XII.—REPORT ON THE NORWEGIAN DEEP-SEA EXPEDITION OF 1878.

By Prof. G. O. Sars.*

I.

Hammerfest, *July* 10, 1878.

Mr. Editor: As has already been announced in the plan of the expedition heretofore published in your paper, Hammerfest will be our chief station during the present year. At this place the expedition is supplied with coal and other necessities for its various cruises into the Arctic Ocean. Three such cruises are mentioned in the plan: one toward the east, one toward the west, and one toward the north. The first of these, which principally concerned the so-called East Sea (Östhav) has now been completed, and I will improve the time while we are lying here at Hammerfest equipping ourselves for our second cruise toward the west, to make good my promise and send your paper something about the expedition and about what it has accomplished so far.

The scientific investigations were begun, as you have already learned from telegrams, in the West-fjord, where we chose a point a considerable distance up the fjord about directly opposite Tran-isle. The West-fjord here has, according to previous soundings, its greatest depth, namely, 350 fathoms. A series of careful observations of the temperature were made in this place, whereby the remarkable fact heretofore observed farther out in the sea, namely, that at a certain depth (here only 40 fathoms) can be found a temperature considerably lower than that found in both lower and higher water-strata, could be established with perfect certainty by the use of instruments improved in many important respects. A cast of the dredge was also made in this place, whereby various curiosities were brought up from the deep. The weather was here, as on our whole cruise, brilliant, and we most thoroughly appreciated the summer breezes, well knowing that we before very long should have to exchange this beautiful sunshine for the rough climate of the Arctic Ocean. In Tromsö, where we stopped only a few hours, we took on board a pilot who is to accompany us on our cruises this summer. He is an experienced Arctic seaman who has spent no less than thirty-five summers in the Arctic seas about Spitzbergen, Jan Mayen, and Nova Zembla, hunting seal and walrus. He has made the

* Translated by Prof. R. B. Anderson of the University of Wisconsin, Madison, Wis., from a series of letters to "Dagbladet" by Prof. G. O. Sars.

impression of being a man of rare reliability and intelligence, and will doubtless prove a great help to the expedition, especially when we come to Spitzbergen, where he seems to be nearly as well acquainted as at his birth-place, Tromsö.

Before we reached Hammerfest we visited the Alten-fjord, where explorations were made at two points. Here, too, we found an intermediate minimum of temperature, though not before reaching the depth of 100 fathoms. The fauna of the sea-bottom showed, as might be expected, a more marked Arctic character than in the West-fjord, where it still was perfectly Atlantic.

In Hammerfest, where we arrived on Saturday the 22d of June, early in the morning, the members of the expedition were most cordially received by the city authorities, and the two days we spent here afforded us ample evidence of the rare hospitality and kindness for which this most northern town of our mundane sphere is famous.

On Monday night, the 24th of June, we weighed anchor and directed our course to the north and east in the usual steamship route. On our way we examined two of the large Finmark-fjords, namely, Porsanger-fjord and Tana-fjord. In both a series of careful observations of the temperature were taken, which did not, however, show any such intermediate minimum as was found in the West-fjord and Alten-fjord, undoubtedly on account of the greater shallowness of the water. The fauna was likewise examined, both with the dredge and the trawl-net, whereby its genuine Arctic character could be established. Among the hauls made here it is necessary to make special mention of the one made in the Tana-fjord with the beam-trawl, under the supervision of Captain Grieg. A richer haul we zoologists have hitherto scarcely seen. The trawl-net was brought up containing more than two barrels of loose mud, out of which protruded large beautiful sea-anemones and variegated star-fishes, and wherein we saw tumbling about a number of fishes (sea-perch, flounder, and skate). We were here thoroughly convinced of the superiority of the beam-trawl over the common dredge, especially after we had made various important improvements, not only in the net but also in reference to the arrangement of the weights which are to hold the runners in the right position against the bottom. But the instrument being very large, it is also difficult to manage, and hence it can as a rule be used only in calm weather, and in a comparatively smooth sea. We have since had occasion to test it with excellent success in the open sea, and desire all the more to make use of it hereafter, since it has been found that even the most active animals and fishes can be secured in this manner.

In fine, calm, bright weather we doubled the barren and exposed coast of East Finmark and arrived during the night on June 25th at Vardö Isle, where we remained during the following day to complete our equipment and to determine more accurately the geographical position of this point. Early on the morning of the 27th of June, we weighed

anchor and turned the prow to the east for our first ocean cruise. The fair weather still continued for some time, so that we dredged with excellent results on the same day at a distance of about forty miles from the coast, where the water was found to be 148 fathoms deep. But the rapidly falling barometer warned us to look out for drizzly weather, which was not long in coming. Toward evening it began to blow from the west, and during the night we had a perfect gale with chopping sea, which made our ship roll in a most disagreeable manner, so that it finally was found expedient to lay the stem of the vessel against the waves and thus await a change in the weather, a method of working the ship with which we had become only too familiar on our first expedition. This state of things continued not only during the remaining portion of the night, but also all of the next day, and while it lasted no kind of investigations could be thought of. Under these circumstances time naturally hung heavily on our hands, and we kept looking anxiously at the barometer to see whether no change might be expected. But the barometer appeared very capricious. Now it would rise a little and make our hopes rise correspondingly, then it fell again without having advanced more than a few millimetres. The following day the weather had cleared up a little, but a pretty stiff breeze was still blowing, and it was so damp and cold that we fairly dreaded the idea of going on deck. Meanwhile we had been able to throw the lead early in the morning and take a series of observations of the temperature, whereby it became evident that we had already advanced within the cold area. Having thus found the eastern boundary line between the Polar and the Atlantic currents, and the manner in which they pass into each other having been more carefully examined, we stopped here, and after having undertaken a dredging we continued northward for the purpose of further tracing the above-mentioned boundary line. The weather continued drizzling and cold, very much like winter, with interchanging showers of snow and sleet, and a temperature that fell even down to 33.8° Fahr. Thus it was not to be wondered at that we who came from summer warmth of more than 68° Fahr., found it disagreeable, and, though being in the midst of summer, we were obliged to put on winter clothes from head to foot whenever we desired to breathe fresh air upon deck. During the four following days the Polar current's boundary was followed accurately. In so doing we first sailed to the north, then to the west in the direction toward Beeren Island. On the way we also undertook a couple of dredgings, whereby we gained a tolerably correct idea of the character of the fauna, though the weather threw many obstacles in the way of these investigations. On the evening of the 3d of July we saw the first ice, which appeared in the form of quite small detached blocks, of the most fantastic shapes, but later in the form of connected floes. Birds increased in number and kind as we advanced. Auks, fulmars ,and gulls flocked everywhere, and in the horizon were seen a number of high columns of smoke as from a fleet of steamships. They

were whales that were gormandizing on the abundant fauna of the Polar waters, and which as we drew nearer exhibited their broad, black backs above the surface of the water, after having emptied their lungs with a rumbling noise and whirled the water up in the form of a high column of smoke. A glittering illumination spread itself over the sea filled with floating blocks of ice. Late in the evening a shout came that land was in sight ahead. It was our experienced pilot, whose keen eye first had discovered Beeren Isle through the fog. The rest of us in vain strained our eyes; all we could see was fog and the sea. Tired of looking, and knowing from the chart that we still were a considerable distance from land, the majority of us resolved to retire to our berths in order to enjoy with quickened energies on the following morning the sight of Beeren Isle and if possible undertake to land.

Our waking the following morning gave us the agreeable sensation of a perfectly smooth sea. We had not known the ship to lie so quietly for a long time, and as the screw only now and then throbbed, we soon understood that we were near the shore. We were therefore not slow in donning our clothes and springing upon deck in order to get a more perfect idea of the situation. At about the distance of a quarter of a mile from the ship lay the barren rocks of Beeren Island before us, partly shrouded in fog. We were in the lee of the land, east of its most southern point, doubtless the most picturesque part of the island. A high promontory, with sharp weather-beaten crests, extends precipitously into the sea, and in front of it rises again, in the form of a beautiful obelisk, a high, wonderfully shaped, isolated rock, called the Stappe. When the fog rose a little from the land in the rear of these rocks, extensive connected masses of snow were seen, interchanging with steep precipices and barren, gravelly flats. Further toward the north lifted itself out of the fog Mount Misery, which is 1,700 feet high, and around the summit of which winds a peculiar precipice, looking like an artificial breastwork. Between this highest mountain on Beeren Island and the south point lies the so-called South Harbor, where we intended to land, in order to put ashore the mail entrusted to us for the Dutch expedition, which, on its passage to the east, had determined to touch the same point somewhat later. According to our instructions the place was situated near the so-called Mayor's Gate (Borgermesterport), a wide gateway in the rock, through which in calm weather one can row a large yawl. By the aid of our glass we soon discovered the portal, minutely described and represented by an illustration in the Report of Nordenskjold's Expedition, in 1863, and therefore, when we had approached as near to it as we dared with the steamship, we dropped our anchor, whereupon two yawls were put into the sea and furnished with men.

We rowed without accident through the famous and grand Mayor's Gate, which was guarded by a multitude of noisy gulls, and landed on a gently sloping, sandy beach, where we, without the slightest difficulty, and perfectly dry-shod, planted our feet on the ground of Beeren Island.

Directly to the right of the Mayor's Gate, and a few paces up from the harbor, lies an old deserted Russian hut, the point indicated to us by the Hollanders. The roof was partially dilapidated, and here and there the floor was torn up and drenched with snow-water; but the walls were well timbered and had resisted the destructive influences of the wintry blasts and of the snow tolerably well. The plain and simple interior arrangement, a couple of bedsteads and a rudely-fashioned table, gave us an insight into the dreary existence which its occupants must have experienced during the long wintry nights, while the storm howled without and the snow gathered in towers round about the hut. That time had hung heavily on their hands was also sufficiently evident from the numerous inscriptions and carvings which covered the walls and bedsteads. With an industry and exactness that partially made up for the lack of artistic talent, we here found carved with a jack-knife ships of all sizes and descriptions, the cordage and yards represented as minutely and accurately as possible. In the rear of the house lay parts of the skeleton of a polar bear, which undoubtedly had been altogether too impertinent to escape with his life. The time required to dispose of the mail was occupied by a part of us for the purpose of taking a short stroll into the interior part of the island. Nothing more melancholy and dreary can be imagined. Even Jan Mayen seemed to us a garden in comparison with these barren flats, strewn with nothing but pebbles and gravel.

After having taken this invigorating exercise on shore, we returned to our ship, where we weighed anchor and proceeded westward, in order to determine more accurately the slope toward the great deep outside. At the distance of about forty miles from the island we cast the dredge at a depth of 35 fathoms. The bottom here consisting chiefly of coarse sand, the harvest was comparatively insignificant. On the other hand, the surface of the water was here filled with pelagic animals; our surface-net especially yielded enormous quantities of peteropods (*Limacina arctica*), and many of the specimens were of quite unusual size. The surface temperature was, as might be expected from the proximity of the ice, very low, and the sea-water was filled with a peculiar sea-slime, which on our former expedition had been observed under similar circumstances. But at a somewhat greater distance from the island a very sudden change took place, the temperature of the water rising at once to from 35.6° to 41° Fahr., while the color changed from a greenish to a dark-blue hue. It was the warm water of the Atlantic that here met the Polar water, without being able, however, as it seems, ever to get over to the coasts of Beeren Island, where the Polar current seems to be as dominating as at Jan Mayen. At somewhat long intervals the lead was thrown as we progressed outward, showing first 115, then 457, and then 750 fathoms, without the discovery of any abrupt descent anywhere. At the last-named station a complete series of observations of the temperature were taken, which showed 32° Fahr. to be situated

much deeper than we had expected to find it so far north, namely, between 400 and 500 fathoms. A dredging undertaken at the same place gave comparatively little return, the bed of the sea being so soft that the mouth of the dredge undoubtedly became filled up too soon with the tough clay, without being able to catch anything after being so filled.

We now bent our course to the south, then again to the west, in order to find the depth of 1,000 fathoms. This having been accomplished, we turned our prow toward Norway, making soundings at suitable intervals, in order to determine the ascent at this place from the deep. The ascent was here much more abrupt than further north, it being between 500 and 300 fathoms, which seems to indicate the existence of a real precipice between Beeren Island and Norway. We could not, however, devote much time now to establishing the details in regard to this precipice, our coal and water supply diminishing to an alarming extent, and we having still to examine the fauna at this point. Two hauls with the beam-trawl at different depths gave exceedingly interesting zoological results. In the first haul, which was made at a depth of 447 fathoms, with a temperature at the bottom of 33.08° Fahr. we got, among other things, a specimen of a species of halibut (*Hippoglossus pinguis*) more than a foot long. This species of halibut is not known on our coasts, and belongs to the far north. In the second haul, which was made in a depth of 190 fathoms, we also secured some fish of the *Cottoid* family, among which there apparently was a new variety, and besides we got an extraordinary amount of lower animals, which gave to us, as zoologists, abundance of work, even long after we arrived at Hammerfest.

We anchored in the harbor of this town on Monday noon, July 8, upon the whole well satisfied with the results of our first cruise into the Polar Sea, and with the brightest expectations in regard to the two cruises yet to be made before the expedition is completed.

II.

HAMMERFEST, *July* 27, 1878.

Mr. EDITOR: We are again lying here well moored in Hammerfest's Harbor, after having once more plowed the waves of the Polar Sea, and I shall avail myself of the opportunity, while we are resting after our work done, of sending you some brief account of our last cruise, continuing my story where I left off in my previous letter.

After stopping about four days in Hammerfest, which was necessary for taking on board coal and other prerequisites, we weighed anchor on the morning of the 13th of July, and proceeded northward through the South Island Sound in beautiful, calm sunshine. On the so-called Bond Island Ridge, one of the most celebrated fishing-grounds in this locality, we stopped for a short time, whereupon our fishing-tackle was brought out. In a short time we hauled up several fine-looking codfish, which

differed in no material respect from the so-called winter codfish (*Skreid*), and in size scarcely were inferior to the common Lofoden codfish. The contents of the stomach were examined carefully, both in these and in other species of fish caught at the same time. It appeared as usual that the codfish had not been very delicate in the choice of his food, which was very mixed, and consisted partly of crabs and mollusks, and partly of small fishes. In one of the stomachs we found a wolf-fish a span long, and this was yet so fresh that it could be preserved as a specimen in spirits. The coal-fish seemed to have been far more delicate in the choice of his food, which consisted exclusively of cuttle-fish, and, upon further examination, this proved to belong to the well-known Arctic form, the *Gonatus amœnus*, of which there heretofore has been found only one specimen on our coasts. This last discovery was of no little interest to us, partly because by it the appearance of this cuttle-fish in large numbers on the coasts of Finmark could be established, partly because the remarkable change in coal-fish fishing that recently has been observed in these regions could be naturally explained by the very appearance of this peculiar food.

A westward course was now taken and the jagged mountains of South Island soon disappeared from above the horizon, while we still had a glimpse of the loftier, snow-covered plateaus of Seiland. An indistinct land-line was yet seen for a short time in the southeast; then all vanished, and we had nothing but the boundless sea on all sides around us in the horizon. On the same day soundings and a series of observations of temperature at a depth of 95 fathoms were taken. At twelve o'clock in the night the lead was thrown out again, indicating 630 fathoms, and on the evening of the following day we found 1,110 fathoms, whence it appeared that the descent toward the deep here was tolerably gradual. At the last-named place we stopped, and the trawl went to the bottom, accompanied by our best wishes. In the morning the apparatus was hauled in good condition on deck, and it brought up from the deep a draught larger than any we ever had gotten before. In the net were found, in addition to a great variety of lower animals, no less than five specimens of a rare Arctic fish (*Lycodes*), one of which measured more than a foot in length and seemed to be full-grown. The excellent qualities of the trawl were still further demonstrated by this successful haul, and for the time being the dredge heretofore used fell wholly into discredit with us. As we progressed westward the air steadily grew colder. During a part of the time we had been surrounded by dense fog, and on the following morning the weather was so disagreeable that we had to put on a complete suit of winter clothing when we went on deck. We sounded in the forenoon, finding 1,200 fathoms, and took with great care a series of observations of the temperature, finding 32° Fahr. at only 30 fathoms' depth. Here we sent the trawl down again; but although the greatest precautions were taken both in letting it down and in the further maneuvering of it, it soon appeared, upon the hauling in

of the trawl, by the insignificant stretching of the accumulator, that the apparatus for some reason or other had not followed the bottom. In spite of this fact the net had caught in the stratum of water nearest above the sea-bed two specimens of the sea fauna of such extraordinary interest that they abundantly repaid the trouble and care we had given to this haul. One of these was a fish, the other a cuttle-fish, both alike remarkable and interesting. The fish was of a brilliant scarlet color, with extraordinarily far-projecting, thread-like ventral fins, and belonged to a hitherto entirely unknown genus and species of the cod family.* The cuttle-fish likewise proved to be a new species of the remarkable and hitherto but little known genus *Cirroteuthis*. Of both a drawing in colors was immediately made, which will be of valuable service in the preparation of the final report.

On the following morning we were surrounded on all sides by a dense fog so that we could see scarcely more than a few fathoms from the ship. The wind changed successively from north to northwest and west, which, in connection with the position of the barometer, indicated that we were just passing the north side of a tornado and that we in all probability soon would be outside of its range. By the heavy swell setting in from the southwest we were also informed with sufficient certainty that there was at no very great distance from us to the south a storm, and that, too, one of the very worst sort, so that we deemed ourselves fortunate that we on this occasion found ourselves so far into the Arctic Sea. Toward evening the sea became remarkably smooth, and an icy cold filled the atmosphere. In the west was seen toward the horizon a peculiarly clear glimmering in the air, which we already, from our former cruise, recognized as being ice-blink. At 9½ o'clock "Drift-ice ahead!" was shouted, and a piece of ice, much worn and perforated by the sea, came slowly floating past our ship, the first messenger from the Greenland ice. This was followed by still another, then by more and more, and finally the sea was filled on all sides with blocks of all possible sizes and of the most fantastic forms. Colossal mushrooms with hollow, beautiful, bright, green stems; swans, with far-extended necks; boats, with full crews; wonderfully jagged pillars stooping or leaning in various directions; flats sloping irregularly and half hid in the sea, crowded one on the top of the other—in short, the most extravagant forms passed in review before our ship as we progressed. Far out in the horizon was discovered a snow-white irregularly winding line, from which single bluish tops reared their heads, and over which a clear ice-blink, not unlike a sort of aurora borealis, appeared. Here the ice seemed to be more continuous, and our experienced pilot, who was sent aloft in order that he might be able to form a more accurate estimate of the situation, advised us that further progress westward was impossible. We had reached the Greenland ice, and although this had taken place somewhat sooner than calculated in our plan, we had to submit to the inevitable

Rhodichthys regina Collett.—T. H. B.

and change our course, steering northward and following the apparent direction of the edge of the ice. The following night we reached the northernmost station, where we cast the lead, finding a depth of about 2,000 fathoms, the greatest depth we had yet observed. We now turned our course to the east, casting the lead at suitable intervals, and usually taking a series of careful observations of the temperature in order to determine accurately the curve which indicates the modifications of the temperature at various depths. Thereby we established, among other things at various stations, the interesting fact that at a certain depth below the surface there is found a minimum of temperature, then again a more or less distinct rise of the temperature, below which the usual gradual decrease toward the bottom was observed.

The following day the trawl was sent down to a depth of 1,200 fathoms, and although it was evident that it had gone down on the wrong side, that is, with the beam down and the runners up, it still contained several interesting objects from the deep, and among them two specimens of the same Arctic fish (*Lycodes*) which we had caught before at a somewhat less depth. In the night we sounded again, finding a depth of 1,500 fathoms, and the series of observations of temperature taken showed that we were already outside of the actual limits of the Polar current, as we did not find 32° Fahr. before reaching the considerable depth of 400 fathoms.

The tornado we had touched recently had now evidently passed us entirely. On the following day the weather was calm, and the sea was so smooth that even microscopic examinations of the peculiar sea-slime, which on this expedition was observed in various places in the ocean, could be made successfully. We were now rapidly approaching a point where the depth, according to a sounding made during the voyage of Gaimard, was recorded as being 260 fathoms, and which, therefore, was to constitute the extreme points of the bank extending between Beeren Island and Spitzbergen. It being of importance to investigate more accurately the ascent from the deep in this place, the lead was cast at short intervals, but the depth did not decrease in any marked degree. Exactly at the point indicated on the chart where Gaimard's lead had been cast, we still found a depth of 1,060 fathoms, which presupposes a considerable error in the chart of the soundings heretofore made at this place. Not before we had made three or four soundings further to the east did we find the real ascent to the bank, and thus we had an opportunity of making here a not unimportant correction in the sketching of the depth-curves. At a depth of 650 fathoms, that is, on the very slope of the bank, the trawl was let down and brought up again late in the forenoon of the following day to be placed in good order on the deck. It contained about three barrels of mud. An exceedingly plentiful harvest of zoological specimens was secured, and, as usual, there was found, in addition to lower animals, a considerable number of fishes in the net, among which were several of great importance. Upon the bank

the trawl was sent to the bottom again at a depth of 180 fathoms, but the net was here torn to pieces by the sharp stones, so that we secured only what had accidentally been caught in the meshes, chiefly hydroids and polyzoa. The temperature both of the atmosphere and of the water had meanwhile sunk to so considerable an extent that it was evident that we had again come within the boundaries of the Polar current. We therefore regarded it as our duty to proceed a little further to the east, in order to investigate the physical and biological conditions in this stretch of the ocean, which for the most part of the year is filled with ice. We cast the lead at short intervals, finding a gradually ascending slope until we reached a depth of only 21 fathoms. At the surface the water was perfectly ice-cold, that is, 31.64° Fahr., the lowest temperature we had observed at the surface. It being presumable that the bottom here was stony, the dredge was sent down instead of the trawl, and it brought up from the bottom a considerable amount of coarse sand mixed with stone. Between and on these stones, and entirely covering the tangles, were found enormous masses of hydroids, many of which were very beautiful. Whole forests of these must cover the bottom in this locality. We did not find it suitable to our present purpose to make investigations further to the east, and so we turned our prow toward Beeren Island, which appeared in sight on the same day about noon. First rose above the horizon the peculiarly formed Mount Misery, and after that a long, low stretch of land on the north side of the mountain. It seemed to be endless, and afterwards proved to be the flat and undiversified northernmost portion of the island. A stiff breeze from the north had meanwhile arisen, which increased as we approached the land, and it soon made the waves so tumultuous that we were obliged to give up all thoughts of landing at this time. Off Mount Misery the wind was so violent that the sea was whipped into mist, and the ship careened fearfully. We hugged the shore so closely that we were in sight of South Harbor and the Russian hut, in order, if possible, to find out whether the mail left here by us for the Dutch expedition had been received. By the aid of our glasses we soon spied the signal left by us, and the flag had been removed, which we of course regarded as a sign that the expedition had been there. A letter just received here, probably brought by some fisherman, assures us that everything had been found in good order. The letter is from the chief of the expedition.

Having lain quiet for some time off the south side of the island awaiting if possible a favorable change in the weather, all sails were hoisted at ten o'clock in the evening, the engine was set to work at its utmost capacity, and we turned the stem of the ship southward toward Norway. So long as we still were in the lee of Beeren Island we had comparatively smooth water and a moderate breeze; but as we got further out to sea the wind increased and the waves waxed higher, and finally there blew a perfect gale from the north, the waves dashed high, and we sped forward at the rate of sixty-five miles per watch. It was the first time

that we were obliged to scud under bare poles on account of a real gale, and although the ship frequently careened and pitched badly, making boxes and other things tumble about in wild confusion, we still had abundant occasion to praise the excellent qualities of the Voring and pronounce her an excellent sea-going vessel. In spite of the fact that the sea was exceedingly chopping and the surges very bad, the latter rushing against the ship from all quarters, the vessel acted splendidly and did not ship a single sea.

We hastened southward with impetuous speed, and at the expiration of less than twenty-four hours we had made the four hundred miles from Beeren Island to Norway. The first landfall was Ing Island, one of the outmost of the islands of Finmark. A large point of it was seen through the fog and was immediately recognized by our experienced pilot.

Thenceforth we had the clearly marked steamship route before us, and we anchored in the Hammerfest Harbor all safe and sound early in the morning of the 25th of July.

III.

ON BOARD THE VORING, *September* 1, 1878.

Mr. EDITOR: The scientific work of the expedition is at length completed, and with the consciousness of having improved the time to the best of our ability, and completely carried out the plan arranged for the expedition, we are now taking a good rest after our exertions, while the Voring is leisurely carrying us southward along the usual steamship route. It is now something more than a month since my last letter, and during this time we have seen so much and had such varied experiences, that I dare not at this time undertake to give you an exhaustive account of our whole cruise. For the present you will therefore have to content yourself with only a part. The continuation will follow as soon as opportunity offers itself.

After a sojourn of four days at Hammerfest, which was necessary for completing our supply of coal and water and of other provisions, we weighed anchor on Monday, the 29th of July, at 6½ o'clock in the afternoon, and after having fired four guns as a farewell salute to the city, we steamed northward along the usual route, out the Sörö Sound past the Ship's Holm out into the ocean. The weather was calm and warm, and the sea was so smooth that scarcely any motion of the ship was discernible. But the atmosphere toward the north was quite hazy, so that the sun, which, during the whole day, had been shining from a perfectly pure and clear sky, later in the evening hid itself behind a heavy bank of fog, and so did not afford us an opportunity of observing the partial eclipse which was just then taking place. The following morning we had already advanced a considerable distance into the ocean, and the fog, so com-

mon here, soon wrapped us in its clammy, cold atmosphere, and compelled us to put on again our traveling clothes, which for some time had been stowed away. In the afternoon the trawl was let down to a depth of 223 fathoms, and in the evening it was brought on deck in good condition, containing a large amount of mud, in which were found several siliceous sponges. As usual we also found several fishes in the net: a rare flounder, a specimen of a Greenland species of *Aspidophorus*, and a small cottoid. Besides, the mud contained numerous lower animals, with the examination of which we zoologists were occupied until late the following day.

We were now rapidly approaching Beeren Island; but the fog was so dense that no land could be seen before we had come within a few miles of it, when the summit of Mount Misery appeared among the masses of fog. Meanwhile the wind had begun to freshen, and a pretty decided swell set in from the west, which made the prospects for landing at the point visited by us before but little promising. Still, we continued our course northward along the east side of the island, keeping as near to the coast as we thought advisable. Now and then broken parts of the somber island, by this time well known to us, became visible, but were again wrapped in the fog which gradually accumulated into threatening driving cloud-banks. The rapid falling of the barometer also warned us that a storm was brewing, and as we would in that case be unable to accomplish anything out at sea, we agreed not to proceed any further for the time being, but to worry the storm out in the lee of the island. Nor was it long before the storm broke and began to creak in our cordage, but we had the land to the windward and therefore lay perfectly at ease, tacking back and forth.

The following day brought but little change in the situation. The fog came hurrying over Beeren Island in dense masses which entirely enveloped the summit of Mount Misery, and left only the gloomy strand with its steep weather-beaten precipices in sight. Toward evening the wind settled somewhat, and finding ourselves just then off the flat northeastern side of the island, where, according to former reports, coal-beds and rich fossil-bearing strata of rock were to be found, we deemed it proper to attempt a landing for the purpose of making careful explorations and gathering specimens of various kinds. Having approached the coast as near as we could with our ship, the boats were let down and hastily filled with a crew of the younger members of the expedition; they were furnished with guns, botanical boxes, and other articles of equipment suitable to the occasion. It was then eleven o'clock in the evening. But the night is here at this time scarcely darker than the day, and there was nothing to hinder our postponing our sleep until the following morning.

We steered into a little bay on the coast which we had observed from the ship, and where the breakers were considerably less formidable than elsewhere, and got the boats safely drawn on shore and made fast on a strand evenly sloping and covered with boulders and driftwood, where

a small stream, the so-called English River, came trickling down. The place was well chosen, and it appeared on our later investigations that it would not have been possible at any other point to get over the precipice, which from the flat land within descends into the sea. Here the ascent was not difficult, and we soon found ourselves upon the plateau, whence endless flat and barren wastes strewn with boulders, with here and there a little lake, stretched as far as the eye could see. Some rare birds, among which a broad-tailed *Lestris pomerina*, resembling a bird of prey, soon attracted our attention, and three fine specimens were brought down by our guns. We followed the coast northward as far as seven miles from the English River, now making excursions into the interior of the island, now approaching the coast, whence we got splendid views of a couple of wonderfully shaped rocks standing isolated in the sea, the English Block and the North Loaf, where myriads of sea-birds had chosen their places for nesting. But now came the fog, dark, cold, and wet, driving upon us from the interior of the island, and it soon became so dense that it robbed us of every outlook, wherefore we concluded that it was about time for us to make an end to further progress and begin our march back. On the way we had the good fortune to stumble upon some fossil-bearing rocks, which here cropped out, and were so loose and crushed by the ice that we found no difficulty in making a large collection. Some slate-formed layers of coal were also found, of which specimens were gathered.

After a pretty exhausting march through the dense fog, over the sharp stones, we finally reached our landing-place at about four o'clock in the morning, whence we could, through the fog, barely catch a glimpse of the Voring, which, in the mean time, had anchored as near to the shore as possible. On board, the captain, with his usual thoughtfulness, kept in readiness for us a cup of steaming coffee, which tasted excellent after our wearisome excursion, and, together with a glass of good grog, gave our bodies the requisite amount of heat.

Meanwhile, there was taking place near the stern of the ship a scene which kept us awake for several hours longer. A couple of the crew had gotten out the trolling-lines, and in an incredibly short time had brought on board some beautiful codfish. As soon as this became known all was life and activity among the crew, and all the trolling-lines that could be found on board were brought into service in a hurry. Several of the members of the expedition also took part in the fishing, and that with a zeal scarcely less intense than that of the crew. One splendid codfish after another was hauled in over the rail, and soon the deck was strewn with sprawling fishes, so that there was scarcely room to walk without stepping on them. About two hundred codfish were in the course of a few hours drawn up, which showed conclusively what a wealth of fish there must be around this island, in other respects so desolate and inhospitable. At six o'clock in the morning we at length tum-

bled into our berths and soon fell asleep, and did not awake again before noon.

We were still in the lee of the island, for a new storm had broken out, which soon compelled our captain to weigh anchor and keep moving, as before, back and forth along the island. In the evening the prospects were very dark and melancholy. The showers came down from Mount Misery howling and creaking through the cordage of the ship, and whipping the sea into foam. The swells of the sea had also increased considerably, and made the ship, as soon as we got ever so little further from the land, pitch and roll terribly, by which we could easily understand what rough weather there must be further out at sea. Meanwhile, it was our intention at the first perceptible improvement in the weather to leave Beeren Island without delay, with which we by this time, to tell the honest truth, were thoroughly disgusted.

The following morning we were already on our way northward. The wind had quieted considerably, the barometer had risen, and the atmosphere had cleared. But the storm during the previous two days had thrown the ocean into so violent a commotion that our ship, having the seas on the beam, rolled with more violence than ever. Later in the day the sea quieted little by little, and a breeze from the north made it settle still more rapidly. When we had advanced to about midway between Beeren Island and Spitzbergen we stopped, the trawl was sent down to a depth of 123 fathoms, and was hauled on board full of specimens of the fauna of the deep. Not less than twenty-eight fishes (the most of them small, it is true) were secured by this haul, besides a multitude of lower animals, among which were some of great interest. We now directed our course to the westward, in order to determine the descent of the Beeren Island Bank toward the deep outside. In three successive soundings we found down along the bank, first, 444 fathoms, then 795 fathoms, and, finally, 1,149 fathoms. At all these stations careful series of observations of the temperature were taken, both with the usual Casella-Miller thermometer and with the improved Negretti-Zambra, the result going to show that in this stretch of the sea there is found a considerably confused distribution of temperature in the deep. The course was again changed and directed northward to Spitzbergen. On the way the trawl was sent down on the declivity of the bank, but came up in disorder, the net, probably on account of the severe ground-swells, having been wound around the beam.

The following day, toward noon, we got the first landfall of Spitzbergen, but the land was for the most part covered with fog, so that we only here and there caught glimpses of immense masses of ice and snow that shimmered through the fog. We sent a dredge down on the bank, where the water was only 70 fathoms deep. But we were unsuccessful again, the sack of the dredge being so torn asunder by the sharp stones on the bottom that only what accidentally stuck fast to it and to the tangles could be secured. In the evening of the same day we

doubled South Cape, with the low island off it, and a pretty stiff north wind having meanwhile set in, we steered toward the southeast point in order to get in lee of the land, and at the same time get, to begin with, some idea of Spitzbergen's grand natural aspects. From a broad valley, completely filled with snow, a mighty glacier extends far into the sea, having abrupt edges and floes at the base. Above it rises a beautiful, dome-like mountain, which bears the name Keilhan's Mountain, so called after our celebrated countryman Keilhan, whose explorations in these northern regions form the basis of geological knowledge of this Arctic land. East of Keilhan's Mountain we got a glimpse of a considerable portion of the east coast facing Storfjord. It lay illuminated by the clear light of the midnight sun, while the west side was enveloped in dense masses of fog. Having made some physical and zoological investigations right by the foot of the glacier, we set our course to the southeast out into Storfjord, until we found a depth of 150 fathoms, where a careful series of observations of temperature was taken, and a dredging made, which gave us a tolerably complete idea of the fauna of the sea-bed. The stem was then turned to the west again in order to complete our first passage between Spitzbergen and the Greenland ice.

The same day we reached the ledge, where a couple of Greenland shark-hunters were seen lying at anchor. The lead here showed a pretty abrupt descent toward the deep, and at a comparatively short distance from the edge we had a depth of 750 fathoms. Here the trawl was sent down, but it was brought up with the net completely torn asunder, which was the more to be regretted, since, from the animals still sticking fast in the meshes of the net, it could be seen that the fauna here must be extraordinarily plentiful. But the bottom was evidently here of such a nature that it would involve a great risk to make another haul, wherefore we proceeded westward, throwing the lead and taking careful observations of the temperature at suitable intervals.

On Thursday, the 8th of August, at noon, we were warned that ice was in sight. And it was found that to the north of us, at the horizon, appeared a white line of considerable length, from which blocks of ice came drifting with the current southward. But the sea being free from ice to the west, we continued our course in that direction. In the evening we passed longitude 0° without our having met with any ice, wherefore the ice previously seen clearly must have been an isolated collection of drift-ice. In the night the trawl was sent down to a depth of 1,700 fathoms, and we awaited with great suspense the result of this haul, as we had never before tried the trawl at so great a depth. But, in hauling it up on the following morning, the rope suddenly snapped on account of the great weight, and the whole trawl, together with 2,000 fathoms of rope, was lost. This was a misfortune greatly to be regretted, and for the time being it could not help depressing our spirits, not only because we had given much time and toil to the maneuvering, but also because we had sent the trawl down with great expectations. As mat-

ters now stood there was nothing else for us to do than to move on, and meanwhile see to getting a new trawl ready as soon as possible. As ice was now seen in the horizon in various directions, we did not deem it advisable to press further forward toward the west, and so we changed our course to the northeast, trying as far as practicable to follow the edge of the ice. The further north we came the more ice we saw, and at last we were surrounded on all sides, wherever we turned our eyes, with large and small floes of ice of the usual bizarre forms, but still with sufficient space between them to allow the ship to be maneuvered further in the above-mentioned direction, provided proper care was taken. At six o'clock in the evening we at last came out of the belt of drift-ice, and had a clear and open sea before us. The weather was brilliant during the whole time, the sun shone bright, and the sea between the ice-floes was as smooth as in a harbor.

The following morning we had already advanced up to the next passage, and when we had established a depth here of 1,640 fathoms, our course was directed to the east again toward Spitzbergen. In the evening we sounded again, finding 1,333 fathoms, and an accurate series of observations of temperature was also taken by which it became evident that we had already gotten out of the Polar current, 32° F. not being found before we reached a depth of 400 fathoms.

Meanwhile we had made a new trawl, with a new rope and other belongings, and although the depth was considerably less than at the last station, it still was so great that a successful haul with this apparatus would be of great interest in a biological respect. Hopeful, we then let the trawl sink down, trusting that the new rope would stand the test this time. But when we came to haul the trawl in, the same unusual strain appeared on the accumulator as the previous time; its strings were stretched to thrice their length, although the trawl was raised from the bottom. On our former expeditions, further south, we had several times used the dredge at a similar depth, without anything like this happening, and hence we were in the greatest suspense to get at a satisfactory explanation of this yet inexplicable phenomenon. After much work and considerable anxiety in regard to our apparatus the trawl finally came up, and with it came the key to the problem. The net contained not only, as we had been wont to find, theretofore, the usual biloculina-clay, but, together with this, large, round stones, of which one was estimated to weigh about 300 pounds. The beam holding the runners apart from each other was broken in two by the great weight, and it must be regarded as a wonder that the net, too, was not torn to pieces. The whole sea-bed here seems to be literally covered with small and great stones lying loose in the mud, and they must, without any doubt, come from the icebergs that during the summer season constantly break loose from the glaciers on Spitzbergen and then melt here under the influence of the warm Atlantic current and unload the stones which by the action of the glacier are brought upon the ice. The further exam-

ination of the materials brought up brought to light several interesting forms of animals; nor were fishes wanting, three specimens of a beautifully banded species of *Lycodes* being secured in good condition and preserved.

Toward evening of the same day we caught sight of land ahead. It was off the northwest coast of Spitzbergen, and proved to be the long and yet but little known Prince Charles' Foreland, the sharp pinnacles of which first lifted their tall heads above the horizon. The following morning the weather was fair and the sun shone clear and bright. We were then only about thirty miles distant from land, and the mountains on Prince Charles' Foreland and around Icefjord lay perfectly clear with their mighty masses of snow and ice. At 125 fathoms' depth we sent down a dredge which brought up a considerable portion of loose mud, containing the usual Arctic animal forms.

It was determined that the next dredging was to take place at a depth of about 400 fathoms, or where the bank declined toward the deep. So we steered to the west, to the point where according to the previously sketched contour-lines we could expect this depth. Upon casting the lead we found, however, to our surprise, that the depth was only 97 fathoms. We were here clearly on a sharp edge, and the soundings made immediately afterwards further out also showed an unusually steep descent toward the deep. At 416 fathoms the dredge went down and came up again with its net full of gravel and stones. On the tangles were hanging beautiful specimens of a sort of Medusa-head (*Astrophyton*) up to two feet in diameter, together with a few specimens of the same beautiful branched sponge which we on our first expedition had caught in the Umbellular region; and from among the gravel was separated a large number of other marine animals, some of which were of great interest.

According to our plan two passages more were to be made between Spitzbergen and the Greenland ice further to the north. Meanwhile from the experience now gained it was thought sufficient to make one cruise to the north, and in this manner considerable time would be gained. The stem was therefore turned to the northwest and then to the north, in order if possible to determine the point where the Atlantic current meets the Polar current. Meanwhile the wind had begun blowing from the northwest, with a chopping sea, so that the ship on account of the constant consumption of coal lay a great deal too high in the water and consequently made extremely slow progress. But fortunately we were sailing with the current, and were thus helped along a little more rapidly than we had expected. The weather remained unchanged all the next day, and the ship lay the whole time fighting the chopping sea, while the propeller was lifted by every heavy swell entirely out of the water, and beat about wildly in the air, without being able to push the vessel forward with its usual force. Still we *did* go forward, and on the following morning we observed the first floes of ice. We had then ad-

vanced to the eighteenth degree. The depth was 450 fathoms, and a series of careful observations of temperature was taken at this point, whereby it appeared, however, that we had not yet by far reached the real Polar current. As it could be judged by these observations that the northern limit of the Atlantic current must be looked for at a considerably higher latitude far in among the drifting ice, and as such a cruise was not really a part of our plan, we decided to stop here and turn our course toward the north side of Spitzbergen. Before this was done we made a cast with the trawl, which gave us ample specimens of the fauna of the sea-bed, among which were several specimens of rare fishes. On the surface of the water were found enormous quantities of the peculiar ocean slime, which we on our previous expedition had observed, and renewed accurate microscopic examinations were made of the same at this time. Dense fog now came drifting in upon us from the ice, and at length so diminished our horizon that the ship seemed to float in the midst of a boundless sea of fog. But suddenly, as if by enchantment, we came in the afternoon out of the dense bank of fog into bright sunshine and had before us at the distance of about forty miles the jagged northwest coast of Spitzbergen, with the so-called seven Ice Mountains. Somewhat nearer the shore, at a depth of 250 fathoms, another haul was made with the trawl, which likewise gave a plentiful zoological harvest, which kept us zoologists busy for a long time. Meanwhile nature claimed her dues, and weary from the day's work we sought our berths, while the Voring directed her course toward the Norse Isles in order to anchor there and take in ballast and water.

The following morning, the 15th of August, we lay well anchored at the place determined upon, and here awaited us the surprise of seeing ourselves in company with no less than four Norse fishermen, and among them the sloop so well known from Nordenskjold's expedition, the Ice Bear. These vessels had already been lying here at anchor for some time while the crews were busily engaged in catching cod in the immediate vicinity. Fog still partially covered the surrounding mountains, so that we were enabled to orient ourselves only piece by piece as the fog rose. We were lying in a quite broad sound, in which the current rushed on with considerable rapidity, carrying with it blocks of ice of various forms and sizes. East of us we had the real so-called Norse Isle. West of us was White Island. Both were barren partially snow-clad masses of rock from which weather-beaten grayish heaps of stones extended down toward the strand. Directly north of us arose out of the fog a peculiarly formed mountain, the so-called Clowen Cliff, and further to the west we caught a glimpse now and then between the fog of the most northwestern of these islands, that is, the Amsterdam Island. South of us we had the northwest point of Spitzbergen's mainland, which extended toward White Island. But the main channel toward Red Bay remained enveloped in a compact mass of fog out of which small and large masses of ice now and then came forth, sailing through the sound past our ship.

In the afternoon a couple of the members of the expedition, accompanied by our pilot, who was well acquainted in these regions, undertook an excursion in a boat southward toward the mainland. On our way we passed numerous large and small ice-floes, which came floating in from the constantly ice-filled sea east of the Norse Islands. Between the ice-blocks were swimming large flocks of auks and black guillemots, of which a few became an easy prey to our guns. At one point where the mountain sides seemed less steep, we landed to take a look at the island. After having passed a high mound of gravel and boulders, among which a few alpine plants eked out a miserable existence, we came into a valley of some width surrounded by steep mountains. The major part of the valley was occupied by a lake of fresh water. But the small amount of summer heat had been able to keep only a small strip nearest to the mound open, while all the rest was covered with eternal ice. The water was carefully examined by the aid of the apparatus which we had brought with us. The only living things we could discover were a couple of specimens of the larvæ of a species of gnat. The round stones strewn everywhere over the bottom of the lake were covered with a close, dirty, greenish crust, which seemed mainly to be formed from a species of alga, of which we took specimens. Over the water flew a pair of solitary gulls. Otherwise everything here seemed so barren and desolate that we were glad to get back to our boat again and pass on further. We rowed north to the other side of White Island and landed again on a flat holm (rocky island), which on account of its somewhat more greenish hue seemed to give promise of a thriftier vegetation. On the sandy strand a few eider ducks tumbled about with their recently-hatched young, but quickly absented themselves when we arrived, plunging dexterously into the sea, one after the other, and they did not come to the surface again before they had gotten outside of the range of our guns. On White Island itself we gathered a few plants, and from its highest point we had a brilliant view of the mighty mountains and glaciers in the so-called Fair Harbor. We returned by way of the north side of White Island. But dense fog soon deprived us of every outlook, so that we only now and then caught a glimpse of the gray, weather-beaten strand of White Island and of one and another iceberg sailing by us. At eight o'clock in the evening we were on board again, where we zoologists were engaged for some time longer in investigating the fauna of the sea-bed in the immediate vicinity of the ship.

On the following morning the fog lifted a little so that we could see a little more of our somber surroundings. Through the sound came, as usual, one floe of ice after another drifting with the current. One of these, which was not observed in time, turned against our bow with so great force that it shook the whole ship as if we had struck bottom, and it warned us sufficiently that it would not have been a mere joke if our ship, at full speed, had collided with one of these compact masses almost as hard as stone. About noon the boats belonging to the fish-

ermen came sailing in from the mouth of the sound, all loaded full to the gunwale. The fishing on the previous night had been quite unusually abundant, and so there was here an unexpectedly convenient opportunity for studying the Spitzbergen codfish and the conditions attending the catching of it in these waters. In order to form a more accurate estimate of the vast amount of fish caught here at this time we give the following reliable figures: On three boats, each having a crew of two men, were caught from 10 o'clock in the evening until 4.30 o'clock in the morning, eleven hundred and fifty-three codfish. After having dressed these fish and rested a short time, the same six men went out again at 8 o'clock the same morning and came back at 1.30 o'clock with eleven hundred codfish. Each man had thus in the course of twelve hours hauled up three hundred and seventy-five fish, which makes one fish every other minute.

At four o'clock we had taken in water and ballast, wherefore we weighed anchor and stood to the north again. According to our plan a few physical and biological observations were to be made on the banks directly north of the Norse Islands. But as it kept freshening with a breeze from the southwest as we came further out, and as the fog was very dense, we changed our plan and directed our course, instead, southward into the "Smeerenberg." The fog, which out at sea stood like a dense, dark wall, had as yet but partially gotten in here, and so we got during our passage through this channel, celebrated from former expeditions for its beautiful mountains and glaciers, a most excellent opportunity of getting acquainted with the mighty and grand natural features of Spitzbergen. Views, each more picturesque and surprising than the preceding one, opened before our eyes as we advanced. Every valley and ravine is here filled with a mighty glacier, which with abrupt walls shoots out into the sea; and above the glaciers tower, further into the interior, beautiful mountains abounding in the boldest peaks and precipices. The straggling masses of fog drifting over the land from the sea, between which the evening sun shed its clear rays of light, spread over all a peculiar mystic halo which added, in a marked degree, to the brilliancy and grandeur of this scene. In the innermost part of the bay unfolded itself before our eyes in the clear light of the evening sun a glorious panorama of mountain peaks, which, with the most fantastic, jagged forms, rose from a valley completely filled for many miles with snow, and from this extended a mighty glacier—the largest one we hitherto had seen—out into the sea. From the greenish blue, shimmering, abrupt end of the glacier came one iceberg after the other, floating with the current out of the fjord. One of these, of mighty dimensions, crowned with glittering peaks, passed close by our ship and was immediately sketched. That our sketch-books did not rest during the remainder of our passage through this interesting channel, is a matter of course. Every one of us that knew how to use a pencil, with some sort of practice, certainly has some view or other in his sketch-book from that glorious

sail, and they who were not bold enough to record on paper what they saw, will, at least, long preserve in their memories a vivid and lasting impression of the imposing and solemn scenery that here, for the first time, met our eyes.

Through the so-called South Gate we once more directed our course to the sea, where we again met the dense threatening bank of fog, accompanied by a fresh breeze from the southwest. As the weather looked anything but promising to the seaward we agreed to run into Magdalene Bay, a bay entering Spitzbergen's plateau south of Smeerenberg, and likewise renowned for its imposing scenery. It was then quite late in the evening, and the fog partially concealed the surrounding mountains. But between these show forth distinctly the mighty glaciers, the number of which is really extraordinary. In the innermost part of the bay, in the lee of a peninsula, joined to the mainland by a flat isthmus, and surrounded on all sides by majestic mountains and glaciers, we cast anchor, and it being already late in the night the most of us sought our berths in order to be able on the following morning to study with refreshed strength the grand scenery of Spitzbergen, and to make some physical and biological observations at this interesting point.

The morning brought calm weather, but the fog still enveloped to a great extent the mighty mountains which here on all sides lift their jagged peaks to the skies. The sea was everywhere filled with blocks of ice of all sizes and forms, from quite small fragments to respectable icebergs, and presented a peculiar greenish color on account of the constant melting of glacial ice. Enormous numbers of the Arctic pteropod (*Limacina*) were seen moving about on the surface of the water, and among them were also a few specimens of the crystal-clear whale-food (*Clione*), and at some distance from the ship a pair of seals were seen inquisitively lifting their heads up to look at the ship. At this last sight our hunters grew lively. Rifles and ammunition were quickly brought out, and three specimens, two ringed seals and one young large cub, had to give their lives as a penalty for their curiosity. Later in the day some of the members of the expedition made a trip ashore to the peninsula lying before us, which seemed for ages to have been used as a burying-ground. Numerous graves bore ample testimony of the sufferings of men who, impelled by love of knowledge or by greed of gain, had been obliged to leave their bones here. But the graves did not really deserve the name. The soil consists chiefly of stone, so that it had been only possible to cover the rudely timbered coffins as well as circumstances would permit with stones. Now the most of them lay exposed to the air, open and broken asunder by the ice, possibly also interfered with by the polar bear and by other beasts, and in the coffins were found only scattered portions of the skeletons. As if the beasts of prey really had shown respect to the noblest part of the human body, the skulls were still, we found to our astonishment, in the most of these graves lying in their places. From the greatly varied forms of the craniums it could be

determined that the deceased had belonged to various nationalities, and a skilled cranologist would undoubtedly be able to point out easily the Dutchman, the Russian, the Norseman, &c. From the highest point of the peninsula we had a splendid view of the south side of the bay. Glacier upon glacier here extended, one beyond the other, as far as the eye could see toward the ocean. The ice here really had the appearance of being the predominating part, and the visible mountain peaks seemed in fact to be nothing more than the boundary lines between the different glaciers. In some places the ice had even been crowded over the mountain peaks and formed peculiar masses suspended, as it were, in the air, and it seemed that they must every moment fall down from the precipitous mountain sides. In the east or at the head of the bay the first one of the glaciers shoots out into the sea. No less than four glaciers here gather themselves into a mighty mass of ice which constantly under the influence of the summer warmth sends out into the sea icebergs of all sizes and forms. One of these, which laid itself right athwart the bow of our ship, gave us considerable trouble when we were to weigh anchor, about eight o'clock in the evening.

In order to investigate the temperature in this bay, constantly filled with ice, we slowly and with all possible care approached the head of the bay where the above-mentioned immense glacier shot out into the sea. Here, surrounded on all sides by floating masses of ice, we sent our lead and our thermometer to the bottom. The depth was 60 fathoms and the temperature at the bottom 28.4° Fahr., the lowest temperature we had observed up to this time. A little further out, where we were less encumbered with ice and could better maneuver the ship, the trawl was sent down and brought up ample specimens of the fauna of the bottom. Not only various lower animal forms, but even fishes were found here and seemed to thrive remarkably well in this ice-cold water. Particularly did we in this haul bring on board numerous specimens of a sort of small codfish, the so-called ice-roach (Ismort, *Gadus polaris*), of which we heretofore had obtained only one specimen.

We now steamed toward the outlet of the bay to the sea, in order finally to make some investigations on the bank and on its declivity west of Prince Charles' Foreland. The wind had entirely subsided and the sea was smooth, but dense fog soon hid the land entirely out of sight. On the following morning we were at our station. The weather was still and calm as on the preceding day, and the fog had so far lifted that the lower parts of Prince Charles' Foreland could be seen. We cast out the lead here, finding 500 fathoms' depth, and hence we were already on the slope of the bank. A little farther out the trawl was sent down at a depth of 110 fathoms and was brought up covered all over with a species of the elegant feather-star (*Antedon*), of which several beautiful and perfect specimens were secured and preserved. We were now nearly through with our investigations in the open sea, and therefore directed our course southward along Prince Charles' Foreland, in order to run into the Ice-

fjord, where we had made up our minds to lie still for a few days and make the necessary examination of the ship's engine, which now had been in almost constant use ever since we left Hammerfest.

The following morning we had already reached the inlet of the Ice-fjord. The north side of the fjord still shows the grand scenery characteristic of Spitzbergen; from the northwestern point, where the Dead Man and the Auk Horn lift their heads, there are, as far as eye can see toward the interior, splendid mountain views separated from the mighty masses of ice and snow. On the other hand, the south side has a totally different appearance; the mountains are here less high, and their summits usually form plateaus, while the sides slope gradually and show a regular arrangement both of the horizontal layers and of the glacial rivers that are dug out in the vertical clefts. There is nothing picturesque in the general effect. About in the middle of the fjord we sent the trawl down, but it brought up nothing of interest excepting a young specimen of a peculiar spiny Arctic fish (*Cyclopterus spinosus*). At noon we directed our course toward Advent Bay, which was intended for our station, and outside of which a couple of fishing-vessels lay at anchor. A long flat strip of land which extends into the sea from the western shore forms here a natural mole, within which there is an excellent harbor, in which the largest fleet might be able to find a convenient anchorage and abundant protection against the storms. Here we let our anchor drop. We were now at our goal, where we were to spend at least three or four days. But nature in this locality has nothing of the grand and imposing features that characterize Spitzbergen. The mountains around the bay have the same monotonous character and dismal grayish hue as those we had seen on the entire south side of the fjord. The splendid glaciers which so beautifully diversified the landscape are here wholly wanting, and in lieu of these the valley ascends gradually from the sea, forming a slope, with the same grayish-brown tiresome color that characterizes the mountains. So far we were not a little disappointed in our expectations, but still we had a few nice evenings when the mountains and glaciers on the north side of the fjord blazed in the evening sunlight, casting a beautiful reflection athwart the fjord to our anchoring place. Meanwhile our time was spent in the most profitable manner possible. While our captain was engaged upon the hydrography and chart of the bay, we zoologists industriously examined the sea-bed with our dredges and made excursions on land for collecting plants and whatever else of interest we might find. Nor was the noble art of hunting neglected, and a party was organized of the best and most skillful marksmen to undertake a reindeer chase. But the reindeer is, at this season of the year, very shy, and usually keeps itself farther from the coast than at other times; and not until we had made several and repeated efforts and accomplished miles of fatiguing marching did we succeed in killing a

very small young deer, whose exceedingly fine and sweet meat was a welcome addition to our mess.

After having remained three days and three nights in Advent Bay everything was ready for the home passage. The boiler had been carefully examined, a new supply of water had been taken on board, and the bay had been mapped. At six o'clock in the afternoon, on the 22d of August, we weighed anchor, and after having made a haul with the trawl at the outlet of the bay, which, however, gave us but a small return, we directed our course out of the Ice-fjord to the sea. We had only enough coal left to last eight days, so that a longer stay at Spitzbergen, for this reason if for no other, could not be looked upon as advisable. But as Bell Sound, a place famous for the beauty of its scenery, lay directly in our way, we agreed among ourselves that, in case we obtained favorable weather, we would, as a sort of leave-taking ceremony, make a short trip in there, in order to be able to bring home with us a perfectly fresh impression of the imposing scenery of Spitzbergen. The evening was still and the sky cleared, so that we retired filled with the fairest hopes of being able on the following morning to enjoy the sight of Bell Sound's celebrated mountain peaks and glaciers. But we were deceived in our expectations. Dense fog on the following morning enveloped the land and hid all the mountain peaks from sight. Under such circumstances we would scarcely gain anything by running into Bell Sound, and as it was out of the question to spend any time waiting for clear weather the trip was abandoned. So the stem of the ship was turned to the south again, and every trace of Spitzbergen soon vanished in the fog. About half way between Spitzbergen and Beeren Island we finally took a series of careful observations of the temperature, in order to get one more factor in the complicated problem of establishing the conditions of temperature in this belt of the ocean. And herewith our investigations were at length completed. Instruments and apparatus were packed away, and what we now had to do was to get southward to Norway as rapidly as possible.

The weather, which up to this time had been unusually still, showed on the next day all signs of changing for the worse. The barometer fell rapidly, in the horizon appeared threatening cloud-banks, and the wind began to blow from the east. Toward evening the breeze had increased into a gale, but it fortunately blew from the northeast, and hence it was favorable to us. The studding-sails were set, and, as if the Voring herself now was longing to get home, she sped on with unusual velocity, so that we were making much more rapid progress than we from the beginning had calculated. As we got farther south the waves became higher, and the ship, which now was uncommonly light, now and then tossed about so violently in the night that we were several times in a rather disagreeable manner awakened from our sleep. But we had already tested the Voring once before, under similar circumstances, and

knew that she would ride the waves securely and bring us all the sooner home across the Arctic seas, and we were all intensely homesick.

At eight o'clock of the next day we got the first landfall of Norway. Far out in the horizon we got a glimpse of something of a deep-bluish hue, which at some times scarcely could be distinguished from the atmosphere, but which gradually became more distinct and defined. In this we finally recognized with certainty the outmost island in the Loppe Sea. It was Bird Island, toward which our course had been directed during the whole time. Still we were a considerable distance from land, and it being late in the night we retired to our berths with the happy consciousness that we should soon be within the skerries in smooth water. When we came on deck the following morning we were just entering Grōt Sound. For the first time for many weeks we again looked upon green fields and trees, and soon the charming Trom Island, with its cultivated fields, its beautiful forests, and its smiling villages, lay before us in its complete summer dress. At twelve o'clock we lay safely moored at anchor in the harbor of Tromsö, and we all soon had the pleasure of receiving by post and telegraph fresh and glad tidings from home.

After stopping a couple of days at Tromsö, which was necessary in order to increase our supply of coal, we weighed anchor on Thursday, the 29th of August, at two o'clock in the morning, and steamed southward along the usual steamship route. The weather was brilliant, and it was a source of great relief to us, after having been tossed about so long on the billows of the Arctic Ocean, to be able to take our ease in smooth water within the skerries. On the evening of the same day we passed West-fjord in perfectly calm, beautiful weather. On the next day our progress was checked somewhat by foggy weather; but the third day was clear and warm as summer, and gave us another opportunity to rejoice at the sight of the glorious mountains and fjord scenes down along the coast of Nordland. On Wednesday, the 4th of September, we swung into the harbor of Bergen, where we were greeted by a general display of flags, and after having given and received a salute we anchored in the usual place near the Sugar-house Wharf. Three of the members of the expedition Chief Physician Dr. Danielssen, Mr. Friele, and Cand. Thorne, here bade us good-bye. The rest of us, after spending two days in Bergen, passed with the Voring to Christiania, where we, after a most delightful voyage, arrived on Monday last, the 9th of September, at four o'clock in the afternoon.

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