Plate 76, fig. *1*, extending to the eastern extremity of Manga Reva.

Another view of the massif of Mount Duff and of the east slope of Manga Reva is shown in Plate 76, fig. *2*. It is seen through a gap between Tarauru-roa and the island to the south of it.

Mata-iutea, the eastern point of Manga Reva Island, is seen across the islets of the eastern encircling reef which front the eastern face of Manga Reva Island in Plate 77, fig. *1*. The next figure on the same plate shows the massif of Mount Duff, with Mount Mokoto as seen from the east across the east face of Manga Reva and the islets fronting it; it will be noticed that the islets of that part of the encircling reefs are covered with a very scanty vegetation.

The remaining plates (Pls. 78–91), are devoted to details taken on the islets of the eastern encircling reef opposite the eastern face of Manga Reva Island. They are the islets north of Tarauru-roa shown in the distance in Plate 70, fig. *1*. In Plate 78, fig. *1*, is given a view of the interior of one of the narrow islets facing the eastern extremity of Manga Reva Island. A Pandanus occupies the foreground, and the bushes in the rear are tall "miki miki." The lower figure of the same plate shows the eastern face of Manga Reva Island seen through a gap in the lagoon sand beach. The gap is flanked with bushes of miki miki and young Pandanus. On Plate 80 are shown a number of miki miki bushes growing close to the beach of the lagoon. The east face of Manga Reva Island is seen across the channel with Mount Duff in the rear (see also Pl. 79). A view of the lagoon coral sandy beach seen at low tide is given in Plate 81. The bushes extend to high-water mark, and are frequently, as well as the Pandanus, washed by high tides (Pl. 89, figs. *1*, *2*), and often run close to the sea face when the islets are narrow (Pl. 91, figs, *1*, *2*). On the lagoon side we find, occasionally, stretches of beach rock (Pl. 89, fig *2*). On the sea face the vegetation runs along the ridge of the coral rubble dam (Pls. 79, 83–85, 87, 88, 90, fig. *2*).

Where the islets are narrow (Pl. 91), coral rubble often extends across the islets from the sea face to the lagoon side or runs along the flanks of the gaps from the sea face towards the lagoon beach (Pl. 90, fig. *1*). Some of the wider gaps are shut off from the lagoon by sand dams, the extensions of the adjoining lagoon beaches across the head of the gaps (Pl. 79), as seen from the coral rubble flat. A view of a lagoon sand dam taken from a point nearer the lagoon dam is seen in Plate 82 and in Plate 90, fig. *1*.

Some of the wider and deeper gaps cut through the coral rubble flats (Pls. 79, 83), and extend well across towards the lagoon.[1] I did not notice any sand dams across gaps, on the sea face, as is so common in other reefs of the Pacific.

The mode of formation of the coral rubble beach is well shown on Plates 83–87, 90, fig. *2*. In Plate 84 the outer reef flat is covered by the tide, and washes at the base of the rubble beach the larger pitted and honey-combed horses which indicate the former level of the reef flat before it had been planed down by the sea and the material thrown up to form the shingle and rubble beach dam (Pl. 84). The Nullipore knolls on the sea face of the reef flats do not assume at Manga Reva the prominence they have in other reefs of the Central Pacific.

In Plate 85 is a similar view of the reef flats and rubble dam seen looking south at a somewhat lower stage of tide and with larger coral horses thrown up at the base of the rubble beach or still forming a part of the reef flat.

[1] Dr. Seurat (Établissements français de l'Océanie, gouvernement de Tahiti; L. G. Seurat, Observations sur les îles basses de l'archipel des Gambier, Mai 1903, p. 2.) has called attention to this structure in the islands on the encircling reef of Manga Reva.

Plate 86 shows a still lower stage of water on the reef flat, a great part of which is dry, and the base of the coral rubble flat is flanked by large horses of coral rubble still attached to the reef flat or piled together in masses previous to being broken up and thrown upon the rubble flat. Plate 90, fig. 2, is a similar view to that of Plate 86.

In Plate 83 the reef flat has not been planed off to such an extent as is seen in Plates 84–86, so that the coral rubble flat is low and has not been thrown up into such high dams as in Plates 84, 86–88, where the outer reef flat has been planed off to a very considerable extent. This is best seen in Plates 84, 87, 88. The rubble dam is very high in Plate 87, where the large coral shingle has encroached to a considerable extent upon the vegetation growing on the ridge of the coral rubble beach dam. The extent to which the rubble may encroach upon the vegetation is well seen in Plate 88, which shows the inner slope of the coral rubble dam extending towards the lagoon side. The whole of this slope is studded with patches of vegetation which are gradually extending over it as fast as the coral shingle becomes decomposed into coarse sand capable of supporting vegetation.

PLATES

AND

EXPLANATION OF THE PLATES.

PLATE 1.

PLATE 1.

Bathymetrical chart of the Eastern Tropical Pacific with the track of the "Albatross" in 1891 in the Panamic district, in 1899–1900 in the Central Tropical Pacific, and in 1904–1905 in the Eastern Pacific.


MOSER BASIN
MOSER DEEP
GREY DEEP
MANZANILLA BASIN
ACAPULCO
ACAPULCO BASIN
GUATEMALA BASIN
TANNER DEEP
PANAMA
Cocos I.
Malpelo I.
GALAPAGOS PLATEAU
GALAPAGOS Is.
CHATHAM I.
AGUJA POINT
CALLAO
BOWERS BASIN
KRÜMMEL DEEP
BARTHOLOMEW DEEP
RICHARDS DEEP
BUCHAN BASIN
MARQUESAS ISLANDS
PAUMOTU OR LOW ARCHIPELAGO
MANGA REVA
GARRETT RIDGE
ALBATROSS PLATEAU
EASTER I.
Sala y Gomez
REFERENCE
Sea Level
100 Fathoms
Track of Albatross in 1891
Track of Albatross in 1899
Track of Albatross in 1904-1905
Stations t denote serial temperature

PLATE 2.

PLATE 2.

Showing position of the stations occupied by the "Albatross" during her cruise in the Eastern Pacific in 1904–1905.


San Francisco
GULF OF CALIFORNIA
Manzanilla
MARQUESAS ISLANDS
PAUMOTU OR LOW ARCHIPELAGO
MANGA REVA
ACAPULCO
MANZANILLA BASIN
ACAPULCO BASIN
GUATEMALA BASIN
TANNER DEEP
PANAMA
Cocos I.
Malpelo I.
GALAPAGOS PLATEAU
GALAPAGOS IS.
CHATHAM I.
AGUJA POINT
CALLAO
MILNE-EDWARDS DEEP
BOWERS BASIN
GARRETT RIDGE
ALBATROSS PLATEAU
KRUMMEL DEEP
BARTHOLOMEW DEEP
BUCHAN BASIN
EASTER I.
Sala y Gomez
REFERENCE
Sea Level
100 Fathoms
Track of Albatross in 1891
Track of Albatross in 1899
Track of Albatross in 1904-1905
Stations t denote serial temperature

Plate 3.

PLATE 3.

Showing the character of the bottom of the area of the Eastern Pacific traversed by the "Albatross" during 1904–1905.

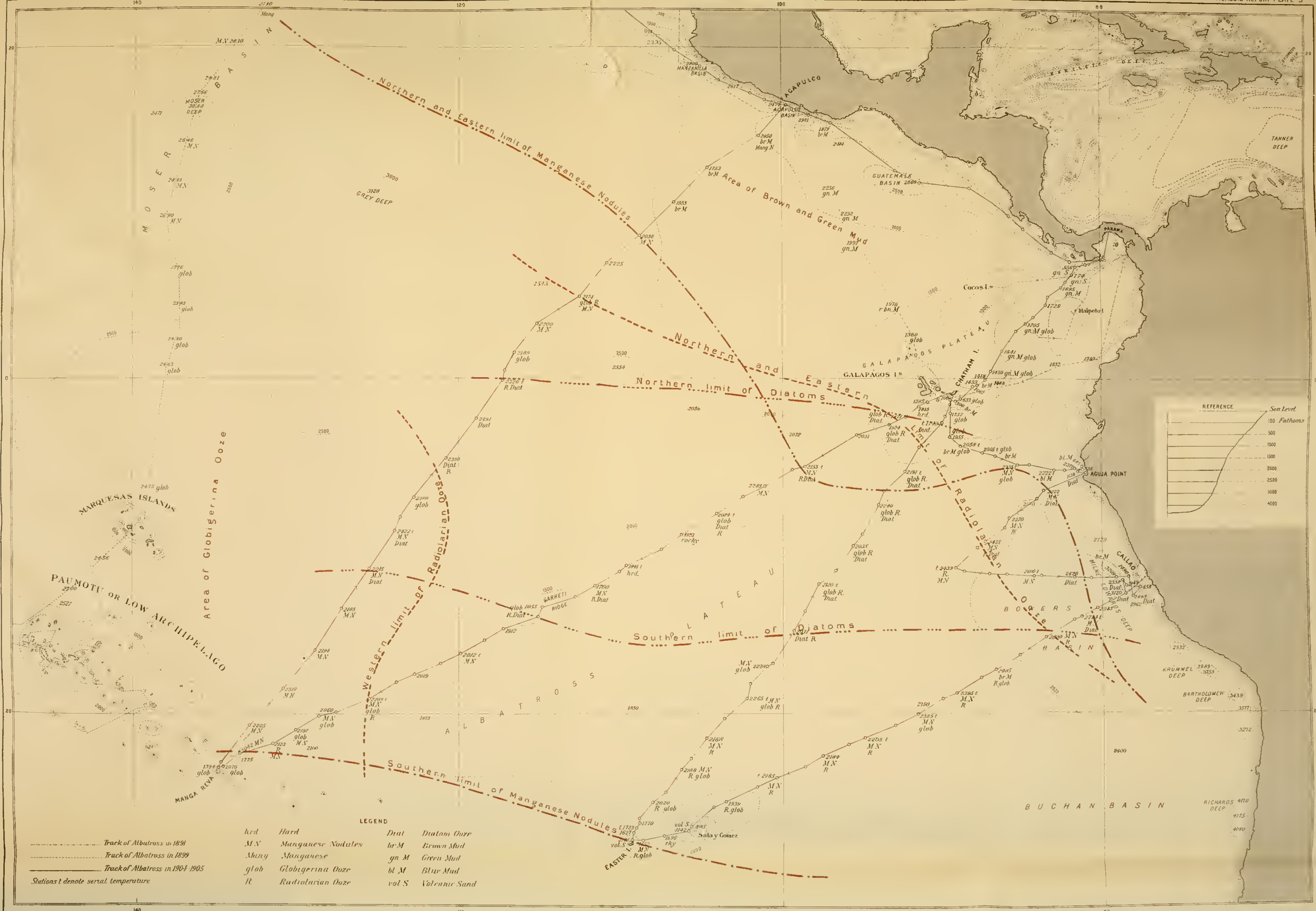
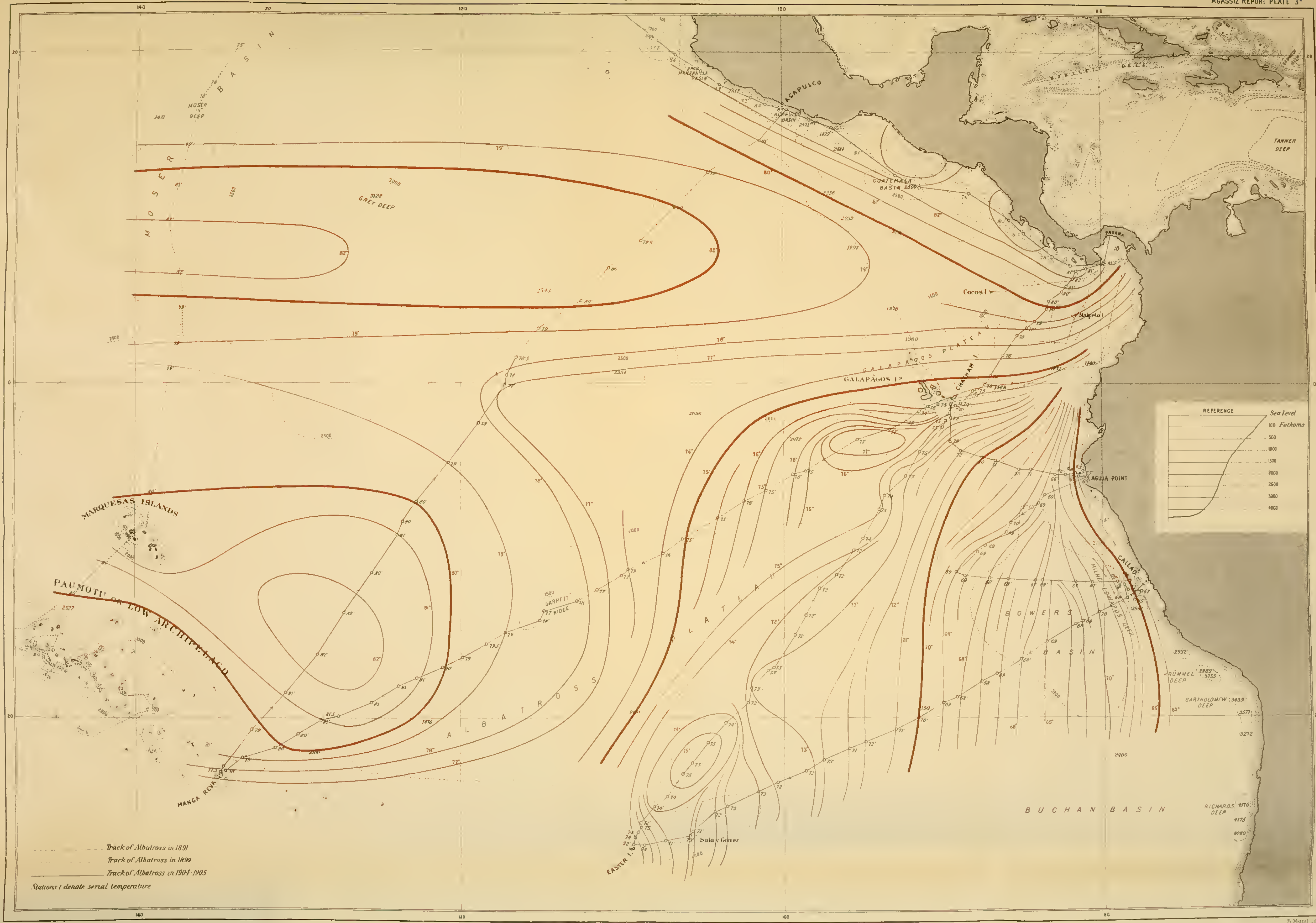

Northern and Eastern limit of Manganese Nodules
Area of Brown and Green Mud
Northern and Eastern limit of Radiolarian Ooze
Northern limit of Diatoms
Southern limit of Diatoms
Western limit of Radiolarian Ooze
Southern limit of Manganese Nodules
Area of Globigerina Ooze
MOSER BASIN
GREY DEEP
MARQUESAS ISLANDS
PAUMOTU OR LOW ARCHIPELAGO
MANGA REVA
ALBATROSS PLATEAU
GARRETT RIDGE
EASTER I.
Sala y Gomez
BUCHAN BASIN
BOWERS BASIN
GALAPAGOS PLATEAU
GALAPAGOS IS
CHATHAM I.
Cocos I.
Malpelo I.
AGUJA POINT
CALLAO
MILNE EDWARDS DEEP
KRÜMMEL DEEP
BARTHOLOMEW DEEP
RICHARDS DEEP
TANNER DEEP
GUATEMALA BASIN
ACAPULCO
ACAPULCO BASIN
MANZANILLA BASIN
PANAMA
REFERENCE
Sea Level
100 Fathoms
500
1000
1500
2000
2500
3000
4000
LEGEND
Track of Albatross in 1891
Track of Albatross in 1899
Track of Albatross in 1904-1905
Stations t denote serial temperature
hrd. Hard
M.N Manganese Nodules
Mang Manganese
glob Globigerina Ooze
R Radiolarian Ooze
Diat Diatom Ooze
br.M Brown Mud
gn.M Green Mud
bl.M Blue Mud
vol.S Volcanic Sand

PLATE 3^a.

Plate 3[a].

Surface temperature observed at the stations occupied by the "Albatross" in the Eastern Pacific during her cruise of 1904–1905. The heavy curves indicate the temperatures of 65°, 70°, 75°, and 80.°



B. Meisel lith.

PLATE 3^{b}.

Plate 3^b.

Record of densities in the Eastern Pacific observed by the "Albatross" during her cruise of 1904–1905. The last decimal figures only of the specific gravities are indicated. Thus 252 off Callao should read 1.0252, and others are similarly abbreviated.

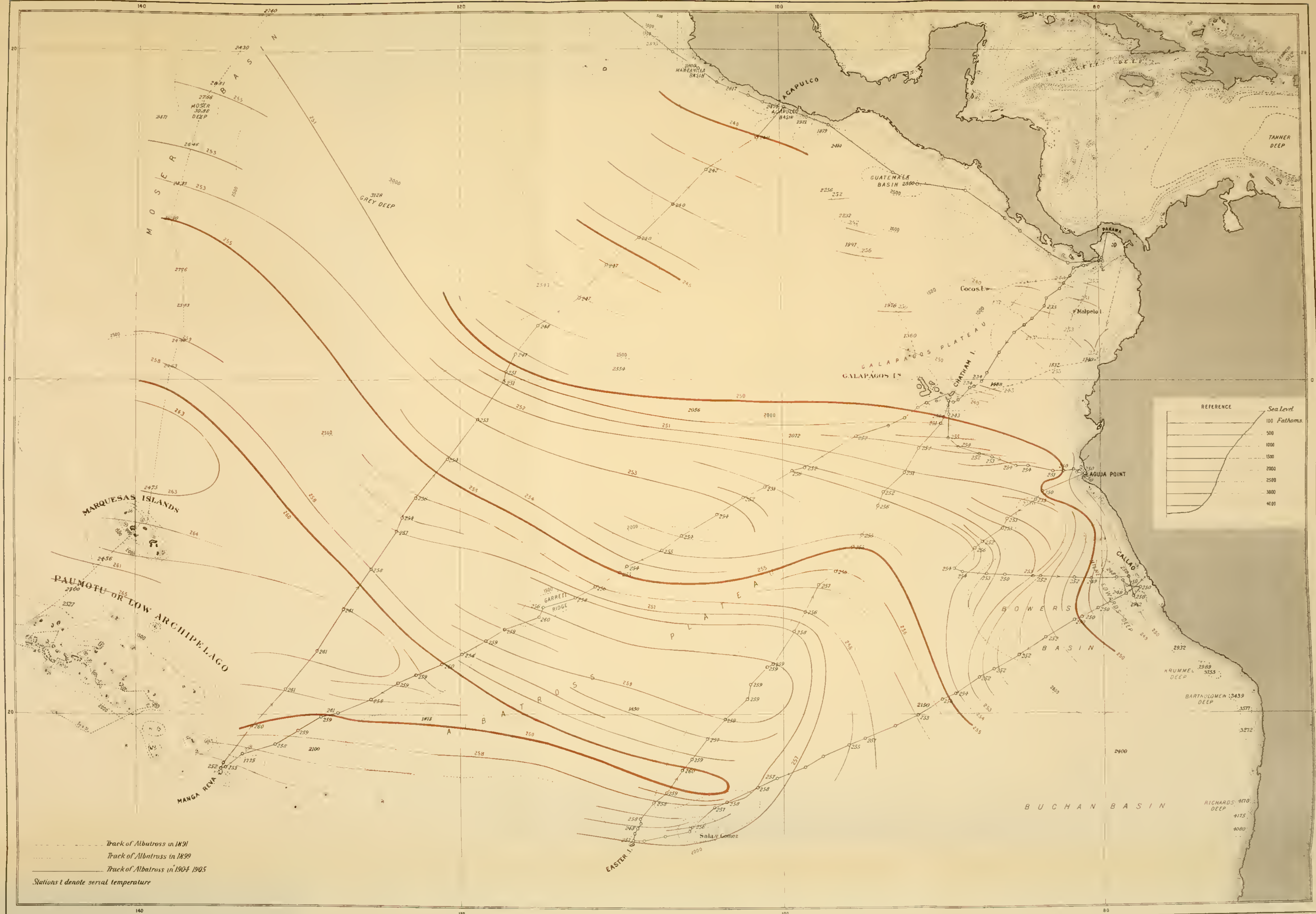

ACAPULCO
GUATEMALA BASIN
TANNER DEEP
PANAMA
Cocos I.
Malpelo I.
GALAPAGOS PLATEAU
GALAPAGOS IS
CHATHAM I.
AGUJA POINT
CALLAO
BOWERS BASIN
MILNE EDWARDS DEEP
KRUMMEL DEEP
BARTHOLOMEW DEEP
RICHARDS DEEP
BUCHAN BASIN
ALBATROSS PLATEAU
GARRETT RIDGE
Sala y Gomez
EASTER I.
MANGA REVA
PAUMOTU OR LOW ARCHIPELAGO
MARQUESAS ISLANDS
MOSER BASIN
MOSER DEEP
GREY DEEP
REFERENCE
Sea Level
100 Fathoms
Track of Albatross in 1891
Track of Albatross in 1899
Track of Albatross in 1904-1905
Stations ⊙ denote serial temperature

PLATE 3^c^.

Plate 3^c.

Showing the pelagic and bottom faunal distribution.

h indicates a good haul of the trawl.

— *h* indicates a poor haul of the trawl.

1 a good surface tow.

2 a poor surface tow.

0 a barren surface tow.

t indicates that serial temperatures were taken at that point.

The curves show the northern limit of (*1*) good surface tows.

The southern limit of *1*.

The southern limit of *h*. Its northern limit is not indicated as the bottom fauna of the Panamic district was everywhere rich.

The curve of the southern limit of (— *h*) poor trawl hauls is indicated.

The curve of the southern limit of (*2*) poor surface tow is shown.

The curves of the northern as well as the southern limit of the barren tows (*0*) are indicated.

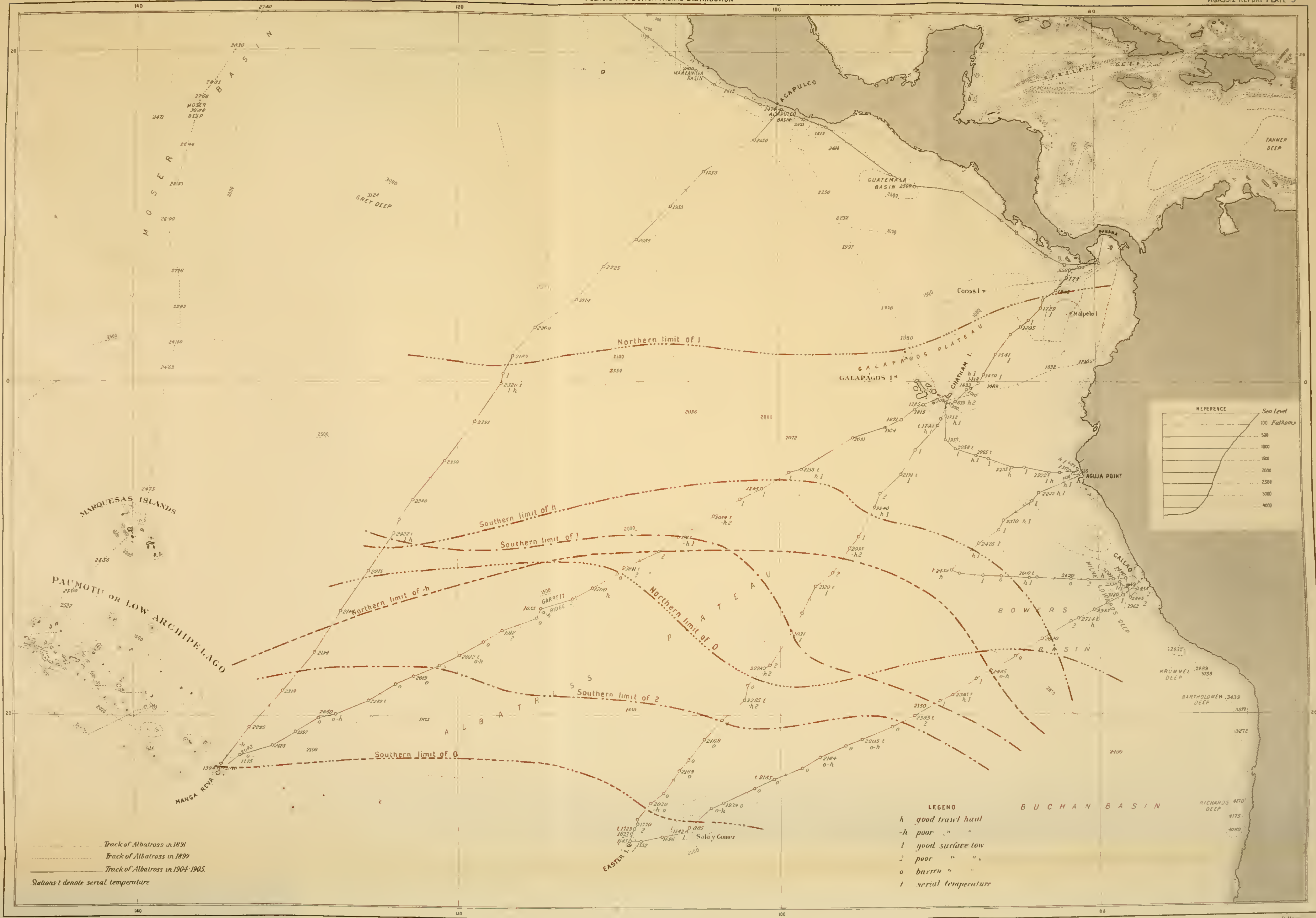

MOSER BASIN
MOSER DEEP
GREY DEEP
MARIANILLA BASIN
ACAPULCO
ACAPULCO BASIN
GUATEMALA BASIN
TANNER DEEP
PANAMA
Cocos I.
Malpelo I.
GALAPAGOS PLATEAU
GALAPAGOS I^s
CHATHAM I.
AGUJA POINT
CALLAO
MILNE EDWARDS DEEP
BOWERS BASIN
KRÜMMEL DEEP
BARTHOLOMEW DEEP
RICHARDS DEEP
BUCHAN BASIN
MARQUESAS ISLANDS
PAUMOTU OR LOW ARCHIPELAGO
MANGA REVA
GARRETT RIDGE
ALBATROSS PLATEAU
EASTER I.
Sala y Gomez
Northern limit of 1
Southern limit of h
Southern limit of 1
Northern limit of -h
Northern limit of 0
Southern limit of 2
Southern limit of 0
REFERENCE
Sea Level
100 Fathoms
500
1000
1500
2000
2500
3000
4000
LEGEND
h good trawl haul
-h poor " "
1 good surface tow
2 poor " "
0 barren " "
t serial temperature
Track of Albatross in 1891
Track of Albatross in 1899
Track of Albatross in 1904-1905.
Stations t denote serial temperature

PLATE 3^d.

PLATE 3^d.

Shows the direction and strength of the wind (Beaufort scale) in the Eastern Pacific; the number of the barbs of the arrows indicates the strength in Beaufort scale.

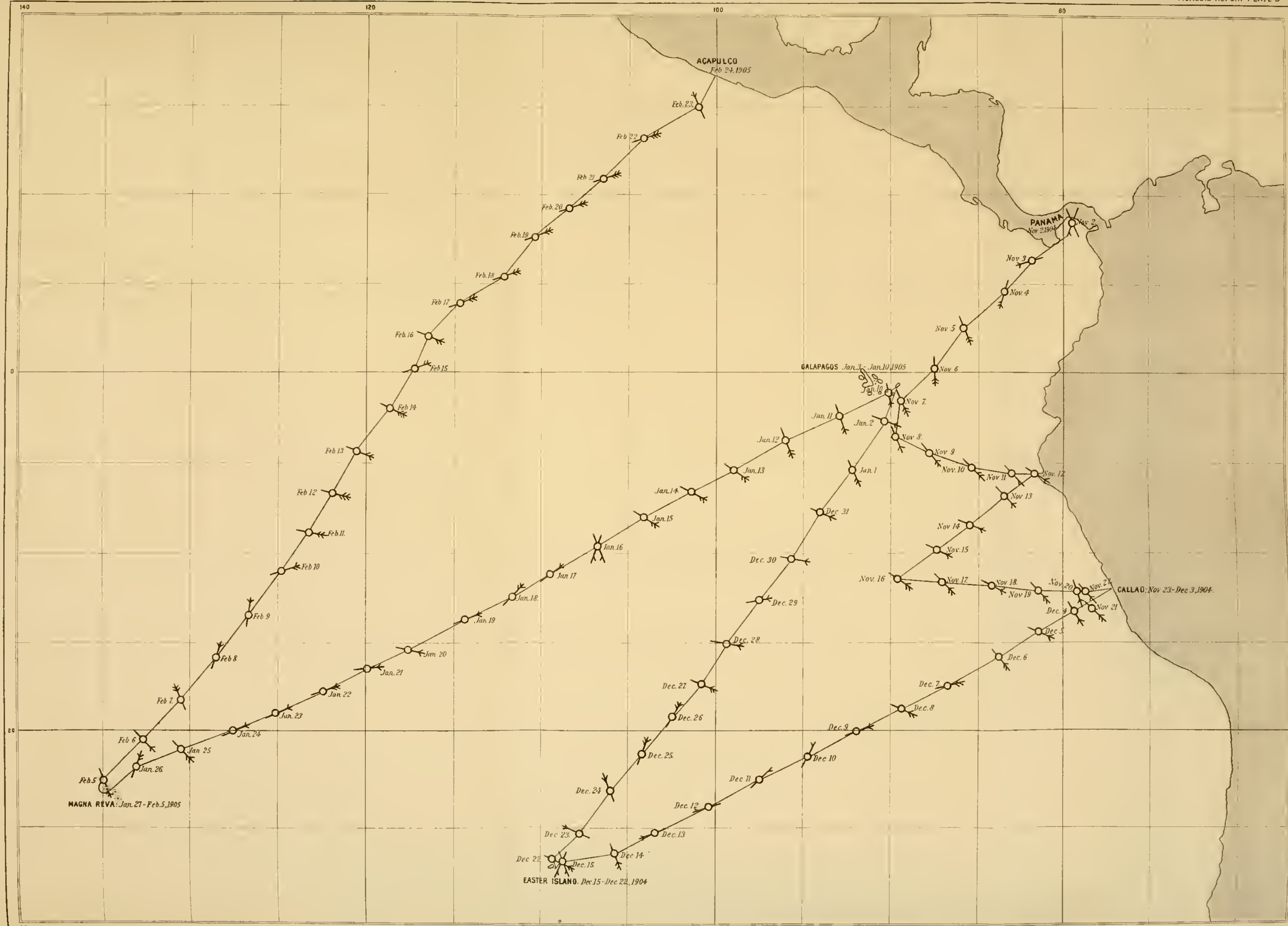

ACAPULCO
Feb 24.1905
PANAMA
Nov 2.1904
GALAPAGOS Jan 3 - Jan 10.1905
CALLAO: Nov 23-Dec 3.1904.
EASTER ISLAND. Dec 15-Dec 22.1904
MAGNA REVA: Jan 27-Feb 5.1905
140
120
100
80
0
20
B. Meisel lith.

PLATE 4.

PLATE 4.

1. Temperature section from Mariato Point to the Galapagos and to Easter Island. November.

2. Temperature at Station 4713 from the surface to 150 fathoms.

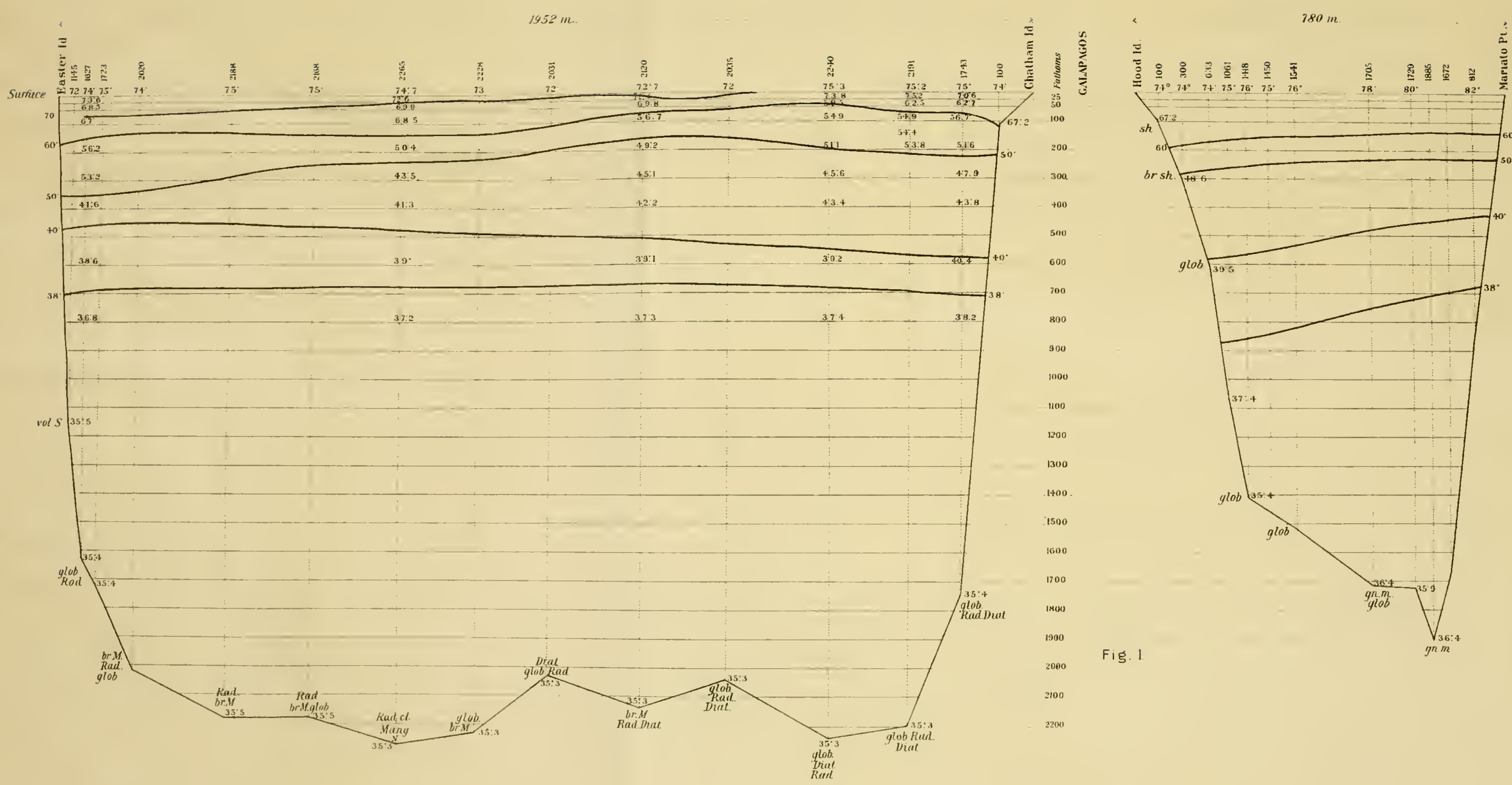

1952 m.
780 m.
Easter Id
Chatham Id
GALAPAGOS
Fathoms
Hood Id.
Mariato Pt.
Surface
vol S
glob
Rad
br.M.
Rad.
glob
Diat
Many
glob Rad Diat
sh
br sh.
gn.m.
gn m

Fig. 1

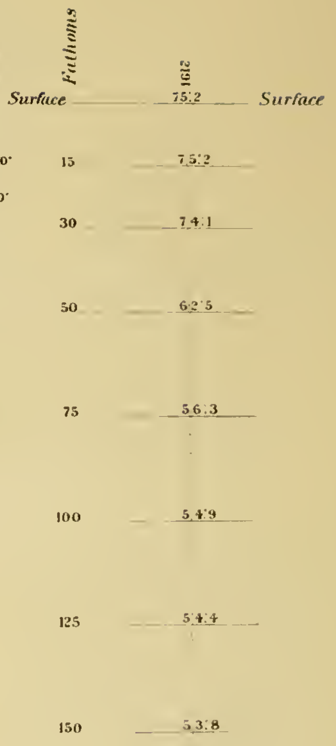
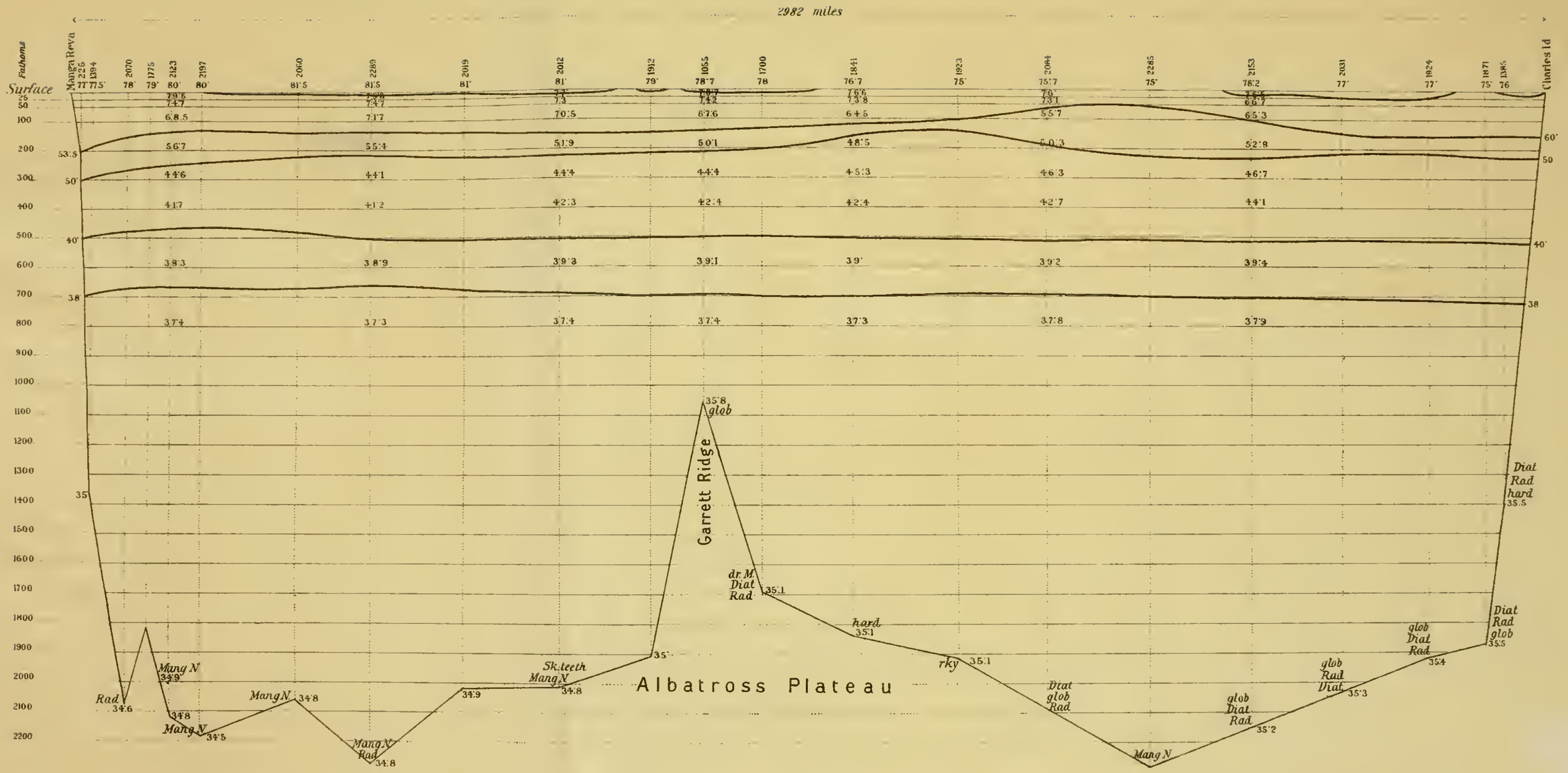

Fathoms
Surface
1612
Surface
15
30
50
75
100
125
150

Fig. 2

Plate 5.

Plate 5.

Temperature section from Charles Island, Galapagos, to Manga Reva, showing the Albatross Plateau and the Garrett Ridge.



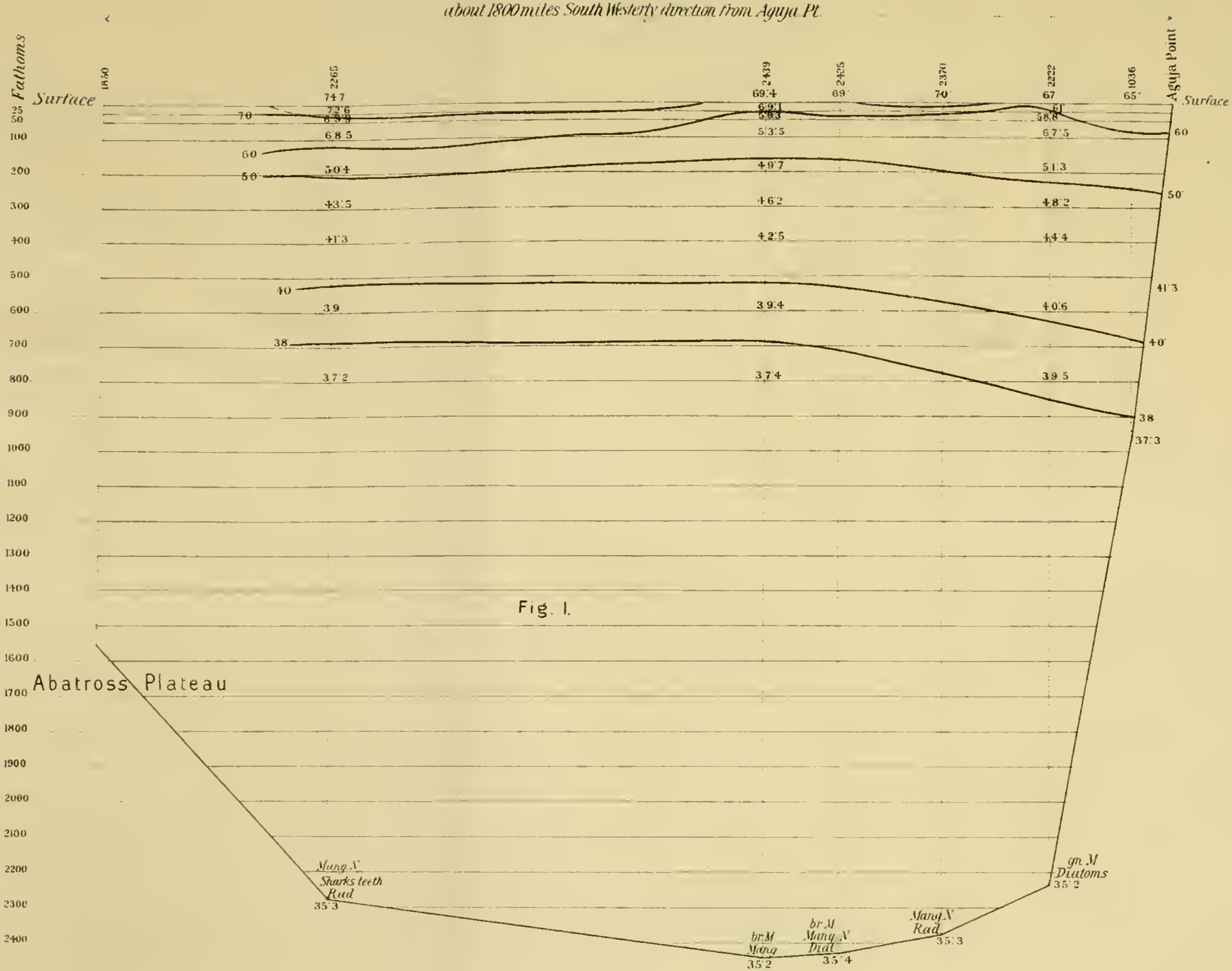
2982 miles
Fathoms
Surface
Manga Reva
Charles Id
Garrett Ridge
Albatross Plateau

Plate 6.

PLATE 6.

1. Temperature section from Aguja Point to a point about 1800 miles in a southwesterly direction.

2. Temperature sections at Stations 4651 and 4656 from the surface to 100 fathoms.


about 1800 miles South Westerly direction from Aguja Pt.
Fathoms
Surface
Aguja Point
Abatross Plateau
Mang. N. Sharks teeth Rad.
br. M Mang.
br. M Mang. N. Diat.
Mang. N. Rad.
gn. M Diatoms
Fig. 1.

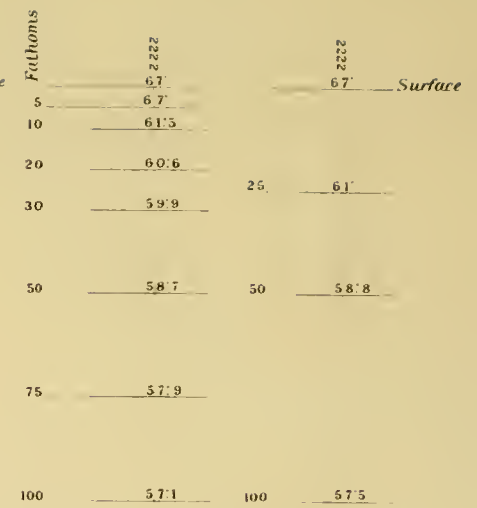

Fathoms
Surface
Fig. 2.

Plate 7.

PLATE 7.

Temperature section from Aguja Point to a point about 2100 miles in a northwesterly direction.

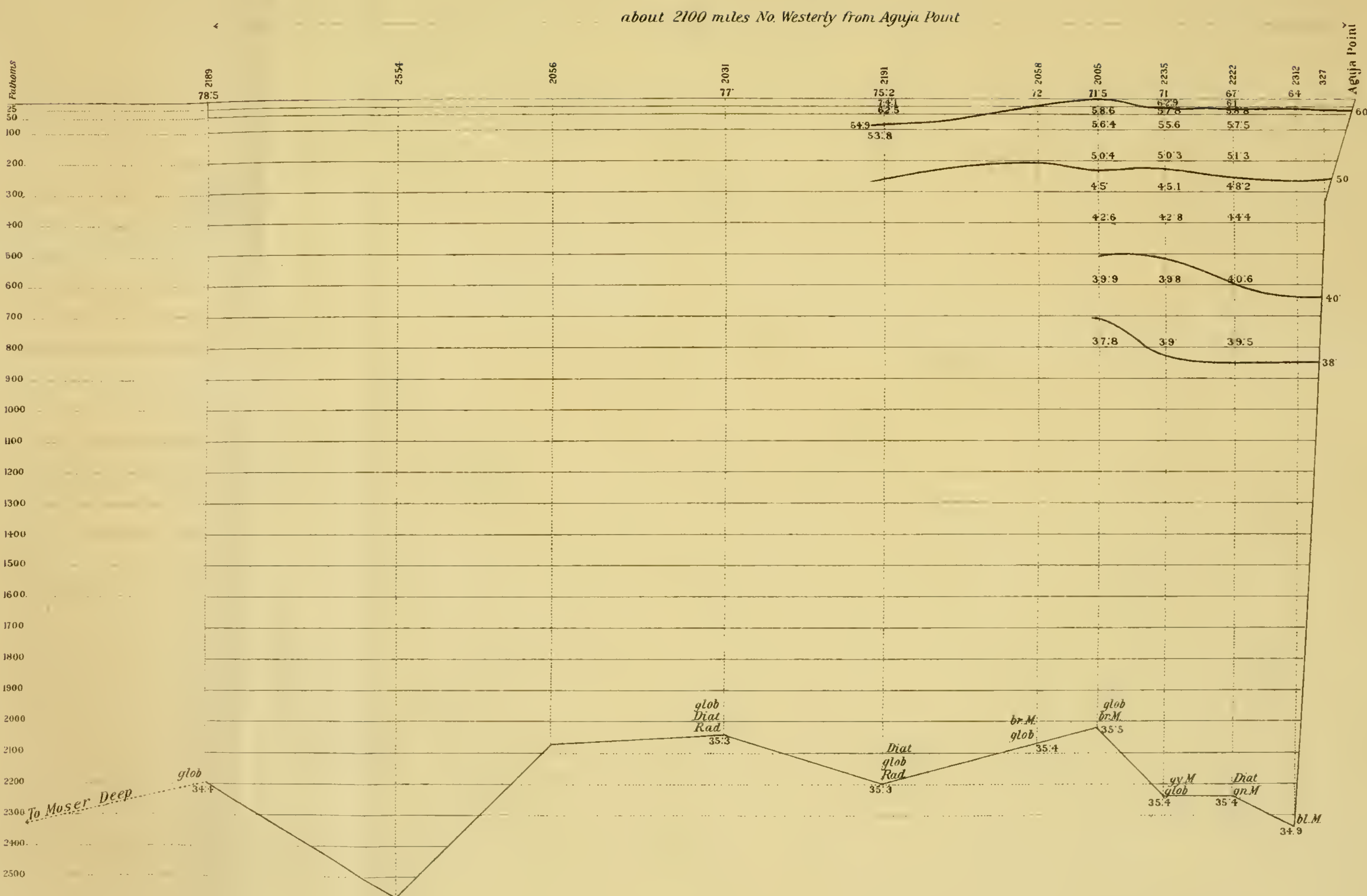

about 2100 miles No. Westerly from Aguja Point
Aguja Point
Fathoms
2189
2554
2056
2031
2191
2058
2005
2235
2222
2312
327
25
50
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
78.5
77
75.2
72
71.5
71
67
64
60
50
40
38
To Moser Deep
glob
Diat
Rad
br.M.
gy.M
gn.M
bl.M
34.4
35.3
35.3
35.4
35.5
35.4
35.4
34.9

PLATE 8.

PLATE 8.

Temperature section from Callao to a point about 2400 miles northwest of Callao.

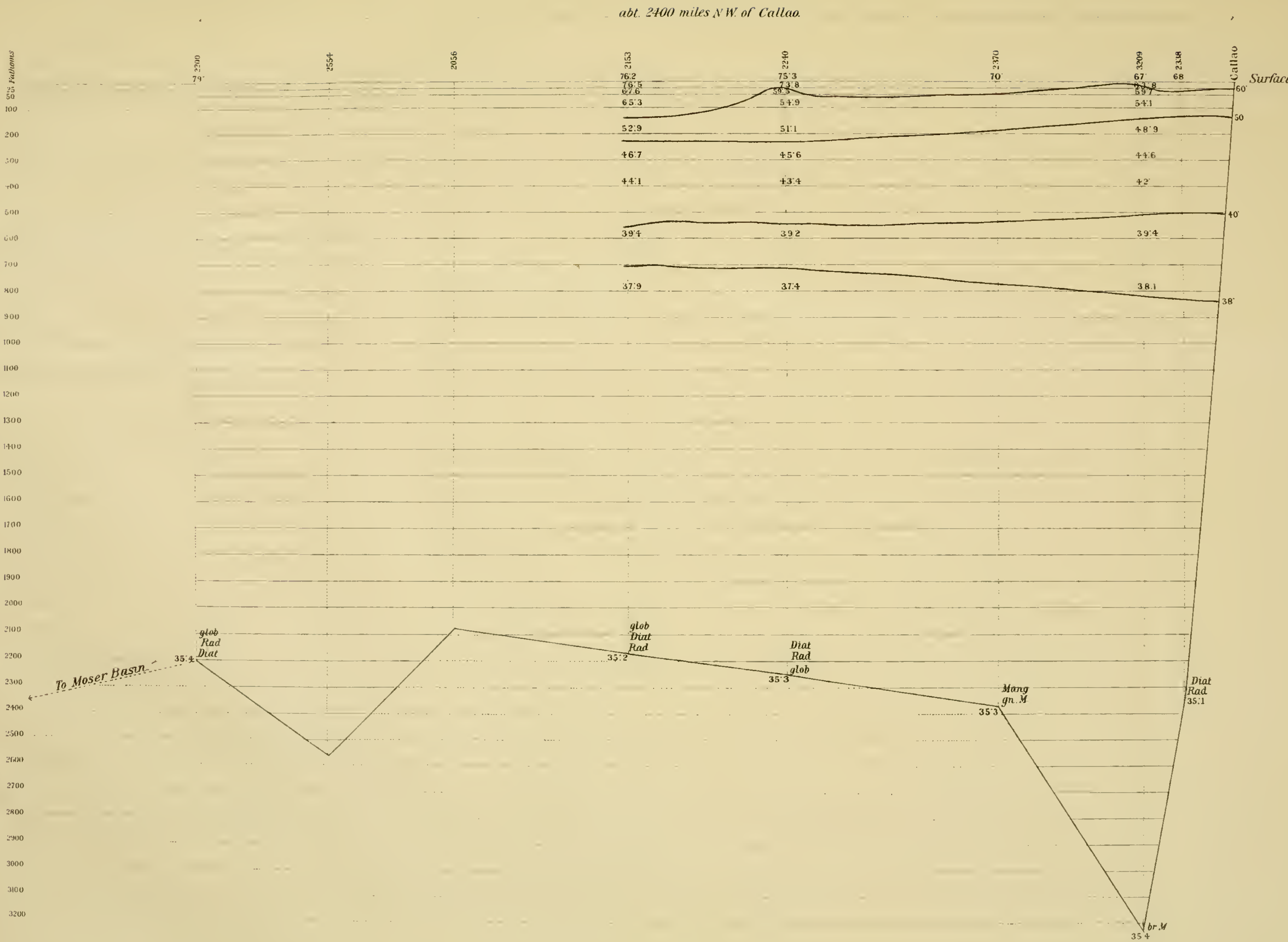

abt. 2400 miles N.W. of Callao.
Fathoms
Surface
Callao
To Moser Basin
glob
Rad
Diat
Mang
gn. M
br. M

Plate 9.

Plate 9.

Temperature section from Callao in a northwesterly direction about 2750 miles.

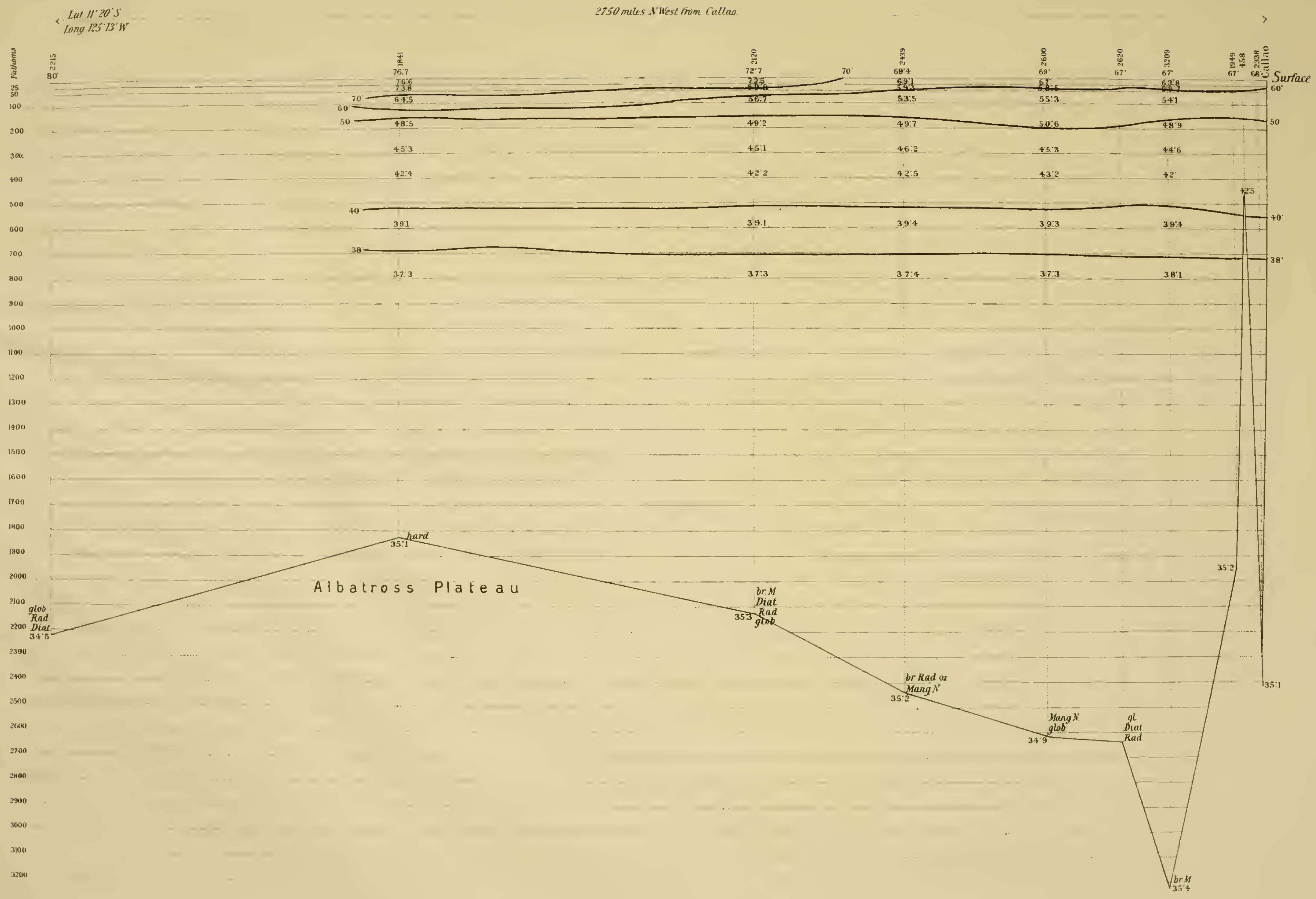

Lat 11° 20' S
Long 125° 13' W
2750 miles N West from Callao
Fathoms
Surface
Callao
Albatross Plateau
hard
br M
Diat
Rad
glob
br Rad oz
Mang N
Mang N
glob
gl
Diat
Rad
br M
glob
Rad
Diat

Plate 10.

Plate 10.

1. Temperature section from Callao to Easter Island through Sala y Gomez.

2. Temperature at Station 4683 from the surface to 200 fathoms.

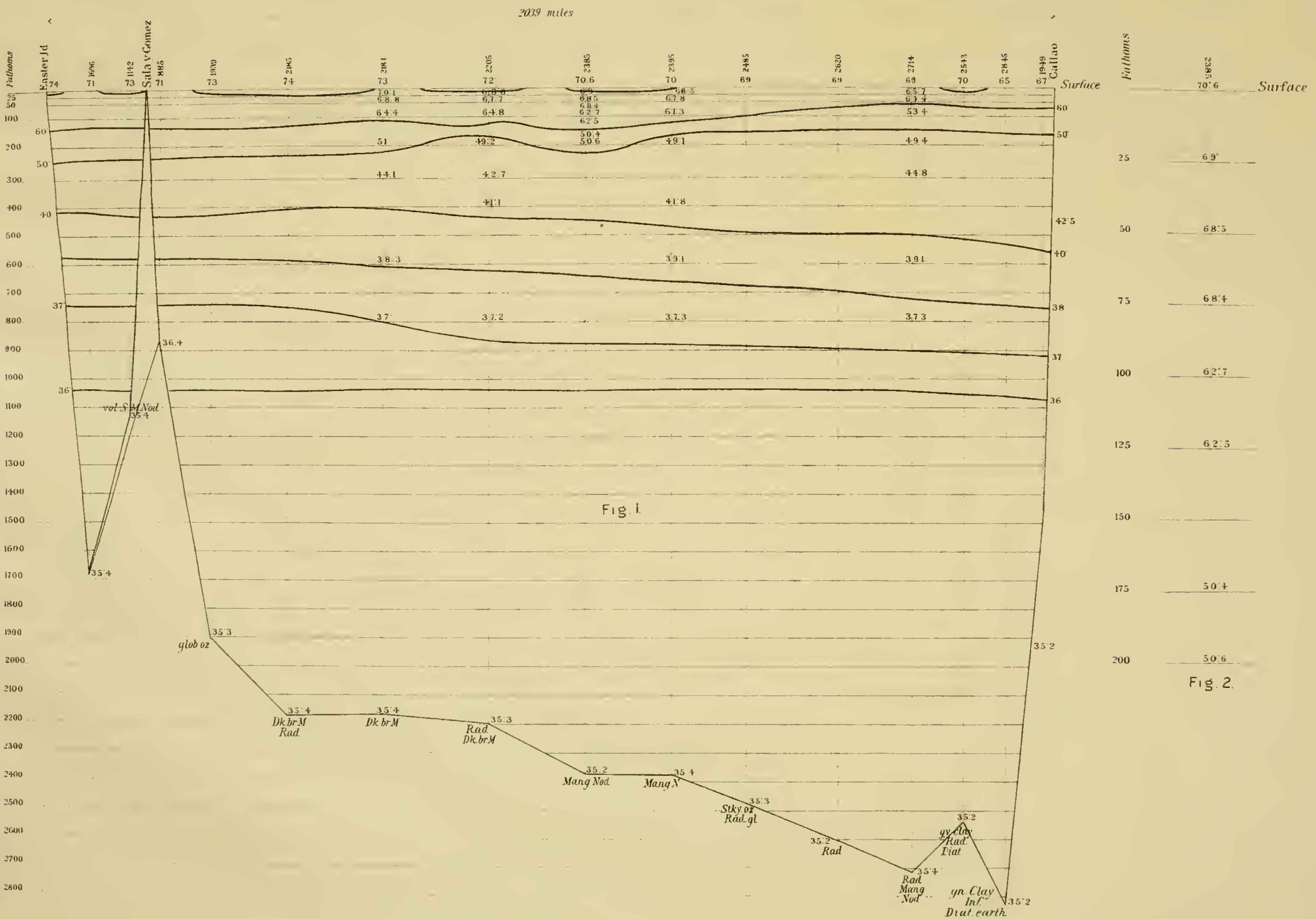

2039 miles
Fathoms
Easter Id
Sala y Gomez
Callao
Surface
Fathoms
Surface

Fig. 1.

Fig. 2.

Plate 11.

Plate 11.

Section from Cape Lobos running approximately west, in the 20° of South Latitude, a distance of about 3600 miles.

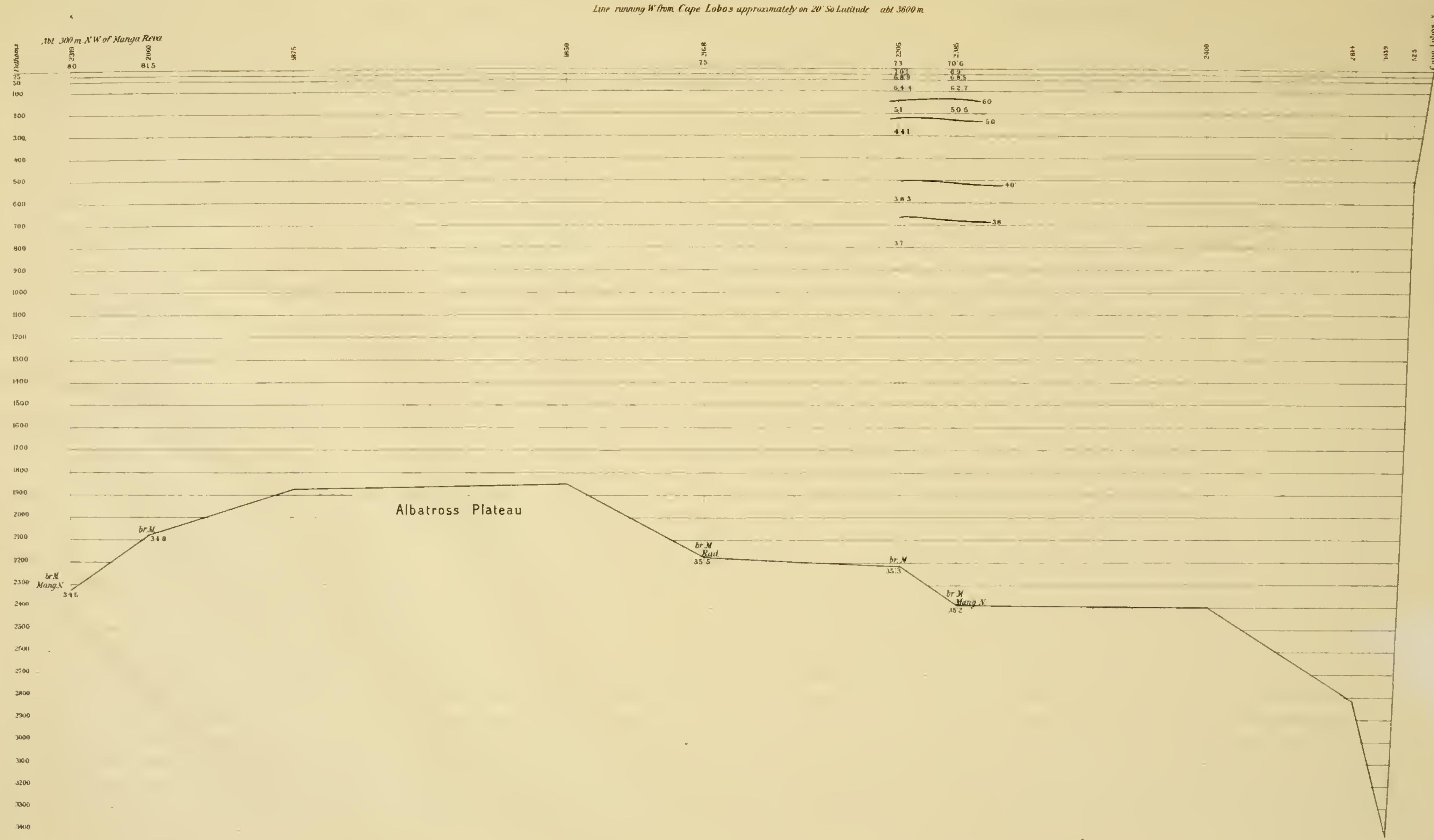

Line running W from Cape Lobos approximately on 20° So Latitude abt 3600 m
Abt 300 m N W of Manga Reva
Fathoms
Cape Lobos
Albatross Plateau

Plate 12.

PLATE 12.

Temperature section from Manga Reva to Acapulco.

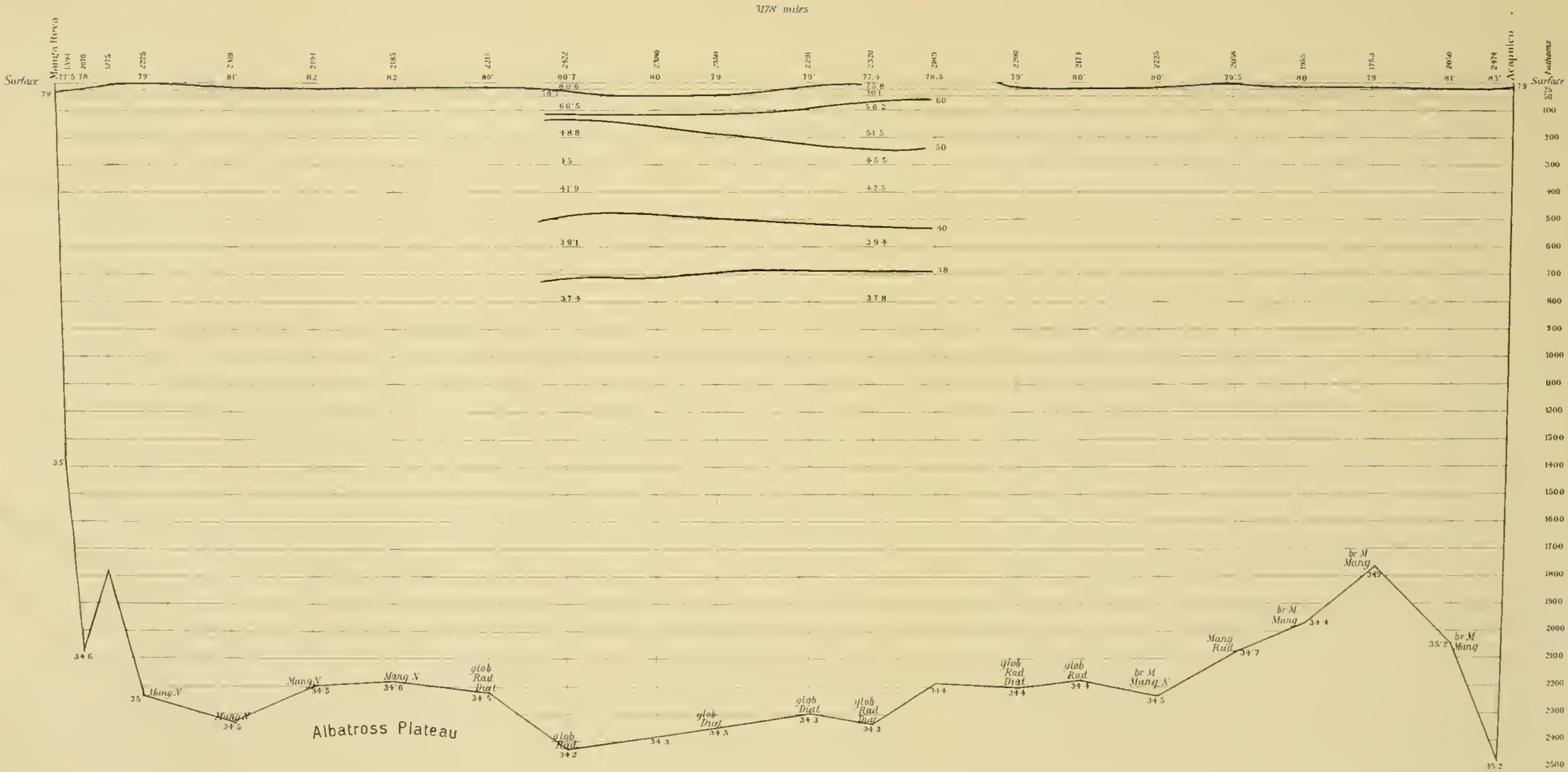

3178 miles
Manga Reva
Acapulco
Surface
Fathoms
Albatross Plateau

PLATE 13.

Plate **13**.

Chart of Easter Island from H. O. Chart No. 1119. Scale 5 miles to 4 inches.

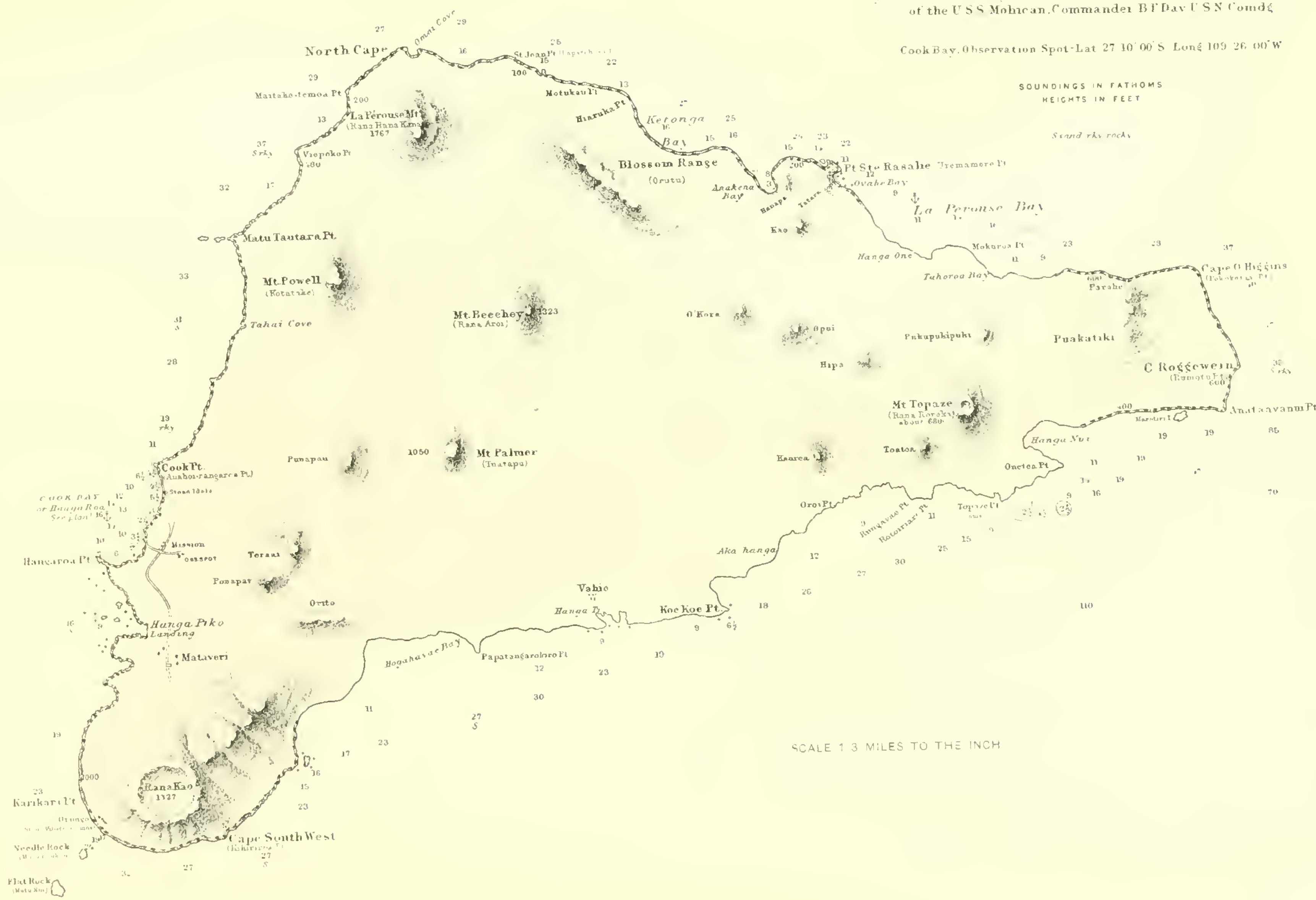
EASTER ISLAND

(TE PITO TE HENUA ISLAND)

From a Chilean Government Survey in 1870
with additions and corrections in 1886
by Lieutenant F M Symonds and Naval Cadet C M McCormick U S N
of the U S S Mohican, Commander B F Day U S N Comdg

Cook Bay, Observation Spot-Lat 27 10' 00" S Long 109 26' 00" W

SOUNDINGS IN FATHOMS
HEIGHTS IN FEET



SCALE 1 3 MILES TO THE INCH

PLATE 14.

Plate 14.

Chart of Manga Reva or Gambier Islands. From Brit. Adm. Chart, No. 1112. Scale 2 miles to the inch.

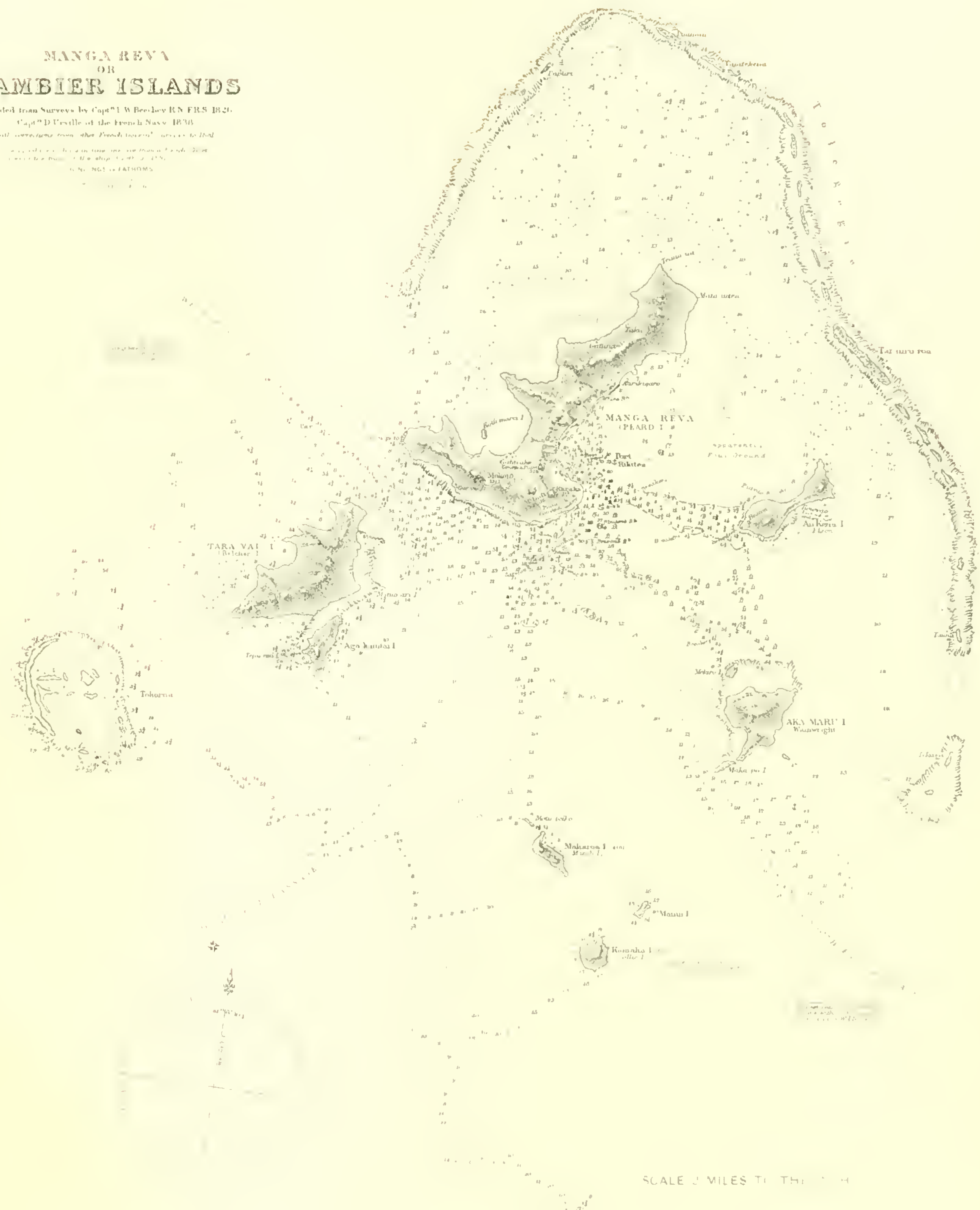

MANGA REVA
OR
GAMBIER ISLANDS
MANGA REVA
(PEARD I.)
TARA VAI I.
AKA MARU I.
Aukena I.
Agakauitai I.
Makaroa I.
Kamaka I.
Tokorua
Port Rikitea
Mata utea
Tarauru roa
SCALE 2 MILES TO THE INCH

Plate 15.

PLATE 15.

1. Sala y Gomez seen from the south. Distant about one-fourth of a mile.

2. Western extremity of Sala y Gomez seen from the southwest. Distant about one-fourth of a mile.

The initials H. B. B., F. M. C., and C. A. K. Photog. indicate that the photographs were taken either by H. B. Bigelow, F. M. Chamberlain, or C. A. Kofoid.

I am indebted to Mr. Kelley, of the San Diego Chamber of Commerce, for his kind assistance in developing our Plates.

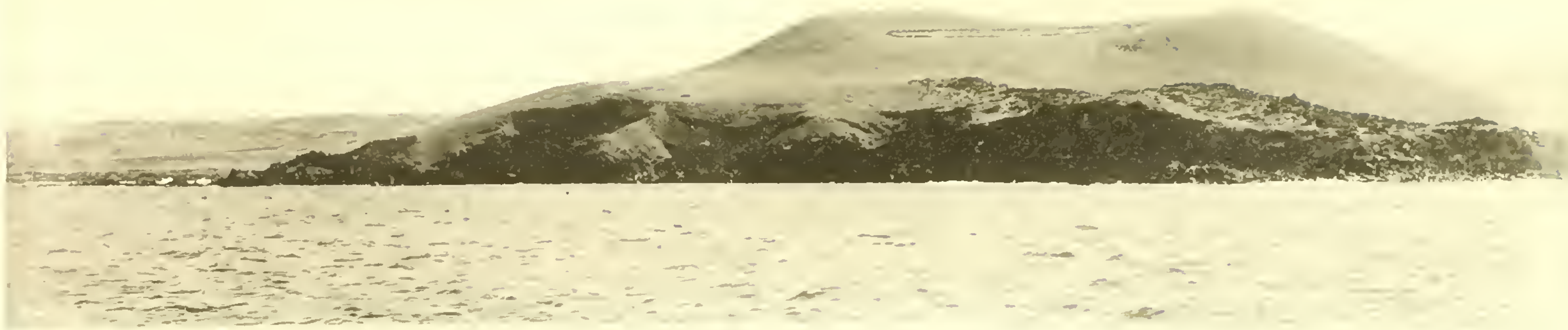
H. B. PHOTO. 2 HELIOTYPE CO., BOSTON

Plate 16.

PLATE 16.

1 North face of Easter Island. Bluff and hill west of La Pérouse Bay.

2. North face of Easter Island. Bluff west of Cape O'Higgins.



H. R. B. PHOTO.

Plate 17.

Plate 17.

Easter Island. Northern bight of La Pérouse Bay, seen from the east.

H. B. B. PHOTOG. HELIOTYPE CO., BOSTON

PLATE 18.

Plate 18.

1. Easter Island. Part of northern rim of crater lake of Rana Roroka with fringe of bulrushes.

2. Easter Island. Landing place at Ovahe Bay, north of La Pérouse Bay.

1

H. B. B. PHOTOG. 2 HELIOTYPE CO., BOSTON.

Plate 19.

Plate 19.

1. Puakatiki Mountain, seen from La Pérouse Bay. Cape O'Higgins to the left.

2. Amphitheatre at foot of Blossom Range, west of La Pérouse Bay. Easter Island.

1

2

HELIOTYPE

Plate 20.

PLATE 20.

1. Looking eastward while skirting west coast of Easter Island between Matu Tautara Point and Cook Bay.

2. Cook Bay with bluff (Rana Kao), forming the southwest cape of Easter Island.

1

H. B. B. PHOTOG

HELIOTYPE CO., BOSTON

Plate 21.

Plate **21**.

General view of western face of Easter Island, looking north towards La Pérouse Mountain, on the way up to Rana Kao.

H. B. B. PHOTOG. HELIOTYPE CO., BOSTON

Plate 22.

Plate 22.

General view of the southern slope of Easter Island, looking eastward towards Cape Roggewein on the way up to Rana Kao. Cape Roggewein, the eastern cape of Easter Island, is seen on the extreme right of the plate.

H. B. B. PHOTOG. HELIOTYPE CO. BOSTON

PLATE 23.

Plate 23.

Gap in the southern rim of Rana Kao, seen from the west, showing the surface of the crater lake overgrown with reeds and mosses.

HELIOTYPE CO. BOSTON

PLATE 24.

Plate 24.

Part of the eastern rim of the crater and of the crater lake of Rana Kao, seen from the west.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON

Plate 25.

PLATE 25.

Part of the northern rim of the crater and crater lake of Rana Roroka with the fringe and patches of bulrushes.

H. B. B. PHOTOS.

HELIOTYPE CO. BOSTON

Plate 26.

Plate 26.

1. The western rim of the crater of Rana Roroka, seen from the west on the way from La Pérouse Bay.

2. The southern rim of the crater of Rana Roroka, seen from Tongariki.

M. C. PHOTOS.

M. C. PHOTOG. HELIOTYPE CO., BOSTON

Plate 27.

Plate 27.

1. Front view of platform near La Pérouse Bay.

2. Remnant of large blocks of platform near La Pérouse Bay.

H. G. B. PHOTO. HELIOTYPE CO. BOSTON

Plate 28.

Plate 28.

Front view of remnant of platform to south of La Pérouse Bay, showing the character of the surrounding country to eastward of Anakena Bay.

H. B. B. PHOTOG.

HELIOTYPE CO., BOSTON.

Plate 29.

Plate 29.

Rear view of large platform at Tongariki, showing the images thrown down. The bluff of Point Anataavanui is seen beyond the islet of Marotiri.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON.

PLATE 30.

Plate 30.

1. The front face of the western extremity of the large platform at Tongariki, facing the sea. A part of one of the images is still standing.

2. The western and central part of the platform at Tongariki, facing the sea. At high tide the sea washes the large blocks of the lower part of the photograph.

1

2

HELIOTYPE CO. BOSTON

PLATE 31.

PLATE 31.

Images on the western face of the rim of Rana Roroka, looking northwest over the plain extending towards Blossom Range.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON

Plate 32.

Plate 32.

Images on the south face of the outer rim of Rana Roroka.

H. B. B. PHOTOG.

HELIOTYPE CO., BOSTON

PLATE 33.

PLATE 33.

Group of images on the southeastern face of the outer rim of Rana Roroka.

H. B. B. PHOTOG. HELIOTYPE CO., BOSTON.

Plate 34.

PLATE 34.

Large image on the outer face of the rim of Rana Roroka.

H. B. B. PHOTOG HELIOTYPE CO., BOSTON.

PLATE 35.

Plate 35.

Large image on the west face of the outer rim of Rana Roroka.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON

Plate 36.

Plate 36.

Large image and cluster of smaller images on the west face of the outer rim of Rana Roroka.

H. B. B. PHOTO.

HELIOTYPE CO., BOSTON

Plate 37.

PLATE 37.

Cluster of images on the western inner face of the southeastern rim of Rana Roroka.

H. B. B. PHOTOS. HELIOTYPE CO. BOSTON

Plate 38.

PLATE 38.

Quarries on the outer face of the southern rim of Rana Roroka.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON.

PLATE 39.

Plate 39.

Large image partly cut out, on the outer face of the rim of Rana Roroka.

H. E. B. PHOT.

HELIOTYPE ... TON

Plate 40.

Plate 40.

Quarry on the outer face of the southern rim of Rana Roroka, looking eastward toward Cape O'Higgins.

Heliotype

Plate 41.

PLATE 41.

Scattered images on way from La Pérouse Bay to Rana Roroka.

H. B. B. PHOTOG.

HELIOTYPE CO., BOSTON.

Plate 42.

Plate 42.

1. Large broken image at foot of the eastern outer face of Rana Roroka, showing the arms held close to the trunk.

2. Large broken image on way from Rana Roroka to La Pérouse Bay.

1

HELIOTYPE

Plate 43.

Plate 43.

Sculptured rocks at Orongo, to the south of crater of Rana Kao; stone house in the rear, on the left.

Plate 44.

PLATE 44.

Sculptured rocks at Orongo, south of crater of Rana Kao.

HELIOTYPE

PLATE 45.

Plate 45.

Stone house at Orongo with two openings and ornamented door jambs.

HELIOTYPE

Plate 46.

Plate 46.

Stone house at Orongo with a single opening.

H. B. B. PHOTO.

HELIOTYPE CO., BOSTON.

Plate 47.

Plate 47.

Stone houses at Orongo forming angle, with sculptured rocks in the background.

H. E. B. PHOTO. HELIOTYPE CO. BOSTON

Plate 48.

Plate 48.

1. Ruins of stone house near shore of La Pérouse Bay.

2. Double stone house at Orongo.

1

H. B. B. PHOTOG. 2 HELIOTYPE CO., BOSTON

PLATE 49.

Plate 49.

1. Ruins of stone house on the edge of crater lake of Rana Kao.

2. Keystone of opening to part of cave of a ruined stone house near La Pérouse Bay.

H. M. C. PHOTOG. 1

H. B. B. PHOTOG. 2 HELIOTYPE CO., BOSTON.

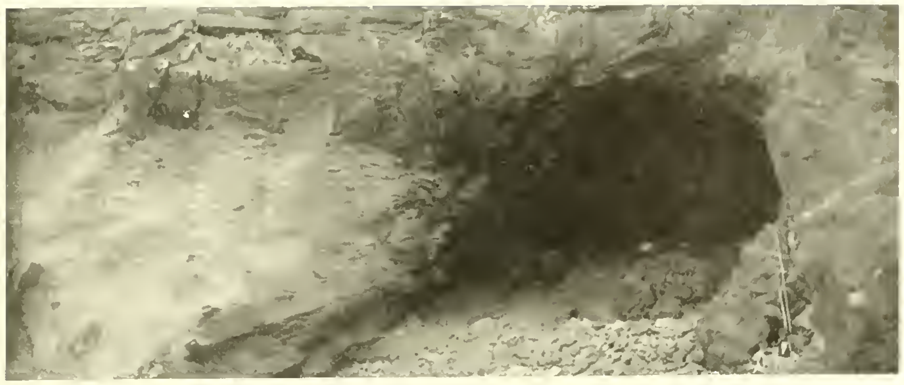
PLATE 49^{a}.

Plate 49[a].

1. Entrance to cave in a small indentation of the coast, south of Hanga Piko Bay, west of Mateveri.

2. Roof paintings on ceiling of cave.

3. Another painting in same cave.



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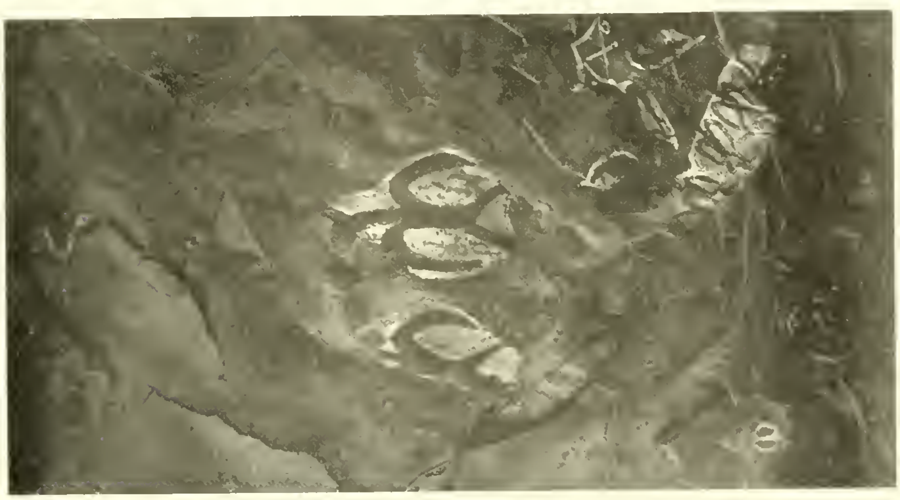


C. A. K. PHOT.

3

Plate 50.

PLATE 50.

1. Summit of Chatham Island, Galapagos, as seen from anchorage at Wreck Bay.

2. First ridge adjoining Wreck Bay, showing character of vegetation on the slopes during the dry season.

Plate 51.

Plate 51.

Looking across Wreck Bay from the beach south of the landing-place.

H. B. B[illegible] PHOTOG

HELIOTYPE [illegible] BOSTON

Plate 52.

PLATE 52.

Vegetation during the dry season on the limestone plateau to the rear of landing-place at Wreck Bay; wild cotton on the right.

HELIOTYPE

PLATE 53.

Plate 53.

Vegetation on volcanic rock soil during the dry season, as seen on road leading to hacienda, Chatham Island.

Plate 54.

Plate 54.

Vegetation on volcanic rock soil during the dry season, on way to hacienda, Chatham Island.

PLATE 55.

Plate 55.

1. Vegetation to rear of landing-place, Wreck Bay, Chatham Island; limestone plateau.

2. Vegetation on way to hacienda, Chatham Island; volcanic rock soil.

1

H. B. B. PHOTOG. 2 HELIOTYPE CO., BOSTON.

PLATE 56.

PLATE 56.

Vegetation on way to hacienda, Chatham Island; volcanic rock soil.

H. [illegible] PHOTOG. HELIOTYPE CO. BOSTON.

PLATE 57.

Plate 57.

Mount Duff, Manga Reva Island, seen from the east from the pass leading into Rikitea Harbor.

H. B. B.

HELIOTYPE CO., BOSTON

Plate 58.

Plate 58.

Mount Duff as seen from the anchorage of Port Rikitea.

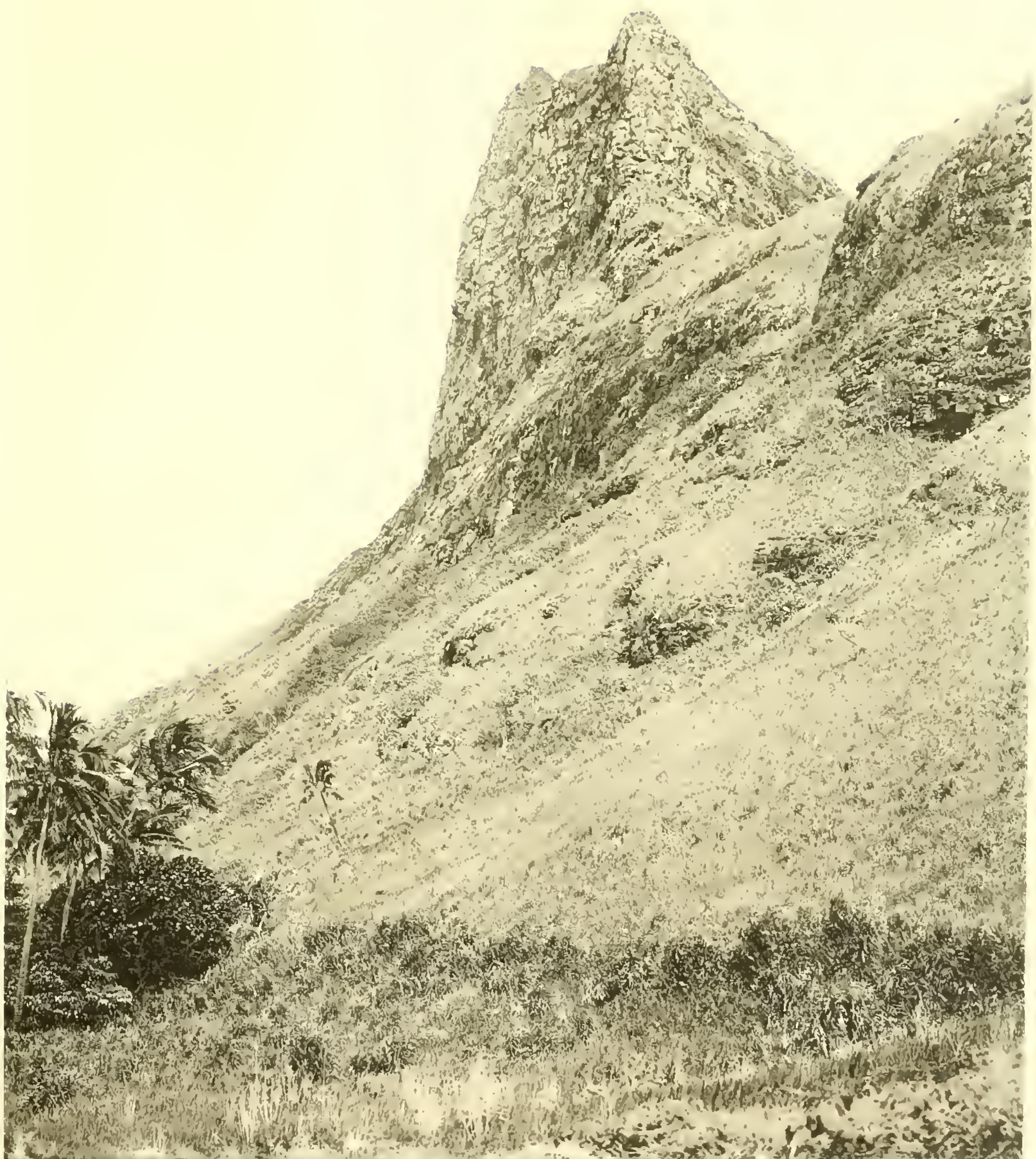
H. B. B. PHOTO.

HELIOTYPE CO., BOSTON

Plate 59.

Plate 59.

Mount Duff as seen from the summit of the plateau, on the south side of the peak.



H. B. B. PHOTOG.

HELIOTYPE CO., BOSTON.

Plate 60.

PLATE 60.

Seen faeing Mount Duff from the same plateau as Plate 59, but somewhat more to the westward.

H. B. B. PHOTO.

HELIOTYPE CO. BOSTON

PLATE 61.

PLATE 61.

Mount Mokoto seen from the anchorage at Port Rikitea.

H. B. B. PHOTOG.

HELIOTYPE CO., BOSTON

Plate 62.

PLATE 62.

A part of the central ridge of Manga Reva Island to the north of Port Rikitea, seen from the anchorage.

H. B. B. PHOTO.

HELIOTYPE CO., BOSTON.

Plate 63.

Plate 63.

1. Ancient volcanic crater, forming bay to south of Kotu Poto Point, with Kotu Marei Island on the west face of Manga Reva Island, seen from the ridge west of Port Rikitea on way to Kirimiro.

2. Bay and Port Rikitea, showing the central ridge of Manga Reva Island to the north.

PLATE 64.

Plate 64.

1. Mount Duff, Mount Mokoto, and central ridge of Manga Reva Island, as seen from south of Moka-pu Island.

2. Mount Duff and Mount Mokoto, seen from the southeast, half-way from Manga Reva to Aka-Maru, showing plateau at base of Mount Duff.

H. U. B. PHOTO. 2 HELIOTYPE CO. BOSTON.

Plate 65.

PLATE 65.

1. The Islands of Aga-kanitai and Tara-Vai, as seen from the anchorage off Aka-Maru.

2. Aga-kanitai and Tara-Vai, as seen from the plateau at the base of Mount Duff. The western line of the outer encircling reef is seen in the gap between the islands.

H. F. B. PHOTO.

HELIOTYPE CO., BOSTON.

Plate 66.

Plate 66.

1. Au Kena as seen from the anchorage at Aka-Maru, with the line of the eastern encircling reef on the north and south of the island.

2. Au Kena as seen from the anchorage at Port Rikitea.

3. The gap between Au Kena and Aka-Maru with the line of the eastern encircling reef, as seen from the anchorage at Port Rikitea.

1

H. B. [illegible] HELIOTYPE [illegible] BOSTON

Plate 67.

Plate 67.

1. The islands of Mekiro and Aka-Maru, seen from our anchorage to the west of Aka-Maru.

2. Aka-Maru, with the island of Maka-pu in front, forming the western rim of the former Aka-Maru Maka-pu crater.

1

HELIOTYPE CO. BOSTON.

PLATE 68.

Plate 68.

1. The islands of Maumi and Kamaka, as seen from the east, steaming out of the southeast pass.

2. The island of Makaroa, with its satellites Motu-teiko and Maumi, as seen from our anchorage off Aka-Maru.

H. P. B. ...

HELIOTYPE CO., BOSTON.

PLATE 69.

PLATE 69.

1. The northwestern and northern encircling reef line, as seen from the ridge of the central crest of Manga Reva near the tunnel leading to Kirimiro, west face of Manga Reva. The extreme land is Point Teaua-ua, the northwestern point of Manga Reva Island.

2. A part of the same encircling reef line as fig. *1*, seen from a somewhat higher point of the central ridge.

1

H. B. B. PHOTO.

2

HELIOTYPE CO., BOSTON.

PLATE 70.

Plate 70.

1. A part of the eastern encircling reef line, as seen from the crest of the eastern end of the central ridge immediately above Point Mata-iutea.

2. A part of the northeastern encircling reef line, as seen from the crest of the central ridge well towards the eastern extremity of Manga Reva Island, looking over Point Mata-iutea.

H. H. B. PHOTO. HELIOTYPE CO., BOSTON.

Plate 71.

Plate 71.

1. A part of the eastern encircling reef line, seen from the southern face of Manga Reva, looking over Point Mata-iutea.

2. A part of the eastern encircling reef line, seen over Point Mata-iutea from the eastern part of the south face of Manga Reva Island.

2

HELIOTYPE CO. BOSTON

Plate 72.

Plate 72.

1. The islands of the southern part of the Gambier group, seen looking to the northwest, across the southeastern line of the encircling reef after rounding the southeast passage going north. The large island is Aka-Maru, with a part of Mekiro to the right, Makaroa to the left of Aka-Maru, and Maumi on the left edge of the plate.

2. The islands of the Gambier group, as seen from the east, looking to the northwest across Tauna Island, Mekiro on the left, Tara Vai in the rear, Mount Duff to the north of Tauna, and Au Kena to the right of the plate.

1

H. B. B. PHOTOG

2

HELIOTYPE CO. BOSTON

Plate 73.

PLATE 73.

1. Looking across the eastern horn of the eastern encircling reef line, to the north of Tekava Island, seen from the south.

2. The islands of the eastern part of the Gambier group, as seen looking west across the last island of the eastern encircling reef line, north of Tauna. Aka-Maru and Mekiro, to the south of the extremity of the barrier reef island, and Au Kena to the right of the plate.

1

H. B. B. PHOTO.

2

HELIOTYPE CO., BOSTON.

Plate 74.

PLATE 74.

1. The Mount Duff massif with the central ridge of Manga Reva, looking across the encircling reef as seen facing the eastern part of Au Kena; on the left, Makaroa in the distance.

2. The islands of Aka-Maru on the left, Mekiro in the centre, and Au Kena on the right, as seen from the east through a gap between the southern end of Tarauru-roa and an islet to the south.

1

2

HELIOTYPE CO.

Plate 75.

Plate 75.

1. Looking westward across an encircling reef islet to the gap between Aka-Maru and Au Kena, with Mount Duff to the right.

2. Looking westward across encircling reef island opposite the eastern face of Au Kena; Mount Duff and Manga Reva to the right.

HELIOTYPE CO. BOSTON

Plate 76.

Plate 76.

1. A view similar to that of Plate 75, fig. 2, but taken nearer the northern extremity of Au Kena, so as to take in the whole of Manga Reva Island from the eastern point to Mount Duff.

2. The western part of Manga Reva Island, with the Mount Duff massif seen from the east through a gap in the eastern encircling reef line between Tarauru-roa Island and an island to the south of it.

1

2

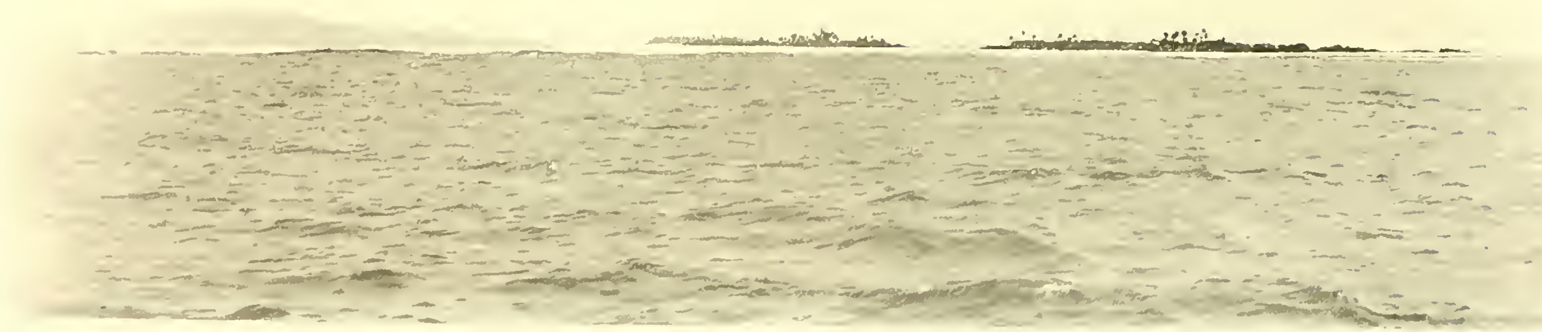
H. B. B. PHOT. HELIOT. BIERSTADT PROC.

Plate 77.

Plate 77.

1. The eastern extremity of Manga Reva Island, seen across a part of the northern horn of the eastern encircling reef. In the distance are seen the islets of the northern horn of the barrier reef.

2. Looking westward across the narrow eastern encircling reef line, opposite the eastern face of Manga Reva Island, with Mount Duff and Mount Mokoto in the distance.



1

2

Plate 73.

PLATE 78.

1. Vegetation of one of the islets of the eastern encircling reef line, about opposite the eastern face of Manga Reva Island.

2. The northeastern part of Manga Reva Island, distant about 2 miles, seen through a gap in the eastern encircling reef line.

A. B. B. PHOTOG. 2 HELIOTYPE CO., BOSTON

Plate 79.

Plate 79.

The eastern face of Manga Reva Island, distant about 3 miles, with Mount Duff in the rear, seen looking westward through a gap in the eastern narrow encircling reef line. Lagoon coral sand dam crossing the gap.

HELIOTYPE CO. BOSTON

Plate 80.

Plate 80.

The eastern face of Manga Reva Island and the Mount Duff massif, seen from nearly the same point of view as that of Plate 79. Point Teaua-iutea on the right and Point Mata-iutea on the left. "Miki Miki" bushes on the sand beach.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON.

PLATE 81.

Plate 81.

Lagoon beach of Vaiatekeue about opposite the eastern face of Manga Reva Island. Islets of the northern horn are seen in the distance. "Miki Miki" bushes.

HELIOTYPE CO., BOSTON

Plate 82.

Plate 82.

Lagoon face of an islet to the north of Vaiatekeue, showing sand dam with gap leading to the sea face of the island through the coral rock beach.

PLATE 83.

PLATE 83.

Wide gap on sea face of another part of the eastern encircling reef line, seen looking north, at high tide. A second gap is seen a little more to the north.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON

PLATE 84.

PLATE 84.

Another part of the sea face of the eastern encircling reef line, looking north, at high tide, sea breaking against the steep coral rock beach.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON.

PLATE 85.

Plate **85**.

Sea face of a part of the eastern encircling reef line, looking south, about half-tide, showing the erosion of the old land line.

HELIOTYPE CO., BOSTON

Plate 86.

PLATE 86.

Near the same part of the eastern encircling reef line as Plate 85, looking north, at low tide, showing the large blocks left from the erosion of the old land line.

H. B. B. PHOTOG HELIOTYPE CO. BOSTON

Plate 87.

Plate 87.

Showing the line of demarcation between the outer reef flat and the eroded face of the old land line at the base of the coral rubble dam.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON

Plate 88.

PLATE 88.

The summit of the coral rubble dam formed from the eroded reef flat, slightly sloping westward and in places covered by vegetation.

Plate 89.

PLATE 89.

1. Islet covered with vegetation, thrown up on a spur between two gaps across the eastern encircling reef line, seen from the sea face.

2. Lagoon beach of eastern encircling reef line looking north, showing beach rock formation.

H. B. B. PHOTO. HELIOTYPE CO., BOSTON

Plate 90.

Plate 90.

1. Gap in eastern encircling reef line, extending from the sea face to the sand dam separating it from the lagoon, also showing beach sand outcrop.

2. Showing line of demarcation between the reef rock flat and eroded blocks of the face of the old land line.

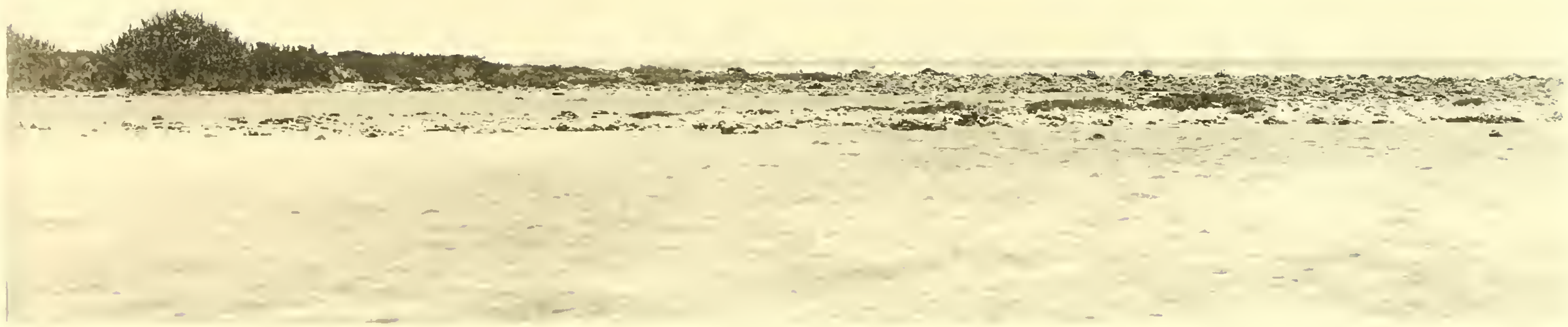
H. B. B. PHOTO. HELIOTYPE CO. BOSTON

Plate 91.

PLATE 91.

1. Narrow part of the eastern encircling reef line seen from the lagoon side, separated from the sea face by a narrow belt of coral boulder breccia.

2. Sea face of Plate 80, with only a narrow belt of coral breccia thrown up from the reef flat.



H. B. B. PHOTOG. HELIOTYPE CO., BOSTON

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OF THE

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AT HARVARD COLLEGE.

There have been published of the BULLETIN Vols. I. to XLII., and also Vols. XLIV., XLV., and XLVII.; of the MEMOIRS, Vols. I. to XXIV., and also Vols. XXVIII., XXIX., XXXI., and XXXII.

Vols. XLIII., XLVI., XLVIII., and XLIX. of the BULLETIN, and Vols. XXV., XXVI., XXVII., XXX., and XXXIII. of the MEMOIRS, are now in course of publication.

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Rebound January, 1969

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