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DEEP-SEA SOUNDING.

A BRIEF ACCOUNT OF THE WORK DONE BY THE

U. S. S. ENTERPRISE

IN

DEEP-SEA SOUNDING DURING 1883-1886.

BY

CAPTAIN A. S. BARKER, U. S. N.

Woods Hole Oceanographic Institution
Purchase Order No. 795

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CHARTS:

Soundings taken in the Indian Ocean while *en route* to the Asiatic Station, in June, July, August, and September, 1883.

Soundings taken in the South Pacific Ocean on returning to the United States, in October, November, and December, 1885.

Soundings taken in the North and South Atlantic Oceans in 1883 and 1886.

DEEP-SEA SOUNDING.

INTRODUCTION.

STANDING against the wall of the Hydrographic Office are two large plaster casts showing the contour of the bottoms of the North and South Atlantic Oceans with their submarine peaks, plateaux, and depressions as revealed by deep-sea soundings. Prominent thereon are two submarine peaks in the South Atlantic Ocean and an extensive sand-bank several hundred miles from the coast of South America, which were discovered by the *Enterprise* while on a cruise around the world from 1883 to 1886 when deep-sea soundings were taken across the Atlantic, Indian, and South Pacific oceans. There is also shown to the northward of Porto Rico the deepest depression yet discovered in the North Atlantic, and into this the *Enterprise* sounded, bringing up a specimen of the bottom from a depth of 4529 fathoms, the position of the cast being within 40 miles of that taken by Commander Brownson in the *Blake*, which showed a depth of 4561 fathoms and which to this day remains the deepest cast ever taken in the Atlantic Ocean.

As little is known of the work of the *Enterprise*, I have concluded to publish a brief account of the voyage in so far as it relates to deep-sea sounding, thinking it may be of some interest to the naval service at large.

The sounding apparatus used was the Sigsbee Improved Sir William Thomson's, consisting of a reel with accumulator and a small reeling-in engine. This reel, which was of the ordinary service type of that day, was completely crushed while on the way to South Africa, and a new one, designed by Chief Engineer H. D. McEwan, was made at Cape Town by the mechanics on board ship, the only expense to the government being the cost of the material. This improved reel was in service during the remainder of the cruise, and was so strongly constructed that, without being injured, it reeled up a 60-pound shot from a depth of 2711 fathoms. It was made as follows: Two steel diaphragms were placed at equal distances between the two outer steel faces of the reel, and all parts thoroughly secured in place by through-bolts, the outer periphery upon which the wire was wound being also composed wholly of these bolts.

The specimen cups supplied were of different kinds, viz., Belknap's No. 1, No. 2, and No. 3, and Sigsbee's Improved Belknap No. 2. During the cruise other cups were used, the best of which, the "*Enterprise*," was a modified Belknap No. 2 made on board ship.

The wire was partly of American and partly of English manufacture, of No. 22 Birmingham gauge. The

sinkers were 8-inch shot weighing from 60 to 64 pounds each, with a hole through the centre sufficiently large to permit the entrance and free movement of the specimen cup.

A full description of the instruments, of the manner of using the machine, and of preparing the wire is found in "A Report on Deep-sea Soundings in the Pacific Ocean obtained in the United States Steamer Tuscarora by Commander George E. Belknap, U. S. N.," and in Lieutenant-Commander Charles D. Sigsbee's elaborate and valuable work on "The Methods and Appliances used on board the Coast and Geodetic Survey Steamer Blake."

As, however, the method of taking the casts by the Enterprise differed somewhat from that adopted by the officers of the Tuscarora and Blake, I will state briefly our own way of sounding.

The Enterprise cruised under sail, with propeller uncoupled; but as steam was necessary to insure a good cast it was our custom to haul up and furl the mainsail, if set, and start fires in two of the six boilers at least two hours before sounding. When steam was ready, sail was shortened and furled, the ship brought head to wind, the propeller "coupled up" by the engineer force below; hence by the time sail was furled the engines were ready for use. The navigator, who had everything in readiness to sound, would now relieve the officer of the deck of so much of his duties as pertained to the handling of the vessel, because, standing almost directly over

the wire, he was in the best position to see if it tended forward or aft, away from or under the ship, and hence with a judicious use of the helm he could keep the wire "up and down" by working the engines ahead or astern.

Sometimes, owing to a strong undercurrent or to the peculiar state of the sea in reference to the wind, it was difficult to keep the vessel in position, but this seldom happened.

When the wire had been reeled in, the ship was put on her course, sail made, fires hauled, and the propeller uncoupled. Lieutenant Geo. A. Norris, U. S. N., took each cast from the United States to the Straits of Sunda, or across the Atlantic and Indian oceans. He had been on similar duty with Commander Belknap in the *Tuscarora* in 1874. The *Tuscarora*, however, almost always had her stern to the wind and sea when a cast was taken (see report of *Tuscarora*'s soundings before referred to), while the *Enterprise* very seldom got in that position. In fact, on her homeward trip in 1885, while sounding in the high latitudes of the South Pacific between New Zealand and Cape Horn, it would have been impossible to run a line satisfactorily had it been necessary to lay the stern of the *Enterprise* to the wind and sea.

Lieutenant Adolph Marix, U. S. N., took the casts on the return voyage to the United States, Mr. Norris having become the executive officer.

Mr. Norris made use of the "foot-break" when sounding; Mr. Marix, after taking a few casts, discarded the

“foot-break,” but used a “friction line,” making one end of the line fast to the platform of the reel, then leading the free end over the friction groove in the direction in which the reel was turning, keeping hold of the line with his left hand. He could thus look about him with greater freedom and could control perfectly the movement of the reel and tell with certainty the instant the sinker struck bottom.

When sounding in the South Pacific it was found that the vessel could be kept in position with comparative ease, even in rough seas and during moderate gales, by using the spanker with sheet to windward, sometimes assisted by the main trysail with its sheet also to windward (thus keeping the wind slightly on the starboard bow), and by moving the engine ahead just enough to stem the wind and sea. Notwithstanding the heavy seas and bad weather in these high southern latitudes not a cast was omitted in the whole line.

I have copied freely from the log-book and my private journal in reference to this particular line, as it was run as far south as the sailing directions advised vessels to go at that season of the year on account of ice, and in a portion of the globe which has hitherto received little attention in the matter of deep-sea soundings. Even to this day (1892), more than six years having elapsed, *the charts do not show a single deep-sea cast to the southward of the line run by the Enterprise and but few soundings for some degrees of latitude to the northward.*

In the line run between Montevideo, Uruguay, and

Barbados in the West Indies, in 1886, many of the casts when within the tropics were taken with sails clewed up and topsail yards mast-headed, the breeze as a rule being light and the sea comparatively smooth, steam, however, being used as before. When the wire had been reeled in to about 2000 fathoms, sufficient sail was made to give the vessel a speed of not more than four knots; when in to 1000 fathoms, all sail was made and the propeller uncoupled. At Cape Town the upper platform of the accommodation ladder was fitted to ship on the starboard side of the vessel in line with but below the level of the bridge, forward of the smoke-pipe, and the sounding apparatus was transferred from the starboard gangway to the bridge. This was an improvement, and all casts after leaving Cape Town were taken with the reel in this position. When this change was made an iron pipe was fitted to lead from the main boilers of the ship to the small "reeling" engine, taking the place of the flexible rubber pipe formerly used. This engine being small required a pressure of 60 pounds of steam to reel in the cup from moderate depths, which of course necessitated keeping as high a pressure on the main boilers of the ship to which the steam-pipe was connected. As a result a greater steam-pressure was required to reel in the wire than to run the ship's engines while sounding. It would have been, therefore, more economical had we been furnished with a larger "reeling" engine,—one requiring a less pressure of steam.

The Enterprise had six cylindrical boilers. Two of

these were reserved for distilling water, and were seldom used for steaming except in cases of emergency, and it was my usual custom during the cruise to use only two boilers when steaming, as this number was found sufficient under favorable circumstances to drive the vessel six knots an hour on a daily consumption of six tons of coal.

The superiority of good bituminous coal for the work of sounding was clearly demonstrated. After many experiments it was proved that the most economical way to sound was to start fires for *each* cast, unless more than two were to be taken in twenty-four hours, and to haul fires as soon as the cast was finished, although for particular reasons fires were sometimes permitted to die out instead of being hauled. When anthracite coal was used, fires had to be kept banked between casts, which prevented the use of the mainsail, because with the smokepipe lowered (its usual position when cruising) the wind which was forced down the funnel would put out the fires; while with the smokepipe raised the mainsail could not be set. With bituminous coal, however, the mainsail could be used twenty hours out of the twenty-four, because fires were hauled as soon as the cast was taken.

Under favorable circumstances it required only about one-half ton of Cardiff coal for each cast, hence we invariably purchased soft coal after leaving the United States.

One thing more is worthy of note, viz.: notwith-

standing the fact that fires were started in the boilers so often, we *did not purchase a stick of cord-wood from the time the Enterprise left the Cape de Verde Islands until the end of the cruise, a period of over three years*, but started fires with empty boxes and barrels which, instead of being thrown overboard, were carefully saved for this purpose.

Particular mention is due to Lieutenant Geo. A. Norris, Lieutenant Adolph Marix, and Chief Engineer H. D. McEwan, whose intelligence, zeal, and devotion to duty could not be surpassed.

These officers were more intimately connected with the work than the others, Mr. Norris being the navigator on the outward, and Mr. Marix on the return voyage, while Chief Engineer McEwan personally superintended everything connected with his own department—keeping it in perfect order, besides assisting in other ways to the success of the work in hand.

CHAPTER I.

ASSUME COMMAND OF THE ENTERPRISE.

VOYAGE TO CAPE TOWN VIA CAPE DE VERDE ISLANDS.

ON the 4th of December, 1882, while in command of the monitor Montauk at League Island, orders were received detaching me from that vessel and directing me to proceed "without delay" to Norfolk, Va., to take command of the U. S. S. Enterprise. On the 8th of December I assumed command, relieving my old friend and classmate Commander E. M. Shepard, U. S. N.

The Enterprise had already been in commission about one year and had proved herself one of the fastest and most efficient vessels on the North Atlantic Station. She was a bark-rigged steam corvette of 1375 tons displacement. Her maximum speed under steam alone was 11.7 knots an hour, while under sail with a fair breeze and propeller uncoupled she could make from 7 to 10 knots according to the force of the wind and the state of the sea. Her battery consisted of one 150-pdr. rifle pivot; one 60-pdr. rifle, on topgallant forecastle; four 9-inch Dahlgren smooth-bore guns; one 3-inch B. L. rifle; one Gatling gun; two howitzers for use in boats and for saluting purposes. She carried 195 officers, sailors, and marines.

To gather information concerning foreign ports and to show the flag where it had not been seen for years, if indeed ever before, the Department had adopted the wise policy of sending our men-of-war to join their stations by different routes. The Enterprise had been assigned to the Asiatic Station, and the route selected was *via* the Cape de Verde Islands and Cape of Good Hope. From the Cape we were to cruise along the coast of South Africa, thence to Madagascar, thence to the Comoro Islands and Zanzibar. From Zanzibar we were to cross the Indian Ocean to the Straits of Sunda, and from thence proceed to China, touching at Borneo and other places.

As this cruise would afford an excellent opportunity to add to our knowledge of the ocean's bed, a deep-sea sounding apparatus was put on board, with cups, sinkers, wire, etc., and instructions were given to sound on the way out, if practicable, at intervals of 100 miles.

Pamphlets were mailed from the Smithsonian Institution treating of the manner of stuffing birds, preserving fishes, etc., and a hope was expressed by letter that we might be able to collect valuable specimens for the National Museum ; but no alcohol, jars, or instruments came with the letter, neither was authority given to purchase any.

We were directed to swing ship every 15 degrees of latitude and longitude made good, and also when on the magnetic equator ; to swing first with starboard helm, then with port helm, and occasionally with the vessel

listed from 6 to 10 degrees, care to be taken to "keep steady" on each point at least four minutes. These instructions were issued for three purposes: (1) to find our own compass errors; (2) to familiarize the officers with the method employed in swinging iron ships; and (3) to ascertain the magnetic variation in various parts of the world.

After taking our powder on board at Fort Norfolk, we weighed anchor on the 28th of December, 1882, steamed to Lynn Haven Bay in the Chesapeake, and awaited a favorable opportunity to swing ship. Bad or cloudy weather detained us for several days, but at last the required observations were made successfully.

I will here state that to heel the ship 7° without moving the guns, it was found necessary to shift over to the starboard side all the extra coal which we had in bags on deck, empty the port boilers of water, and lower the port boats, hanging them by tackles to the starboard fore and main yard-arms.

Our last letters were sent to Norfolk by a light-house tender which was entering the bay, and on the 2d of January, 1883, we proceeded to sea, passing Cape Henry at 5.30 P. M.

The navigator had already spliced together and reeled off more than 6000 fathoms of sounding wire, and had set up the reel and engine in the starboard gangway ready for work.

The passage to the Cape de Verde Islands was an unusually stormy one, even for the month of January.

the weather at the start being gloomy and disagreeable.

On the 7th a gale sprung up from the S.S.W., which was followed by a succession of heavy gales in the Gulf Stream on the 10th, 11th, 12th, and 13th, veering from the S.W. to N.N.W., accompanied by high and irregular seas. The ship, laden with provisions, stores, and a deck-load of coal, rolled deeply.

On the 10th the second cutter was struck by a heavy sea and torn from her davits.

On the 16th of January it became sufficiently smooth to warrant taking a cast. The reel and engine, which on the appearance of bad weather had been taken in-board, were again mounted on the flying platform and secured in the starboard gangway, with outer end projecting sufficiently over the side of the ship to allow the wire to run clear.

As the apparatus had not been tried previously, the first cast was taken under difficulties. The machine worked stiffly and the connecting hook of the leather belt broke several times. Then an improvised manila belt was tried, but, failing to give satisfaction, was replaced by the original leather belt, which in the mean time had been repaired by discarding the hooks and securing the ends together.

A depth of 2854 fathoms was found in lat. $35^{\circ} 35' N.$, long. $48^{\circ} 22' W.$ Character of bottom, gray ooze, with sand and small shells. The whole time occupied in this our first cast was nearly five hours.

On the 19th the second cast was taken in 2166 fathoms, lat. $31^{\circ} 12' 47''$ N., long. $42^{\circ} 34' 48''$ W. Character of bottom, gray ooze, with sand and minute shells.

While reeling in, the flange opposite the V-groove tore with a loud report for a distance of nearly 18 inches, although the reel was not subjected to an unusual strain. The fracture was in the metal itself, not at the welding, and in the line of the washers to the outer row of bolts. At the time of the accident 1900 fathoms were out and everything was working smoothly. Fortunately the wire did not part. The reel was repaired on board by bolting securely to it a sheet-iron band 4 inches wide and $\frac{1}{4}$ inch thick, cut to coincide with the outer circumference of the flange.

On the 22d, 23d, and 24th a heavy gale, beginning at the northward and westward and ending at about E.N.E., was experienced, making it necessary to lie to for the greater part of the time.

On the 27th the reel was repaired and the third cast taken in 2698 fathoms, lat. $27^{\circ} 37' 57''$ N., long. $33^{\circ} 56' 45''$ W. Character of bottom the same as in the last cast, viz., gray ooze, with sand and minute shells. The belt parted while reeling in, and a new one was tried. The whole time occupied in taking this cast was 2 hrs. 29 min.

On the 28th the fourth cast was taken in 3093 fathoms, lat. $26^{\circ} 47'$ N., long. $31^{\circ} 58'$ W. Bottom, red ooze, mixed with sand and shells.

In the above four casts the Miller-Casella self-regis-

tering thermometer was used to ascertain the temperature of the bottom, the results being 36° , $36\frac{1}{4}^{\circ}$, 36° , and 37° Fahr., respectively, the surface temperatures being 66° , 69° , 71° , and 72° Fahr.

These were the only casts taken before reaching the Cape de Verdes, but they had served to demonstrate the weakness of the reel and the bad working of the leather belts.

We arrived at St. Vincent, Porto Grande, before daylight on the morning of the 2d of February, 1883, and as soon as possible filled up with excellent Welsh coal, taking twenty-five tons on deck. The usual visits of ceremony were made while the vessel was fitting for sea.

The importance of St. Vincent as a coaling station can scarcely be overestimated. It has cable communication with the continent and lies directly in the route of steamers running from Europe to South America and other portions of the globe. During the year 1882, 180,000 tons of coal were supplied to steamers touching at this port.

When the *Enterprise* visited St. Vincent no drinking-water could be obtained except what was distilled on shore, but I understand that good fresh water is now conducted through pipes from the mountains to the harbor.

On the 8th of February the *Enterprise* left St. Vincent for Porto Praya, where she arrived on the following day, having taken two casts *en route*, viz., one on the

8th, in 1471 fathoms, lat. $16^{\circ} 35'$ N., long. $24^{\circ} 52'$ W., the bottom being red sand mixed with shells; and the other on the 9th, in 1061 fathoms, lat. $14^{\circ} 57'$ N., long. $23^{\circ} 51'$ W. Owing to the carelessness of the attendant his guiding-rod slipped and 703 fathoms of wire were lost with the specimen-cup. Before entering port the ship was swung for compass deviations, after which we exercised at target-firing. We remained at Porto Praya just long enough to make official calls and to lay in fresh provisions.

Porto Praya is also an important coaling station, 60,000 tons of coal having been delivered to steamers during the year 1882. It has the advantage over St. Vincent in respect to supplies. Fruit and poultry abound, and fresh water is conducted from the mountains in the interior through pipes to a large cistern in town.

A contract for laying a submarine cable to the continent had just been signed, and the cable has since been successfully laid.

On the afternoon of the 10th we sailed from Porto Praya for Cape Town, finding the northeast trade winds fairly strong when away from the land.

A course was shaped to cross the equator between 25° and 26° west longitude, and before night a cast was taken in 2742 fathoms, lat. $12^{\circ} 10'$ N., long. $23^{\circ} 45'$ W.

In reeling in, the composition part of the specimen-cup, Belknap No. 2, became unscrewed, and the specimen was lost.

On the 12th the trade winds became lighter, but the

ship made fair speed under port studdingsails. In the afternoon we sounded in 2668 fathoms, lat. $9^{\circ} 28' N.$, long. $24^{\circ} 08' W.$ The cup used was Sigsbee's improved Belknap No. 2, and a good specimen was obtained of gray ooze mixed with sand and minute shells.

The flexible pipe leading from the main boilers to the small reeling-engine showed signs of weakness, and to strengthen it the pipe was covered with canvas and served over with marline.

On the 13th the trades were very light, but the weather was delightful. In the afternoon we sounded in 2509 fathoms, lat. $7^{\circ} 16' N.$, long. $24^{\circ} 24' W.$ The cup brought up a large specimen of minute shells of different colors and shapes, giving off a peculiar odor resembling that of clams. These shells had every appearance of being alive, and the specimen as a whole differed from all others. After being exposed to the air for some hours the shells would gradually change color, become lighter and lighter in appearance, and a portion of the specimen exposed for a day became white and chalky.

On the 14th sounded in 2307 fathoms, lat. $5^{\circ} 27' 25'' N.$, long. $24^{\circ} 33' 18'' W.$ Tried a new belt of rattling stuff and changed the action of the engine to obviate the necessity for crossing the belt. This was found to be an improvement, and was continued during the rest of the cruise. While reeling in, the wire parted at a splice, causing the loss of over 2000 fathoms. The wind had now become so light that it was decided to get up steam.

On the 15th a cast was taken in 2339 fathoms, lat. $3^{\circ} 29' 47''$ N., long. $24^{\circ} 46' 34''$ W.—character of bottom, dark gray ooze mixed with sand and shells—and the ship was swung for compass deviation early in the morning and again in the afternoon. We ran out of the N.E. trades before night.

On the 16th, at 2 P.M., sounded in 2213 fathoms, lat. $0^{\circ} 55' 25''$ N., long. $25^{\circ} 04' 38''$ W., the specimen-cup bringing up a gray ooze, mixed with sand and a few shells. We continued under steam as the breeze was very light from the southward and eastward, and before night struck below the last of the coal which had been stowed in bags on deck at Porto Grande.

On the 17th, after crossing the equator, we sounded in 1919 fathoms, lat. $0^{\circ} 06' 08''$ S., long. $26^{\circ} 35' 27''$ W.; gray ooze mixed with sand and shells—the same character of bottom as on the 16th, although there was a material change in depth.

At 10 P.M. sail was made to a light breeze from the S.E.

On the 18th, at 2 P.M., sounded in 2627 fathoms, lat. $1^{\circ} 33' 00''$ S., long. $27^{\circ} 43' 45''$ W. After reeling in a few turns the wire parted from no apparent cause, as it was leading “up and down” and no signs of a kink could be found, causing the loss of 2600 fathoms of wire and our last deep-sea thermometer. Spoke an English bark 72 days from Port Adelaide, and sighted another vessel in the distance.

On the 20th, at 4 P.M., sounded in 2803 fathoms,

lat. $4^{\circ} 06' S.$, long. $29^{\circ} 04' 22'' W.$; brown mud with occasional small shells—a decided change in the character of the bottom since the last specimen was taken. The southeast trades were well to the southward and very light.

On the 21st, sounded in the afternoon in 2801 fathoms, lat. $5^{\circ} 28' S.$, long. $30^{\circ} 14' 22'' W.$ In reeling in, the belt, which had shown no signs of weakness, parted suddenly, causing the wire to jump from the reel, thereby losing 2687 fathoms of wire and our last specimen cup. A new belt of rattling stuff was fitted and an improvised specimen cup made as follows: A piece of $1\frac{1}{2}$ -inch iron pipe was cut to the right length, one end pointed, and a large hole made in the side. The detacher was screwed into a nipple secured in the upper end of the pipe, and a tin sleeve was fitted with a wire spring to cause it to close over the aperture in the cup when the sinker was detached. This cup was therefore a modification of the Belknap No. 1.

On the 22d the ship was dressed with flags at the mastheads and peak, and at noon a salute of twenty-one guns was fired in honor of Washington's birthday.

The next cast was taken on the 24th in 2898 fathoms, lat. $10^{\circ} 25' S.$, long. $32^{\circ} 19' 36'' W.$, the cup just described bringing up a specimen of brown ooze.

Being near the magnetic equator on the afternoon of the 25th, the ship was swung with port helm for compass deviations.

On the 26th we swung ship in the afternoon with

starboard helm, having sounded in the morning in 2561 fathoms, lat. $14^{\circ} 27' 40''$ S., long. $33^{\circ} 46' 45''$ W.; brown ooze mixed with a few shells. We had experienced beautiful sunsets for several days, but I think I never before saw such a glorious one as that which we beheld this evening.

On the 27th sounded in 2492 fathoms, lat. $15^{\circ} 27' 30''$ S., long. $33^{\circ} 57' 19''$ W., the cup bringing up a yellowish-brown ooze.

On the 28th we sounded in the morning in 2498 fathoms, lat. $16^{\circ} 30'$ S., long. $33^{\circ} 46'$ W.; yellowish-brown ooze.

On March 1st sounded in 2498 fathoms, lat. $17^{\circ} 42' 10''$ S., long. $33^{\circ} 26' 26''$ W.; again yellowish-brown ooze.

It is worthy of note that the last two casts were the same to a fathom and differed from that taken on the 27th by only six fathoms; also, that the character of the bottom was the same.

The usual drills of a man-of-war were kept up rigorously throughout the cruise, notwithstanding the extra work of sounding. I find noted in my journal: "In the afternoon had dress parade. Our companies did very well indeed. I am proud of the apprentice-boys; the most of them are fine fellows."

Let me add here that nearly nine years have passed since that entry in my journal. Of the apprentices of whom I was so justly proud some are now efficient warrant officers in the Navy, and others are filling impor-

tant positions as petty officers. Several who have left the service are well-to-do business men; and of these, one whom I met a year or two ago told me that the experience which he had gained in the Navy had been of the greatest service to him.

On the 2d, at 8 A.M., sounded in 2319 fathoms, lat. $19^{\circ} 06' 27''$ S., long. $32^{\circ} 40'$ W., the bottom having changed to a brown mud.

On the 3d sounded in 2475 fathoms, lat. $20^{\circ} 11' 43''$ S., long. $31^{\circ} 54' 18''$ W.; yellowish sticky brown mud. The sleeve of the specimen-cup did not close, and the specimen brought up was small.

On the 5th, at 7.30 A.M., sounded in 2892 fathoms, lat. $22^{\circ} 24' 53''$ S., long. $29^{\circ} 54' 27''$ W. Character of bottom, brown ooze.

On the 6th, at 8 A.M., a cast was taken in 3020 fathoms, lat. $23^{\circ} 46' 20''$ S., long. $28^{\circ} 54' 20''$ W.; yellowish brown ooze. The specimen-cup used was one devised and made by Robert Knight, the blacksmith of the ship, being a little different from those which had hitherto been made on board. It brought up a large specimen.

On the 7th sounded in 2999 fathoms, lat. $24^{\circ} 54'$ S., long. $28^{\circ} 18' 16''$ W.; dark brown mud.

On the 8th sounded in 2908 fathoms, lat. $25^{\circ} 53' 18''$ S., long. $28^{\circ} 09' 39''$ W. The specimen brought up was chocolate-colored sticky mud.

On the 9th sounded in 3147 fathoms, lat. $26^{\circ} 56' 08''$ S., long. $27^{\circ} 44' 40''$ W.; dark-brown sticky mud, chocolate color. The reel showed signs of distress for the

first time since it was repaired, the after face beginning to cave in.

On the 10th a cast was taken in 2288 fathoms, lat. $28^{\circ} 49' 47''$ S., long. $27^{\circ} 30' 27''$ W. No specimen was recovered, but the bottom of the cup was bright, showing that it had struck hard bottom, probably rock. The ship was swung in the afternoon with port helm.

On the 11th, early in the morning, we swung ship with starboard helm, and then sounded in 2509 fathoms, lat. $29^{\circ} 52' 57''$ S., long. $27^{\circ} 23' 04''$ W.; light brown mud mixed with minute shells.

On the 12th we again swung ship early in the morning with starboard helm, and then sounded in 2537 fathoms, lat. $30^{\circ} 22' 18''$ S., long. $26^{\circ} 12' 54''$ W.; hard bottom. The only specimen recovered was a small piece of half-formed rock, yellowish inside and black outside, but dark specks were also found on the bottom of the cup.

On the 13th, at 4 P.M., sounded in 2530 fathoms, lat. $30^{\circ} 42' 16''$ S., long. $24^{\circ} 24' 26''$ W., the cup bringing up a stiff light-brown mud mixed with minute shells.

On the 14th sounded in 2511 fathoms, lat. $31^{\circ} 01' 36''$ S., long. $22^{\circ} 46' 15''$ W., finding the same bottom as yesterday.

The weather had been delightful, as a rule, from the time we left Porto Praya until this date, but there being indications of bad weather, I had another cast taken in the afternoon in 2372 fathoms, lat. $31^{\circ} 08' 28''$ S., long. $21^{\circ} 57' 30''$ W., in bottom of light-brown mud.

On the 15th a gale set in from the northward and westward; nevertheless, we succeeded in getting a good cast in the morning, although the sea was rough. Found a depth of 2351 fathoms, lat. $31^{\circ} 23' 40''$ S., long. $19^{\circ} 43' 16''$ W., the bottom being of light-brown mud. In the afternoon, owing to the increasing gale, the ship was hove to under close-reefed main top-sail.

On the morning of the 16th, the wind having veered to the southward and westward, she was put on her course; but it was not smooth enough to sound again until the 18th, which was a great disappointment to us, as an interesting portion of the South Atlantic Ocean had been reached where I desired to take a number of casts; but the length of the route, together with the limited amount of coal and provisions on board, made it necessary to take advantage of the favoring winds.

On the 18th sounded in 1700 fathoms, lat. $30^{\circ} 35' 02''$ S., long. $12^{\circ} 49' 03''$ W.; bottom of light-brown mud. The sea was long and moderately rough and the ship rolled deeply, but the cast was an excellent one.

On the 19th sounded at 1 P.M. in 1364 fathoms, lat. $31^{\circ} 12' 16''$ S., long. $12^{\circ} 38' 53''$ W., finding black mud mixed with scoria; and again at 6 in the afternoon, in 1507 fathoms, lat. $31^{\circ} 15' 16''$ S., long. $12^{\circ} 19' 32''$ W., in a bottom of hard black mud.

On the 20th, at 7.35 A.M., sounded in 1864 fathoms, lat. $31^{\circ} 38' 42''$ S., long. $12^{\circ} 05' 28''$ W. The character of the bottom had undergone a wonderful change within

a few miles, viz., from hard black mud to white ooze mixed with shells.

Being now near the position of "Grant's Breakers," as shown on the chart, we continued under steam, and at 1.30 P.M. sounded directly over the spot, in lat. $31^{\circ} 37' 29''$ S., long. $11^{\circ} 29' 22''$ W. Found a depth of 1919 fathoms, *hard* bottom—again a decided change in character, although comparatively near the position of the last cast. We had undoubtedly crossed a submarine ridge during the last twenty-four hours.

On the 21st, at 8.15 A.M., sounded in 2050 fathoms, lat. $31^{\circ} 57' 20''$ S., long. $9^{\circ} 43' 26''$ W., finding hard bottom.

On the 22d, at 7.30 A.M., sounded in 2314 fathoms, lat. $32^{\circ} 03' 48''$ S., long. $7^{\circ} 09' 22''$ W., hard bottom; and at 6 P.M., in 2308 fathoms, lat. $32^{\circ} 11' 31''$ S., long. $6^{\circ} 03' 58''$ W., this time finding white ooze mixed with sand and shells—again a most noticeable change in the character of the bottom.

The specimen-cup used in this cast was a modification of Belknap No. 2, designed by Chief Engineer McEwan.

On the 23d, at 7.30 A.M., we sounded in 2008 fathoms, lat. $32^{\circ} 19'$ S., long. $4^{\circ} 23' 34''$ W., hard white sand, and in the afternoon began to swing ship, but before the observations could be completed masses of clouds formed which obscured the sun. At 6.30 P.M. we again sounded in 2353 fathoms, lat. $32^{\circ} 26'$ S., long. $3^{\circ} 23' 32''$ W.; white sand and shells. While reeling in,

the wire came in contact with a fish, of which small bits of the skin and flesh were found on the upper end of one of the splices.

On the 24th the ship was swung with starboard helm, beginning shortly after sunrise. At 9 A.M. a cast was taken in 2343 fathoms, lat. $32^{\circ} 24' S.$, long. $1^{\circ} 32' 52'' W.$, white sand and shells; and at 6 P.M. another in 1255 fathoms, lat. $32^{\circ} 30' S.$, long. $0^{\circ} 27' 46'' W.$; white sand. The depth being so much less than that found in the morning, still another cast was taken at 11 P.M. in 979 fathoms, lat. $32^{\circ} 33' 20'' S.$, long. $0^{\circ} 00' 20'' East$; white sand. We were evidently crossing another submarine ridge; hence about four hours later, at 4.15 A.M. on the 25th, we sounded in 2492 fathoms, lat. $32^{\circ} 41' 54'' S.$, long. $0^{\circ} 41' 04'' E.$; light brown ooze.

As ranges of mountains are sometimes found on land in close proximity to each other and running in nearly parallel lines, I thought it possible there might be a second submarine range near the one over which we had just passed, and gave orders to sound again at 1.30 P.M. The result was startling. A depth of only 731 fathoms was found, or *two statute miles* less than the last cast! Lat. $32^{\circ} 48' 25'' S.$, long. $1^{\circ} 47' 34'' E.$, the character of the bottom being white coral, sand, and shells.

Such a remarkable change in depth gave us reason to think that breakers *might* exist somewhere in this part of the South Atlantic after all, and a bright look-

out was kept. Of course it was impossible to state whether or not we had sounded over the highest point of this submarine peak. At 3.15 P.M. another cast was taken about ten miles from the last position, but the depth had increased to 1203 fathoms, lat. $32^{\circ} 49' 25''$ S., long. $1^{\circ} 59' 28''$ E; white coral, sand, and shells. Again at 6.15 P.M. we sounded in 1724 fathoms, lat. $32^{\circ} 50' 54''$ S., long. $2^{\circ} 19' 09''$ E., the character of the bottom being still the same,—white coral, sand, and shells.

Although this was such an interesting locality for our work we were obliged to press on, having but *six bags of bread* remaining on board for a crew of nearly two hundred men. Our salt beef and pork, and in truth all other provisions, were nearly exhausted, and still we had more than 800 miles to run to reach Cape Town.

On the 26th, at 7.45 A.M., sounded in 2765 fathoms, lat. $33^{\circ} 14' 45''$ S., long. $4^{\circ} 29' 18''$ E.—brown ooze; and again at 6 P.M. in 2938 fathoms, lat. $33^{\circ} 24' 33''$ S., long. $5^{\circ} 52' 57''$ E., finding the same kind of bottom—brown ooze.

When the wire was reeled in there were found on the grommet at the end two long worms, alive, and resembling ordinary earth-worms except in respect to their heads. One was 26 inches long and the other $19\frac{1}{2}$ inches. We were 600 miles from any known dry land. It was impossible to tell whether they came from the bottom or were caught by the grommet near the surface, but they were considered of sufficient importance to preserve in alcohol and send to the Smithsonian Institution.

The condition of the reel had been growing worse ever since the 9th instant, when it first showed signs of distress, and fears were entertained that it might give out entirely before reaching Cape Town. The greatest care was therefore taken in using it. There being indications of a gale, and wishing to keep ahead of and, if possible, avoid it, I used steam and sail and made from 10 to 11 knots an hour.

On the 27th, at 7.30 A.M., sounded in 2855 fathoms, lat. $33^{\circ} 48' 46''$ S., long. $8^{\circ} 29' 02''$ E.—brown ooze; and again at 4.30 P.M. in 2773 fathoms, lat. $33^{\circ} 56' 39''$ S., long. $9^{\circ} 52' 24''$ E.—brown ooze.

On the 28th, at 7.30 A.M., a cast was taken in 2596 fathoms, lat. $34^{\circ} 00'$ S., long. $12^{\circ} 17' 38''$ E. Character of bottom the same as for the last few days, viz., brown ooze.

In the afternoon the ship was swung for compass deviations.

On the 29th the gale overtook us, but before the sea became too rough we sounded in 2231 fathoms, lat. $34^{\circ} 04'$ S., long. $15^{\circ} 49' 11''$ E.; light brown ooze.

Soon after this cast was taken the ship was brought to the wind under storm sails, on account of the increasing gale, and as but little coal remained in the bunkers I did not deem it wise to expend any to assist in riding out the storm. The gale was what is called a "black southeaster," with very heavy gusts from the southward. Entered in my journal are these words: "*The last bag of bread was served out to the crew to-day.*"

On the morning of the 30th the gale broke, and we proceeded under steam. The sea was so rough that we were unable to make more than four knots an hour with the necessarily limited allowance of coal. Cape Town was still 120 miles distant.

During the night the wind and sea subsided, but a fog set in which at times was very dense.

On the 31st sounded in 110 fathoms, lat. $34^{\circ} 10'$ S., long. $18^{\circ} 11'$ E.; sand and black specks. The weather was still foggy, but the nearer we approached land the thinner the fog became. At last Table Rock loomed up through the mists, and at 10.18 A.M. the ship was anchored under the breakwater in Table Bay, Cape Town, and the British flag saluted with twenty-one guns.

We had been three months and three days from Norfolk, Va., and forty-nine days from the Cape de Verdes. *Only three tons of coal were left in the bunkers. Not a single bag of bread remained,* and but one or two barrels of beef and pork. From the Cape de Verde Islands to Cape Town we had sailed 5608 miles following the route of sailing-vessels, had taken 53 casts, 41 of which were between two and three and one-half (2 and $3\frac{1}{2}$) statute miles in depth. The last 44 casts were taken without loss of wire or any accident.

In 1876, H. M. S. Challenger ran a line of soundings between Tristan d'Acunha and the Ascension Islands, demonstrating the existence of a submarine ridge connecting those two islands. The varying depths found between 28° west longitude and Cape Town

incline me to believe that another submarine range, and possibly more than one, may be found to run nearly parallel to the above, but a few hundred miles to the eastward, to which the submarine peaks revealed by our casts of 731 and 979 fathoms and the island of St. Helena may belong. Future investigations of the depths of the sea in that part of the South Atlantic will be of great interest.

CHAPTER II.

VOYAGE FROM CAPE TOWN TO CHINA.

SIMONS BAY.—PORT ELIZABETH.—NATAL.—MADAGASCAR. — COMORO ISLANDS. — ZANZIBAR. — SEYCHELLE ISLANDS.—STRAITS OF SUNDA.—WARNED BY A DUTCH MAN-OF-WAR OF THE DANGERS TO NAVIGATION OCCASIONED BY THE ERUPTION OF KRAKATOA.—DESTRUCTION OF ANJER. —ARRIVAL AT BATAVIA.—SINGAPORE.

WE remained at Cape Town until the 8th of May, enjoying, as only those who have passed weeks at sea can enjoy, the products of the farms and vineyards, and, above all, the refinements of cultivated society. We were received with great kindness by the Governor, Sir Hercules Robinson, and by the leading officials and citizens of the place, and in a modest way we tried to reciprocate their hospitality. Our stay was somewhat prolonged, that a boat might be built to replace the cutter lost during the gale of the 17th of January. After filling up with coal and provisions and getting the new boat, we said good-by to our friends, and on the 8th of

May left for Simons Bay, where we arrived the following day, anchoring off the Naval Station. Here we remained until the 11th, long enough to win a boat-race, then sailed for Port Elizabeth, South Africa, and anchored in Algoa Bay (Port Elizabeth) on the 14th.

An agreeable surprise awaited us. We came with vague ideas of this part of South Africa, but we found a fine city, whose inhabitants are as enterprising and hospitable as any in the world. They had converted a rocky wilderness into a garden, had tapped the distant mountains and brought fresh water to their doors, had built railroads to points in the interior hundreds of miles distant ; in short, had overcome all obstacles except the treacherous sea, and a portion of that will doubtless soon be captive if a breakwater and docks are built on plans already approved by competent engineers. Large ocean steamers arrive and depart with regularity, and the trade of the place is already great.

It was stated that an American man-of-war had not touched there for years. The *Vanderbilt* looked in during the Civil War, in 1863, when in search of the *Alabama*, but did not anchor.

It was odd to find peoples representing distinct and opposite types of civilization so closely associated. The whites live chiefly in town, while the blacks (Kaffirs) live in native villages within a short distance of the city, and retain to a large degree their native customs both in dress and mode of life. Photographs taken of some of the chiefs while standing before their huts surrounded

by their wives and children, though possessing artistic merit, could hardly be shown with propriety in a mixed company, and yet from the native point of view they are perfectly proper. Blacks are engaged to discharge and load ocean steamers, and when thus employed they divest themselves of all clothing.

After an agreeable stay at this place of nearly two weeks, we left on the 26th for Durban (Port Natal). As we skirted this part of the coast of South Africa, we called to mind the fact that nearly every point of prominence is named after some officer or seaman who died while engaged in its survey, or after civilians who were prominent among the early settlers, the city of Port Elizabeth itself being named in memory of the devoted wife of Acting Governor-General Donkin, who "traced out the town."

It is less than seventy years since Captain Owen, of the Royal Navy, and his small surveying party exhibited to a marked degree the skill and endurance which characterize the Anglo-Saxon. It is stated in "Owen's Voyages" that in seven months from the time the surveying party "last quitted the Cape" (Cape Town) "*two-thirds* of the officers and *one-half* of the seamen had fallen victims to the fever," but the work did not stop.

On the 29th the Enterprise arrived off Port Natal. A strong breeze was blowing, which caused a heavy swell to set in, making it impracticable to send a ship's boat on shore. Indeed, it is usually so rough on the

bar that ships' boats are seldom used, but surf boats built for the purpose are employed instead.*

The same cordial hospitality which we had experienced in other parts of South Africa was extended to us here. So far as could be learned, the *Enterprise* was the first United States man-of-war to visit this colony. Although we remained only long enough to fill up with coal and lay in some fresh provisions, still it was my good fortune to meet nearly all the American missionaries stationed in this part of South Africa. It came about in this way. They were assembled at Isipingo at an annual convention, and on hearing of the arrival of the *Enterprise*, the general assembly sent a letter to Durban by one of their number, the Rev. Mr. Wilder, inviting the officers to visit them. It was the day before sailing, and all who were on shore were busy laying in mess stores, and there was not sufficient time to communicate with the ship. Fortunately I was at the consulate when Mr. Wilder arrived. Mr. Cato, our distinguished consular agent, earnestly seconded the invitation and kindly volunteered his company; hence, after luncheon we drove to Isipingo, about ten miles distant, and there took the conveyance that had been sent to meet us. Another drive of eleven miles over a very rough road brought us a little after dark to the Adams Mission, where—including children—nearly forty

* The harbor has been greatly improved since the visit of the *Enterprise*. Extensive breakwaters are being constructed and docks built capable of accommodating a large number of ships; vessels drawing 15 feet are now taken into the inner harbor.

Americans were assembled ; a fine body of intelligent, cultivated, and earnest workers. A very enjoyable evening was passed, and at daylight the next morning we started on horseback for Isipingo Station, arriving there in time to take the train for Durban. I was delighted with this visit, though so very brief, and it gives me pleasure to state that the labors of these missionaries were greatly appreciated not only by the natives but by the government itself. Of this I was assured by several intelligent and disinterested gentlemen.

On the 1st of June the Enterprise left Port Natal with thirty tons of coal on deck, and on the 7th arrived at Nos Vey, a small island near the coast of Madagascar, where several European traders have their store-houses.

Six casts were taken while crossing Mozambique Channel, as follows :

On June 1st in 824 fathoms, lat. $29^{\circ} 46'$ S., long. $31^{\circ} 58' 48''$ E.—bluish mud, sand and shells ; on the 2d in 1325 fathoms, lat. $29^{\circ} 44' 30''$ S., long. $33^{\circ} 26'$ E.—light brown mud, sand, and shells ; on the 3d in 1107 fathoms, lat. $29^{\circ} 51' 10''$ S., long. $35^{\circ} 46' 45''$ E.—gray sand and shells ; on the 4th in 2607 fathoms, lat. $28^{\circ} 52' 25''$ S., long. $38^{\circ} 17' 30''$ E.—no specimen ; on the 6th in 1985 fathoms, lat. $24^{\circ} 49' 47''$ S., long. $42^{\circ} 52' 45''$ E.—light brown ooze ; and on the 7th in 935 fathoms, lat. $23^{\circ} 51' 10''$ S., long. $43^{\circ} 31' 42''$ E.—light brown ooze.

We remained here one day, then steamed to San Augustine Bay, a distance of about eight miles from Nos

Vey. Before reaching the anchorage, which was very close to the shore, three casts were taken in the bay, in depths of 337, 520, and 338 fathoms ; dark brown mud.

On the 9th we left San Augustine for Tullear Bay, fifteen miles distant, where we remained several days, taking advantage of the sea-breeze and smooth water in this well-protected and superb bay to exercise the crew in fleet tactics with boats, and at target-practice with great guns.

This coast is the only one I have visited in late years where money is of little or no use and where empty bottles, *provided they can stand on their own bottoms*, will purchase poultry and other supplies. Soda bottles were of no value whatever.

The people are savages, armed with spears and such old guns as traders have been accustomed to exchange for the products of the country. It was in this neighborhood that an American and a Frenchman were killed the year previous to our arrival.

We left Tullear Bay on the 15th, and during the afternoon sounded in 569 fathoms, lat. $23^{\circ} 20' 15''$ S., long. $43^{\circ} 35'$ E.; brown mud.

On the 16th sounded in 587 fathoms, lat. $22^{\circ} 07'$ S., long. $42^{\circ} 59' 30''$ E.—yellowish-brown mud, sand ; and on the 17th again sounded in 872 fathoms, lat. $20^{\circ} 22' 30''$ S., long. $43^{\circ} 45' 30''$ E.—yellowish-brown mud—and swung ship for compass deviations, arriving off Mourondava after dark.

We had now reached a part of Madagascar which

was under the rule of the Hova government, and a faint resemblance to civilization was found. I at once communicated with our consular agent, a man of very eccentric habits, and before leaving entertained him and the Governor of the province on board ship.

On the evening of the 20th we sailed from Mourondava, and on the 22d reached Mainterano, a trading station on the coast of Madagascar, situated in Sacalava territory. Here we met an American from New England who had professed the faith of Mohammed and who seemed to be sincere in his belief, having married a Mohammedan wife.

On the 23d we left Mainterano under sail, and on the 24th sounded in a dead calm without getting up steam, finding bottom in 1445 fathoms, lat. $15^{\circ} 32'$ S., long. $44^{\circ} 10' 45''$ E.; light brown mud. This completed our deep-sea work in the Mozambique Channel. We then skirted the coast of Madagascar, finding in lat. $15^{\circ} 44' 15''$ S., long. $45^{\circ} 30' 30''$ E., quite an extensive shoal which was not on the chart, Cape Tanzon bearing about E.S.E. $\frac{1}{8}$ E., distant 12 miles. The least water found was $3\frac{3}{4}$ fathoms, but as there was not time to survey it thoroughly there may be still less water on some portions of the shoal. We anchored after dark, and on the morning of the 26th steamed into the harbor of Majunga. Knowing that for some time before our arrival in these waters the French had been at war with the Hovas, we were not surprised to find two French men-of-war in port,—the “Vaudreuil” and the “Pique,”

—or to learn that the French had laid claim to this part of Madagascar. We were told that a French fleet of five vessels had bombarded the place on the 16th of May, dismantling the fort and destroying the Hova settlement. I visited the fort and deserted village, and among the ruins picked up a Hova grammar and a mutilated copy of the “Moody and Sankey” hymn book printed in the Malagasy language.

How little do we realize the changes that have taken place within this century ! Less than seventy years ago this people had no written language, but now, thanks chiefly to the missionaries, they not only have books printed in their own tongue, but their children are by law compelled to go to school.

On the 27th of June we left Majunga, and on the 28th reached Nossé Bé, steaming into one of the many magnificent bays of Madagascar.

The scenery was inspiring ; the mountain peaks and sloping green hills were reflected in the smooth waters of the bay, forming a picture of surpassing beauty. The French have been established at Nossé Bé for years, and have made it the seat of government.

On the following day, after visiting the Governor, we took a walk through the native portion of the town, and as the day was very hot and the town dirty we thought its name—Hellville—a very appropriate one.

We were, however, fortunate enough to find a merchant who had a small quantity of coal which he was willing to sell at a fair price, and on the 29th took on board about

forty tons, and towards evening steamed out of the harbor.

We had now reached that portion of the globe where it was necessary to swing ship careened at least 7° . To do this I had directed that enough of the coal should be dumped in the starboard gangway to give the desired list. Twenty or more tons were thus disposed of and we left the harbor careened $7\frac{1}{2}^{\circ}$ to starboard, doubtless much to the surprise of the people on shore who were accustomed to see men-of-war arrive and depart neat and trim in appearance. When the required observations were completed it was almost sunset, and in order to be prepared the following morning to swing again on an even keel the coal was struck below and stowed in the bunkers after dark. The dust penetrated every part of the ship, but we were now schooled into such a happy frame of mind that, in the interests of science, we could put up with anything!

On the 30th of June, the remaining observations on an even keel having been completed, we left for Tamatave prepared to encounter the very strong head-winds which usually blow at this season along the east coast of Madagascar, but fortunately they proved of only moderate strength.

The night of the 3d was passed at anchor under the Island of St. Mary's, and on the 4th of July we arrived at Tamatave, finding in port four French men-of-war, including the flagship Flore, bearing the flag of Rear-Admiral Pierre, one English vessel, H. M. S. Dryad,—

Captain Johnstone,—and two American merchant-vessels. It was pleasing to note how quickly the foreign men-of-war followed the movements of the *Enterprise* in dressing ship. A national salute had been fired at sea in honor of the day about two hours before entering port, and our flags bent on in readiness to hoist and dress ship with a “rainbow” upon letting go the anchor. This was done, and simultaneously the English man-of-war hoisted her flags, dressing in “rainbow,” and a moment later all the French ships were covered with bunting. It showed that the day was remembered, and that preparations were made to dress ship as soon as an American man-of-war was seen in the offing.

Tamatave had been declared French territory and was in a state of siege. At intervals during the day and night the French men-of-war fired into the Hova camp, about five miles distant from the anchorage. On the night after our arrival a raid was made by the Hovas upon the French troops occupying Tamatave, and a few were killed on both sides. The relations between the French and English were very much strained, doubtless on account of misapprehension of each other's motives.

Fresh provisions were very scarce, owing to the successful efforts of the natives to keep their cattle inland.

Having visited the three Americans who persisted in living on shore—all others having left at the outbreak of war—and learning from them that they did not consider their lives in danger on account of hostilities, I left Tamatave on the 6th of July for the Comoro

Islands, the two American merchant-vessels having sailed a few hours before the departure of the *Enterprise*. The fresh winds which we had expected to encounter on our way to Tamatave, but which fortunately had failed us, now set in with much force, and a comparatively quick trip was made, chiefly under sail.

We arrived at Johanna Town, Comoro Islands, on the morning of the 10th. I visited the blind but intelligent Sultan at his country residence on the opposite side of the island, and, while there, at his request viewed a lot of slaves which he told me had been landed on the island without his permission and against his wish, and which he was about to turn over to the commander of a small English gunboat to take to Zanzibar where they would be set free. There were 107 of these poor wretches huddled together, nearly all of whom were young,—apparently from five to seven years of age,—male and female. Before my interview with the Sultan was over they had started to cross the island to embark on board the gunboat. The English commander and I, mounted on good donkeys, overtook the slaves as they were being driven up the steep mountain-paths in the hot sun by the Sultan's followers, and it was painful to witness their sufferings.

I was told afterwards that the crafty Sultan had kept back about thirty of the best of the slaves, and had secreted them where they could not be found; and that, of the 107 which started to cross the island, only 85 reached the ship, the others having been kidnapped on the way.

It was well known that the Sultan's virtuous act in voluntarily surrendering these poor slaves to the English was inspired, not by the promptings of humanity, but by feelings of resentment towards a wealthy planter to whom it was said they were consigned. This planter, however, denied positively that he had sent for the slaves, and he appeared very much amused at the Sultan's action.

The English sailors were of course greatly pleased at this episode, as they receive five pounds for each slave delivered at Zanzibar. The commander told me he would "worry the life" out of some one if those who had been kidnapped while crossing the island were not delivered up to him.

Visits were exchanged with the young prince, who impressed us very favorably. He was intelligent, refined, and the husband of only one wife, to whom he was greatly attached.

On the 13th we sailed for Zanzibar, arriving there on the 16th. Here we remained until the 25th of July, when, having filled up with coal and provisions and received on board a quantity of sounding wire which had been sent out from England, we sailed for the Seychelle Islands and resumed the work of deep-sea sounding. Two casts were taken daily, as a rule, one early in the morning and the other in the afternoon. A strong easterly current was found nearly the whole distance, at times amounting to one knot an hour.

On the night of the 1st of August, having reached the vicinity of an outlying coral reef, we anchored in

27 fathoms, and the next morning steamed into the inner harbor, Port Victoria, Seychelle Islands. The depths of the casts taken on the way were as follows: 876, 1352, 1791, 2007, 2227, 2342, 2472, 2582, 2626, 2713, 2682, and 2199 fathoms, respectively. Thus the depths increased regularly from Zanzibar until within 100 miles of these islands, and the character of the bottom changed with some regularity, as follows: gray ooze, gray ooze mixed with sand, gray ooze mixed with sand and shells, light brown ooze, sticky brown mud, bluish-colored mud, and finally dark brown mud. The temperature of the bottom was taken at each cast (except the tenth, when the wire parted), and found to be 30° Fahr. All of these casts were taken under steam, and in most cases with sails clewed up but not furled.

I had intended giving liberty to the crew at the Seychelles, but found an epidemic prevailing on the islands, which resembled a mild form of smallpox, although the Commissioner Resident said that physicians on shore called it chicken-pox. I deemed it best, however, to keep every one on board, particularly as our surgeon was quite positive as to the character of the disease. Took on board fifty tons of coal, and on the 4th of August, at 5.15 P.M., steamed out of the inner harbor, anchoring, at 7 P.M., when well outside.

On the 5th we got under way at 5.40 A.M. and made sail for the Straits of Sunda, sounding at 1 P.M. in 682 fathoms, lat. 4° 23' 46" S., long. 56° 18' 00" E.,

finding a bottom of gray ooze, sand, and shells. The weather was squally and the sea moderately rough.

On the 6th a cast was taken in 2160 fathoms, lat. $4^{\circ} 03' 26''$ S., long. $57^{\circ} 55' 30''$ E.; the character of the bottom being the same as in the last cast. The weather was still squally with rain and there was a heavy swell from the S.E. Current 0.7 knot an hour, setting S. 82° E.

On the 7th sounded at 6.30 A.M. in 2006 fathoms, lat. $3^{\circ} 08' 49''$ S., long. $60^{\circ} 08' 15''$ E.—gray ooze, sand, and shells; and again at 4.50 P.M. in 2302 fathoms, lat. $2^{\circ} 58' 54''$ S., long. $60^{\circ} 57' 03''$ E.—same character of bottom as before. Current 0.5 knot an hour, setting N. 65° E. The weather was still squally, with rain, accompanied by a swell from the southward and eastward. During the night the rain-squalls were very heavy, but the wind was not strong.

On the 8th sounded in 2495 fathoms, lat. $2^{\circ} 35' 17''$ S., long. $61^{\circ} 40' 15''$ E.; gray ooze, sand, and shells. At 9.10 P.M. a brilliant meteoric shower illumined the entire heavens. The winds were still from the southward and eastward, though inclined to be variable. Current 0.7 knot an hour, setting S. 53° W., which was a marked change in direction.

On the 9th sounded in 2501 fathoms, lat. $2^{\circ} 04' 47''$ S., long. $62^{\circ} 15' 35''$ E.; gray ooze, sand, and shells. The weather was squally, with rain in the forenoon, but pleasant in the afternoon, and the wind gradually de-

creased in force, but still held from the southward and eastward. Current 0.12 knot an hour, setting S. 59° W.

On the 10th sounded in 2364 fathoms, lat. $1^{\circ} 33' 51''$ S., long. $63^{\circ} 11' 30''$ E.; very light brown ooze, sand, and shells. The breeze was very light from the southward and eastward during the day. After dark there was much lightning to the northward and westward, and at midnight we had very heavy rain-squalls. Current 0.5 knot an hour, setting S. 25° E.

On the 11th sounded in 2559 fathoms, lat. $1^{\circ} 11' 49''$ S., long. $64^{\circ} 20' 09''$ E.; brown ooze. The last three days were very warm, the mercury standing at 83° in the shade in the afternoon. The wind dying out, we started ahead under steam. Current 0.5 knot an hour, setting S. 25° E.

On the 12th a cast was taken in 2212 fathoms, lat. $0^{\circ} 43' 10''$ S., long. $66^{\circ} 05' 42''$ E.; very light brown ooze. The day was delightfully pleasant, though warm. At 8 A.M. a light breeze sprung up from the S.W., when sail was made and fires hauled. Current 0.9 knot an hour, setting S. 49° E.

On the 13th sounded in 1812 fathoms, lat. $0^{\circ} 13' 59''$ S., long. $67^{\circ} 40' 33''$ E.; gray ooze, sand, and shells. The weather was very disagreeable, the wind changing to N.W., bringing heavy rain with squalls. Sea moderate. No noon observation.

On the 14th we sounded in the morning in 2019 fathoms, lat. $0^{\circ} 01' 04''$ S., long. $68^{\circ} 55' 16''$ E.; gray ooze, sand, and shells. The weather was very wet and

squally, and a heavy squall struck the vesse. while the cast was being taken. We were now approaching the low Maldivh Islands, and a course was steered for the equatorial channel. The equator was crossed before noon, and at 4 P.M. another cast was taken in 2322 fathoms, lat. $0^{\circ} 09' 35''$ N., long. $69^{\circ} 41' 06''$ E.; very light brown ooze. The winds were variable from the W., W.S.W., and S.W. No observation at noon.

On the 15th sounded in 2305 fathoms, lat. $0^{\circ} 14' 20''$ N., long. $70^{\circ} 44' 45''$ E. gray ooze, sand, and shells. The wind came out from the southward, and the weather cleared, the sun coming out bright and warm, drying the sails and decks, which had been soaked by the past rains. The wind later in the day was variable, from N.W., S.W., and S.E., becoming almost calm. Steam was raised at 8 P.M., as we were quite near to the Maldivhs. Current 0.63 knot an hour, setting N. 73° E.

On the 16th, soon after daylight, we sighted some of the small low islands of the Swadive Atoll, and during the day were steaming through the equatorial channel. At noon we were just south of the principal island of this atoll (Wahdu Island).

Four casts were taken, viz.: at 4.10 A.M. in 1977 fathoms, lat. $0^{\circ} 04' 29''$ N., long. $72^{\circ} 30' 42''$ E.—gray ooze, sand, and shells; at 9 A.M. in 1243 fathoms, lat. $0^{\circ} 03' 52''$ N., long. $73^{\circ} 00' 00''$ E.—dark gray sand and shells; at 12 noon in 1027 fathoms, lat. $0^{\circ} 03' 52''$ N., long. $73^{\circ} 17' 18''$ E.—gray sand; and at 6 P.M. in 1329 fathoms, lat. $0^{\circ} 03' 52''$ N., long. $73^{\circ} 44' 30''$ E.—gray

sand. The ship was swung for compass deviations between the last two casts, the weather being pleasant. Current 1.5 knots an hour, setting S. 86° E. A light breeze sprung up from the southward and westward about sunset, when sail was made and fires were hauled as usual.

On the 17th sounded in 2217 fathoms, lat. $0^{\circ} 21' 49''$ N., long. $74^{\circ} 46' 30''$ E. In reeling in the last 50 fathoms the wire parted with a jerk, losing 29 fathoms, cup, and thermometer. A shark which was seen swimming about the ship while sounding is supposed to have snapped at the specimen-cup and caused the wire to part. Current 1.3 knots an hour, setting N. 54° E.

On the 18th a cast was taken in 2472 fathoms, lat. $0^{\circ} 26' 52''$ N., long. $76^{\circ} 34' 45''$ E.; brown mud mixed with shells. Current 1.66 knots an hour, setting N. 87° E. A few squalls were experienced during the day.

On the 19th sounded in 2578 fathoms, lat. $0^{\circ} 18' 28''$ N., long. $78^{\circ} 33' 48''$ E.; dark brown mud. Current 1.54 knots an hour, setting S. 71° E. The weather was somewhat squally during the day, with occasional rain.

On the 20th sounded in 2609 fathoms, lat. $0^{\circ} 12' 9''$ N., long. $80^{\circ} 29' 55''$ E.; dark brown mud. Several heavy rain-squalls struck us during the day, and at times the rain came down in torrents. Current 1.33 knots an hour, setting S. 69° E.

On the 21st sounded at 7 A.M. in 2472 fathoms, lat. $0^{\circ} 14' 07''$ N., long. $82^{\circ} 36' 27''$ E.—dark brown mud; and again at 5.30 P. M. in 2436 fathoms, lat. $0^{\circ} 18' 19''$

N., long. $83^{\circ} 25' 30''$ E., brown mud. The weather was squally as usual, with sunshine between squalls; the wind being from the westward. Current 1.54 knots an hour, setting N. 81° E.

On the 22d a cast was taken in 2435 fathoms, lat. $0^{\circ} 33' 19''$ N., long. $84^{\circ} 58' 00''$ E.; light brown mud. Rain-squalls as usual flooded our decks, but the wind became light, varying in direction from W. by S. to S.S.W. Current 1.88 knots an hour, setting N. 73° E.

On the 23d sounded in 2425 fathoms, lat. $0^{\circ} 39' 30''$ N., long. $86^{\circ} 53' 15''$ E.; brown mud. We had occasional squalls, with light breeze from southward and eastward. Current 1.92 knots an hour, setting N. 63° E.

On the 24th sounded in 2394 fathoms, lat. $0^{\circ} 33' 22''$ N., long. $88^{\circ} 18' 00''$ E.; very light brown mud. The weather was pleasant, with an occasional heavy rain-squall for variety. Current 1.41 knots an hour, setting N. 50° E. The first death on board occurred to-day—John Robertson, seaman, dying suddenly of heart-complaint.

On the 25th we sounded in 2231 fathoms, lat. $0^{\circ} 04' 30''$ South, long. $90^{\circ} 16' 15''$ E.—gray ooze, sand, and shells—having a few moments before noon crossed the equator in fine pleasant weather. Current 1.1 knots an hour, setting N. 68° E. Robertson was buried at sea in the morning with the usual honors.

On the 26th a cast was taken in 2426 fathoms, lat. $0^{\circ} 11' 00''$ S., long. $91^{\circ} 15'$ E.; brown ooze. The day

was charming, with light breeze from W.S.W. Current 0.66 knot an hour, setting N. 77° E.

On the 27th sounded at 6.30 A.M. in 2437 fathoms, lat. $0^{\circ} 18' 00''$ S., long. $92^{\circ} 19' 00''$ E.—brown ooze; and again in the afternoon in 2453 fathoms, lat. $0^{\circ} 23' 56''$ S., long. $93^{\circ} 16' 43''$ E.—brown ooze. The wind became so light during the day that we got up steam. Shortly after sunset a peculiar brightening effect was observed, the whole atmosphere assuming a greenish hue which lasted a few minutes and then gradually disappeared. Current 0.66 knot an hour, setting S. 73° E.

On the 28th a cast was taken at 8 A.M. in 2442 fathoms, lat. $0^{\circ} 37' 26''$ S., long. $94^{\circ} 23'$ E.—brown ooze; and another at 5.20 P.M. in 2469 fathoms, lat. $1^{\circ} 03' 23''$ S., long. $95^{\circ} 02' 40''$ E.—brown ooze. The surface of the sea was covered with a peculiar kind of stringy stuff resembling Manila fibre, but of the consistency of jelly. The weather continued pleasant. Current 1 knot an hour, setting S. 34° W.

On the 29th sounded at 6 A.M. in 2681 fathoms, lat. $1^{\circ} 55' 24''$ S., long. $95^{\circ} 56' 27''$ E.—brown ooze; and again at 5.20 P.M. in 2518 fathoms, lat. $2^{\circ} 26' 42''$ S., long. $96^{\circ} 47' 09''$ E.—brown ooze, black specks. Current 0.83 knot an hour, setting S. 11° W.

On the 30th sounded in 2355 fathoms, lat. $2^{\circ} 50' 24''$ S., long. $97^{\circ} 51' 09''$ E.—brown ooze, black specks—having swung ship for compass deviations before beginning to sound. In the afternoon the ship was again swung for compass deviations. Current 0.5 knot an hour, setting N.

86° E. Constant lightning was observed on the eastern horizon during the whole night.

On the 31st sounded at 6 A.M. in 2683 fathoms, lat. 3° 47' 52" S., long. 99° 09' 57" E.—brown mud; and again in the afternoon in 3097 fathoms, lat. 4° 14' 29" S., long. 99° 50' 29" E.—bluish-brown mud. No current. Lightning was observed to the east and northeast all night.

On September 1st at 6 A.M. a cast was taken in 1593 fathoms, lat. 4° 45' 31" S., long. 100° 50' 39" E.—light brown ooze, sand, and shells; and another in the afternoon in 627 fathoms, lat. 5° 11' 54" S., long. 101° 39' 53" E.—gray sand and shells. Engano Island was sighted before dark. Current 0.37 knot an hour, setting S. 67° E.

On the 2d we took four casts as follows: at 6.30 A.M. in 203 fathoms, lat. 5° 42' 18" S., long. 102° 29' 46" E.—gray sand and shells; at 10.30 A.M. in 720 fathoms, lat. 5° 44' 29" S., long. 102° 52' 49" E.—blue clay mixed with shells; at 2.30 P.M. in 1087 fathoms, lat. 5° 46' 02" S., long. 103° 29' 29" E.—blue clay mixed with gray sand and shells; and at 6.30 P.M. in 1207 fathoms, lat. 5° 51' 12" S., long. 103° 35' 40" E.—gray sand and black specks.

Fine pumice-stone was spread over the surface of the water. Thick disagreeable weather and heavy rains were experienced at intervals throughout the day and night, and after dark vivid lightnings flashed continually.

The 3d of September began with fresh but variable

breezes from the southward and eastward. Egyptian darkness prevailed, made more intense by the vivid lightning which flashed from all parts of the heavens. We continued on towards Flat Cape light until well within the circle of illumination as marked on the chart, when at 1.25 A.M., not seeing the light, and being deluged with heavy rains, I decided to head off shore and await daylight—a wise conclusion, as will be shortly seen. At 6.45 A.M. we sounded in 522 fathoms, lat. $6^{\circ} 05' 36''$ S., long. $104^{\circ} 15' 24''$ E.; coarse gray sand. The weather remained extremely thick, with heavy rain-squalls accompanied by thunder and lightning. At 8.30 A.M. we sounded in 227 fathoms, lat. $6^{\circ} 08' 54''$ S., long. $104^{\circ} 27' 12''$ E.—coarse gray sand, mixed with scoriæ and pumice; and at 10.20 A.M. again sounded in 200 fathoms, lat. $6^{\circ} 11' 30''$ S., long. $104^{\circ} 26' 30''$ E.—coarse gray sand mixed with scoriæ and pumice.

This completed the line of sounding across the Indian Ocean. Thick rainy weather still continued, but at 11.15 A.M. it lighted up a moment, revealing Flat Cape light-house bearing north.

The sea at this time was covered with floating pumicestone from pulverized dust to blocks of large size. Extensive patches of driftwood, trees of large size, and heavy limbs stripped bare, apparently but recently broken off, were also floating with the current. We were steaming through this drift all day, and frequently were obliged to change the course to avoid running into the larger trees. Occasionally nude bodies of white men and

women were seen floating on the water, and here and there the swollen carcass of a drowned animal.

In the afternoon we sighted a man-of-war standing towards us, and at 4.45 P.M. stopped to communicate with the *Prins Hendrick*, a Dutch iron-clad, Captain McLeod, in answer to a signal flying from her masthead. We were told by the boarding officer that on the 27th of August—only a week before our arrival—there had been a great earthquake and eruption of the Island of Krakatoa, two-thirds of which had disappeared; that a tidal wave had destroyed Anjer and all the villages on both sides of the straits; that Bezee Channel, through which I had intended to pass, was blocked up by newly-formed islands; that the coast line of the straits had been somewhat changed; that thousands upon thousands of people had been drowned; that all the light-houses in the neighborhood had been destroyed or seriously injured, and that all lights were extinguished, including that of Flat Cape, which had not yet been relighted. No wonder, therefore, that we had not seen the light though well within the radius of its usual illumination. And it was well that the vessel was headed off shore in time, for, had we continued ten miles farther towards Flat Cape in search of the light, our cruise might have ended there. This officer also told us that the pumice-stone was so thick on the Sumatra side of the straits—the wind having driven vast quantities of it to that side—that it was impossible to communicate with the shore. This appalling news ac-

counted for the drift which we had encountered in the straits.

I volunteered to remain to assist in warning incoming vessels, but the captain did not consider it necessary, preferring that I should take despatches to the Dutch authorities at Batavia, with whom he had not communicated for some time. Accordingly we kept on for Batavia, changing the course of the vessel to avoid Bezee Channel. At 11.30 P.M. dropped anchor in 27 fathoms to await the morning.

Under way at daylight on the morning of the 4th, with Krakatoa in full view; and as we passed along the coast we could see something of the effects of the tidal wave. Not a house was standing where before there had been villages. At Anjer a portion of the base of the light-house was seen, and a few feet of the trunk of the large banyan tree which had been a prominent mark for many years.

Thwartway Island, reported to have been rent in twain by the earthquake, at a distance appeared like two or more islands, but a closer inspection dispelled the illusion.

At 6.45 P.M., September 4, 1883, the *Enterprise* anchored off Batavia.

Two days after our arrival we were agreeably surprised to see the U. S. S. *Juniata*, Commander Harrington, entering port. This vessel had touched at Singapore, where a cablegram from the Navy Department was found directing the *Juniata* and the *Enterprise* to

go to the Straits of Sunda to assist in warning vessels. Fortunately the *Enterprise* had already been there ; and although it was not really necessary that the *Juniata* should go, as the Dutch authorities had detailed several vessels for this work, still, to carry out the Department's order, the *Juniata* left at once and remained a few days. A large number of men were calking our decks when the *Juniata* arrived, and before the work was finished and the bunkers filled with coal the *Juniata* returned to Batavia, as her services were not needed.

We remained at Batavia until the 19th, giving liberty to the crew and preparing for sea. For a few days previous to our departure fears were entertained that the iron-clad *Prins Hendrick* had come to grief, as the Dutch admiral had heard nothing from her captain for some time and no incoming vessel had seen her. I at once volunteered to search for the missing vessel, and agreed to cruise outside Flat Cape to Engano and 300 miles beyond, thence to Bencoolen and back, as there was a possibility that she had become disabled in some way near the entrance to the straits and had drifted out to sea. The small Dutch vessels were to examine the bays and indentations on the Sumatra side of the straits.

On the 18th, therefore, I took on board an extra amount of coal, intending to sail the following morning, but before dark a vessel arrived bringing the welcome news that the *Prins Hendrick* had been seen in Semanka Bay, Sumatra. This intelligence was at once

sent to me by the admiral, with a letter of thanks for the proposed aid.

As there was nothing to detain us longer at Batavia we got under way on the morning of the 19th, and proceeded to the Straits of Sunda to examine more closely the effects of the earthquake and tidal wave. From St. Nicholas Point we steamed along the shore as close as was prudent, to see if the formation of the coast line had been changed, but no material alteration was discovered. The small island of Tempoza was stripped entirely of trees and soil, and the sides of the island of Merak were badly scored. We took a number of soundings close to the island and found them to agree with those on the chart.

We then steamed for Anjer and anchored off the ruins. As many as could be spared went on shore. The desolation was truly appalling. Everything had been swept into the sea or levelled to the ground. Where before there was an extensive town, now not a house remained, but only the foundations, which were shown by rows and squares of bricks and mortar; there was scarcely one brick upon another above the level of the ground. The streets, and indeed the whole place, were strewn with brick and coral. Every tree within the limits of the town had been twisted off near the ground, or had been uprooted altogether. A more perfect scene of desolation cannot be imagined. We walked from the battery, where the dismantled guns were lying on the ground, to a point distant perhaps a

mile back from the town, where a few cocoanut and other trees were standing. Mud and ashes adhered to the limbs to the very tops; branches were found broken off at an estimated distance of at least thirty feet from the ground, and as these trees were on a higher level than the town, we judged that the tidal wave must have reached a height at this point of fifty feet. I was assured by the Dutch authorities at Batavia that the wave rushed up one of the valleys on the Sumatra side until it reached the base of a house which was 105 feet above the level of the sea by actual measurement. Before leaving the site Lieut. M. A. Shufeldt, U. S. N., took several photographs of the ruins.

From Anjer we steamed to Thwartway and anchored for the night. The next morning I went on shore accompanied by some of the officers. The tidal wave had swept through the depressions or valleys on the island, uprooting all the trees within its reach and washing them, together with every particle of soil and vegetation, into the sea. The bed of the valley was composed of stones, coral, and boulders, with occasional patches of driftwood which had been caught therein when the waters subsided.

Portions of the southern and western sides of the island gave evidence of more or less extensive landslides. No trees remained except on the tops of the high portions of the island which had not been reached by the tidal wave, thus giving such a peculiar appear-

ance to the island as to make it seem to be rent in twain by the earthquake.

From Thwartway we steamed slowly towards Krakatoa, taking frequent soundings. When about five miles from the new island which had formed in Bezee Channel, the leadsman reported 14 fathoms, which was much less than the chart gave. While engaged in locating the shoal by sextant angles, this island, called by the Dutch Calmeijer, suddenly began sending up large puffs of smoke and dust, and at the same time a line of heavy breakers appeared extending all the way across the channel between Bezee Island and Krakatoa. Thinking that a small tidal wave might be coming, the air-ports and the cabin stern-ports were closed quickly, boats hoisted which had just been lowered, and preparations made to batten down the hatches. The disturbance, however, proved local and had no appreciable effect on the ship, although the eruption continued a half-hour and the chief engineer reported that the temperature of the injection-water went up 4°.

We continued taking casts as we passed Krakatoa, whose bare sides, covered with ashes and scoria, revealed rents or gulleys running from top to bottom in irregular lines. Shortly after sunset, having steamed several miles beyond the volcano, the engines were stopped and the vessel was allowed to drift under fore-and-aft sails.

Some time after dark a steamer was seen slowly approaching our ship from the direction of Bezee Island.

When a short distance away she fired a gun and sent up a rocket, then bore down on us and came within hail. It was the iron-clad Prinz Hendrick. Having a curiosity to learn of her experiences, I went on board myself. The captain told me that several days before he had run into Semanka Bay and sent two boats to communicate with the shore; that while waiting for them to return the wind drove vast quantities of pumice-stone into the bay, making it impossible for the boats to return to the ship. Seeing that they had communicated with the shore, and knowing therefore that his men would have sufficient food, he signalled them that he must put to sea on account of the increasing drift. Soon after getting under way, fine particles of pumice got into the valves and temporarily disabled the engines, and he was obliged to anchor in 60 fathoms. Thirty hours were consumed in making repairs. He then made another attempt to push through the pumice-drift, which was at least three feet thick, and at last made out to reach clear water. He was surprised that there had been any anxiety on his account, as he had seen several vessels at a distance while he was in Semanka Bay, and supposed that his vessel had been seen and that her position had been reported. He, in turn, was feeling anxious for the safety of a small gunboat which had been sent in search of him. We remained in the neighborhood until daylight, then steamed back, and while skirting the islands of Verlaten and Krakatoa, a man-of-war was

seen approaching. I signalled to her that I had a communication to make, and sent an officer to explain the situation. She proved to be the vessel about which Captain McLeod had expressed some concern.

Many of the crew and several of the officers, including the navigator, having by this time come down with the dengue fever, fortunately of a comparatively mild type, I decided to proceed at once to Singapore.

We sailed leisurely through the Java Sea, which was covered with fine particles of pumice-stone, and on the 30th of September arrived at Singapore, having stopped *en route* one day at Mintok.

At Singapore a telegram was received from Rear-Admiral Crosby directing me to proceed at once with the *Enterprise* to Hong Kong, on account of the riot at Canton and the disturbed condition of affairs in China. Thus the visit to Borneo had to be given up.

Note.

I can finish this chapter in no better way than to copy extracts from a Boston newspaper giving the experiences of the bark W. H. Besse near the Straits of Sunda at the time of the earthquake.

"EXTRAORDINARY EXPERIENCES.

"STRANGE MISHAPS WHICH BEFELL THE BARK W. H. BESSE.

"Nestling since Thursday afternoon in her cosey land-locked quarters at the yard of the Standard Sugar Refinery, South Boston, the bark W. H. Besse, from Manila, the first that has reached us with vivid realization of the volcanic eruptions in Asia, gives little indication of the extraordinary perils through which she has passed. . . . Having sailed toward the Straits of Sunda, on the 26th of August light airs and calms were met. Throughout the afternoon and night heavy reports were heard, like the discharge of monstrous artillery, the sounds seeming to come from the direction of Krakatoa Island, which is situated in the Straits of Sunda, lat. $6^{\circ} 9' S.$, long. $105^{\circ} 29' E.$, and is about seven miles long and five miles broad. It became very dark and cloudy through the night, with continuous and countless flashes of lightning in every direction. The barometer was 30.15. Monday, August 27th, opened with strong breezes and thick, cloudy weather. At 9.30 A.M. the pilot left the vessel. Ever since daybreak a dark heavy bank had been noticed to the westward, which continuing to rise, the sun became obscured and the whole heavens grew black. All hands were called on deck, every bit of canvas was furled, the port anchor was let go, and Captain Baker, with the fortitude of one resolved to die at his post if necessary, calmly awaited the catastrophe.

Scarcely had the sails and port anchor been disposed of than the squall struck the side of the bark with terrible force. The starboard anchor was then let go with eighty fathoms of chain. With the squall came a heavy shower of sand and ashes. The atmosphere had become by this time darker than the darkest night. The barometer continued to rise and fall an inch at a time, the wind was blowing a hurricane, and the water was lashed into such a tumultuous motion as can hardly be conceived. A heavy rumbling with reports like steadily increasing thunder continued, and the awful blackness overhead was rendered still more appalling by the lurid and fitful lightning that flashed in jagged yet concentric streaks. The captain describes the contrasting darkness as the most intense he ever knew, and although it was still daytime there was not enough daylight to see one's own hand. At this time Bezee Island was bearing north by west about five or six miles, and Anjier, which witnessed the terrible destruction of land and life caused by the earthquake and eruptions, was in comparative proximity. A stifling smell of sulphur permeated the whole atmosphere, making it difficult to do the amount of breathing necessary to sustain consciousness. All the elements of nature seemed to be massed in menacing hostility. The tide was setting strongly to the west, and the bark rushed along under bare poles at the speed of 14 knots an hour. A seaman on account of the darkness walked off the forward house, striking his head on the

deck and was shockingly injured. The sounds and scenes through all the hours of the day and night were of the most awful description that can be imagined; the shrieking winds, the spuming and churning waters, the murky and impenetrable veil overhead and on every side, and the tons of ashes, pumice-stone, and earthy fragments that threatened to engulf the fated bark, combining to daze and appal every soul on board. From the poor little Chinaman who has linked his lot with this vessel for six years, to the hapless native of the Philippines, the hardy Scandinavian who had weathered many a gale, the cheery and courteous mate, and even to the master of the ship, there was spread the common feeling of some catastrophe, and the sense of a disturbance in nature utterly beyond any before experience by mariner. Several were convinced that the day of final judgment had come.

“At 3 P.M. the sky began to grow a little lighter, although the ashes and other volcanic matter continued to fall. The bark hove short on her starboard anchor. The barometer rose and fell rapidly and then became stationary. The whole ship, rigging and masts were coated with sand and ashes to the depth of several inches.

“August 27th began with light airs and thick, smoky weather, and there was a dead calm through the day and night. The men on the Besse saw vast quantities of trees and dead fish floating by with the tide, the water having a whitish appearance, caused by a surface of light ashes. It was soon discovered that in the

midst of the natural convulsion mighty changes had been wrought in the outlines of sea and shore, while islands had sunk, the entire northwest part of Krakatoa Island had disappeared, and the beautiful forest-clothed islands of Lang and Verlaten had been completely denuded. The day ended with a dead calm and thick, smoky atmosphere.

“On August 28th the day came in with calms, but thick, murky weather. Immense masses of cocoanuts, trees, and fish were encountered, the débris extending over a surface of more than five hundred miles. In the afternoon no light-house or sign of life could be discerned on any side. All light sails were furled and the bark stood out under easy sail through the night.

“On Thursday, August 30th, the water was found covered with large trees and driftwood, it being almost impossible to steer clear of them. A sharp lookout was kept in the forecastle through the day, and large masses of dead bodies were passed. At 10 A.M. Java light-houses were sighted, but the wind hauling ahead, the bark kept away to the westward of Punce Island. . . .”

CHAPTER III.

HOMEWARD BOUND.

RECEIVE ORDERS TO PROCEED WITH THE ENTERPRISE TO THE UNITED STATES VIA AUSTRALIA.—HONG KONG.—SOURABAYA, JAVA.—ALBANY, WEST AUSTRALIA.—MELBOURNE, VICTORIA.—WELLINGTON, NEW ZEALAND.—RUN LINE OF DEEP-SEA SOUNDINGS FROM WELLINGTON TO MAGELLAN STRAITS.—SANDY POINT.—MONTEVIDEO, URUGUAY.

As this is not a general history of the cruise of the *Enterprise*, I pass over an interesting period of nearly two years, merely mentioning that the winter of 1883 was passed in the waters of Korea, when Chemulpo consisted of a handful of small rude houses, and Seoul, the capital, had but two ladies of western civilization within her walls; that in the spring of 1884 we had the honor of taking our minister, the Hon. John Russell Young, and the commander-in-chief of the U. S. naval forces, Rear-Admiral J. L. Davis, to nearly all the treaty ports in China, including those up the Yangtse River, as far as Hankow; and that later in the year the *Enterprise* was present at the bombardment of Foochoo arsenal, Pagoda Anchorage, and witnessed the

destruction of the Chinese fleet, and the passing of the forts in the Min River, by the French squadron under Vice-Admiral Courbet.

On the 9th of July, 1885, while in Min River, China, where we had been for the third time during the cruise, the long-expected orders to proceed home were received. Upon being relieved by another United States vessel, the *Enterprise* was to proceed to New York via Australia, run a line of soundings between Wellington, New Zealand, and Cape Horn, and between Montevideo and the United States. The choice of route to Australia and New Zealand, as well as the parallel of latitude on which to run the soundings in the South Pacific, were left to my discretion.

Upon the arrival of the *Palos* I took from her a sounding reel and a quantity of spare wire, and on the 20th of July left Min River, arriving on the 24th at Hong Kong, having touched at Amoy on the way.

We filled up with coal and provisions and sailed from Hong Kong on the 24th of July with a homeward-bound pennant, 365 feet long, streaming from the main-truck. It was the season of the S.W. monsoons, and the weather at the start was very thick. Expecting to encounter head-winds on the passage, we housed top-masts as soon as clear of land, sent down topsail yards, and landed the lower yards on the rail. For much the greater part of the way the wind and currents were against us, but on the 10th of August we reached

Sourabaya, Java, having steamed the whole distance, 1978 miles, with no help from our canvas except occasionally when the wind veered enough to permit the fore-and-aft sails to draw. The actual number of knots steamed was considerably more than 2000, on an expenditure of coal of about 150 tons.

Sourabaya had recently been scourged by the Asiatic cholera, but as there were no cases when we arrived the physicians thought it would be perfectly safe to give the crew liberty. This was particularly desirable, as for months there had been no opportunity to let the men go on shore. I therefore remained a number of days at Sourabaya for this purpose, filling up with coal and provisions in the mean time. The Dutch residents were very cordial in their welcome, and made our visit an agreeable one. Our accomplished consular agent, Mr. Silva Rupe, won our hearts by his uniform kindness. The only American man-of-war that had visited Sourabaya within the memory of any white resident was the U. S. S. Iroquois, Captain C. R. P. Rodgers, and this occurred about twenty years before our arrival. We left Sourabaya on the 16th of August, and on the morning of the 17th passed through Baly Straits.

On the 19th, when but three days out, Charles Christensen, captain of the foretop, died suddenly of what appeared to be genuine Asiatic cholera, and was buried the same day. The ship was at once fumigated and the clothing of the deceased destroyed. Fortunately no other cases followed.

Although we were not directed to sound before reaching Wellington, New Zealand, it was thought best to take a few casts on the passage to Australia, to test the wire, which had remained on the reel for two years, and also the working of the whole apparatus; accordingly on the 24th of August a cast was taken in 3066 fathoms, lat. $19^{\circ} 08'$ S., long. $105^{\circ} 20'$ E. The shot did not detach itself upon reaching bottom, and while working it up and down the wire parted and 2826 fathoms were lost.

On the 27th another cast was taken in 3182 fathoms, lat. $23^{\circ} 01'$ S., long. $101^{\circ} 20'$ E. When the wire was nearly reeled in it parted with a jerk. Two enormous sharks had been swimming about the ship while this cast was being taken, and one of them was supposed to have snapped at the specimen-cup as it was nearing the surface—possibly swallowing it—as happened once before on our outward voyage. A large steel hook was immediately baited with a piece of salt pork, and soon one of the two was caught and hoisted half-way out of the water, but unfortunately it succeeded in getting away, much to our disappointment, as we had hoped to recover the lost specimen-cup. This was not an absurd expectation, for it is well known that sharks are not fastidious in regard to their diet. I myself have seen in the stomach of a shark caught off Mobile in 1862 two meat-cans and an old shoe.

On the 31st of August we sounded in 2586 fathoms, lat. $29^{\circ} 20'$ S., long. $101^{\circ} 55'$ E., and again the wire

parted when it was nearly reeled in, but in this case the cause was due to a kink.

On the 5th of September we rounded Cape Leuwin, the southwesternmost point of Australia, and on the 6th entered King George's Sound and anchored off Albany. This magnificent harbor will one day be of immense importance as a naval arsenal. Here we filled up with coal, taking it from hulks which were brought alongside. No one on shore could remember any visit of an American man-of-war before the arrival of the *Enterprise*.

On the 8th of September we got under way for Port Melbourne. When sufficiently clear of the land the ship was swung for compass deviations, and then a cast was taken in 1128 fathoms, lat. $35^{\circ} 26' S.$, long. $118^{\circ} 37' E.$, well within view of Bald Head and Eclipse Island.

On the 16th September we anchored off Port Melbourne. Here we remained one month fitting the ship for her coming voyage across the South Pacific, enjoying the hospitality of the good citizens of Melbourne and gaining grander ideas of the possibilities of republics. We saw much of the colonists, and were impressed with the advances they are making in civilization. Having the experiences of the Old World and the New World to guide them, they sift the good from the bad, and enact laws which in turn serve as models for the older nations. The so-called "working people" appear to exert a greater influence in Australia than they do in the United States; and it struck me that the average intel-

ligence of the colonists was higher than that of our own people.

Australasia is not appreciated by us as it should be. An empire is growing at the antipodes which, if imperial federation is not brought about within a few years, will become independent and will exert a tremendous influence, not only among the islands of the Pacific, but throughout the world. As large in territory as the United States, it already has about 4,000,000 whites, or more than the population of the original thirteen colonies when they became an independent nation. They are a whole-souled, gallant race, and we left their country with a genuine love for the people and a firm belief in their future greatness.

The idea of a federation or alliance of all English-speaking peoples was discussed with enthusiasm, and their orators in eloquent language depicted the beneficial results which might follow the realization of their dream.

On the 16th of October the *Enterprise* sailed for New Zealand. The weather became thick as we approached land, and nothing could be seen until we were well within Cook's Straits. A moderate gale increased the difficulties of navigation, but at last we sighted the entrance to Queen Charlotte's Sound, where we anchored on the 25th.

On the 26th the *Enterprise* reached Wellington, New Zealand, from which point the line of soundings to Cape Horn was to begin.

The cordial greeting extended to us by the government and by the good people of Wellington generally, because of their high regard for the United States, was particularly gratifying. The sentiment in favor of a federation of all the English-speaking peoples was stronger, if possible, here than in Australia. As in Melbourne, so also at Wellington we were treated like brothers, and it was a matter of deep regret that our time was too limited to enable us to visit other parts of New Zealand or make excursions into the interior.

Having before us a long run of at least 4500 miles over a portion of the South Pacific noted for its storms and heavy seas, I thought it advisable to fill up with the very best coal in Wellington, and through the exertions of Mr. Levin, our accomplished consular agent, was fortunate enough to obtain a supply of Cardiff coal of superior quality.

Late in the afternoon of the 5th of November, 1885, we left Wellington, anchoring when out of sight of the city in a small bay a few miles distant, in order that the crew, many of whom had been entertained at a banquet on shore the evening before, might have a refreshing sleep. Moreover, New Zealand being noted for its sudden and heavy gales, I wished to be fully prepared to encounter bad weather.

We got under way early in the morning of the 6th and put to sea. The ship, deeply laden, had her decks encumbered with coal, of which thirty tons were in bags; hen-coops filled with poultry; twelve live sheep

and a dozen pigs, besides quantities of provisions laid in by the different messes.

As night approached a fresh gale from the N.N.W. overtook us which necessitated lying to, but before the gale became too heavy we sounded in 637 fathoms.

When discussing the subject of deep-sea soundings with some of the inhabitants of Wellington, I was led to expect that a plateau existed between New Zealand and the Chatham Islands upon which shallow water might be found. Tradition states that once upon a time a fisherman had anchored between the two groups well out of sight of land. We found a plateau, as will be seen further on, and it is very possible that the tradition is true. Considering the route taken, the season of the year in which the line of soundings was run, and the fact that the *Enterprise* was the *first vessel* to sound the depths of this part of the Pacific, I have thought it best to quote freely from my private journal and the ship's log-book. As stated in the Introduction, the latest charts (1892) do not record a single deep-sea cast south of this line between New Zealand and Cape Horn, a distance of one hundred and fifty degrees of longitude, although nearly seven years have elapsed since the *Enterprise* visited those waters. Moreover, a detailed account will give a better idea of the work required of the crew in taking these casts, and it should also be remembered that the terms of enlistment of many of the men had expired, and that nearly every officer had been away from his home three years or more.

November 6, 1885. At 5.12 A.M. got under way and proceeded to sea with a falling barometer. At 8.05 A.M. shortened and furled sail, then sounded in 637 fathoms, lat. $41^{\circ} 41'$ S., long. $175^{\circ} 00'$ E. In reeling in the wire parted, losing 300 fathoms and the sounding-cup. At 8.50 A.M. made sail, uncoupled propeller, and banked fires. The wind increasing to a moderate gale from the N.N.W. to N.W., accompanied by a rough sea, fires were spread, and at 4 P.M. the vessel was lying to under after-stormsails, assisted by the engines, which were kept moving slowly. The roll of the ship was deep, at times 32° to starboard and 20° to port. The decks were continually drenched with spray, the hatches were battened down, and altogether the night was a most uncomfortable one. The success of our undertaking did not look promising. At 8 the barometer stood 29.27; at midnight 29.31. Temperature 54° .

November 7. At midnight the gale broke, and at 1.30 A.M. the ship was put on her course under sail, the wind decreasing steadily in force and veering to the westward. At 6.15 A.M. shortened and furled sail, then sounded in 1192 fathoms, lat. $42^{\circ} 27'$ S., long. $175^{\circ} 34'$ E.; blue mud. At 7.10 A.M. started ahead under steam. The wind became variable and light during the day, the sky overcast with mist and drizzling rain. In the evening the wind veered to the southward of east. At 8.40 P.M. stopped steaming, uncoupled, made sail, and banked fires. Sea moderately smooth at night. At midnight barometer 29.81, temperature 54° .

November 8. The wind gradually backed from E. by S. at 1 A.M. to S.E. at 3 P.M., then veered to N.E. by E. near midnight, decreasing in force until the ship made but one knot an hour. Sea quite smooth. Temperature of surface-water both yesterday and to-day varied from 54° to 58° , the change taking place in an hour, evidently produced by a current. Found a current averaging 0.5 knots an hour setting N. 71° E. At midnight barometer 30.10, temperature 59° .

November 9 (1). Wind light from N.E. by N. to N.N.E. until 9 P.M., when it veered to the northward and westward, force variable. At 3.25 A.M. shortened and furled sail, then sounded in 1320 fathoms, lat. $43^{\circ} 07'$ S., long. $178^{\circ} 19'$ E.; gray ooze. After sounding, swung ship for compass deviations. At 5.25 A.M. made sail, uncoupled, hauled fires, and shaped a course to pass to the southward of the Chatham Islands. Sea smooth until afternoon, when the wind freshened, causing a moderate sea by midnight. Current 0.6. knot an hour, setting S. 54° W. At midnight barometer 29.98, temperature 58° .

November 9 (2). Crossed the 180th meridian this morning. At 6.25 A.M. started fires in two boilers and took in mainsail. At 8.30 A.M. took in all sail, then sounded in 224 fathoms, lat. $43^{\circ} 37'$ S., long. $179^{\circ} 37'$ W.; soft blue mud, black specks—a great change since yesterday. We had evidently struck the edge of the plateau of which tradition speaks. At 8.45 A.M. made sail and banked fires. At 1 P.M. took in sail, then

sounded in 160 fathoms, lat. $43^{\circ} 53'$ S., long. $179^{\circ} 11'$ W. ; gray and black sand, shells, lava. At 1.15 P.M. made sail to royals, banked fires. At 6.50 P.M. hove to and sounded in 184 fathoms, lat. $44^{\circ} 08'$ S., long. $178^{\circ} 57'$ W. ; gray sand, black specks, shells, and lava. At 7 P.M. put ship on her course, uncoupled, let fires die out. During the forenoon there was a moderately stiff breeze from the northward, varying a point or two on either side. In the afternoon the wind gradually veered to the N.W., decreasing in force, and by 10 P.M. the vessel had no steerage way. Long swell from the northward. At 8 P.M. it became foggy. Current 0.8 knot an hour, setting S. 48° E. At midnight barometer 29.93, temperature 56° .

November 10. Began with light airs from northward, then calm. At 4 A.M. light airs from eastward. Foggy about the horizon. At 8.15 A.M. hove to, to sound, using the casting lead; but not finding bottom in 300 fathoms, filled away and started fires in two boilers. At 10.30 A.M. shortened and furled sail, then sounded in 751 fathoms, lat. $44^{\circ} 41'$ S., long. $178^{\circ} 53'$ W. ; gray sand, black specks, blue mud. At 11.15 A.M. made sail, banked fires, uncoupled. Set in thick and foggy again in the afternoon, with wind increasing to a fresh breeze from N.N.E. Barometer falling. At 3 P.M. spread fires. At 3.45 P.M. took in sail and sounded again in 996 fathoms, lat. $45^{\circ} 02'$ S., long. $178^{\circ} 21'$ W. ; gray mud and sand. At 4.15 P.M. made sail, uncoupled, and banked fires. At 7.35 P.M. shortened and furled sail, then sounded again in

1381 fathoms, lat. $45^{\circ} 11'$ S., long. $177^{\circ} 53'$ W.; gray mud and sand. At 8.10 P.M. made sail, uncoupled. Long swell from S.S.W. Stiff breeze at midnight. Current 0.5 knot an hour, setting S. 25° E. Barometer at midnight 29.84, temperature 54° .

November 11. Moderate to fresh breeze from the northward and eastward during the day. Weather cloudy, with occasional light rain and fog. At 3 A.M. took in mainsail and started fires in two boilers. At 4.45 A.M. shortened and furled sail, then sounded in 2180 fathoms, lat. $45^{\circ} 45'$ S., long. $176^{\circ} 37'$ W.; gray mud and sand. At 6 A.M. made sail, uncoupled, and let fires die out. At 3.30 P.M. took in mainsail and started fires. At 5.35 P.M. shortened and furled sail and sounded in 2237 fathoms, lat. $46^{\circ} 19'$ S., long. $174^{\circ} 34'$ W.; gray mud. At 6.40 P.M. made sail, uncoupled, and let fires die out. Foggy drizzling rain. Moderate sea from northward, gradually increasing. Current 0.7 knot per hour, setting S. 37° E. Barometer falling during the day from 29.79 to 29.22 at midnight. Temperature 55° .

November 12. Overcast, foggy with drizzling rain. Fresh to stiff breeze from northward and westward. Moderate sea from the northward. Ship under top-gallant sails. At 3 A.M. took in mainsail and started fires. At 5.18 A.M. shortened and furled sail, then sounded in 2782 fathoms, lat. $46^{\circ} 36'$ S., long. $172^{\circ} 34'$ W.; dark gray mud. At 7.27 A.M. made sail, uncoupled, banked fires. Roll of ship 20° to starboard, 15° to port. At 5.20 P.M. hauled up mainsail and spread fires.

At 6.10 P.M. took in all sail, then sounded in 3002 fathoms, lat. $46^{\circ} 50' S.$, long. $170^{\circ} 34' W.$ In reeling in, the attendant carelessly let the instrument used in guiding the wire catch in a splice and the wire parted, losing 1300 fathoms and specimen-cup. At 8.50 P.M. made sail, uncoupled, and let fires die out. Current 0.8 knot per hour, setting S. $58^{\circ} E.$ Barometer at midnight 29.66, temperature 54° .

November 13. Misty with light drizzle. Wind light from the northward and westward, becoming calm at 6 P.M., followed by light breeze from the southward and eastward at 9 P.M. At 12.26 P.M. took in mainsail and started fires in two boilers. At 3.40 P.M. shortened and furled sail, then sounded in 2972 fathoms, lat. $47^{\circ} 08' S.$, long. $168^{\circ} 00' W.$; gray and brown mud. At 4.55 P.M. made sail, uncoupled, and hauled fires. Roll of ship 22° to starboard and the same to port. "Weather has been so wet and foggy, with so little sunshine, the decks are always damp and the pigs have bad colds!" Current 0.8 knot per hour, setting S. $58^{\circ} E.$ Barometer at midnight 29.71.

November 14. Gentle breeze from southward and eastward, increasing to fresh breeze in the afternoon. At 11.30 A.M. took in mainsail and started fires. At 3.30 P.M. shortened and furled sail, then sounded in 2881 fathoms, lat. $46^{\circ} 52' S.$, long. $166^{\circ} 46' W.$; brown mud. At 4.55 P.M. made sail, uncoupled, and let fires die out. Long swell from the northward. Current 0.3 knot per hour, setting to the eastward. Caught a

small albatross—nine feet from tip to tip—and released it after taking measurements. At midnight light airs. Barometer 29.76, temperature 51°.

November 15. Light and variable airs from midnight to 4 A.M., when a breeze came out from the northward a little easterly, increasing to a stiff breeze with squalls and threatening weather, accompanied by drizzling rain until 11 P.M., when breeze died out. Moderate sea with long swell. At 1.25 P.M. hauled up mainsail and started fires. At 4.30 P.M. took in all sail, then sounded in 2793 fathoms, lat. 47° 22' S., long. 164° 34' W.; brown mud and gravel. At 5.50 P.M. made sail, uncoupled and hauled fires. Current 0.3 knot per hour, setting to the eastward. Barometer at midnight 29.61, temperature 52°.

November 16. Light breeze from the westward, veering to south and increasing to moderate breeze. Pleasant weather. At 12.30 P.M. took in mainsail and started fires. At 3 P.M. shortened and furled sail, then sounded in 2750 fathoms, lat. 47° 54' S., long. 162° 22' W.; brown mud. At 4.25 P.M. commenced swinging ship for compass deviations. At 5.15 P.M. made sail, uncoupled, and hauled fires. The reel showed signs of distress, and, in order to repair it, the wire was transferred to the reel taken from the Palos. Current 0.5 knots per hour, setting S. 44° E. Barometer at midnight 29.56, temperature 50°.

November 17. Moderate to gentle breeze from the southward and westward until 9 A.M., then light

and variable, and for the rest of the day there was scarcely steerage way on the ship. At 10.15 A.M. took in mainsail and started fires. At 1.08 P.M. took in all sail, then sounded in 2533 fathoms, lat. $48^{\circ} 16' S.$, long. $160^{\circ} 17' W.$; light brown mud, stone, shells. After sounding, swung ship for compass deviations. At 5.15 P.M. finished swinging ship, then made sail, uncoupled, and hauled fires. At 11.15 P.M. the wind came out from the southward, increasing to a moderate breeze. Current 0.75 knot per hour, setting to the eastward. Barometer at midnight 29.79, temperature 50° . A large number of albatross following the ship, caught a small one whose wings measured ten feet from tip to tip.

November 18. Light to gentle breeze from S.S.E., veering to northward and westward during the latter part of the day. Long heavy swell from the eastward. There has evidently been a gale in front of us, which accounts for the calm of yesterday and the light breeze to-day. At 3.35 P.M. took in mainsail and started fires. At 6.18 P.M. shortened and furled sail, then sounded in 2796 fathoms, lat. $48^{\circ} 23' S.$, long. $159^{\circ} 05' W.$; brown mud. Yesterday and to-day we used the Palos reel, which necessitates reeling in by hand, thus consuming more time than usual. At 8.45 P.M. made sail, uncoupled, hauled fires. No current observed during the last 24 hours, doubtless on account of the heavy swell from the eastward. Barometer at midnight 29.92, temperature 50° .

November 19. Fresh breeze, varying slightly in direction between north and northwest, and increasing to a fresh gale with squalls from N.N.W. Moderate, increasing to rough sea. At 9.25 A.M. took in main-sail and started fires in distiller boiler, and at 11.25 A.M. started fires in another boiler for sounding. At 2 P.M. shortened and furled sail, then sounded in 2789 fathoms, lat. $48^{\circ} 51' S.$, long. $156^{\circ} 43' W.$; brown mud, black specks. At 3.45 P.M. made sail to double-reefed topsails and single-reefed foresail, uncoupled, and banked fires. Used the old working reel to-day, it having been repaired. The gale increasing and the sea becoming heavy from the N.N.W., I was obliged to shorten sail and lie to under after-stormsails, with engines turning slowly. Ship rolling deeply. Greatest observed roll 34° to starboard and 28° to port. Current 0.5 knot per hour, setting S. 44° E. Barometer at midnight 29.42, temperature 51° .

November 20. Began with overcast, squally, and rainy weather; moderate gale from northward and westward, accompanied by a long swell and heavy sea. Ship lying to and rolling deeply. Extreme observed roll 33° to starboard and 31° to port. At about 4 A.M. the gale broke and the sea soon moderated, the wind veering to the westward, bringing a bright cheerful day with sunshine. Made sail at 4.30 A.M. and put vessel on her course. Spread fires and at 2.45 P.M. took in all sail, then sounded in 2509 fathoms, lat. $48^{\circ} 57' S.$, long. $154^{\circ} 21' W.$; yellowish-brown mud and broken shells.

At 4.20 P.M. made sail, uncoupled, hauled fires. Current 1 knot per hour, setting S. 73° E. Barometer at midnight 29.91, temperature 50° .

November 21. Began pleasant, with fresh breeze from the northward and westward, accompanied by a long swell and moderate sea. At 4.20 A.M. hauled up mainsail and started fires. At 7.20 A.M. shortened and furled sail, then sounded in 2650 fathoms, lat. $49^{\circ} 09'$ S., long. $152^{\circ} 02'$ W.; yellow mud, shells. At 8.50 A.M. made sail to topgallant sails, hauled fires, uncoupled. The wind freshened towards noon and in the afternoon was squally. At 4.05 P.M. hauled up mainsail and started fires. At 6.55 P.M. shortened and furled sail, then sounded in 2915 fathoms, lat. $49^{\circ} 06'$ S., long. $150^{\circ} 00'$ W. After having reeled in to within 75 fathoms of the cup the wire parted. Upon examination a defect was found in the wire. Lost 75 fathoms and specimen-cup. At 8.35 P.M. made sail, uncoupled, and hauled fires. At 10 P.M. the wind veered to the S.W. Current 0.6 knot per hour, setting S. 73° E. At noon barometer stood 29.78, at midnight 29.90. Temperature 49° .

November 22. Began with fresh breeze from S.S.W., and during the day the wind continued steady from the southward and westward, with long swell and moderate sea. At 10.30 A.M. started fires. At 3.30 P.M. took in all sail, then sounded in 2506 fathoms, lat. $49^{\circ} 04'$ S., long. $147^{\circ} 27'$ W.; yellow sand, broken shells. At 3.55 P.M. made sail, hauled fires, and uncoupled.

Current 0.15 knot per hour, setting east. Barometer at midnight 30.08, temperature 47°.

November 23. Light to moderate breeze from southward to westward, with moderate following sea until 3 P.M., when the wind backed to the westward, remaining at N.W. by W. after 6 P.M. In the afternoon long heavy swell from the southward. Ship rolling 20° to windward and 23° to leeward. At 7 A.M. hauled up mainsail and started fires. At 10.07 A.M. shortened and furled sail, then sounded in 2522 fathoms, lat. 49° 02' S., long. 145° 11' W.; yellow sand. At 4.35 P.M. shortened and furled sail and swung ship for compass deviations. At 5.20 P.M. made sail and hauled fires. Current 0.6 knot per hour, setting N. 68° E. Barometer at midnight 30.13, temperature 49.

November 24. Stiff breeze from N.W. to W. with moderate sea. Occasional long swell from the southward. Mist and drizzling rain during the day. At 2.12 A.M. hauled up mainsail and started fires. At 4.50 A.M. took in all sail, then sounded in 2584 fathoms, lat. 49° 04' S., long. 142° 55' W. In reeling in the wire parted, losing 764 fathoms and a cup. Upon examination it was found that *inside* the wire there had been a small bubble not visible from the outside, which reduced the cross-section nearly one half. At 6.50 A.M. made sail, uncoupled, and banked fires. At 6.02 P.M. shortened and furled sail, then sounded in 2613 fathoms, lat. 49° 14' S., long. 140° 33' W.; yellow sand, broken shells. At 7.35 P.M. made sail,

uncoupled, and banked fires. Current 0.25 knot per hour, setting east. Barometer at midnight 29.92, temperature 50°.

November 25. Fresh to strong breeze from N.W. by W., with squalls. Moderate to high sea, with occasional heavy swell from westward. Misty and drizzling rain. At 9.45 A.M. shortened and furled sail, then sounded in 2383 fathoms, lat. 49° 21' S., long. 137° 27' W.; yellow sand, broken shells. At 11.40 A.M. made sail, uncoupled, and banked fires. At 5 P.M. the wind veered to the westward, and at 10 P.M. was S.W., decreasing in force to a gentle breeze. Ship rolling easily but deeply, the greatest recorded roll being 30° to starboard and 28° to port. Current 0.6 knot per hour, setting S. 63° E. Barometer at midnight 29.62, temperature 46°. "Killed the first of our pigs, and have but two sheep remaining."

November 26. Began with gentle to fresh breeze from S.W., with long swell and moderate sea from same direction. At 3 A.M. spread fires. At 3.50 A.M. took in all sail, then sounded in 2646 fathoms, lat. 49° 27' S., long. 134° 53' W. While reeling in the wire parted, losing 1446 fathoms, a specimen-cup, and a deep-sea thermometer which had been attached, the only one in the ship. Upon examination the wire was found to have a defect in it where it parted similar to that which was discovered on the 24th instant—a bubble inside the wire. At 4.54 A.M. made sail, uncoupled, banked fires. A bright sun all day. "A curious fact was observed to-

day. We are half-way between New Zealand and Magellan Straits, and until this morning a large number of albatross have followed the ship, but now not one is to be seen. Two other kinds of sea-birds have taken their places: one resembling a large sea-gull, the other a small sea-gull with brown wings. A few petrel continue with us, but the most of them have disappeared. Perhaps their departure is occasioned by a coming storm. We have remaining on board 107 tons of coal." At 6.30 P.M. shortened and furled sail, then sounded in 2467 fathoms, lat. $49^{\circ} 28'$ S., long. $132^{\circ} 28'$ W.; gray sand. At 8.10 P.M. made sail and hauled fires. In the afternoon the wind backed to the westward, and at 10 P.M. to N.W. by W., increasing in force to a moderate gale with fresh squalls and rain. Current 0.6 knot per hour, setting S. 63° E. Barometer at midnight 29.62, temperature 48° .

November 27. Began with cloudy, unsettled, threatening weather. Stiff breeze to moderate gale, with an occasional heavy squall from W.N.W. to W. by N., accompanied by drizzling rain. Long following and heavy sea. Ship rolling deeply; greatest roll observed, 30° each way. At 5.50 A.M. a heavy sea carried away the port whaleboat. At 8.30 A.M. shortened sail and lay to under stormsails and double-reefed main top-sail. At 9.15 A.M. started fires in order to have steam ready in case of necessity. Barometer 29.50 at 10 A.M., remained steady until 4 P.M., then rose quite rapidly. At 3 P.M. the wind veered to the southward

of west in a heavy squall, after which it decreased in force somewhat. At 4 P.M. took in all sail, then sounded, notwithstanding the gale and rough sea, in 2423 fathoms, lat. $49^{\circ} 26'$ S., long. $129^{\circ} 18'$ W.; gray sand. After sounding lay to under stormsails, with engines moving slowly. Had this cast been delayed an hour it could not have been taken. From 6 P.M. until midnight a gale was blowing from the S.W., with heavy squalls. Heavy rough sea. Barometer rising rapidly from 11 P.M. Vessel rolling deeply. Extreme recorded roll 35° to port and 33° to starboard. Current 0.75 knot per hour, setting S. 80° E. Barometer at midnight 29.70, temperature 47° .

November 28. The gale broke at midnight, and at 1 A.M. had subsided to a fresh breeze, with squalls from west by south. At 1.10 A.M. made sail and put the ship on her course, uncoupled, and let fires die out. Ship rolling deeply, the greatest recorded roll being 36° to starboard and 32° to port, making about 12 oscillations per minute. During the morning watch the wind decreased to a gentle breeze with light rain-squalls. Long following swell. At 11 A.M. hauled up lee clew of mainsail which had been set, and started fires. At 3.55 P.M. shortened and furled sail, and at 4.05 began swinging ship for compass deviations, but the sun becoming obscured, sounded at 5.20 P.M. in 2239 fathoms, lat. $49^{\circ} 25'$ S., long. $127^{\circ} 48'$ W.; gray and black sand, broken shells. At 6.20 P.M. made sail, uncoupled, and hauled fires. From 8 to midnight the

wind backed to N.E. by N. in a gentle breeze, sky became overcast, and a drizzling rain set in. Current 0.9 knot per hour, setting to the eastward. The barometer, which at noon had risen to 29.83, fell by midnight to 29.62. Temperature 47°.

November 29. Began with overcast weather, wind in moderate puffs from N.E. by N., veering to northward. Barometer falling rapidly from 29.62 to 29.45 at 4 A.M. Swell from S.W. Moderate sea from the northward.

From 4 to 8 A.M. Weather squally, misty, and rainy, wind increasing to a fresh breeze. Barometer fell to 29.25 by 8 A.M. At 5.30 double-reefed topsails, furled mainsail and topgallant sails, stowed jib, and set main try-sail. At 6.30 A.M. started fires in two boilers. Moderate swell from S.W.

From 8 to meridian. Weather squally with drizzling rain. Stiff to strong breeze from N.N.E. At 8.30 took in foresail, foretopsail, and foretopmast staysail. Hoisted smokepipe, coupled up, and lay to. At 10.15 made sail and ran for an hour under steam and sail, due south, to see what effect it would have on the barometer, but as it continued falling rapidly I took in sail and lay to under close-reefed maintopsail and stormsails. Barometer had fallen at noon to 28.98.

From 12 to 4 P.M. Moderate to fresh breeze from N.N.E., gradually shifting to N.W. by N. Made preparations for a heavy gale. Sent down topgallant yards and masts. Sent below the two howitzers which were

on the topgallant forecastle ; put extra lashings on boats, sails, and guns ; struck below all shot and shell which were on deck ; rove life-lines, and made everything ready for battening down hatches. At 4 P.M. the ship was under close-reefed main topsail and stormsails. Wind from N.N.W., force about 6, with moderate sea. Had it not been for the rapidly falling barometer, there was nothing to indicate exceptionally stormy weather. Barometer at 4 P.M., 28.72.

From 4 to 6 P.M. Rainy, squally weather. Wind in fresh squalls from N.W. by N. to N.W. Moderately rough and increasing sea from N.W. At 4.30 P.M. furled main topsail and started fires in another boiler, making three in all. At 5.30 P.M. started engines ahead slowly to assist in lying to. At 6 P.M. barometer had fallen to 28.67.

From 6 to 8 P.M. Wind fresh and blowing a moderate gale during squalls, unsteady in direction. Hatches closely battened down. At 8 P.M. barometer had fallen to 28.63 and for a few minutes remained steady, then the wind came out in a fierce squall from W.S.W. with rising barometer.

From 8 to midnight. Blowing a very heavy gale in squalls from W.S.W. to S.W. by W. Rough and increasing sea. At times the squalls were of hurricane violence, dashing the spray over the ship and keeping the deck flooded. It ceased raining towards the end of watch and stars appeared. At midnight wind from S.W. to S.W. by W., force 11. Very rough high sea.

Ship rolling deeply and uneasily. Barometer 28.97, temperature 44°.

November 30. Midnight to 4 A.M. Blowing a heavy gale from S.W. by W. to S.W. Very rough sea from S.W. Ship rolling and pitching heavily. At a little after 2 A.M. a heavy sea came over the quarter, flooding cabin, wardroom, and steerage. Shipped other seas occasionally during the watch. Force of wind in gusts 11. Barometer at 4 A.M. 29.31.

From 4 to 8 A.M. Partly clear, squally weather, blowing a gale from S.W. in squalls, moderating at 8 A.M. Very heavy, rough, mountainous seas from S.W. At 8 A.M., barometer 29.36.

From 8 to meridian. Squally weather with light passing rain. Moderate to strong gale from S.W., gradually moderating in force. Sea still heavy and rough. At 11.35 A.M., the wind and sea having moderated considerably, made sail to foresail, single-reefed fore topsail, double-reefed main topsail, and foretopmast staysail. Force of wind 7 to 9. Barometer at noon 29.49. Banked fires.

From 12 to 4 P.M. Stiff to strong breeze from S.W. to S.S.W., moderating towards 4 P.M. Squally, unsettled weather, with passing showers of rain. Rough sea with heavy swell. Ship rolling deeply at times. At 12.40 shook reefs out of topsails. Barometer at 4 P.M., 29.55.

From 4 to 6 P.M. Fresh breeze from S.S.W., decreasing in force. Long heavy swell from S.S.W.

From 6 to 8 P.M. Partly clear and pleasant. Mod-

erate breeze from S.S.W. Although the sea was very rough, I decided to sound before dark in order not to overrun the distance, i.e., one hundred miles from the last cast. Hence at 7.37 P.M. shortened and furled sail, setting the storm-mizzen, and main trysail. At 7.50 P.M. commenced sounding, the vessel rolling 30° to starboard, 25° to port.

From 8 to midnight. At 9.10 P.M. finished sounding, having found bottom in 2253 fathoms, lat. $49^{\circ} 37'$ S., long. $125^{\circ} 33'$ W.; gray sand. The cast was a good one, notwithstanding the state of the sea. Made sail to single-reefed topsails, etc., put ship on her course, uncoupled, banked fires, and lowered smokepipe. Barometer at midnight 29.68. The gale of the 29th and 30th was the worst one ever experienced by any of the officers on board. The waves were exceedingly high, and for hours seemed as if they would engulf the ship. Every precaution, however, had been taken for the vessel's safety.

December 1. Fresh to gentle breezes from the southward. Long swell from S.S.W. Ship rolling 18° to starboard, 23° to port. Sent up topgallant masts and light yards. Being bright and clear, the day was devoted to drying clothes and articles of all kinds which had been soaked during the gale. At 3.30 P.M. shortened and furled sail, then sounded in 1964 fathoms, lat. $49^{\circ} 36'$ S., long. $123^{\circ} 00'$ W.; white sand. After sounding, the ship was swung for compass deviations. At 6.15 P.M. made sail, uncoupled, and hauled fires. Cur-

rent 0.8 knot per hour, setting N. 72° E. Barometer at midnight 30.01, temperature 46° .

December 2. Light airs and calms in forenoon, followed by gentle breeze in afternoon from N.W. Long heavy swell from S.E. Pleasant weather. Current 0.5 knots per hour, setting N. 51° E. Barometer at midnight 30.12, temperature 48° . This day was also devoted to drying and putting things to rights.

December 3. Light breeze from the N.W. during the whole day. At 9.15 A.M. hauled up mainsail and started fires. At 12.43 P.M. took in all sail, coupled up, then sounded in 1895 fathoms, lat. $49^{\circ} 39'$ S., long. $120^{\circ} 54'$ W. Wire parted at 97 fathoms while reeling in, caused by a defect in the wire. At 1.45 P.M. made sail, uncoupled, hauled fires. Heavy sea from S.E., with an occasional long swell from S.W. and also from N.W., causing a peculiar state of the sea. No current observed. Barometer at midnight 30.14, temperature 47° .

December 4. Light to moderate breeze during the day from N.W., with occasional long swell from the eastward. At 8 A.M. hauled up weather clew of mainsail and started fires. At 11.45 took in all sail, then sounded in 1690 fathoms, lat. $49^{\circ} 49'$ S., long. $118^{\circ} 38'$ W.; hard bottom. At 12.45 P.M. made sail to studding-sails, uncoupled, banked fires. As there was such a marked decrease in depth I decided to take another cast before dark, and at 7.25 P.M. shortened and furled sail, then sounded in 1562 fathoms, lat. $49^{\circ} 51'$ S., long. $117^{\circ} 36'$ W.; light gray sand, broken shells. At 8.20

made sail, uncoupled, and banked fires. The night was dark and rainy. No current. Barometer at midnight 29.96, temperature 47°.

December 5. Began with moderate and fresh breeze from N.W. with drizzling rain and mist. Wind veered to S.W. shortly after 8 A.M., bringing clearing weather, but backing to N.W. by W. in the latter part of the day. Barometer falling. At 3.45 A.M. shortened and furled sail, then sounded in 1583 fathoms, lat. 50° 00' S., long. 115° 50' W.; gray sand, broken shells. At 4.53 A.M. made sail, uncoupled, banked fires. At 5.55 P.M. took in all sail, then sounded in 1847 fathoms, lat. 50° 05' S., long. 114° 16' W. The cup came up with sleeve lifted and jammed; the specimen of bottom had washed out. At 7 P.M. made sail, uncoupled, and hauled fires. Current 0.7 knot per hour, setting S. 48° E. Barometer at midnight 29.78, temperature 48°.

December 6. Fresh to stiff breeze from northward and westward during the day, with falling barometer. At 3.40 A.M. started fires. At 6.35 A.M. took in all sail, then sounded in 2162 fathoms, lat. 50° 15' S., long. 112° 00' W.; yellow sand, mud. At 7.55 A.M. made sail, uncoupled, and let fires die out. Irregular sea from S.W. to N.W. At 3.30 P.M. started fires and hauled up main-sail. At 6.50 P.M. took in all sail, then sounded in 1848 fathoms, lat. 50° 21' S., long. 109° 32' W.; gray and yellow sand, broken shells. At 7.55 P.M. made sail, uncoupled, and banked fires. Current 0.6 knot per hour,

setting S. 40° E. Barometer at midnight 29.48, temperature 47° .

December 7. Stiff to fresh breeze from W.N.W. to W.S.W., squally in the afternoon, wind increasing to moderate gale. Misty, with occasional drizzling rain. Moderate sea from northward and westward, with occasional heavy swell from S.W. Barometer falling all day. At 5.50 A.M. took in sail, then sounded in 1997 fathoms, lat. $50^{\circ} 30'$ S., long. $107^{\circ} 36'$ W.; yellow sand, broken shells. At 7.30 A.M. made sail, uncoupled, banked fires. At 6.15 P.M. shortened and furled sail, then sounded in 2197 fathoms, lat. $50^{\circ} 35'$ S., long. $105^{\circ} 51'$ W.; yellow sand, broken shells. After taking this cast the wind having increased to a moderate gale with increasing sea, the ship was hove to under stormsails. Roll of ship 25° to starboard and 20° to port. Current 0.6 knot an hour, setting S. 40° E. Barometer fell during the 24 hours from 29.48 to 29.07, at midnight. Temperature 45° .

December 8. Lying to in moderate gale with squalls from W.S.W. At 3 A.M. the wind backed to W. and until noon was irregular in force, but gradually moderating. Vessel rolling deeply, the greatest recorded roll being 34° to starboard and 24° to port. Long swell and rough sea from the westward. At 8 A.M. made sail and put vessel on her course. Stiff to fresh breeze blowing all day, veering to S.S.W. At 6.30 P.M. shortened and furled sail, then sounded in 2224 fathoms, lat. $50^{\circ} 42'$ S., long. $103^{\circ} 52'$ W.; yellowish-brown mud,

broken shells. At 7.45 P.M. made sail. Current 0.75 knot per hour, setting S. 50° E. Barometer fell to 28.94 at 8 A.M., then rose gradually, standing at midnight 29.05. Temperature 45° .

December 9. Blowing from fresh breeze to a gale in heavy squalls from S.W. Rough, heavy sea. Ship rolling at times 25° to starboard and 28° to port. The wind moderated somewhat during the day, but continued squally with heavy sea. Not wishing to miss a single cast in the line of soundings, I had fires spread and at 2.45 P.M. shortened and furled sail, then sounded in 2324 fathoms, lat. $50^{\circ} 42'$ S., long. $101^{\circ} 09'$ W.; yellow-brown mud, broken shells. The cast was a very good one, in spite of the heavy sea and consequent rolling and pitching while engaged in taking it. At 4.02 P.M. made sail and banked fires. Current 0.6 knot per hour, setting E. Barometer at midnight 29.37, temperature 46° .

December 10. Stiff to fresh breeze with squalls from W.S.W. Moderate sea, with heavy swell at times from S.W. by W. At 7.20 A.M. spread fires. At 7.45 A.M. shortened and furled sail, then sounded in 2291 fathoms, lat. $50^{\circ} 43'$ S., long. $98^{\circ} 55'$ W.; yellow-brown mud, broken shells. Sighted a square-rigged vessel about ten miles to the southward standing to the eastward. (This, by the way, was the only vessel seen during the passage from New Zealand to Magellan Straits.) At 9.05 A.M. made sail, uncoupled, and banked fires. Wind moderated in afternoon, with drizzling rain. At 7.23 P.M. shortened and furled sail, then sounded in 2383

fathoms, lat. $50^{\circ} 44'$ S., long. $97^{\circ} 20'$ W. At 8.40 P.M. made sail, uncoupled, and let fires die out. Current 0.6 knot per hour, setting to the eastward. Barometer at midnight 29.25, temperature 46° .

December 11. Fresh to moderate breeze from W.S.W., decreasing in force. Foggy and drizzling rain. Moderate sea and long following swell. At 7 A.M. started fires. At 9.53 A.M. shortened and furled sail, then sounded in 2540 fathoms, lat. $50^{\circ} 50'$ S., long. $95^{\circ} 14'$ W.; brown mud, shells. Ship rolling from 20° to 23° . At 11.10 A.M. made sail, uncoupled, and banked fires. In the afternoon the wind increased to a stiff breeze with squalls; drizzling rain. At 7.20 P.M. shortened and furled sail, then sounded in 2711 fathoms, lat. $50^{\circ} 54'$ S., long. $93^{\circ} 40'$ W.; brown mud. The shot would not detach, although many attempts were made by reeling in a few fathoms and then letting the wire run out quickly. After working nearly an hour I ordered the wire to be reeled in with the shot attached if it could be done. Many thought the reel would not stand the pressure, but having confidence in its strength I thought it worth while to make the attempt, particularly as the Palos reel could be used for the remaining casts should this one be crushed. As the reeling engine could not do the work unaided, the crew were called on to assist. By detailing four men at a time to work the cranks of the reel, and relieving them at every hundred turns, the whole 2711 fathoms with shot and cup were recovered without injury to the reel.

So far as known no shot except this has ever been reeled in from so great a depth. The bale of the shot had caught on a knot in a rope yarn which was attached to the cup. I think that the thick mud which had packed between the cup and the hollow of the sinker also prevented the shot from detaching. It took until 11.08 P.M. to reel in the wire; then sail was made, fires hauled, and propeller uncoupled. Current 0.6 knot per hour, setting S. 70° E. Barometer at midnight 29.19, temperature 46° .

December 12. Fresh breeze from W.S.W. to W.N.W., with moderate and at times rough sea from the westward. At 6.50 A.M. started fires. At 9.05 A.M. shortened and furled sail, then sounded in 2677 fathoms, lat. $50^{\circ} 58' S.$, long. $91^{\circ} 33' W.$; brown mud. At 10.25 A.M. made sail, uncoupled, and banked fires. At 7.20 P.M. shortened and furled sail, then sounded again in 2579 fathoms, lat. $51^{\circ} 01' S.$, long. $89^{\circ} 30' W.$; brown mud. At 8.44 P.M. made sail, uncoupled, and banked fires. Current 0.6 knot per hour, setting S. 70° E. Barometer at midnight 29.27, temperature 48° .

December 13. Fresh breeze from N.W. by W. to N.N.W., increasing in afternoon to a strong breeze with squalls. Moderately rough sea. Drizzling rain and mist during the day. At 7.15 A.M. shortened and furled sail, then sounded in 2516 fathoms, lat. $51^{\circ} 07' S.$, long. $87^{\circ} W.$; brown mud. At 8.50 A.M. made sail, banked fires. At 6.40 P.M. took in all sail, then sounded in 2477 fathoms, lat. $51^{\circ} 13' S.$, long. $84^{\circ} 38' W.$; brown

mud, shells. At 8.10 P.M. made sail and banked fires. Ship rolling from 18° to 27° . Long swells from westward. Current 0.75 knot per hour, setting E. Barometer at midnight 29.19, temperature 48° .

December 14. Fresh breeze with very fresh squalls from the N.W. and drizzling rain. Long heavy swell with rough sea. At 4.30 A.M. spread fires. At 7.05 A.M. shortened and furled sail, then sounded in 2378 fathoms, lat. $51^{\circ} 18' S.$, long. $82^{\circ} 31' W.$; brown mud and shells. At 9.10 A.M. made sail, uncoupled, and banked fires. During the forenoon the sun came out bright, the breeze continuing strong from the northward and westward. Directly in our route and only seventy miles from the last cast there was recorded on the chart a solitary sounding which agreed very well with the depth found in the morning, and, as we were making about ten knots an hour, I decided to run past that position and take the next cast beyond. The day was spent in bending chains, preparing for port, and getting ready for anchoring, as we were only 270 miles from Magellan Straits. At 11.45 P.M. started fires. Current 0.6 knot an hour, setting S. $64^{\circ} E.$ Barometer at midnight, 29.92, temperature 48° .

December 15. Fresh, squally, but increasing breeze from W.N.W. Moderately heavy sea from W. to N.W. At 2.35 A.M. sounded in 2162 fathoms, lat. $51^{\circ} 57' S.$, long. $78^{\circ} 34' W.$; gray-brown mud, shells. At 4 A.M. made sail and banked fires. At 8 A.M. spread fires and started another boiler for steaming purposes;

hoisted smokepipe. The wind moderated to a gentle breeze during the day. At 9.05 A.M. commenced steaming ahead with two boilers. At 9.50 A.M. connected on the third boiler. At 11.45 A.M. shortened and furled sail, then sounded in 2167 fathoms, lat. $52^{\circ} 10' S.$, long. $77^{\circ} 08' W.$; gray-brown mud, shells. At 12.45 P.M. made sail, and continued on under steam and sail. At 5 P.M. shortened and furled sail, then sounded in 1200 fathoms, lat. $52^{\circ} 16' S.$, long. $76^{\circ} 02' W.$; gray sand. At 5.40 P.M. made sail and continued on our course. At 7.15 P.M. the lookout at the masthead sighted land ahead and one-half point off port bow. We had been running under steam and sail, hoping to reach the Evangelist Islands before dark. Fortunately the weather was clear. The wind decreased to a gentle breeze and the sea became comparatively smooth. At 9 P.M., when Sugar Loaf, an island of the Evangelist group, bore about north, a cast was taken in 25 fathoms. The anchor was let go at once, but we had drifted into 35 fathoms before it brought up. Veered to 90 fathoms of chain. My reason for anchoring in the broad Pacific, rather than lying to to await daylight, was because our exact position was known, and therefore a course could be laid for the entrance to the straits, and we could run with confidence even should the weather be thick. The wisdom of this course was soon proved, for during the night it clouded up and a rain set in with thick mist.

December 16. At 3 A.M. we were under way, heading for the straits, the weather so thick we could

not see land. At 4.15 A.M. sighted Cape Pillar off star-board bow, about three miles distant. Weather continued very thick, giving us only occasional glimpses of land. At 5.25 A.M. the Spanish Launches bore abeam, and at 6 A.M. Westminster Hall was abeam. At 8 A.M. it cleared off, and during the remainder of the day the weather was clear, with a bright sun. Steamed until 6.55 P.M., when we anchored in Fortesque Bay. It rained again during the night.

December 17. Under way at 5 A.M., and reached Sandy Point (Punta Arenas) at 1.30 P.M., where we found at anchor the French man-of-war *Reine Blanche*, bearing the flag of Rear Admiral Franquet. Had remaining on board $40\frac{1}{2}$ tons of coal. Draught of ship, 14 feet forward, 16 feet 3 inches aft.

Of the fifty-seven casts taken in the line just completed, forty-four were between 2 and $3\frac{1}{2}$ statute miles, as follows:

Between 2 and $2\frac{1}{2}$ miles.....	10
Between $2\frac{1}{2}$ and 3 miles.....	21
Between 3 and $3\frac{1}{2}$ miles.....	13

At Sandy Point sixteen tons of coal were taken on board, to insure enough for emergencies. Exchanged visits with the governor of the place, and on the 10th of December left for Montevideo, where we arrived on the 1st January, 1886, having swung ship and had target-practice *en route*.

The distance from Wellington, New Zealand, to Montevideo, following the course of the *Enterprise*, was 6110 miles. Only 140 tons of coal were consumed in making this distance, as follows :

Expended for steaming purposes.....	63 tons
Expended for deep-sea soundings.....	36 “
Expended for distilling water.....	26 “
Expended for swinging ship for compass de- viations.....	3 “
Expended for galley (cooking).....	12 “
	<hr/>
Total.....	140 tons

CHAPTER IV.

HOMEWARD BOUND (CONTINUED).

DISCOVER AN EXTENSIVE BANK.—CONNECT WITH LINE OF SOUNDINGS TAKEN IN 1883 BY THE ENTERPRISE ON OUTWARD VOYAGE, AND THUS COMPLETE THE CIRCUM-NAVIGATION OF THE GLOBE.—BARBADOS.—ST. THOMAS.—NEW YORK.—ENTERPRISE GOES OUT OF COMMISSION.

AT the beginning of the year 1886 the terms of enlistment of more than eighty of the crew had expired, and every week added to the number. As the law entitles each enlisted man to one fourth more pay while detained abroad after the expiration of his enlistment, it was necessary to hasten our departure, if for no other reason than that of economy. We therefore remained at Montevideo only long enough to give the crew a well-earned recreation on shore and to prepare the ship for sea.

On the 9th of January, having laid in an extra supply of coal, provisions, and sinkers, the Enterprise left Montevideo and steamed slowly down the river.

By noon of the 11th the 100-fathom curve was passed, beyond which in the immediate vicinity there were no soundings noted on the chart. Here a cast was taken

in 761 fathoms, lat. $35^{\circ} 06'$ S., long. $52^{\circ} 05'$ W., in a bottom of green mud. The weather during the night had been peculiar. Wild-looking black clouds piled up in the northwest, vivid lightnings flashed, and distant thunder rolled continually. The wind also shifted suddenly from N.E. to N.W. Naturally we expected a tempest and made preparation accordingly, but it did not reach the ship, though for hours the weather maintained a threatening attitude.

In order to avoid the track made by the Challenger some years before, the Enterprise was headed well to the northward towards Nelson Shoal, on which the chart showed 19 fathoms. At 7 P.M. we took the second cast for the day in 1126 fathoms, lat. $34^{\circ} 49'$ S., long. $51^{\circ} 23'$ W., the character of the bottom having changed to dark mud.

On the 12th, soon after daylight, we sounded in 1633 fathoms, lat. $34^{\circ} 30'$ S., long. $50^{\circ} 47'$ W.—dark mud; and again at 3.40 P.M. in 1589 fathoms, lat. $34^{\circ} 04'$ S., long. $49^{\circ} 49'$ W., but no specimen of the bottom was recovered, as the cup failed to close tightly.

On the 13th, at daylight, we sounded in 1775 fathoms, lat. $33^{\circ} 45'$ S., long. $48^{\circ} 48'$ W.—dark mud; and at 5 P.M. in 1859 fathoms, lat. $33^{\circ} 18'$ S., long. $47^{\circ} 53'$ W.—gray mud, broken shells; a marked change in the character of the bottom. The wind had now freshened to a strong breeze from the northward and eastward, but as I wished to sound on Nelson Bank, we continued under steam, making slow progress.

On the morning of the 14th a cast was taken in 1976 fathoms, lat. $32^{\circ} 58' S.$, long. $47^{\circ} 22' W.$ —dark mud; and at 4.30 P.M. we sounded over Nelson Shoal,* finding 2088 fathoms, lat. $32^{\circ} 33' S.$, long. $46^{\circ} 48' W.$ —dark mud. This certainly was no shoal, and yet from our experience a few days later it is possible that one may exist somewhere in the neighborhood. After taking this cast, I kept the fore-and-aft sails full on port tack, making nearly an E. by N. course, steaming as before under two boilers.

On the 15th, just after daylight, we swung ship for compass deviations, and then sounded in 2192 fathoms, lat. $32^{\circ} 24' S.$, long. $45^{\circ} 32' W.$ —dark mud; and again in the afternoon in 2132 fathoms, lat. $32^{\circ} 14' S.$, long. $44^{\circ} 14' W.$ —brown mud.

On the 16th sounded at 5 A.M. in 2145 fathoms, lat. $31^{\circ} 57' S.$, long. $43^{\circ} 16' W.$; brown mud. From this point, the wind being about N.N.E., I changed course and ran to the eastward in order to connect with the line of soundings which the Enterprise made on her outward voyage in 1883. A good cast was taken in the afternoon in 2036 fathoms, lat. $31^{\circ} 43' S.$, long. $41^{\circ} 55' W.$; light brown mud.

On the 17th, after daylight, sounded in 1999 fathoms, lat. $31^{\circ} 40' S.$, long. $40^{\circ} 28' W.$; brown mud. The wind becoming more favorable, stopped steaming and put the ship under sail, continuing the same course. At 7 P.M.

* The shoal has had several positions given to it, but the latitude and longitude of this cast represents about the average of the positions assigned.

another cast was taken in 2334 fathoms, lat. $31^{\circ} 35'$ S., long. $39^{\circ} 08'$ W., in a bottom of brown mud.

On the 18th, in the morning, sounded in 1949 fathoms, lat. $31^{\circ} 29'$ S., long. $38^{\circ} 05'$ W. Character of bottom, *sand*—a great change in depth and character of specimen. Took another cast in the afternoon in 1469 fathoms, lat. $31^{\circ} 22'$ S., long. $36^{\circ} 39'$ W., the cup bringing up a specimen of yellow and white sand and shells. Still shoaling with sandy bottom.

On the 19th, at 5 A.M., sounded in 547 fathoms, lat. $31^{\circ} 13'$ S., long. $35^{\circ} 42'$ W., the character of bottom being the same as before, viz., yellow and white sand and shells. The small depth revealed by this cast was a genuine surprise, as we had no particular reason to expect a bank in this neighborhood, its position being about 600 miles S.E. $\frac{3}{4}$ S. *true* from Cape Frio. We now took casts for some time at distances of five miles, finding depths of 467, 471, 444, 481, 400, and 847 fathoms, the latter cast being taken at noon in lat. $31^{\circ} 07'$ S., long. $35^{\circ} 03'$ W. As this depth was so much greater than the previous one, I judged we had passed over the shoalest part of the bank; and wishing to give the crew time for target-practice with small arms, we sailed slowly along with a light breeze and did not sound again until 3.30 P.M., when a cast was taken in 1095 fathoms. This increased depth strengthened my belief that the shoalest part of the bank had been crossed; but thinking it well to take one more cast before dark, I gave directions to sound at sundown, when a depth of only 378 fathoms

was found, lat. $31^{\circ} 02'$ S., long. $34^{\circ} 27'$ W. This was again a surprise and to most of the officers and crew a disappointment, as they were anxious to reach the United States. Frequent casts were now taken in order to develop the shoal. Casts were taken at 7.30 P.M. in 390 fathoms, at 8.50 in 426 fathoms, and at 10 P.M. in 495 fathoms. General character of bottom, coarse yellow and white sand and shells, with occasional black specks.

On the 20th, at 1 A.M. sounded in 584 fathoms, at 5 A.M. in 956 fathoms, and at noon in 1827 fathoms. The character of the bottom had changed but little except in the quality of the sand, which had become much finer. This last cast was taken in lat. $30^{\circ} 39'$ S., long. $32^{\circ} 43'$ W. We sounded again at 5 P.M. in 2113 fathoms, lat. $30^{\circ} 32'$ S., long. $31^{\circ} 50'$ W.; hard bottom. The cup brought up no specimen.

On the 21st sounded at 5 A.M. in 1834 fathoms, lat. $30^{\circ} 21'$ S., long. $30^{\circ} 40'$ W., fine white sand and shells. Finding such a decided difference in depth with water shoaling, I had another cast taken at 4 P.M. in 1296 fathoms; fine white sand and shells. There was a fresh light breeze wafting us along on our course at the rate of seven knots an hour, and I knew that this frequent stopping to sound under the circumstances was very trying to every one on board; still, as the water was shoaling, I had another cast taken at 10.30 P.M. in 1766 fathoms, lat. $29^{\circ} 54'$ S., long. $29^{\circ} 00'$ W. We were indeed glad to find the water deepening,

and as this cast was only 85 miles *west* of one of 2509 fathoms taken by the *Enterprise* on her way out in 1883, and about 100 miles S.W. of another cast of 2288 fathoms, we could properly consider the line between Montevideo and Cape Town, or across the South Atlantic, completed. On the 22d, at 2 P.M., we sounded in 2539 fathoms, lat. $28^{\circ} 52' S.$, long. $28^{\circ} 11' W.$; brown mud and shells. While taking this cast a remarkably strong undercurrent was found setting to the westward. It was very decided in character and I deeply regretted that there were no deep-sea thermometers on board with which to determine its temperature. A course was now shaped to cut our former line half-way between two of the soundings therein.

On the 23d, at 10 A.M., we crossed the track of the *Enterprise* on her outward voyage, *thus completing the circumnavigation of the globe*. Sail was immediately shortened and furled, and a cast taken in 2851 fathoms, lat. $27^{\circ} 54' S.$, long. $27^{\circ} 32' W.$; dark brown mud—the position being just midway between former casts of 3147 fathoms, lat. $26^{\circ} 56' S.$, long. $27^{\circ} 44' 40'' W.$, and 2288 fathoms, lat. $28^{\circ} 49' 47'' S.$, long. $27^{\circ} 31' 27'' W.$, and about 60 miles from each. The depth agreed excellently well with what we might expect. The same strong westerly undercurrent previously mentioned was again noticed. We swung ship for compass deviations in the afternoon about 200 miles north of where we swung on the outward voyage. The wind becoming very light, at sundown the vessel was put under steam.

On the morning of the 24th, a light breeze from the westward having sprung up, fires were hauled and sail made.

On the 25th sounded in 3002 fathoms, lat. $24^{\circ} 14' S.$, long. $27^{\circ} 20' W.$; dark brown mud. This cast was about 60 miles from one of 2994 fathoms taken on the way out and about 90 miles from another of 3020 fathoms, showing a remarkably level floor. The breeze died out during the night, and there was a calm during the whole of the following day.

On the night of the 26th steam was raised, and on the 27th two casts were taken: one in 2995 fathoms, lat. $22^{\circ} 56' S.$, long. $27^{\circ} 22' W.$; and the other in 2865 fathoms, lat. $21^{\circ} 43' S.$, long. $27^{\circ} 19' W.$

At 9.30 A.M. of the 28th sounded in 2727 fathoms, lat. $20^{\circ} 24' S.$, long. $27^{\circ} 40' W.$ —stiff brown mud, after which, a light breeze having sprung up, fires were hauled, and sail made to royals. Scarcely had this been done when the breeze died out completely, and for twenty hours I think there was the *deadest* calm I ever experienced.

On the 29th we still had 3000 miles to make to reach Barbados, with only 58 tons of coal in the bunkers. I had steam raised again in the afternoon, hoping that a short run would bring us into the trades. The night of the 29th was perfect for steaming. The sea was glassy, the sky cloudless; Venus shone with remarkable brilliancy, and as the vessel steamed through the water causing small undulations to spread over its surface, I counted eight distinct reflections of this star at the same instant.

For several days light breezes and variable airs from N.E. to N. wafted us on our course, although we were well within the belt of the S.E. trades.

Casts were taken daily, sails being clewed up, with topsail yards mastheaded. When the wire had been reeled in to 2000 fathoms topsails were sheeted home, care being taken to keep the speed of the ship down to four knots; when the cup was within 1000 fathoms of the surface all sail was made. Steam was raised as usual for each cast.

On February 3d we were 200 miles to the eastward of the outward-bound track, but from this time on light breezes headed us off, so that on the 7th of February our track was again crossed, when a cast was immediately taken in 2878 fathoms (between two of our former casts) in lat. $8^{\circ} 26'$ S., long. $31^{\circ} 31'$ W.; yellow-brown mud.

Our course took us about 140 miles to the eastward of Pernambuco and Cape St. Roque and about 20 miles to the eastward of "The Rocas."

The breeze continued very light, the ship sometimes not making more than half a knot an hour; still, as the current was favorable and the vessel had steerage way, I did not care to use steam except for sounding.

On the 12th our last cast was taken in the *South* Atlantic, and during the night the equator was crossed.

On the 13th we were in the doldrums, experiencing rainy squally weather, with little or no wind.

We got up steam at 2 A.M., and on the 14th started

ahead and were soon in clear weather, so that we were able to swing ship in the morning for compass deviations. At 1 A.M. the N.E. trades set in as we supposed, when the engines were stopped and sail made, but a dead calm soon followed and at night there was a deluge of rain.

On the 15th a light breeze again sprung up from the N.E., accompanied by rain-squalls which were particularly heavy at night. We did not neglect, however, to take a cast each day. Rainy disagreeable weather continued until the 20th when the wind freshened to a stiff breeze. At noon on the 22d a salute of twenty-one guns was fired in honor of the day. This is a day of rest on shore, but at sea the sailor has no holiday; he makes and shortens sail or shovels coal into furnaces, as occasion may require.

We were running a line where few soundings had ever before been taken, and it would not do to neglect our opportunities. Two casts were therefore taken this day, one in 2593 fathoms, the other in 2728 fathoms.

On the 23d two more casts were taken, in 2997 and 2714 fathoms; on the 24th, in 2673 and 2560 fathoms; and on the 25th, in 2425 and 2421 fathoms.

The character of the bottom in each case was ooze.

On the 26th we were so near Barbados that I added steam to sail to insure reaching the anchorage by night. At 2 P.M. we sighted land ahead. At 6 P.M. we took the last cast in this line in 1204 fathoms, lat. $12^{\circ} 38'$ N., long. $58^{\circ} 14'$ W.; ooze, sand, and shells. At 7 P.M.

anchored off Bridgetown, having about five tons of coal remaining in the bunkers.

We had steamed and sailed from Montevideo 5031 miles and had taken 72 casts, of which 49 were between 2 and $3\frac{1}{2}$ miles in depth. Of these 14 were between 2 and $2\frac{1}{2}$ statute miles in depth, 16 between $2\frac{1}{2}$ and 3 miles, and 19 between 3 and $3\frac{1}{2}$ miles in depth.

On the following morning, the 27th, the *Enterprise* steamed into the inner harbor, saluted the port with twenty-one guns, and also the broad pennant of Commodore FitzRoy, commander-in-chief of the British flying squadron, consisting of the *Active* (flag-ship), *Calypso*, *Volage*, and *Rover*. H. M. S. *Bellerophon*, Captain Fitzgerald, was also in port. I was delighted to find in command of the *Volage* my old acquaintance Captain Johnstone, whom I last met in command of H. M. S. *Dryad* at Tamatave, Madagascar, in 1883.

As soon as possible the ship was coaled, and on the 2d of March we were under way for St. Thomas, where we arrived on the night of the 4th. We sailed on the following day for the United States, after having taken on board a few tons of coal.

On the 6th of March, when in lat. $19^{\circ} 53' N.$, long. $65^{\circ} 45' W.$, we sounded in 4529 fathoms, a depth of more than five statute miles, bringing up a good specimen of bottom, consisting of brown ooze. We began this cast at 5.55 A.M., reached bottom at 7, and finished at 8.25 A.M. This cast was forty-two miles from the position of the deepest cast ever taken in the Atlantic,

and only 32 fathoms less than that in depth. The cast referred to being taken by Lieutenant-Commander W. H. Brownson, U. S. N., when in command of the Coast Survey Steamer Blake. In the afternoon we sounded again in 2990 fathoms, lat. $21^{\circ} 00' N.$, long. $66^{\circ} 14' W.$; brown mud.

On the 7th we sounded at 5.30 A.M. in 3079 fathoms, lat. $22^{\circ} 06' N.$, long. $66^{\circ} 44' W.$ —light brown mud; and again at 5.30 P.M. in 3101 fathoms, lat. $23^{\circ} 07' N.$, long. $67^{\circ} 08' W.$, finding the same kind of bottom.

On the 8th, at 5.30 A.M., a cast was taken in 3133 fathoms, lat. $24^{\circ} 23' N.$, long. $67^{\circ} 58' W.$ —light brown mud; and in the afternoon in 3006 fathoms, lat. $25^{\circ} 22' N.$, long. $68^{\circ} 41' W.$, in the same bottom, light brown mud.

On the 9th, at 5.30 A.M., sounded in 2880 fathoms. In reeling in the wire parted, losing 1400 fathoms and a specimen-cup. Again in the afternoon we sounded in 3004 fathoms, lat. $27^{\circ} 36' N.$, long. $70^{\circ} 14' W.$; brown mud.

On the 10th there was a stiff breeze with squalls and falling barometer, giving evidence of a coming gale. Sail was therefore furled and our *last cast* taken in 2956 fathoms, lat. $29^{\circ} 36' N.$, long. $71^{\circ} 33' W.$, the character of the bottom being brown mud as before. There was general rejoicing when this last sinker was expended. By the time the cast was finished the gale had freshened causing a rough sea. We therefore lay to until daylight of the morning of the 12th, when the vessel proceeded

on her course under steam. On the 13th bad weather was again encountered, and once more the ship was hove to under stormsails. During the afternoon of the 14th, the wind having rapidly decreased in force, we continued on our course.

On the night of the 16th, while steaming *in a dense fog* off the capes of the Chesapeake, a large steamer suddenly appeared close aboard, apparently running at full speed and without blowing her whistle, although our own was being sounded according to regulations. Our engines were backed as soon as the steamer was seen off our starboard bow, which enabled her to clear us by about a ship's length. This incident is mentioned as an example of reckless running in fogs on the part of some of the ocean greyhounds.

On the 17th we reached the anchorage in New York harbor, and on the 24th, after discharging our ammunition at Ellis Island, we proceeded to the New York Navy Yard.

On the 31st of March, 1886, the *Enterprise* was put out of commission.

In the following pages is given a tabular summary of the casts taken throughout the cruise. An explanation of the symbols employed is appended for the information of those not familiar with them.

SYMBOLS FOR STATE OF SEA.

B—Broken or irregular sea.	M—Moderate sea or swell.
C—Chopping, short or cross sea.	R—Rough sea.
G—Ground swell.	S—Smooth Sea.
H—Heavy sea.	T—Tide-rips.
L—Long rolling sea.	

ABBREVIATIONS OF BOTTOMS

M. for Mud.	bk. for black.	hrd. for hard.
S. " Sand.	wh. " white.	sft. " soft.
G. " Gravel.	yl. " yellow.	fne. " fine.
Sh. " Shells.	gy. " gray.	crs " coarse.
P. " Pebbles.	bu. " blue.	brk. " broken.
Sp. " Specks.	dk. " dark.	stk. " sticky.
C. " Clay.	gn. " green.	rky. " rocky.
St. " Stones.	br. " brown.	
R. " Rock.	rd. " red.	
Co. " Coral.		
La. " Lava.		

WEATHER SYMBOLS.

<i>b</i> —Clear blue sky.	<i>q</i> —Squally weather.
<i>c</i> —Cloudy weather.	<i>r</i> —Rainy weather or continuous rain.
<i>d</i> —Drizzling or light rain.	<i>s</i> —Snow, snowy weather, or snow falling.
<i>f</i> —Fog or foggy weather.	<i>t</i> —Thunder.
<i>g</i> —Gloomy or dark, stormy-looking weather.	<i>u</i> —Ugly appearances or threatening weather.
<i>h</i> —Hail.	<i>v</i> —Visibility of distant objects.
<i>l</i> —Lightning.	<i>w</i> —Wet or heavy dew.
<i>m</i> —Misty weather.	<i>z</i> —Hazy.
<i>o</i> —Overcast.	
<i>p</i> —Passing showers of rain.	

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
BETWEEN THE UNITED STATES AND PORTA PRAYA—VIA PORTO GRANDE,

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
1	1883. Jan. 16	° ' " 35 35 00 N.	° ' " 48 22 00 W.	2854	gy. ooze, S., Sh.	N.E.	2
2	Jan. 19	31 12 47	42 34 48	2166	gy. ooze, S., minute shells	S.W. by W.	4-5
3	Jan. 27	27 37 57	33 56 45	2698	gy. ooze, S., minute shells	S.E. by E.	3
4	Jan. 28	26 47 00	31 58 00	3093	rd. ooze, S., Sh.	S.E.	2
5	Feb. 8	16 35 00	24 52 00	1471	rd. S., Sh.	E. by N.	6
6	Feb. 9	14 57 00	23 51 00	1061	no specimen	E. by N.	3-4

BETWEEN PORTA PRAYA, CAPE DE VERDE

7	Feb. 11	12 10 00 N.	23 45 18 W.	2742	no specimen	N.E.	4
8	Feb. 12	9 28 00	24 08 24	2668	gy. ooze, S., Sh.	N.E. by E.	4
9	Feb. 13	7 16 22	24 23 59	2509	gy. ooze, S., Sh.	E.N.E.	3
10	Feb. 14	5 27 25	24 33 18	2307	no specimen	E.N.E.	2
11	Feb. 15	3 29 47	24 46 34	2339	dk. gy. ooze, S., Sh.	N.E.	2
12	Feb. 16	0 55 25	25 04 38	2213	gy. ooze, S., Sh.	S. by E.	2
13	Feb. 17	0 06 08 S.	26 35 27	1919	gy. ooze, S., Sh.	S.S.E.	2-3
14	Feb. 18	1 33 00	27 43 45	2627	no specimen	S. by E.	2-3
15	Feb. 20	4 06 00	29 04 22	2803	br. m., Sh.	S.E.	2
16	Feb. 21	5 28 00	30 14 22	2801	no specimen	S.E. by S.	3
17	Feb. 24	10 25 00	32 19 36	2898	br. ooze	S.E. by S.	4

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

CAPE DE VERDE ISLANDS. CASTS TAKEN BY LIEUT. G. A. NORRIS, U.S.N.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
b. c.	S.	65	66	36	h. m. s. 0 49 12	h. m. s. 4 00 00	Wire jumped off when sounding. Connecting hook of belt broke several times. Manila belt tried, but it stretched too much. Repaired leather belt by discarding hook and serving ends together—worked well.
p. c. q.	R.	68	69	36½	0 39 05	0 40 55	Ship got stern to wind—backing engines. In reeling in the flange opposite the V-groove carried away about 18 inches.
b. c.	S.	72	71	36	0 31 45	1 57 00	In reeling in the belt parted. Made a new one. Detained about one half-hour by this accident.
b. c.	S.	73	72	36	1 32 30	0 49 00	Some of the splices showed signs of giving out.
b. c.	M.	71	71	37	0 16 50	0 20 00	Apparently an undercurrent setting to the southward and westward.
b. c.	S.	70	71	39	0 10 00	wire broke	The attendant guiding the wire carelessly let the wire catch under the belt; wire parted, losing cup, thermometer, and 703 fathoms wire.

ISLANDS, AND CAPE TOWN, SOUTH AFRICA.

b. c.	M.	74	72		1 11 30	0 40 30	Wire broke when 450 fathoms had been paid out, losing thermometer, cup, and 50 fathoms wire. Caused by kink which had been turned in while reeling up new wire yesterday, and which had escaped notice. Bent on new grommet and distant line and took the cast. In reeling in the composition part of the specimen-cup became unscrewed and was lost.
b. c. z.	M.	75	77		0 34 45	0 34 50	The flexible steam-pipe showed signs of weakness; covered it with canvas and served it over.
b. c.	M.	77	79		0 29 32	0 30 15	The specimen was gray ooze, composed of minute shells of different colors and shapes—evidently alive. Looks like a mess of fish-spawn with a peculiar smell like clams. Different from anything before brought up.
b. c.	S.	81	81		0 29 04	wire broke	Wire broke at a splice. The flexible steam-pipe burst and another was fitted.
b. c.	S.	82	81		0 24 35	0 33 00	This specimen entirely different from the last.
b. c.	S.	81	82		0 25 14	0 29 05	
b. c.	S.	80	79		0 21 05	0 22 40	
b. c.	S.	80	79		0 32 00	wire broke	Wire broken when a few turns were taken. Lost 2600 fathoms wire and specimen-cup.
o. c.	S.	81	80		0 32 55	0 42 50	Evidently strong current. Ship kept over wire with difficulty.
b. c.	S.	82	80		0 33 00	wire broke	In reeling in the belt parted, causing the wire to jump off the reel. Parted, losing 2687 fathoms and specimen-cup
b. c.	S.	82	82		0 39 39	0 44 40	Tried a new belt of rattling stuff which worked well. Specimen-cup was made on board out of materials found in the ship.

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
BETWEEN PORTA PRAYA, CAPE DE VERDE

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1883	° ' "	° ' "				
18	Feb. 26	14 27 40	33 46 45 W.	2561	br. ooze, Sh.	S.E. by S. East	2-3
19	Feb. 27	15 27 30	33 57 19	2492	yl. br. ooze		3
20	Feb. 28	16 30 00	33 46 00	2498	yl. br. ooze	East	3
21	Mar. 1	17 42 10	33 26 26	2498	yl. br. ooze	E. by N.	2
22	Mar. 2	19 06 27	32 40 00	2319	br. M.	East	3
23	Mar. 3	20 11 43	31 54 18	2475	yl. br. M., stk.	N.E. by E.	3
24	Mar. 5	22 24 53	29 54 27	2892	br. ooze	E.N.E.	4
25	Mar. 6	23 46 20	28 54 20	3020	yl. br. ooze	E.N.E.	3
26	Mar. 7	24 54 00	28 18 16	2999	dk. br. M., stk.	E. by S.	3
27	Mar. 8	25 53 18	28 09 39	2908	dk. br. M., stk.	E. by S.	1
28	Mar. 9	26 56 08	27 44 40	3147	dk. br. M., stk.	East	3
29	Mar. 10	28 49 47	27 30 27	2288	hard bottom	E.S.E.	3-4
30	Mar. 11	29 52 57	27 23 04	2509	lt. br. M., Sh.	E. by S.	2
31	Mar. 12	30 22 18	26 12 54	2537	yl. hard M., dk. Sp.	N.E. by E.	1-2
32	Mar. 13	30 42 16	24 24 26	2530	hrd. lt. br. M., Sh.	N. by W.	4
33	Mar. 14	31 01 36	22 46 15	2511	hrd. lt. br. M., Sh.	North	4
34	Mar. 14	31 08 28	21 57 30	2372	lt. br. M.	N. by E.	4-5
35	Mar. 15	31 23 40	19 43 16	2351	lt. br. M.	North	5-6
36	Mar. 18	30 35 02	12 49 03	1700	lt. br. M.	S.E. by S.	3
37	Mar. 19	31 12 16	12 38 53	1364	bk. M., scoria	E. by S.	3-4
38	Mar. 19	31 15 16	12 19 32	1507	hrd. bk. M.	East	3-4
39	Mar. 20	31 38 42	12 05 28	1864	wh. ooze, Sh.	E. by N.	2
40	Mar. 20	31 37 29	11 29 22	1919	hard bottom	E.N.E.	3
41	Mar. 21	31 57 20	9 43 26	2050	hard bottom	N.W.	4
42	Mar. 22	32 03 48	7 09 22	2314	hard bottom	S.E. by S.	3
43	Mar. 22	32 11 31	6 03 58	2308	wh. ooze, s., sh.	S.E. by E.	2
44	Mar. 23	32 19 00	4 23 34	2008	hrd. wh. S.	S.S.E.	2
45	Mar. 23	32 26 00 S.	3 23 32	2353	wh. S. and Sh.	S. by W.	3
46	Mar. 24	32 24 00	1 32 52	2343	wh. S. and Sh.	S. by W.	4
47	Mar. 24	32 30 00	0 27 46	1255	wh. S.	S.E. by E.	3

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.
ISLANDS, AND CAPE TOWN, SOUTH AFRICA.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
		°	°		h. m. s.	h. m. s.	
b. c.	S.	79	82		0 31 05	0 39 35	
b. c.	S.	79	81		0 29 45	0 42 45	Sails clewed up but not furled. Ship fell off and got before the wind. Backed engines to keep over the wire. Small specimen recovered, as the cup attached to the rod became unscrewed while being reeled in.
b. c.	S.	80	82		0 29 38	0 47 45	The "reeling in" engine gave some trouble.
b. c.	S.	79	81		0 29 07	0 44 25	Small specimen recovered.
b. c.	S.	80	82		0 23 50	0 31 40	
b. c.	S.	82	82		0 26 05	0 32 00	The specimen-cup came up with sleeve up. Specimen small. As the cup was a new one and had not been thoroughly cleaned, a few iron filings were found mixed with specimen.
b. c.	S.	80	82		0 32 44	0 48 35	
b. c.	S.	80	81		0 36 24	0 57 00	Old belt slipped considerably, as it was saturated with oil. Cup made by Blacksmith Knight—improvement.
b. c.	S.	81	81		0 32 05	0 49 00	Tried a new bell of 21-thread stuff. Worked well.
b. c. p. q.	S.	81	81		0 33 33	0 44 10	
b. c.	S.	80	81		0 33 45	0 43 15	The reel shows signs of distress for the first time since the flange was repaired. The after part of the face has commenced to cave in.
b. c.	M.	78	79		0 25 00	0 27 04	Shot did not detach until a second trial.
b. c.	M.	79	79		0 26 24	0 38 24	Drum of reel continues to show signs of caving in.
b. c.	S.	82	81		0 27 22	0 36 38	The only specimen was a piece of half-formed rock, yellowish inside and black outside. Darkspecks on bottom of cup.
b. c.	S.	79	80		0 26 33	0 34 27	
p. q. c.	M.	77	79		0 28 58	0 37 01	
b. c.	M.	78	78		0 24 17	0 26 37	
b. c. p. q.	R.	74	79		0 26 04	0 29 45	Rolling deeply at times. No specimen except that brought up on the arming.
o. c.	L.	69	75		0 21 39	0 22 14	Rolling deeply at times. No specimen brought up except on arming.
b. c.	M.	70	75		0 15 27	0 14 17	Very small specimen. Particles of scoria on end of cup, and black mud.
b. c.	L.	71	76		0 16 32	0 16 55	Very hard bottom. Very small specimen
b. c.	S.	72	75		0 19 39	0 21 49	The reel is continually weakening.
b. c.	S.	74	75		0 20 08	0 23 51	This cast is right over "Grant's Breakers."
b. c.	S.	74	74		0 20 38	0 25 00	
b. c.	S.	68	71		0 26 31	0 27 08	
o. c.	S.	70	72		0 23 53	0 31 40	A new cup made by Ch. Engr. McEwan, particularly adapted for hard bottom. Modified Belknap No. 2.
b. c.	S.	70	71		0 18 52	0 26 05	Reel continues to weaken.
b. c.	S.	69	71		0 24 17	0 39 00	The specimen-cup was new, and some of the iron filings got mixed with the specimen. On one of the splices flesh and skin of a fish adhered.
b. c.	M.	69	70		0 25 00	0 26 20	
b. c.	S.	67	70		0 11 33	0 13 05	

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
BETWEEN PORTA PRAYA, CAPE DE VERDE

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1883.	° ' "	° ' "				
48	Mar. 24	32 33 20 S.	0 00 20 E.	979	wh. S.	S.E. by S.	3
49	Mar. 25	32 41 54	0 41 04	2492	lt. br. ooze	S.E. by E.	3
50	Mar. 25	32 48 25	1 47 34	731	wh. Co., S. and Sh.	E. by N.	2
51	Mar. 25	32 49 25	1 59 28	1203	wh. Co., S. and Sh.	N.E.	2
52	Mar. 25	32 50 54	2 19 09	1724	wh. Co., S. and Sh.	N.E.	2
53	Mar. 26	33 14 45	4 29 18	2765	br. ooze	N. by E.	3
54	Mar. 26	33 24 33	5 52 57	2938	br. ooze	N.N.E.	4
55	Mar. 27	33 48 46	8 29 02	2855	br. ooze	North	3
56	Mar. 27	33 56 39	9 52 24	2773	br. ooze	North	3
57	Mar. 28	34 00 00	12 17 38	2596	br. ooze	N.N.E.	1
58	Mar. 29	34 04 00	15 49 11	2231	lt. br. ooze	S. by E.	5-7
59	Mar. 31	34 10 00	18 11 00	110	S. with bk. Sp.	N.E.	4

MOZAMBIQUE CHANNEL AND

60	June 1	29 46 00 S.	31 58 48 E.	824	bu. M., S. and Sh.	N.N.E.	1
61	June 2	29 44 30	33 26 00	1325	lt. br. M., S. and Sh.	N. by E.	6
62	June 3	29 51 10	35 46 45	1107	gy. S. and Sh.	E. by N.	1
63	June 4	28 52 25	38 17 30	2607	no specimen	S.W. by S.	4
64	June 6	24 49 47	42 52 45	1985	lt. br. ooze	West	4-5
65	June 7	23 51 10	43 31 42	935	lt. br. ooze	W.S.W.	3
66	June 8	23 33 42	43 40 45	337	dk. br. M.	N.E.	3
67	June 8	23 32 42	43 41 06	520	dk. br. M.	W.S.W.	3
68	June 8	23 32 36	43 42 12	339	dk. br. M.	W.S.W.	2
69	June 15	23 20 15	43 35 00	569	br. M.	W. by S.	2
70	June 16	22 07 00	42 59 30	587	yl. br. M. and S.	S.S.E.	4
71	June 17	20 22 30	43 45 30	872	yl. br. M. and S.	N.E.	1
72	June 24	15 32 00	44 10 45	1445	lt. br. M.	S.W.	0
73	July 25	6 15 00	40 21 09	876	gy. ooze	S.E. by S.	3
74	July 25	6 09 31	41 14 30	1352	gy. ooze	S.S.E.	3
75	July 26	5 36 00	42 08 30	1791	gy. ooze, S.	S.E. by S.	4
76	July 26	5 11 13	42 41 15	2007	gy. ooze, S., Sh.	S.E. by S.	3-4

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

ISLANDS, AND CAPE TOWN, SOUTH AFRICA.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
		°	°		h. m. s.	h. m. s.	
b. c.	S.	65	70		0 08 00	0 08 55	Good specimen.
b. c.	S.	65	70		0 25 15	0 31 40	Remarkable decrease in depth.
b. c.	S.	67	70		0 05 40	0 06 25	
b. c.	S.	67	70		0 09 39	0 11 30	
b. c.	S.	67	70		0 16 00	0 18 20	
b. c.	S.	68	69		0 31 30	0 38 03	The reel is in a very bad condition.
o. c.	S.	68	69		0 32 08	0 39 10	The grommet on end of wire brought up two worms, one 26 inches long and one 19½ inches. They were alive, and except their heads they looked like earth-worms.
b. c.	L.	67	67		0 34 50	0 35 10	Very small specimen.
b. c.	L.	68	67		0 32 10	0 32 35	Brought up a good specimen.
b.	L.	69	69		0 28 28	0 33 27	Long swell from the westward. Blowing very fresh, with rough sea.
b. c. d. q.	R.	66	67		0 27 05	0 35 00	In reeling in the wire caught on the bottom of ship and took off a small piece of copper, but did not break.
foggy	S.	57					

COAST OF MADAGASCAR.

b. c.	S.	72	73		0 07 00	0 10 40	Since last cast a new reel has been made by Ch. Eng. McEwan, which works well, and the position of sounding apparatus changed from starboard gangway to starboard end of bridge.
b. q.	S.	74	73		0 15 39	0 16 30	
b. c.	S.	74	74		0 10 45	0 13 10	
b. c.	S.	72	74		0 33 32	wire broke	Shot would not detach. After working at it a half-hour tried to reel in by hand, but the wire parted after reeling in about 200 turns. Lost 2377 fathoms of wire.
b. c.	M.	74	74		0 25 08	0 27 35	
b. c.	S.	72	76		0 09 07	0 10 15	
b. c.	S.						In San Augustine Bay.
b. c.	S.						" " " "
b.	S.	75	74		0 05 08	0 05 40	" " " "
b. c.	M.	71	76		0 04 52	0 05 12	
b. c.	S.	78	77		0 11 32	0 12 28	
b. c.	S.	77	79				Took this cast without steam.
b. c.	S.	76	78		0 06 24	0 12 00	
b. c.	S.	77	78	36	0 13 43	0 13 15	Thermometer remained on bottom 5 min. 20 sec.
b. c.	M.	78	78	34.5	0 20 08	0 18 05	Sails clewed up. Commenced to make sail with 1200 fathoms out. Thermometer on bottom 3 min. 17 sec.
b. c.	S.	77	78	34	0 21 25	0 25 00	Sails clewed up but not furled. Time on bottom 6 min. 40 sec.

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
MOZAMBIQUE CHANNEL AND

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1883	° ' "	° ' "				
77	July 27	4 28 33 S.	43 41 15 E.	2227	lt. br. ooze, S., Sh.	S.E. by S.	4
78	July 27	4 00 56	44 23 00	2342	br. M., stk.	S.S.E.	3
79	July 28	3 43 49	45 11 15	2472	bu. M.	S.S.E.	3
80	July 29	3 38 13	46 53 15	2582	br. M.	S. by E.	2-3
81	July 30	3 01 33	48 20 15	2626	bu. br. M.	S.E.	3
82	July 31	3 02 22	50 44 06	2713	no specimen	S. by E.	4-5
83	July 31	3 20 37	51 45 47	2682	dk. br. M.	S.E. by E.	3-4
84	Aug. 1	3 43 06	53 11 51	2199	gy. ooze, S. and Sh.	S.S.E.	4

SEYCHELLE ISLANDS TO

85	Aug. 5	4 23 46 S.	56 18 00 E.	682	gy. ooze, S. and Sh.	S. by E.	4
86	Aug. 6	4 03 26	57 55 30	2160	gy. ooze, S., Sh.	S. by E.	4-5
87	Aug. 7	3 08 49	60 08 15	2006	gy. ooze, S., Sh.	S.S.E.	4
88	Aug. 7	2 58 54	60 57 03	2302	gy. ooze, S., Sh.	S.E. by S.	4
89	Aug. 8	2 35 17	61 40 15	2495	gy. ooze, S., Sh.	S.E.	2
90	Aug. 9	2 04 47	62 15 35	2501	gy. ooze, S., Sh.	S. by E.	1-2
91	Aug. 10	1 33 51	63 11 30	2364	lt. br. ooze, S., Sh.	S.E. by E.	3
92	Aug. 11	1 11 49	64 20 09	2559	br. ooze	S.	0-1
93	Aug. 12	0 43 10	66 05 42	2212	lt. br. ooze	S. by E.	1
94	Aug. 13	0 13 59	67 40 33	1812	gy. ooze, S., Sh.	West	4-5
95	Aug. 14	0 01 04	68 55 16	2019	gy. ooze, S., Sh.	N.W.	5-6
96	Aug. 14	0 09 35 N.	69 41 06	2322	lt. br. ooze	W.N.W.	4-5
97	Aug. 15	0 14 20	70 44 45	2305	gy. ooze, S. and Sh.	West	3-4
98	Aug. 16	0 04 29	72 30 42	1977	gy. ooze, S., Sh.	S.E.	3
99	Aug. 16	0 03 52	73 00 00	1243	dk. gy., S., and Sh.	S.E.	2
100	Aug. 16	0 03 52	73 17 18	1027	gy. S.	S.	1
101	Aug. 16	0 03 52	73 44 30	1329	gy. S.	S.W.	0-1
102	Aug. 17	0 21 49	74 46 30	2217	no specimen	W. by S.	2
103	Aug. 18	0 26 52	76 34 45	2472	br. m., Sh.	W.N.W.	3
104	Aug. 19	0 18 28	78 33 48	2578	dk. br. M.	W.S.W.	3-5
105	Aug. 20	0 12 09	80 29 55	2609	dk. br. M.	S.W.	3-4
106	Aug. 21	0 14 07	82 36 27	2472	dk. br. M.	W.S.W.	2-3
107	Aug. 21	0 18 19	83 25 30	2436	br. M.	W. by S.	3
108	Aug. 22	0 33 19	84 58 00	2435	lt. br. M.	S.W.	2-3
109	Aug. 23	0 39 30	86 53 15	2425	br. M.	S.	3
110	Aug. 24	0 33 22	88 18 00	2394	lt. br. M.	S.W. by S.	3

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

COAST OF MADAGASCAR.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
b. c.	M.	77	78	34	h. m. s. 0 23 55	h. m. s. 0 25 05	Sails clewed up but not furled. Time on bottom, 5 min.
b. c.	M.	76	76	34	0 23 50	0 26 45	Sails clewed up but not furled. Time on bottom, 5 min.
b. c.	M.	75	77	34	0 30 29	0 30 09	Sails clewed up but not furled. Time on bottom, 5 min.
b. c.	M.	74	75	34.5	0 31 23	0 31 30	
b. c.	M.	75	75	34.25	0 32 35	0 29 28	Time on bottom, 5 min. 32 sec.
b. c.	H.	75	75		0 32 38	wire broke	Rolling heavily at times. In reeling in wire parted near a splice. Lost 1998 fathoms, with cup and thermometer.
b. c. p.	M.	77	75	34.75	0 34 01	0 37 05	Time on bottom, 5 min. 35 sec.
b. c. p.	M.	78	75	34.50	0 25 15	0 25 30	" " " 5 min. 45 sec.

STRAITS OF SUNDA.

b. c.	L.	78	79	40.5	0 05 51	0 06 52	Time on bottom, 6 min. 52 sec.
b. c. q.	L.	78	81	34.25	0 25 15	0 31 25	" " " 5 min. 30 sec.
b. c. q.	L.	80	81	34.5	0 20 32	0 21 12	Rolling heavily. Time on bottom, 5 min. 15 sec.
b. c. q.	L.	79	82	34.75	0 39 45	0 26 35	Rolling considerably. Wire caught, but was cleared. Time on bottom, 4 min. 15 sec.
o. c.	L.	80	84	34	0 29 00	0 30 30	Some difficulty in keeping ship over wire. Time on bottom, 5 min.
b. c.	S.	83	84	34	0 28 25	0 31 45	Time on bottom, 5 min.
b. c.	S.	82	83	34.25	0 29 25	0 30 00	" " " 5 min. 5 sec.
b. c.	L.	83	84	34.25	0 26 21	0 36 00	" " " 6 min. 30 sec.
b. c.	S.	81	83	34.25	0 25 41	0 27 20	" " " 5 min. 25 sec.
b. c. q. p.	M.	78	83	35	0 17 40	0 18 00	" " " 5 min. 15 sec.
b. c. q. p.	M.	75	82	34.5	0 22 00	0 23 15	" " " 5 min. 5 sec.
o.	M.	80	82	34.5	0 28 31	0 28 25	" " " 5 min. 4 sec.
o. e. d.	M.	79	82	34.75	0 26 27	0 29 55	" " " 8 min. 45 sec.
b. c.	S.	81	82		0 20 00	0 24 00	
b. c.	S.	81	82	34.75	0 12 07	0 11 08	Time on bottom, 5 min. 4 sec.
b. c.	S.	83	83	36.50	0 12 30	0 10 17	" " " 5 min. 20 sec.
b. c.	S.	83	83	36	0 13 57	0 12 25	" " " 5 min.
o. c.	S.	81	83		0 24 30	wire broke	When reeled in within 50 fathoms the wire parted with a jerk. A shark which was swimming about the ship is supposed to have snapped at the cup. Lost 29 fathoms, cup, and thermometer.
b. c.	S.	80	82	34.5	0 27 12	0 35 05	Time on bottom, 11 min. 5 sec.
b. c. q. p.	S.	81	83	34.5	0 28 35	1 01 35	" " " 6 min.
o. q. r.	M.	77	82	34.5	0 33 25	0 36 35	" " " 6 min. 40 sec.
o. c.	G.	81	82	34.75	0 26 57	0 29 50	" " " 5 min. 6 sec.
b. c.	G.	81	82	34.5	0 28 49	0 28 03	" " " 5 min. 1 sec.
o. c. q. r.	G.	82	83	34.5	0 28 48	0 33 25	Did not detach until second trial. Time on bottom, 20 min. 15 sec.
o. c.	G.	82	83	34.25	0 28 20	0 30 27	Time on bottom, 5 min. 1 sec.
b. c.	G.	82	83	34.1	0 27 24	0 29 27	" " " 5 min. 6 sec. Rolling heavily at times.

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
SEYCHELLE ISLANDS TO

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1883	° ' "	° ' "				
111	Aug. 25	0 04 30 S.	90 16 15 E.	2231	gy. ooze, S., Sh.	S.S.W.	3
112	Aug. 26	0 11 00	91 15 00	2426	br. ooze	W.S.W.	4
113	Aug. 27	0 18 00	92 19 00	2437	br. ooze	S.W.	0-1
114	Aug. 27	0 23 56	93 16 43	2453	br. ooze	calm	0
115	Aug. 28	0 37 26	94 23 00	2442	br. ooze	E.S.E.	1
116	Aug. 28	1 03 23	95 02 40	2169	br. ooze	E.S.E.	1
117	Aug. 29	1 55 24	95 56 27	2681	br. ooze	E. by N.	1
118	Aug. 29	2 26 42	96 47 09	2518	br. ooze, bk. Sp.	East	1-2
119	Aug. 30	2 50 24	97 51 09	2355	br. ooze, bk. Sp.	E.S.E.	1
120	Aug. 31	3 47 52	99 09 57	2683	br. M.	S.E. by S.	1-2
121	Aug. 31	4 14 29	99 50 29	3097	bu. br. M.	S. by E.	2-3
122	Sept. 1	4 45 31	100 50 39	1593	lt. br. ooze, S., Sh.	S.E.	3
123	Sept. 1	5 11 54	101 39 53	627	gy. S., Sh.	S.E.	3-4
124	Sept. 2	5 42 18	102 29 46	203	gy. S., Sh.	S.E.	2-3
125	Sept. 2	5 44 29	102 52 49	720	bu. C., Sh.	E.	2-3
126	Sept. 2	5 46 02	103 29 29	1087	bu. C., gy. S., and Sh.	S.S.E.	1
127	Sept. 2	5 51 12	103 35 40	1207	gy. S., bk. Sp.	S.E.	3-4
128	Sept. 3	6 05 36	104 15 24	522	crs. gy. S.	S.E.	2
129	Sept. 3	6 08 54	104 27 12	227	crs. gy. S., with scoria and pumice	S.E.	1-2
130	Sept. 3	6 11 30	104 26 30	200	crs. gy. S., with scoria and pumice	S.E.	2

INDIAN OCEAN.

	1885						
131	Aug. 24	19 08 S.	105 20 E.	3066	no specimen	S.E. by S.	3
132	Aug. 27	23 01	101 20	3182	no specimen	S. by E.	1-2
133	Aug. 31	29 20	101 55	2586	no specimen	E.N.E.	1
134	Sept. 8	35 26	118 37	1128	S.	S.E.	1

SOUTH PACIFIC OCEAN. FROM WELLINGTON, NEW ZEALAND, TO

135	Nov. 6	41 41 S.	175 00	637	no specimen	N.N.W.	5-7
136	Nov. 7	42 27	175 34	1192	gy. ooze	N.N.W.	2
137	Nov. 9	42 07	178 19	1320	gy. ooze	N.E. by N.	4-5
138	Nov. 9	43 37	179 37 W.	224	sft. bo. M., bk. Sp.	North	4-5
139	Nov. 9	43 53	179 11	160	gy. S. bk. Sp. Sh., La.	N.N.W.	4
140	Nov. 9	44 08	178 57	184	gy. S. bk. Sp. Sh., La.	N.W.	1-2
141	Nov. 10	44 41	178 53	751	gy. S. bk. Sp. bu. M.	E.N.E.	3
142	Nov. 10	45 02	178 21	996	gy. M., S.	N.N.E.	4-5
143	Nov. 10	45 11	177 53	1381	gy. M., S.	N. by E.	4-5
144	Nov. 11	45 45	176 37	2180	gy. M., S.	N. by E.	4-5
145	Nov. 11	46 19	174 34	2237	gy. M.	N. by W.	4-5

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

STRAITS OF SUNDA.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
		°	°	°	h. m. s.	h. m. s.	
b. c.	S.	83	84	34.25	0 24 30	0 26 06	Time on bottom, 5 min. 30 sec. Sails clewed up but not furled.
b. c.	G.	82	82	34	0 25 40	0 29 10	Time on bottom, 22 min. 30 sec. Difficulty in making shot detach.
b. c.	S.	82	83	34.5	0 25 52	0 28 30	Time on bottom, 14 min. 29 sec. Difficulty in making shot detach.
b. c.	S.	84	86	34	0 27 10	0 25 18	Time on bottom, 5 min.
b. c. p.	S.	84	84	34	0 25 40	0 25 45	" " " 6 min. 7 sec.
b. c.	S.	84	86	34	0 26 50	0 24 15	" " " 5 min. 5 sec.
b. c.	S.	82	83	34.25	0 29 00	0 27 47	" " " 5 min. 8 sec.
b. c.	S.	81	85	34.25	0 25 35	0 22 35	" " " 5 min.
b. c.	S.	85	83	34	0 23 50	0 24 40	" " " 5 min. 20 sec.
b. c.	S.	82	84	34	0 27 50	0 29 20	" " " 5 min. 40 sec.
b. c.	S.	83	84	33.5	0 34 38	0 38 15	" " " 5 min. 20 sec.
b. c.	S.	82	85	35	0 15 14	0 15 00	" " " 8 min. 25 sec.
b. c.	M.	83	84	42	0 05 12	0 04 57	" " " 5 min.
b. o. c.	S.	81	83	52			
b. c.	S.	81	84	40.5	0 06 02	0 04 50	Time on bottom, 5 min. 5 sec.
o. c. l. p. q.	S.	77	84	36.5	0 14 40	0 09 01	" " " 5 min.
o. r. l. t.	S.	81	83		0 13 14	0 10 00	
o. r. l. t.	S.	75	83	44	0 04 00	0 03 55	Time on bottom, 5 min. 5 sec.
o. r. l. t.	M.	75	83				Very heavy rains.
o. r. l. t.	M.	75	82				Very heavy rains.

OFF AUSTRALIA.

b. c.	M.	70	74	Not taken		Old wire that had been on reel two years.
b. c.	L.	65	69			While reeling in the wire parted.
b. c.	G.	65	65			Wire parted. Old wire.
b. c.	L.	59	60			Wire parted.

MAGELLAN STRAITS. CASTS TAKEN BY LIEUT. ADOLPH MARIX, U.S.N.

b. c. q.	M. R.	61	53	0 10	0 05	Wire fouled bottom in reeling in and parted at 438 fathoms. Cup lost.
b. c.	M. C.	58	53	0 20	0 25	
b. c.	M. C.	61	57	0 20	0 19	
b. c. z.	M. C.	58	54	0 02	0 03	
b. c. z.	M.	59	55	0 02	0 02	Used ordinary 25-lb. coasting lead.
b. c. z.	M.	59	55	0 03	0 02	
o. c. f.	L.	53	52	0 11	0 11	
o. c. f.	L. M.	54	51	0 12	0 12	
o. c. f. w.	L. M.	54	51	0 17	0 16	
b. c.	S.	54	50	0 28	0 34	
o. c. f. d.	M.	55	51	0 29	0 27	

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
SOUTH PACIFIC OCEAN. FROM WELLINGTON, NEW ZEALAND, TO

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1885	° /	° /				
146	Nov. 12	46 36 S.	172 34 W.	2782	dk. gy. M.	N.N.W.	5-6
147	Nov. 12	46 50	170 34	3002	no specimen	N.W. by N.	3-4
148	Nov. 13	47 08	168 00	2972	gy. and br. M.	N.N.W.	2
149	Nov. 14	46 52	166 46	2881	br. M.	S.E. by S.	5
150	Nov. 15	47 22	164 34	2793	br. M., G.	North	5-6
151	Nov. 16	47 54	162 22	2750	br. M.	South	4
152	Nov. 17	48 16	160 17	2533	br. M., St., Sh.	W. by N.	0-2
153	Nov. 18	48 23	159 05	2796	br. M.	W. by S.	2
154	Nov. 19	48 51	156 43	2789	br. M., bk. Sp.	N. by W.	6-7
155	Nov. 20	48 57	154 21	2509	br. M., bk. Sh.	West	1-2
156	Nov. 21	49 09	152 02	2650	yl. M., brk. Sh.	N.N.W.	5
157	Nov. 21	49 06	150 00	2915	no specimen	West	4-6
158	Nov. 22	49 04	147 27	2506	yl. S., brk. Sh.	S.W. by S.	3-4
159	Nov. 23	49 02	145 11	2522	yl. Sand	S.W. by S.	2
160	Nov. 24	49 04	142 55	2584	no specimen	N.W.	5
161	Nov. 24	49 14	140 33	2613	yl. S., brk. Sh.	W. by N.	5
162	Nov. 25	49 21	137 27	2383	yl. S., brk. Sh.	N.W. by W.	6
163	Nov. 26	49 27	134 53	2646	no specimen	S.W.	3-5
164	Nov. 26	49 28	132 28	2467	gy. S.	West	5
165	Nov. 27	49 26	129 18	2423	gy. S.	W. by S.	6-8
166	Nov. 28	49 25	127 48	2239	gy. & bk. S., brk. Sh.	North	2
167	Nov. 30	49 37	125 33	2253	gy. S.	S.S.W.	4-5
168	Dec. 1	49 36	123 00	1964	wh. S.	S.S.E.	3-4
169	Dec. 3	49 39	120 54	1895	no specimen	W. by N.	2
170	Dec. 4	49 49	118 38	1690	hard	N.W.	3-4
171	Dec. 4	49 51	117 36	1562	lt. gy. S., brk. Sh.	N.N.W.	4-5
172	Dec. 5	50 00	115 50	1583	gy. S., brk. Sh.	N.W.	4-5
173	Dec. 5	50 05	114 16	1847	no specimen	W. by N.	3
174	Dec. 6	50 15	112 00	2162	yl. S., M.	N.W. by W.	5-6
175	Dec. 6	50 21	109 32	1848	gy. & yl. S., brk. Sh.	N.W.	5-6
176	Dec. 7	50 30	107 36	1997	yl. S., brk. Sh.	N.W. by N.	4-5
177	Dec. 7	50 35	105 51	2197	yl. S., brk. Sh.	N.W. by W.	5-6
178	Dec. 8	50 42	103 52	2224	yl. br. M., brk. Sh.	S.W. by S.	3-4
179	Dec. 9	50 42	101 09	2324	yl. br. M., brk. Sh.	S.W. by S.	5-6
180	Dec. 10	50 43	98 55	2291	yl. br. M., brk. Sh.	W.S.W.	4-5
181	Dec. 10	50 44	97 20	2383	yl. br. M., brk. Sh.	W.S.W.	3-4
182	Dec. 11	50 50	95 14	2540	br. M., Sh.	W.S.W.	3-4
183	Dec. 11	50 54	93 40	2711	br. M.	West	5-6

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.
MAGELLAN STRAITS. CASTS TAKEN BY LIEUT. ADOLPH MARIX, U.S.N.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
		°	°		h. m.	h. m.	
o. c. f. d.	M.	53	51		0 41	0 42	Wire parted while reeling in at 1300 fathoms through carelessness of attendant.
o. c. f.	M.	55	51		0 48		
o. c. m.	M.	54	53		0 39	0 35	
b. c.	M.	50	51		0 34	0 30	The regular reel having need of repairs, the old brass reel was used for this and the following cast, hence had to reel up by hand.
o. c. d. q.	M.	54	52		0 39	0 31	
b. c.	S.	53	51		0 41	0 29	
b. c.	S.	55	52		1 00	1 11	Iron reel having been repaired is again in use.
b. c.	L.	52	51		0 51	1 10	
o. c. q.	L.M.	53	50		0 46	0 36	
b. c.	M.	55	50		0 39	0 25	Wire parted at 70 fathoms while reeling in. Defect in wire.
b. c.	L.	52	49		0 37	0 37	
o. c. d. m. q.	M.	52	48		0 49	0 35	
b. c.	M.	52	49		0 37	0 37	In reeling in, wire parted at 764 fathoms.
b. c. p.	L.	50	49		0 38	0 26	
a.	M.	51	49		0 47	0 50	
o. m.	M.	52	48		0 40	0 39	In reeling in, wire parted at 1446 fathoms.
o. m. d.	M.R.	52	48		0 35	0 41	
b. c.	M.L.	48	47		0 38	0 21	
b. c.	M.L.	49	47		0 39	0 59	Ship lying to under steam and sail.
b. c. q. p.	H.R.	47	47		0 41	0 36	
b. c.	L.H.	50	47		0 29	0 28	
b. c.	H.R.	46	46		0 42	0 32	Wire parted at 97 fathoms while reeling in.
b. c.	L.	48	46		0 28	0 21	
b. c.	M.	52	48		0 25	0 24	
o. c.	M.	50	46		0 22	0 33	No specimen recovered, but cup showed signs of having struck hard bottom.
b. c.	M.	48	45		0 21	0 23	
o. c. m. f.	M.	48	46		0 28	0 20	
o. c.	S.	48	47		0 20	0 26	Cup came up with sleeve lifted and jammed. Specimen was washed out.
o. c.	M.	48	46		0 29	0 33	
b. c.	M.	49	47		0 23	0 23	
b. c. m.	M.C.	49	46		0 37	0 26	Tending out from side of ship about 5° when bottom was reached.
b. c. m.	M.C.	48	47		0 32	0 30	
o. c. h. p. q.	M.R.	47	46		0 30	0 31	
o. c. q. m.	M.L.	48	46		0 32	0 31	Could not detach shot when on bottom the ball having hooked on the cup. Hove in by steam, assisted by hand, and brought shot back. Reel showed no signs of distress. The power of the engine alone was not sufficient to reel in.
b. c.	M.	48	46		0 32	0 32	
o. c. m.	M.L.	47	46		0 31	0 33	
o. c. f. d.	L.	49	47		0 32	0 33	
o. c. q. m.	M.L.	49	46		0 35	2 58	

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
SOUTH PACIFIC OCEAN. FROM WELLINGTON, NEW ZEALAND, TO

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1885	° /	° /				
184	Dec. 12	50 58 S.	91 33 W.	2677	br. M.	W. by N.	5-6
185	Dec. 12	51 01	89 30	2579	br. M.	W. by N.	5-6
186	Dec. 13	51 07	87 00	2516	br. M.	W. by N.	5-6
187	Dec. 13	51 13	84 38	2477	br. M.	W.N.W.	5-7
188	Dec. 14	51 18	82 31	2378	br. M., Sh.	W.N.W.	5-6
189	Dec. 15	51 57	78 34	2162	gy. br. M., Sh.	W.N.W.	4-6
190	Dec. 15	52 10	77 08	2167	gy. br. M., Sh.	W.N.W.	2-3
191	Dec. 15	52 16	76 02	1200	gy. S.	N.W.	3

SOUTH ATLANTIC. FROM MONTEVIDEO,

	1886						
192	Jan. 11	35 06 S.	52 05 W.	761	gn. M.	N.W.	2-3
193	Jan. 11	34 49	51 23	1126	dk. M.	South	1-2
194	Jan. 12	34 30	50 47	1633	dk. M.	E. by N.	1-2
195	Jan. 12	34 04	49 49	1589	no specimen	N.E.	2-3
196	Jan. 13	33 45	48 48	1775	dk. M.	North	3
197	Jan. 13	33 18	47 53	1859	gy. M., brk. Sh.	N.N.E.	3
198	Jan. 14	32 58	47 22	1976	dk. M.	N.E.	4-6
199	Jan. 14	32 33	46 48	2088	dk. M.	N.E. by N.	4-5
200	Jan. 15	32 24	45 32	2192	dk. M.	N. by E.	4
201	Jan. 15	32 14	44 14	2132	br. M.	N.N.E.	3
202	Jan. 16	31 57	43 16	2145	br. M.	N.N.E.	3-4
203	Jan. 16	31 43	41 55	2036	lt. br. M.	N.N.E.	4
204	Jan. 17	31 40	40 28	1999	br. M.	North	4-5
205	Jan. 17	31 35	39 08	2334	br. M.	N.E.	3
206	Jan. 18	31 29	38 05	1949	S	N. by W.	4
207	Jan. 18	31 22	36 39	1469	wh. S. and Sh.	W.N.W.	3-4
208	Jan. 19	31 13	35 42	547	yl. & wh. S. and Sh.	N. by W.	3
209	Jan. 19	31 12	35 35	467	crs. yl. & wh. S. & Sh.	N.N.W.	3
210	Jan. 19	31 11	35 29	471	crs. yl. & wh. S. & Sh.	N.N.W.	3
211	Jan. 19	31 10	35 23	444	wh. S., bk. Sp.	N.N.W.	3
212	Jan. 19	31 09	35 16	481	wh. S., bk. Sp.	North	3
213	Jan. 19	31 08	35 09	400	wh. S., bk. Sp.	North	3
214	Jan. 19	31 07	35 03	867	Sh.	North	3
215	Jan. 19	31 05	34 48	1095	no specimen	North	2-3
216	Jan. 19	31 02	34 27	378	crs. wh. and yl. S.	North	2
217	Jan. 19	31 01	34 21	390	crs. wh. and yl. S.	North	2-3
218	Jan. 19	30 59	34 16	426	wh. S., bk. Sp.	N. by E.	2-3
219	Jan. 19	30 57	34 11	495	fne. wh. S., Sh.	N. by E.	2-3
220	Jan. 20	30 53	33 52	584	no specimen	North	3
221	Jan. 20	30 48	33 21	956	wh. S.	North	3-4
222	Jan. 20	30 39	32 43	1827	fne. wh. S., Sh.	North	4
223	Jan. 20	30 32	31 50	2113	hard; no specimen	North	3-4

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

MAGELLAN STRAITS. CASTS TAKEN BY LIEUT. ADOLPH MARIX, U.S.N.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
b. c. m.	M.	49	46		h. m. 0 38	h. m. 0 44	Line tending out about 3° when bottom was reached.
b. c. z.	M.	48	46		0 33	0 37	Only small specimen obtained.
o. c. m. d.	M.	50	47		0 38	0 31	
o. c. m. d.	M.	49	46		0 41	0 34	Line tending slightly out when bottom was reached.
b. c. p.	R.	50	46		0 42	0 34	
o. c. q. m.	M. H.	48	47		0 45	0 36	
b. c.	L.	49	47		0 30	0 23	
b. c.	M.	49	48		0 14	0 11	

URUGUAY, TO BARBADOS, W. I.

b. c.	S.	73	71		0 13	0 10	Used 25-lb. coasting lead.
b. c.	G.	74	74		0 21	0 18	Line tending slightly to port.
b. c.	S.	74	73		0 24	0 19	Cup failed to act, brought up no specimen.
b. c. z.	S.	78	74		0 19	0 15	
b. c.	S.	76	74		0 17	0 15	
o. c.	M.	77	75		0 20	0 26	
b. c.	M.	75	74		0 31	0 28	
b. c. z.	M.	76	75		0 28	0 24	
b. c.	M.	76	74		0 26	0 24	
b. c. m.	M.	76	75		0 26	0 26	
b. c. m.	M.	75	74		0 26	0 22	
b. c.	S.	76	75		0 24	0 19	
b. c. m.	M.	76	75		0 27	0 20	
b. c.	S.	77	76		0 28	0 20	
b. c.	S.	76	75		0 22	0 20	
b. c.	S.	77	77		0 20	0 18	
b. c. w.	S.	74	75		0 04	0 16	
b. c.	S.	75	75		0 05	0 16	
b. c.	S.	76	75		0 06	0 05	
b. c.	S.	77	75		0 05	0 05	
b. c.	S.	77	75		0 05	0 06	
b. c.	S.	77	75		0 06	0 07	
b. c.	S.	78	76		0 11	0 11	
b. c.	S.	77	75		0 15	0 10	Evidences of hard bottom. No specimen recovered.
b. c.	S.	76	75		0 04	0 03	
b. c.	S.	76	75		0 05	0 06	
b. c.	S.	76	75		0 07	0 05	Used 25-lb. coasting lead.
b. c. n.	S.	76	75		0 07	0 05	Used 25-lb. coasting lead.
b. c. w.	S.	76	75		0 12	0 06	Specimen washed out in reeling in.
b. c. w.	S.	76	75		0 13	0 08	
b. c.	S.	77	76		0 20	0 21	
b. c.	S.	76	75		0 27	0 34	Delay in reeling in caused by slight accident to engine.

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,
SOUTH ATLANTIC. FROM MONTEVIDEO,

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1886	° /	° /				
224	Jan. 21	30 21 S.	30 40 W.	1834	fne. wh. S., Sh.	North	4-5
225	Jan. 21	30 05	29 22	1296	fne. wh. S., Sh.	N.W. by N.	4
226	Jan. 21	29 54	29 00	1766	no specimen	N.W. by N.	3-4
227	Jan. 22	28 52	28 11	2539	br. M., Sh.	W.N.W.	3
228	Jan. 23	27 54	27 32	2851	dk. br. M.	S.W.	3
229	Jan. 25	24 14	27 20	3002	dk. br. M.	E. by S.	3-4
230	Jan. 27	22 56	27 22	2995	yl. br. M., brk. Sh.	N.E.	1
231	Jan. 27	21 43	27 19	2865	stf. br. M.	East	1
232	Jan. 28	20 24	27 40	2727	stf. br. M.	E.S.E.	1-2
233	Jan. 30	18 53	28 09	2924	stf. br. M.	N.E.	1
234	Jan. 31	17 43	29 01	2839	br. M.	N.N.E.	2
235	Feb. 2	16 10	29 57	2678	br. M.	East	3
236	Feb. 3	14 49	30 10	2770	br. M.	East	2
237	Feb. 4	13 10	30 26	2814	br. M.	E. by S.	4
238	Feb. 5	11 35	31 00	2892	br. M.	E. by S.	3-4
239	Feb. 6	10 02	31 01	2887	br. M. and S.	E.S.E.	4
240	Feb. 7	8 26	31 31	2878	yl. br. M.	E. by S.	4
241	Feb. 8	6 54	32 13	2620	br. M., Sh.	East	3
242	Feb. 9	4 28	33 07	2280	gy. M., S. and Sh.	E. by S.	4
243	Feb. 10	3 03	33 53	2202	ooze, Sh.	E.S.E.	3-4
244	Feb. 11	1 41	35 02	2222	ooze, Sh.	S.E. by E.	2
245	Feb. 12	0 22	35 45	2443	ooze, Sh.	N.E.	4-7

NORTH ATLANTIC

	1886						
246	Feb. 14	1 12 N.	36 32 W.	2152	ooze, Sh.	N.N.E.	0-1
247	Feb. 16	2 08	38 13	2407	ooze, Sh.	N. by E.	3-4
248	Feb. 17	3 14	39 49	2405	ooze, Sh.	N.E. by E.	4
249	Feb. 18	4 09	41 09	2235	ooze, Sh.	E.N.E.	1-2
250	Feb. 19	5 14	42 09	2580	ooze, Sh.	E.N.E.	4
251	Feb. 20	6 35	43 32	2546	ooze, Sh.	E.N.E.	5-6
252	Feb. 20	7 29	44 40	2547	ooze, Sh.	E.N.E.	5
253	Feb. 21	8 19	45 52	2682	ooze, Sh.	E.N.E.	4-5
254	Feb. 21	8 50	47 06	2552	ooze, Sh.	N.E. by E.	4
255	Feb. 22	9 30	48 39	2593	ooze, Sh.	N.E.	5-6
256	Feb. 22	10 06	50 00	2728	ooze	East	5-6
257	Feb. 23	10 52	51 23	2697	ooze	E.N.E.	5-6
258	Feb. 23	11 25	52 41	2714	no specimen	E.N.E.	5
259	Feb. 24	11 43	54 00	2673	ooze	East	4-5
260	Feb. 24	11 56	55 01	2560	ooze	East	3-4
261	Feb. 25	12 17	56 10	2425	ooze	E.N.E.	5
262	Feb. 25	12 31	57 05	2421	ooze, S., Sh.	E.N.E.	4
263	Feb. 26	12 38	58 14	1204	ooze, S., Sh.	East	4

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

URUGUAY, TO BARBADOS, W. I.

State of Weather.	State of Sea.	Temperature.			Time.		Remarks.
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
		°	°		h. m.	h. m.	
b. c.	S.	75	74		0 24	0 16	Some sub-surface current.
b. c.	S.	77	76		0 14	0 15	
b. c. w.	S.	77	75		0 26	0 18	
b. c.	S.	81	78		0 32	0 21	
b. c.	S.	79	78		0 36	0 35	
b. c.	S.	80	80		0 43	0 36	
b. c.	S.	79	80		0 38	0 36	
b. c. p.	S.	80	82		0 37	0 33	
b. c.	S.	80	80		0 32	0 31	
b. c.	S.	79	80		0 38	0 37	
b. c.	S.	79	80		0 39	0 39	Wire tending slightly aft.
b. c.	S.	80	79		0 35	0 37	
b. c.	S.	81	79		0 34	0 43	
b. c.	S.	79	80		0 31	0 39	
b. c.	S.	81	81		0 34	0 35	
b. c.	S.	83	81		0 33	0 52	
b. c. q.	S.	83	82		0 37	0 32	
b. c.	S.	83	82		0 31	0 36	
b. c.	S.	83	82		0 28	0 27	
b. c.	S.	84	82		0 27	0 27	
b. c.	S.	83	82		0 23	0 23	Very heavy squall during cast.
o. c. u. q. m.	S.	74	81		0 40	0 30	

OCEAN.

b. c.	S.	80	81		0 23	0 23	Wire tended under ship on reeling in, causing delay.
b. c. r.	M.	79	81		0 30	0 27	
b. c.	S.	82	81		0 31	0 30	
b. c.	S.	81	81		0 36	0 24	
o. c. d.	S.	80	80		0 33	0 30	
o. c. q. d.	R.	79	81		0 35	0 47	After beginning to sound found that the ship had not sufficient steam to breast the wind, so clamped wire until steam was raised sufficiently to continue.
b. c.	M.	81	80		0 32	0 34	
b. c.	M.	79	80		2 03	0 39	
b. c.	M.	79	80		0 29	0 36	
b. c. p.	M.	78	80		0 34	0 36	
b. c. p.	M.	80	79		0 51	0 39	In reeling in the wire fouled propeller; lost 204 fathoms.
b. c. p. q.	M.	78	79		0 33	0 29	
b. c.	M.	80	79		0 37	0 36	
b. c.	M.	79	79		0 41	0 34	
b. c.	S.	83	79		0 34	0 30	
b. c.	M.	79	79		0 34	0 28	
b. c.	S.	81	80		0 30	0 30	
b. c.	S.	79	79		0 14	0 08	

DEEP-SEA SOUNDINGS TAKEN BY THE U.S.S. ENTERPRISE,

BETWEEN ST. THOMAS, W. I.,

Serial Number.	Date.	Position.		Depth in Fathoms.	Character of Bottom.	Wind.	
		Lat.	Long.			Direction.	Force.
	1886	° /	° /				
264	Mar. 6	19 53 N.	65 45 W.	4529	br. ooze	S.W.	2-3
265	Mar. 6	21 00	66 14	2990	br. M.	W.S.W.	4
266	Mar. 7	22 06	66 44	3079	lt. br. M.	N.N.W.	3
267	Mar. 7	23 07	67 08	3101	lt. br. M.	N.W. by N.	2
268	Mar. 8	24 23	67 58	3133	lt. br. M.	West	2
269	Mar. 8	25 22	68 41	3006	lt. br. M.	W. by N.	1-2
270	Mar. 9	26 33	69 30	2880	no specimen	N.W. by W.	2-3
271	Mar. 9	27 36	70 14	3004	br. M.	S.W.	3
272	Mar. 10	29 36	71 33	2956	br. M.	W. by N.	6-8

COMMANDER ALBERT S. BARKER, U.S.N., COMMANDING.

AND CAPE HATTERAS.

State of Weather.	State of Sea.	Tempera- ture.			Time.		Remarks
		Air.	Surface.	Bottom.	Paying Out.	Reeling In.	
b. c.	G.	78	79	°	h. m. 1 06	h. m. 1 21	Used crank to assist engine in reeling in the first 1500 fathoms.
b. c.	G.	79	78		0 38	0 35	
b. c.	G.	76	78		0 40	0 41	
b. c.	S.	76	78		0 38	0 34	
b. c.	S.	73	73		0 37	0 36	
b. c. z.	S.	74	74		0 35	0 34	In reeling in the wire parted at 1450 fathoms. No cause discovered.
b. c.	S.	69	71		0 33		
b. c.	S.	70	70		0 40	0 42	
r. c. q. r.	R.	66	66		0 39	0 38	

OFFICERS ATTACHED TO THE U. S. S. ENTERPRISE
ON THE DAY OF SAILING FROM NORFOLK,
DECEMBER 27, 1882.

Albert S. Barker,	Commander, U. S. N., Commanding.
G. M. Book,	Lieutenant-Commander, Executive.
G. A. Norris,	Lieutenant, Navigator.
Hugo Osterhaus,	Lieutenant.
M. A. Shufeldt,	Master.
H. M. Hodges,	Ensign.
W. G. Hannum,	Ensign.
N. J. L. T. Halpine,	Ensign.
Edward Lloyd,	Ensign.
H. D. McEwan,	Chief Engineer.
C. J. Habighurst,	Passed Assistant Engineer.
G. W. McElroy,	Assistant Engineer.
J. H. Baker,	Assistant Engineer.
H. N. Beaumont,	Surgeon.
J. A. Ring,	Passed Assistant Paymaster.
T. G. Fillette,	Second Lieutenant, U. S. M. C.
W. J. Sears,	Midshipman.
R. F. Lopez,	Midshipman.
R. O. Bitler,	Midshipman.
W. C. P. Muir,	Midshipman.
L. J. Clark,	Midshipman.
Albert Moritz,	Naval Cadet.
F. A. McNutt,	Naval Cadet.
H. D. Alexander,	Paymaster's Clerk.

OFFICERS ATTACHED TO THE U. S. S. ENTERPRISE
UPON HER RETURN TO THE UNITED STATES,
MARCH, 1886.

Albert S. Barker,	Commander, U. S. N., Commanding.
Geo. A. Norris,	Lieutenant, Executive.
Adolph Marix,	Lieutenant, Navigator.
Hugo Osterhaus,	Lieutenant.
W. P. Conway,	Lieutenant.
H. M. Hodges,	Lieutenant.
G. W. Denfield,	Ensign.
R. F. Lopez,	Ensign.
P. W. Hourigan,	Ensign.
H. C. Poundstone,	Ensign.
W. C. P. Muir,	Ensign.
J. H. Rohrbacher,	Ensign.
L. J. Clark,	Ensign.
H. D. McEwan,	Chief Engineer.
G. R. Salisbury,	Assistant Engineer.
H. N. Beaumont,	Surgeon.
W. B. Wilcox,	Assistant Paymaster.

MEN WHO WERE ON BOARD THE ENTERPRISE DURING THE WHOLE CRUISE.

Anderson, Andrew	Landman, Chas.
Baggott, Patrick	McDonough, Jas.
Barnett, John	McKinley, J. J.
Bartleson, T. M.	McNeal, John
Bennett, Eugene	McNicol, James
Birch, Walter H.	McTighe, Patrick
Borgenson, Francis	Morgan, W. T.
Bowles, Edward	Morrison, A. M.
Brown, Charles	Mullaly, Michael
Buck, Patrick	Murphy, John
Campbell, William	Nailor, H. Bernard
Carlsen, Andrew	O'Hern, William
Cope, George	Oberg, C. A.
Corr, Henry	Pequati, Emil
Crabtree, C. W.	Peterson, Neil
Craven, Thomas	Porter, J. B.
Darnell, M. D.	Raferty, J. F.
Dazy, W. J.	Reiley, Mich. P.
Derrick, George	Roche, James F.
Farrell, James	Robinson, A. J.
Fountain, B.	Schewder, A. K.
Foy, W. H.	Schneider, Carl
Gleason, James	Schurig, Edw.
Gordon, E. T.	Smit, Gustav
Griffith, Wm.	Smith, E. T.
Gustavsen, James	Smith, Thomas
Hanna, Jno. W.	Stiles, H. T.
Harvey, Thomas	Stugerweld, Adam
Hassett, John	Sweeney, James
Hatter, James	Thompson, Wm.
Henderson, Robt.	Twiss, George
Herbert, Frank	Weston, Louis
Holm, G. A.	Will, Alexander
Johnson, James	Wirtz, H. I.
Knight, Robert	Withers, Nelson A
Landers, Thomas	Wogan, Michael

APPRENTICES.

Becker, David H.	Mehrtens, R. C.
Broderick, Thomas	Odenath, J. J.
Brown, Henry J.	Parker, Charles
Dally, Clarence M.	Ramsay, L. M.
Fields, G. W.	Smith, Aug. F.
Hanly, Peter	Stuart, William
Hopkins, Chas. W.	Turk, F. J.
Hughes, Patrick	

MARINES.

Albert Conrey, First Sergeant.
Douglass Smith, Sergeant.
Bernard Duddy, Corporal.
A. A. Thatcher, Drummer.
Wm. M. Jordan, Fifer.

Adams, Thomas A.	Gallagher, J. J.
Bader, Gottlieb	Lyon, Thos. A.
Brennan, J. M.	Little, J. M.
Benz, Frederick	Murphy, J. A.
Flemming, S. M.	Tierney, Jas. P.

MEN WHO WENT OUT IN THE SHIP BUT DID NOT RETURN IN HER.

Aki Suzia (Japanese)	McGovern, M.
A Lam (Chinese)	Moite, E.
Allen, George L.	Montegenico, F. de
Angel, Louis	Nakamura, S. (Japanese)
Bird, Frank	O'Shea, John
Black, Chas.	Perry, Thomas
Boller, Wm.	Quirk, Edw.
Christensen, Chas.	Quine, William
Coombs, Peter	Robertson, John
Cowen, Lindley	Sajaro (Japanese)
Day, Daniel	Sherman, F. I.
Eto Matz (Japanese)	Smith, C. M.
Ferguson, Thos.	Soung, Y. W.
Fumersdorf, J.	Stevens, Chas.
George, C. W.	Suzui Wakamoto (Japanese)
Gisabon, E.	Swan, Eric
Godfrey, Wm.	Tarro, K.
Jensen, Julius	Taylor, Wm.
Kami, M.	Thornton, Thomas
Kandoli, M.	Toku Hisia (Japanese)
Kregor, Chas.	Townson, Jno. C.
Lee, George	Waldron, T. C.
Lewis, Laban	White, Andrew
McGarr, James	Williams, G. A.
McGee, Lincoln	

APPRENTICES.

Barcklay, C. W.	Saunders, Chas. B.
Dudley, L. S.	Stevens, F. W.
Gardner, Jno. P.	Stokes, Joseph
Green, Daniel	Whitney, F. W.
Johnson, Jas. T.	Wilson, Henry L.
Moury, Edw. T.	Wolf, Geo. L.
Rice, Edw. L.	

MARINES.

W. F. Jones, Corporal.	Finnerty, P. J.
Brite, Jonathan O.	Griffin, James
Carey, Francis	Lewis, D. H.
Ellsworth, S. M.	Murray, Thomas
Foley, W. T.	Ryan, Patrick
	Wood, W. J.

MEN WHO WERE ON BOARD AT END OF CRUISE
BUT WERE NOT ON BOARD AT THE BEGIN-
NING OF THE CRUISE.

Baker, Wm.	Lindenberg, Waldemar
Besant, C. I.	McCabe, J.
Boyd, C. A.	McGrath, J. M.
Brown, Joseph	Marlingford, John
Cartwright, J. H.	Moller, Adolf
Cox, Maurice	Nojuna (Japanese)
Daniels, Wm.	Olsen, Saren
Diggs, W. G.	Olsson, A. G.
Esha (Japanese)	Pagan, Frank
Fabling, A. F.	Pease, Arthur
Fechner, O. H.	Rooke, George
Gotting, Leonard	Russell, Wm. I.
Harding, W. M.	Silvia, Antone, distressed
Ivers, Wm. W.	American
Jackson, F. A.	Sheridan, Daniel
Jones, H. G.	Smith, Thomas, 2d
Karlson, K. E.	Stebbins, A. H.
Kege Izaké (Japanese)	Taki Kichi (Japanese)
King, D. F.	Wirada, G. (Japanese)
Koeber, Charles	Yamagata (Japanese)
Kruss, Harry	Yskihi Tanaka (Japanese)
Lamken, Adolph	Yu Long (Chinese)
Landstrom, G.	

APPRENTICES.

Aiken, E. L.	Kimmell, A. J.
Alexander, Benjamin T.	Lawrence, S. M.
Emery, Thos. H.	Lee, Robert
Golden, A. J.	Postill, J. C.

MARINES.

Harry Scott, Corporal.	Murphy, Wm.
Bates, Charles	McCarthy, Thos.
Davis, Joseph T.	Rice, Arthur
Jones, Wm. F.	Shanahan, Daniel
Keiley, Roger	Marcus, Albert