XXX.—Shackleton Antarctic Expedition, 1914–1917: Depths and Deposits of the Weddell Sea.

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Introductory.

Previous to the voyage of the *Endurance* in 1914–1915, the depth and extent of the Weddell Sea were either based on or surmised from the deep-sea soundings made on the *Scotia* by Dr Bruce in 1903 and 1904; on Dr Otto Nordenskjöld's ship *Antarctic* in 1901–1902; and on the German Expedition ship *Deutschland* under the leadership of Lieut. Filchner in 1912–1913. The first set are confined to the eastern and north-eastern portion, and may be said to run diagonally across the mouth of the sea; the second set were made in the extreme north-western area; whilst those of the *Deutschland* are disposed right down the centre of the sea, and consist mainly of a south-to-north series approximately along the meridian of 43° W.

In the early part of her voyage the *Endurance* was on ground partly covered by the *Scotia*, and she was thus able to supplement very considerably Dr Bruce's work off Coats Land; in January and February 1915 her track crossed that of the *Deutschland* at about a right angle; thereafter it lay on entirely new ground to the west of all previous routes. She drifted right across that unknown tract which some map-makers have called New South Greenland, and the majority of people Morrell Land.* Apart, therefore, from the importance which attaches to the soundings by reason of their being on ground previously unexplored, they are also of value inasmuch as they definitely prove that "Morrell's land" is no part of the Antarctic continent, and probably does not exist even as an island.

Equipment.

The instruments used for sounding were three in number: a Lucas machine graduated up to 5000 fathoms; a smaller machine of the same type for depths of 1000 fathoms; and a Kelvin machine registering up to 300 fathoms. By splicing on additional wire, however, it later on became possible to use the Kelvin for depths of 450 fathoms. This, of course, meant that the dial, which was arranged for a 300-fathom drum, did not register quite accurately for 450 fathoms of wire. It must have slightly under-registered, but there was no opportunity of actually checking the error; in any case, it can hardly have been as much as 1 per cent., and can well be neglected.

* Morrell himself called it "New South Greenland," and stated that it had been discovered by Captain Johnson. To refer to it as "Morrell's land," rather than "Morrell Land," would be more correct.

The type of attachment employed for collecting bottom samples varied with the machine. In the case of the Lucas, there was used either a snapper or a group of four short tubes, each about 4 inches in length and $\frac{1}{2}$-inch diameter; both were fitted with a detachable weight of 50 lbs. In the smaller Lucas machine, the 28-lb. weight was not detachable; this machine, however, was very seldom required, and was finally stowed away as unnecessary. In the case of the Kelvin a 14-lb. sounding lead was at first in use, but later on a snapper with fixed weight (belonging to the small Lucas machine) was found to give better samples. When the deposits ultimately became so monotonous that they were no longer desirable as specimens, a return was made to using the simple 14-lb. lead. Experience showed that in Antarctic waters the snapper is the best all-round form of attachment.

This equipment was found to be quite adequate to its purpose.* Sufficient detachable weights were carried to take one hundred deep-sea soundings. As the great majority of the casts, however, were made in shallow waters where a machine with recoverable sinker could be employed, not quite half of these weights had been used up to the time when the ship was crushed and had to be abandoned. It is hardly necessary here to give details or hints on the methods.† It may be mentioned, however, that winding-in was done by hand; in the case of the deeper soundings (1500–2000 fathoms) this took almost an hour.

Position of the Soundings.

While the ship was a free agent and fighting her way southwards through the ice, soundings were made whenever she was held up by close pack. The ship's course was never interrupted to take a sounding, for the number of times both in the pack and off Coats Land when she was stationary was quite sufficient for the purpose. After she was beset (January 1915), casts were made more frequently, and, when the depths became moderate, sounding became a routine task practically every forenoon. Later (August 1915), when deep water was again met with, an attempt was made to sound twice in every degree of latitude. This at least was what was aimed at; the programme only lasted for a short time, however, as at the end of October the ship was crushed and abandoned, and sounding gear was naturally not among the essentials salved from the wreck.

In the Table of Soundings the positions up to and including January 19, 1915 (when the drift commenced), are those at which the sounding was made, calculated by dead reckoning from an observed noon position. Onwards from January 20, however, the positions entered are the daily noon positions observed by the ship's officers; their

* This was the only branch of oceanography which was well provided for—a result, of course, of planning the scientific equipment of the Expedition almost entirely for a base on land. In view of the opportunities for oceanographical work, whether the ship is beset or not, it is desirable that this science, as it was on the *Scotia* voyage, should be well in the forefront of the programme of any future expedition.

† Dr Pirie gives very full and useful information about methods, etc., in his report.

accuracy, by reason of the occultation observations obtained during the winter, is of the order of one nautical mile.* During the latter period the ship was drifting in the ice at an average rate of four sea miles per day. As the soundings were practically all made within three hours of noon, none of them are likely to be distant from the latter position by more than one mile—that is to say, they differ by no more than the possible error of the ship's noon position.

Deposits.

The actual samples were all abandoned when the ship was crushed. At the time they were collected, however, brief notes were always made, and these are quite sufficient to provide a short geological description.

Everywhere in the Weddell Sea the deposit was found to be terrigenous in origin; in keeping with Philippi and Pirie, the term "Glacial Mud (and Clay)" is therefore employed. Pirie rather emphasises the distinction between glacial mud and glacial clay; on board the *Endurance* it was not thought necessary to do so, or indeed practicable without a detailed examination of the deposit. In the table the term "Glacial Mud" covers both muds and clays. Where the deposit was sandy, or where pebbles were commoner than usual, attention is drawn to these features. The origin, of course, of a deposit such as this glacial mud—namely, the agency of drifting ice—makes the presence of rocks from the size of a pebble up to boulders weighing several hundredweights everywhere possible. Traces of sand should also have the same wide distribution; yet a deposit which could be truthfully called sand rather than mud was something unusual.

In former days this characteristic deposit of Antarctic waters was classed as "Blue Mud." Everything terrigenous in origin found below 100 fathoms (if not separated off into the small subdivisions such as Volcanic and Coral Muds) was in fact liable to be put down as such. This cannot have been Sir John Murray's original intention, but after the publication of the *Challenger* volume the term certainly had a tendency to become almost synonymous with a deep-sea terrigenous deposit. For these Antarctic muds, however, the term was by no means a fortunate one. To begin with, the deposit in question characterises the continental shelf as well as oceanic depths. The colour, moreover (owing probably to deficiency in organic matter), is practically never blue, but rather dark grey or brown to brownish-grey. As a rule, when dried it becomes lighter in colour. Blue Mud, for these and other reasons detailed by Philippi, can no longer be considered a fit name. A subdivision of the same standing as Volcanic or Coral Mud is necessary. Philippi and Pirie have accordingly adopted Glacial Mud as being the most suitable term. To sum up: Glacial Mud differs from most terrigenous deposits in being found not only in shallow water (*i.e.* on the shelf which in the Antarctic is 200, not 100, fathoms

* The occultation observations have since been checked by Mr A. C. D. Crommelin of Greenwich Observatory, and the positions adjusted accordingly by Mr James, physicist to the Expedition.

in depth), but also in depths of as much as 2000 fathoms; it differs from Deep-Sea Terrigenous Deposits in there being no arrangement of the constituents according to size, the transporting agency being a solid, namely, ice; and it differs from Blue Mud both in colour and in the fact that there is practically no carbonate of lime present in the deposit and very few organic constituents.*

As regards the Weddell Sea deposits, PIRIE seems to imply that the distribution of clay lies farther out from the continent than the mud. On the *Endurance*, however, it was noticed that deposits on the shelf were fully as worthy of being called clays as those from deep water, at least as far as macroscopic evidence went. The consistency, indeed, of the bottom deposit might vary very rapidly in a very small area. One day the lead would plunge in to the depth of a foot into soft mud, and the next, but a few miles away, sink only about half an inch into tough clay.

Sand or grit was frequently present, but never in large quantity except off Coats Land, where some of the deposits were labelled as sand rather than mud; and in 70° S. lat., 40° W. long., where for the space of a week in the middle of April 1915 the deposits were all very sandy. This unusual feature makes it quite possible that at the latter place the *Endurance* was nearer land than at any other time after leaving Coats Land; absolutely no sign, however, of what might be land was seen from the crow's-nest.

The proportion of rock fragments, mainly small pebbles, was highest along the Coats Land coast. Pebbles and boulders, however, were likely to occur at any time, and particularly when a bottom sample was procured by means of the dredge. These rocks were always very carefully examined (as hand specimens, and not under the microscope) in view of the complete lack of knowledge of Coats Land geology. Considering the ice-bound nature of that land, it seems very unlikely that exposures of rock will ever be found there in any quantity, so that any data, however scanty, obtainable from bottom samples such as these must be of value.

GEOLOGY OF THE ROCK-FRAGMENTS.

The rock specimens obtained directly off Coats Land are best treated separately from those got farther west in the Weddell Sea, as their source is not so much a matter of doubt. On January 12, 1915, in 74° 07′ S., 23° 02′ W., a dredging was made in 103 fathoms and brought up a sandy deposit full of sponge fragments and small pieces of rock. Among the latter, granite with white felspar was the commonest igneous rock; basalt and dolerite were not quite so abundant; a grey grit was much the commonest sedimentary rock, and a purple sandstone was found, but not in any quantity. At a later date, in 76° 34′ S., 31° 27′ W., the dredge yielded, in addition to granite with white felspar, another variety with hornblende and red felspar;

* MURRAY and RENARD'S classification as given in *The Depths of the Ocean*, p. 161, requires a slight alteration accordingly. "Glacial Mud (and Clay)" should be inserted after "Coral Mud," grouped on the one side with "Deep-Sea Deposits" and on the other with "Terrigenous Deposits."

basalt also occurred, and a rock which was provisionally classed as a peridotite. On other occasions grit (both red and green), shale, and pebbles of hard mud were obtained. The shales were generally marked with glacial striæ. On all these occasions the glacial mud which formed the bulk of the sample was extremely sandy. Among the material collected, two rock types only could be called common, namely, grey granite and grits, grey to green in colour. Some of the sediments recalled the Beacon Sandstone of Victoria Land in general appearance, but they were never sufficiently distinctive types to warrant one in saying definitely that Coats Land geologically resembles the lands east of the Ross Sea.

The remainder of the dredgings were made farther out from land; but there is every reason for saying that here, as well as nearer Coats Land, the source of the material was to the east. This conclusion is founded on the clockwise motion of the Weddell Sea ice, proved by the *Deutschland* and *Endurance* drifts. Among these later dredgings shale, quartzite, and green grit were the commonest rocks; grit particularly was very common. On March 26, 1915, in 76° 27′ S., 38° 43′ W., the haul was remarkable for including a red grit boulder weighing over 70 lbs., and a block of limestone (with fossils) about half that weight. Another block of similar limestone was brought up not ten miles away a few days later. The specimens have, of course, been lost, but it is quite possible that two of them represent the Archæocyathus Lst. of Cambrian age, previously known from Victoria Land and from a *Scotia* dredging in 62° 10′ S., 41° 20′ W. Other sediments identified were oolitic limestone, white and dark-grey quartzite, arkose (noted as being fairly common), banded shale, spotted shale, and chert. Of igneous rocks there was a considerable variety. Granite, although a hornblende variety with red felspar is noted more than once, was never so abundant as farther east. Dolerite, however, was common. Peridotite appears again, also pitchstone, porphyrite, and quartz felsite; diorite and basalt sometimes occurred, but not often. On one occasion a fragment possibly of tuff was obtained, but its identification was apparently a matter of doubt. Metamorphic rocks were represented by gneiss, garnetiferous gneiss, and mica-schist. None of the igneous or metamorphic rocks, however, occurred in quantity at all comparable to grey grit and white quartzite.

On the whole the data are insufficient for determining whether Coats Land is geologically similar to Victoria Land or to Graham Land. The balance of probability has always been in favour of the former alternative. The *Endurance* observations, however, do not bring the problem any nearer solution, but they have certainly produced nothing to render it improbable that Coats Land, like Victoria Land, belongs to the plateau type of Antarctica.

Bathymetrical Results.

Previous bathymetrical maps of this area have in two instances put down hypothetical contours over the region explored by the *Endurance*. Bruce on the

one hand has crowded his contours in a somewhat unnatural way to ensure "Morrell's land" being part of the Antarctic continent. BRENNECKE of the *Deutschland*, on the other hand, in prolonging his 1000-, 2000-, and 3000-metre depth-contours has made them sweep across to Graham Land in natural curves, and to the south-west of them has inserted the term "Flachsee." The result of the *Endurance* soundings definitely removes "Morrell's land" from the realm of probability, and substantiates practically all that BRENNECKE had inferred as likely to occur in the west. His "Flachsee" has proved to be a remarkably shrewd guess, though it still remains doubtful what grounds he had for inferring such a broad continental shelf.

The main results of the *Endurance* soundings are these :—

(1) The 1000-, 1500-, and 2000-fathom lines apparently sweep across without disturbance from Coats Land to Graham Land, passing south and west of the position where MORRELL claimed land and where Ross charted "strong appearance of land" (but without, however, deeming it sufficiently important or well founded to mention it in his book of travels).* The latter "land" was first called in question when NORDENSKJÖLD made a sounding of 2050 fathoms within thirty miles of Ross's "appearance of land." The behaviour of these contours, therefore, makes "Ross's land" and "Morrell's land" highly improbable. It is true that there is plenty of room for an island here; but it would have to rise from oceanic depths, and the rule for other Antarctic islands is that they are generally linked to the continent by a rise or something similar. Such cannot be the case here. Moreover, there are very good grounds for concluding that MORRELL'S chronometer was far from correct, making (if his "north-east cape of New South Greenland" is Joinville Island) his positions fully eight degrees too far east; if his statements are to be believed, the land off whose coast he claims to have been sealing was simply the east coast of Graham Land. Map-makers of the future, therefore, are hardly likely to insert land in 68° S., 48° W., unless it is vouched for by someone else besides this somewhat discredited American sealer.

(2) The 500-fathom line follows a much more irregular course, and at one point is deflected south as far as the face of the Wilhelm Barrier. This suggests the existence just here of a deep channel, with a somewhat sinuous course, running south approximately between the 36th and 37th meridians.

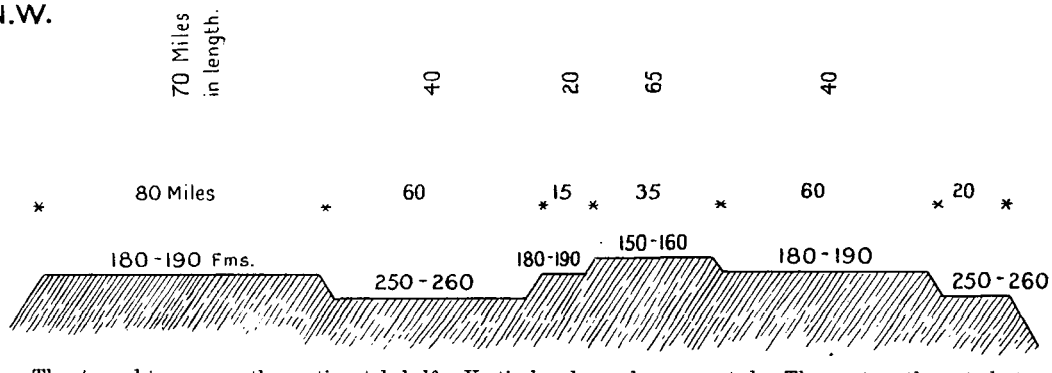
(3) East of the above-mentioned deep channel the bottom shoals gently towards Leopold and Caird Coasts. The continental shelf off Coats Land is in fact comparatively narrow. Deep water, therefore, is found off such features as the protruding Stancomb Wills Promontory, a barrier remnant of a once larger area; under the ice-cliffs 676 fathoms, no bottom, and ten miles off a depth of 1355 fathoms were recorded. The shelf is narrow but by no means regular; the soundings of the three expeditions which have visited Coats Land make it pretty certain that although that

* Ross in his narrative (vol. i, pp. 177-178) tells how his inexperienced officers were often deceived by appearance of land, and would not be persuaded that it was otherwise until they had actually sailed over the place.

country is now completely ice-covered, except for some nunataks in the extreme south in 78° S. lat., the solid rock below is nevertheless sculptured into hills and valleys. This is indicated not only by the irregularity of the soundings, but also by the uneven, mountainous character of the snow-covered land itself.

(4) West of the deep channel down the centre of the sea there is a somewhat sharper rise than to the east; and there are also more uniform conditions on the shelf itself. The *Endurance* drifted on to the shelf in the last week of March 1915. Up till then the total number of casts which had found bottom was thirty-five; besides these, there were some doubtful and some incomplete soundings, not without importance. Once on the shelf, soundings could be made without the sinking weight having to be sacrificed each time; a daily cast therefore became the rule. From March 31 till July 31 (both inclusive) 103 soundings were made. All of these were in depths under 275 fathoms.

In a way this series of soundings on the continental shelf was unique, and it would have been a matter of surprise if some important result had not been the outcome of it all. The majority of the soundings clustered round 180–190 or 250–260 fathoms. Over a large area the depth was about the same, day after day, and then it would suddenly change to another level. The back and forward drift of the ship now had its uses, for the numerous soundings are so distributed as to



The stepped terraces on the continental shelf. Vertical scale much exaggerated. The most north-westerly terrace is eighty miles broad, and at least seventy in length (*i.e.* from south-west to north-east), and so on.

prove the existence of a series of stepped terraces with boundaries running N.E.–S.W.; these run at right angles, apparently, to the presumed coast line farther to the south-west, but are parallel to the known coast line of the Leopold and Caird Coasts of Coats Land. The stepped terraces extend from 76° 18′ S., 38° 23′ W., to 72° 37′ S., 47° 47′ W., a distance of about 270 sea miles. The line so measured (*i.e.* across the terraces) represents very nearly the mean course of the ship's drift from S.E. to N.W.; at the same time, however, she was drifting sometimes more to the north-east, at other times more to the south-west; and in neither direction did the water show the least sign of shoaling. The extent of this shallow area therefore came to be known as at least forty miles across in the south-east, and over seventy

in the north-west. These terraces are shown diagrammatically on the accompanying figure. The slope from one terrace to another is of course much distorted; if drawn to scale it would be almost imperceptible, as it works out on the average at only 1 in 200.

On the east coast of Graham Land the Charcot Expeditions have shown the shelf there to be at least one hundred miles broad and of similar depth to what it is in the Weddell Sea. In the past indeed the Antarctic continental shelf has aroused considerable interest by reason of its depth being double the average depth of the shelf round the other continents—200–250 as against 100 fathoms. PHILIPPI, commenting on this, thought it might be due to planing down by ice during the once greater extent of the Antarctic ice-cap. NORDENSKJÖLD, on the other hand, thinks there may be some connection between the existence of the great Antarctic ice-cap and a resulting land submergence. The terraced structure, which the *Endurance* observations show, at once disproves PHILIPPI'S idea. These features, however, can be explained by faulting;* and it may therefore be the case that the deep Antarctic shelf here and elsewhere is the result of earth movement of some sort rather than of erosion.

(5) The slope of the continental edge as deduced from the *Endurance* figures is 1 in 62. This result is certainly misleading; for unfortunately the edge was crossed in a three-day blizzard at the beginning of August 1915, when the ship was in considerable danger and sounding therefore of secondary importance. There is an interval of forty miles or more in which to place the edge; the 185-fathom sounding is just over sixty sea-miles from a depth of 1146 fathoms. The sounding of 370 fathoms, no bottom, is of practically no value, as it is only ten miles from 1146 fathoms. That the edge is much steeper than 1 in 62 is more than likely, judged by the paired soundings of other expeditions. The steepest slope recorded by any Antarctic expedition is 1 in 17, and the average 1 in 26; the real slopes, moreover, will probably be a trifle steeper, as the chance that a ship crossed the edge at right angles is small. The *Endurance* figure should therefore be put aside.

	Sounding on Shelf.	Sounding in Deep Water.	Distance Apart in Sea-miles.	Slope.
Belgica . . .	279	1476	25	1 in 29
Gauss	209	1267	18	1 „ 17
Scotia	159	1950	45	1 „ 25
Deutschland . . .	305	820	18	1 „ 35
Endurance . . .	185	1146	60	1 „ 62

(6) In the forefront of all bathymetrical work in the American sector of Antarctica is the question of the one-time relationship to each other of the various island groups which border the Weddell Sea to the north. On this important point, however, the

* NORDENSKJÖLD states that Bransfield Strait is due to faulting.

Endurance results have nothing fresh to bring forward. Much that is new has, indeed, been found in recent years and been published, mainly in foreign periodicals. Such are, for instance, the finding by the Swedish Expedition of a rise between Joinville Island and the Powell Group, and the extremely important line of soundings made by the *Deutschland* between the South Orkneys and the South Sandwich Group. The latter show not a simple rise, but a series of alternate rises and deeps trending E.—W. and perhaps linking these two island groups. Reference may also be made to a rock reported by a whaler in 1916 as lying in latitude 58° 31′ S., longitude 41° 48′ W. Much more evidence, however, is certainly required before it can be decided whether the necessary link between the geologically similar regions of Graham Land and Patagonia connects all the island groups forming the so-called Southern Antilles, or passes somewhat more to the west, as Professor GREGORY would have it.

Table of Soundings.

Abbreviations:—K = Kelvin machine; L = Lucas; S.L. = Small Lucas; l = lead; sn = snapper; t = tubes; Gl.m. = Glacial mud or clay.

No.	Date.	Position. Latitude S.	Position. Longitude W.	Depth in Fathoms.	Depth in Metres.	Machine.	Attachment.	Nature of Bottom. Remarks.
	1914							
1	Dec. 18	62° 42′	18° 14′	(2810)	(5139)	L.	...	Very doubtful sounding.
2	,, 26	65 43	17 36	2819	5155	L.	sn.	Gl.m., brownish-grey in colour. The consistency is like that of clay. Under the microscope fragments of quartz and of some coloured mineral were noticed.
	1915							
3	Jan. 6	70 44	21 25	2400	4389	L.	...	Gl.m., brownish-grey. Quartz fragments very common; besides other unidentified minerals.
4	,, 10	72 02	16 07	$\overline{200}$	$\overline{366}$	K.	...	
5	,, 10	72 43	18 47	$\overline{210}$	$\overline{384}$	K	...	Barrier edge only about 100 yards distant.
6	,, 11	73 20	20 55	155	283	S.L.	sn.	Pebbles and sand grains; the former include dolerite and basalt (? with olivine). At this point barrier cliff turns sharply to S.E.
7	,, 11	73 29	21 50	190	347	S.L.	l.	Stony bottom. (A sounding half an hour later gave 210 fathoms, no bottom.)
8	,, 12	74 06	22 51	95	174	S.L. / K.	sn. / l.	Pebbles (of grit), sand, and mud.
9	,, 12	74 10	22 58	128	234	K.	sn.	Greenish-brown sand, pebbles, and mud; sponge spicules, and foraminifera.
10	,, 12	74 07	23 02	103	188	K.	sn.	Sand and pebbles. A dredging made in this position brought up a mass of sponges. The bottom deposit was sandy, with many pebbles (the largest 2 inches across) of:—Grey grit, common; purple sandstone; granite with white felspar, common; basalt; dolerite; syenite (possibly).
11	,, 13	74 2	26 12	$\overline{676}$	$\overline{1236}$	...	...	Stancomb Wills Promontory bore E. 2½ miles.
12	,, 14	74 10	27 21	1355	2478	L.	sn.	Gl.m., greyish-brown. No pebbles.
13	,, 15	75 2	25 25	268	490	L.	sn.	Gl.m., somewhat sandy, with a few pebbles.
14	,, 15	75 20	26 41	120	219	K.	l.	Some sand on the arming.
15	,, 16	76 26	28 40	134	245	K.	l.	Sand grains and sponge spicules.
16	,, 16	76 22	28 31	136	249	K.	sn.	Pebble of hornblende-granite, coated with bryozoa.
17	,, 19	76 34	31 27	312	570	L.	sn.	Gl.m., bluish-grey, sand, and small pebbles. A dredging made later in the day brought up sandy mud with pebbles of:—Peridotite (possibly); granite with white felspar; granite with red felspar; arkose; basalt; pebbles of indurated mud.

Table of Soundings—continued.

No.	Date.	Position.		Depth in Fathoms.	Depth in Metres.	Machine.	Attachment.	Nature of Bottom. Remarks.
		Latitude S.	Longitude W.					
18	Jan. 20	76° 39′	32° 08′	270	494	...	...	Very doubtful sounding.
19	,, 21	76 44	32 45	350	640	L.	sn.	Gl.m. and sand ; about half a dozen small pebbles.
20	,, 22	76 49	33 22	337	616	L.	sn.	
21	,, 25	76 48	33 36	382	699	L.	sn.	Gl.m. and sand, the former grey and bluish-grey in colour ; probably grey the surface colour.
22	,, 26	76 50	33 57	360	658	K.	sn.	Mud, dark grey, sand, and pebbles. A fish trap which was in use came up filled with waterlogged mud, sand, and a few pebbles, the latter include shale and hornblende-granite with red felspar.
	,, 27	76 50	34 02	...	...	...	...	The fish trap was in use at a depth of about 355 fathoms. It filled with sand, mud, and pebbles :—Hornblende syenite ; red grit ; green grit ; shale (some pieces showing glacial striæ).
23	,, 28	76 46	34 05	449	821	L.	sn.	Gl.m., dark grey ; very little sand and a few very small pebbles.
24	,, 29	76 47	34 12	449	821	L.	sn.	Gl.m., dark grey ; very little sand and a few pebbles.
25	Feb. 1	76 49	34 31	510	933	L.	sn.	Gl.m., dark grey, a trifle sandy ; a few small pebbles.
26	,, 3	76 50	34 47	520	951	L.	sn.	Gl.m., dark grey, sandy.
27	,, 4	76 53	34 38	520	951	L.	sn.	
28	,, 6	76 53	34 48	530	969	L.	sn.	Gl.m., dark grey.
29	,, 8	76 55	35 01	529	967	L.	sn.	Gl.m., dark grey and sandy.
30	,, 13	76 50	35 18	529	967	L.	sn.	Gl.m., dark grey, sand, and small rock fragments ; dark grey mud when dried becomes light dusty grey in colour.
31	,, 19	76 55	34 54	522	955	L.	sn.	Gl.m., dark grey.
32	Mar. 5	76 53	35 54	561	1026	L.	sn.	
33	,, 18	76 53	37 17	606	1108	L.	sn.	Gl.m.
34	,, 22	76 37	38 15	442	808	L.	sn.	Gl.m.
35	,, 23	76 37	38 22	443	810	L.	sn.	Gl.m. Dredge brought up much Gl.m., together with pebbles of black shale and grit.
36	,, 24	76 36	38 22	419	766	L.	sn.	Gl.m. Dredge yielded pebbles of shale and grit, one of the latter being false-bedded.
37	,, 25	76 32	38 37	406	742	L.	t.	Gl.m.
38	,, 26	76 27	38 43	380	695	L.	t.	Gl.m., light grey, at least 2 inches deep. Dredge was down twice. The first haul yielded a porphyrite pebble 3 inches across ; the second brought up numerous pebbles of grit and shale besides a block of red grit 70 lbs. in weight, and one of fossiliferous limestone 7 inches across.
39	,, 27	76 22	38 50	358	655	L.	t.	Gl.m. Dredge contained pebbles of :—Granite with red felspar ; grit ; shale ; banded shale, brown and dark grey.
40	,, 30	76 20	38 28	338	618	L.	...	Gl.m. A Rutherford tube was used for the first and only time. Dredge brought up a block of fossiliferous limestone 6 inches across.
41	,, 31	76 18	38 23	256	468	K.	l.	Gl.m.
42	Apr. 2	76 17	38 24	262	479	K.	l.	Gl.m. Dredge besides abundant mud contained two small pebbles, one a mica schist.
43	,, 3	76 17	38 34	264	483	K.	l.	
44	,, 4	76 9	38 30	250	457	K.	l.	
45	,, 5	76 9	38 43	245	448	K.	l.	Gl.m. Dredge included a few small pebbles.
46	,, 6	76 12	39 04	244	446	K.	l.	Gl.m.
47	,, 7	76 18	39 48	242	443	K.	l.	Gl.m., slightly gritty.
48	,, 9	76 29	40 14	273	499	K.	l.	Gl.m., gritty. Dredge brought up sandy mud. Two pebbles, one a limestone, the other an oolite.

Table of Soundings—continued.

No.	Date.	Position.		Depth in Fathoms.	Depth in Metres.	Machine.	Attachment.	Nature of Bottom. Remarks.
		Latitude S.	Longitude W.					
49	Apr. 10	76° 27′	40° 09′	253	463	K.	l.	Gl.m., gritty. Dredge contained a block of white grit about the size of one's hand.
50	,, 11	76 24	40 03	255	466	K.	l.	Gl.m., gritty. Dredge contained pebbles of:—Grey shale; quartzite; grit; diorite (?).
51	,, 12	76 14	39 14	238	435	K.	l.	
52	,, 12	...	...	232	424	K.	l.	Sounding made about six hours later than No 51.
53	,, 13	76 04	39 20	212	388	K.	l.	Gl.m. and sand.
54	,, 14	75 59	39 13	197	360	K.	l.	
55	,, 15	75 54	39 16	192	351	K.	sn.	Gl. sand and mud.
56	,, 16	75 55	39 31	192	351	K.	sn.	Sand and pebbles.
57	,, 17	75 57	39 41	196	358	K.	sn.	Moist sand and mud.
58	,, 18	75 57	39 49	193	353	K.	sn.	Gl.m.
59	,, 19	75 59	40 11	181	331	K.	sn.	Firm dark grey sand and mud.
60	,, 19	...	...	177	324	K.	l.	Sounding about six hours later than No. 59.
61	,, 20	76 00	40 48	178	325	K.	sn.	
62	,, 20	...	...	178	325	K.	sn.	Sounding about six hours later than No. 61.
63	,, 21	76 03	41 48	181	331	K.	sn.	Sand, mud, and pebble.
64	,, 22	76 01	42 01	180	329	K.	sn.	Gl.m. and sand. Dredge yielded over 100 pebbles up to 3 inches across. For the most part they were rounded and enclosed in tough sandy gl.m. Some appeared to be facetted:—Grey grits, common; quartzite, white; pink grit; arkose, fairly common; dolerite, common; diorite; granite with pink felspar; granite-gneiss; garnetiferous gneiss; peridotite (possibly); chert breccia; spotted shale; shales.
65	,, 23	76 02	41 48	179	327	K.	sn.	Gl.m.
66	,, 25	75 56	41 40	178	325	K.	sn.	Gl.m.
67	,, 26	75 49	41 42	179	327	K.	sn.	Gl.m.
68	,, 27	75 45	41 42	177	324	K.	sn.	Gl.m., stiff.
69	,, 28	75 38	41 33	174	318	K.	sn.	Gl.m.
70	,, 29	75 29	41 25	169	309	K.	l.	Gl.m.
71	,, 30	75 25	41 43	172	314	K.	l.	Gl.m.
72	May 1	75 27	42 00	175	320	K.	l.	Gl.m.
73	,, 3	75 22	42 18	175	320	K.	l.	Gl.m.
74	,, 4	75 23	42 26	173	316	K.	l.	Gl.m. Fish trap was lowered and filled with bluish-grey gl.m.
75	,, 5	75 19	42 26	170	311	K.	sn.	Gl.m. and sand.
76	,, 6	75 10	42 20	161	294	K.	l.	Gl.m. with a little grit.
77	,, 7	75 07	41 52	159	291	K.	l.	Gl.m. and a little grit. Dredge filled with 2 feet of tenacious mud. About a dozen pebbles:—Arkose; grits, white and pink; green igneous rock.
78	,, 8	75 03	42 17	162	296	K.	l.	Gl.m., slightly gritty.
79	,, 10	74 59	42 06	152	278	K.	l.	Gl.m., light grey, gritty to the feel.
80	,, 11	75 00	41 58	157	287	K.	l.	Gl.m.
81	,, 12	75 08	41 54	157	287	K.	l.	Gl.m., gritty.
82	,, 13	75 19	42 22	170	311	K.	l.	Gl.m., very little grit.
83	,, 14	75 23	42 52	163	298	K.	l.	Gl.m.
84	,, 15	75 27	43 09	161	294	K.	l.	Gl.m.
85	,, 16	75 26	43 37	153	280	K.	l.	Gl.m., very slightly gritty.
86	,, 17	75 24	43 57	157	287	K.	l.	Gl.m., slightly gritty.
87	,, 18	75 23	44 01	156	285	K.	sn.	Gl.m., slightly sandy.
88	,, 20	75 27	44 26	155	283	K.	l.	Gl.m., with a little sand.
89	,, 21	75 24	44 45	155	283	K.	l.	Gl.m., with a little grit.
90	,, 22	75 23	44 59	157	287	K.	l.	Gl.m., light grey; practically no sand.
91	,, 24	75 22	45 45	165	302	K.	l.	Gl.m., light grey.
92	,, 26	75 14	44 54	172	314	K.	l.	Gl.m. Dredge contained following pebbles:—Quartzite, white; chert; grits; dolerite (?); shale, black and grey.
93	,, 27	75 04	44 51	187	342	K.	l.	Gl.m.

Table of Soundings—continued.

No.	Date.	Position.		Depth in Fathoms.	Depth in Metres.	Machine.	Attachment.	Nature of Bottom. Remarks.
		Latitude S.	Longitude W.					
94	May 28	74° 59′	44° 56′	197	360	K.	l.	Gl.m., dark grey.
95	,, 28	...	...	205	375	K.	l.	Gl.m., grey (brownish); no sand. Sounding about twelve hours later than No. 94.
96	,, 29	74 55	44 41	204	373	K.	l.	Gl.m. Dredge brought up a few pebbles:—Quartzite, dark grey; slate.
97	,, 30	74 46	44 57	224	410	K.	l.	Gl.m.
98	,, 31	74 49	45 30	253	463	K.	l.	Gl.m., grey.
99	June 2	74 47	45 12	254	464	K.	l.	Gl.m.
100	,, 3	74 45	45 05	256	468	K.	l.	Gl.m., slightly gritty.
101	,, 4	74 44	44 57	256	468	K.	l.	Gl.m.; colour had a bluish tinge.
102	,, 5	74 43	44 55	254	464	K.	l.	Gl.m,, grey.
103	,, 7	74 32	45 03	256	468	K.	l.	Gl.m., grey; no grit.
104	,, 8	74 27	45 13	258	472	K.	l.	Gl.m.
105	,, 9	74 26	45 23	259	474	K.	l.	Gl.m., slightly sandy.
106	,, 10	74 25	45 28	259	474	K.	l.	Gl.m.
107	,, 11	74 27	44 45	254	464	K.	l.	Gl.m. Minute ice crystals present in the mud; make determination of grittiness by feel quite impossible.
108	,, 13	74 29	46 21	259	474	K.	l.	Gl.m.
109	,, 14	74 30	46 21	258	472	K.	sn.	Gl.m., brownish-grey.
110	,, 15	74 33	46 23	258	472	K.	l.	Gl.m.
111	,, 17	74 39	46 39	252	461	K.	l.	Gl.m.
112	,, 18	74 37	46 48	255	466	K.	l.	Gl.m. Dredge brought up mud with very few pebbles. One of these is a white quartzite, 3 inches across.
113	,, 21	74 30	47 39	260	475	K.	l.	Gl.m.
114	,, 22	74 21	47 39	262	479	K.	l.	Gl.m.
115	,, 24	75 02	47 23	249	455	K.	l.	
116	,, 25	73 57	47 18	239	437	K.	l.	Gl.m., grey. Dredge contained numerous subangular and angular pebbles;—Hornblende-granite with red felspar; arkose; quartz felsite; quartzite; grits, grey and green, common; pitchstone; indurated mud pebbles.
117	,, 26	73 58	47 17	238	435	K.	l.	
118	,, 28	73 59	47 20	255	466	K.	l.	Gl.m., grey.
119	,, 29	74 03	47 29	260	475	K.	l.	Gl.m.
120	July 1	74 08	47 54	255	466	K.	l.	Gl.m. Dredge brought up mud; no pebbles.
121	,, 3	74 11	48 39	226	413	K.	l.	Gl.m.
122	,, 4	74 09	48 50	203	371	K.	l.	Gl.m.
123	,, 4	...	...	194	355	K.	l.	Gl.m., brownish. Sounding made twelve hours later than No. 122.
124	,, 5	74 06	49 08	184	336	K.	l.	Gl.m., brownish. Dredge yielded nearly 60 pebbles:—Grits, quartzites (white), very common; shales; tuff (?); gneiss; garnetiferous gneiss; diorite or gabbro; felsite; basalt; arkose.
125	,, 6	74 06	49 11	185	338	K.	l.	Gl.m., with very small rock pieces. Instead of plunging the usual distance of about 1 foot into the mud the lead only went in $\frac{3}{4}$ inch.
126	,, 7	74 07	49 14	192	351	K.	l.	Gl.m., distinctly sandy.
127	,, 8	74 08	48 53	192	351	K.	l.	Gl.m.
128	,, 9	74 06	49 20	192	351	K.	l.	Lead absolutely clean.
129	,, 11	74 06	49 17	189	346	K.	l.	Little mud in cup; otherwise lead clean.
130	,, 13	74 12	48 57	190	347	K.	l.	Mud only in cup.
131	,, 16	73 36	48 27	202	369	K.	l.	Gl.m., brownish-grey; lead nearly clean.
132	,, 17	73 38	48 28	196	358	K.	l.	Gl.m., covering lead to depth of 1 foot.
133	,, 20	73 26	48 05	190	347	K.	l.	Gl.m., 6 inches deep.
134	,, 21	73 26	48 07	190	347	K.	l.	Gl.m., brownish-grey. Dredge yielded:—Grits, quartzites, 40–50 pebbles $\frac{1}{4}$–3 inches across; granite with red felspar.
135	,, 22	73 19	47 50	185	338	K.	l.	Gl.m.
136	,, 24	73 07	48 12	186	340	K.	l.	Gl.m.; lead sank very deep in mud.
137	,, 25	72 59	48 04	187	342	K.	l.	Gl.m, 8–10 inches.

Table of Soundings—continued.

No.	Date.	Position.		Depth in Fathoms.	Depth in Metres.	Machine.	Attachment.	Nature of Bottom. Remarks.
		Latitude S.	Longitude W.					
138	July 26	72° 51′	47° 34′	189	346	K.	l.	Gl.m., 6 inches.
139	,, 27	72 47	47 36	190	347	K.	l.	Gl.m., 6 inches.
140	,, 28	72 44	47 34	188	344	K.	l.	Gl.m., 6 inches.
141	,, 29	72 40	47 34	189	346	K.	l.	Gl.m., 10 inches.
142	,, 30	72 39	47 34	187	342	K.	l.	Gl.m., dried to light grey colour. Pebble of white quartzite.
143	,, 31	72 37	47 47	185	338	K.	l.	Gl.m.
144	Aug. 4	...	...	370	677	K.	...	Sounding made three hours earlier than No. 145. Ship drifting rapidly.
145	,, 4	71 50	48 41	452	827	L.	l.	Doubtful sounding, owing to lightness of sinker.
146	,, 5	71 42	49 16	1146	2096	L.	t.	Gl.m., light grey, 6 inches deep.
...	,, 10	...	...	...	...	...	...	Extremely doubtful sounding on this date.
147	,, 12	71 03	49 40	1550	2835	L	t.	
148	,, 17	70 38	49 54	1676	3065	L.	t.	Gl.m., light grey.
149	,, 25	70 09	50 08	1900	3475	L.	t.	Gl.m., grey.
150	Sept. 6	69 54	50 22	1850	3383	L.	...	Gl.m., light grey.
151	,, 20	69 38	50 35	1856	3394	L.	t.	Gl.m., light grey.
152	,, 28	69 32	51 12	1876	3431	L.	t.	Gl.m., grey.

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