
Visits to Barents and Kara Seas, with Rambles in Novaya Zemlya, 1895 and 1897

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VISITS TO BARENTS AND KARA SEAS, WITH RAMBLES IN NOVAYA ZEMLYA, 1895 AND 1897.*

By Colonel H. W. FEILDEN.

THE paper which I have the honour of reading to-night contains no thrilling narrative of arctic adventure, no conflicts with "thick-ribbed ice," no dangers or perils which are not incidental to an ordinary yacht voyage in the arctic seas, and no suffering from want of food or the vicissitudes of climate. So far our story will be humdrum enough.

First of all, I must apologize for reading this paper; properly my colleague, Mr. Pearson, ought to have done so, as he was the originator of both voyages and paid for them. The interesting photographic slides which illustrate the voyages were all taken by Mr. Pearson, and represent an enormous amount of labour and hard work.

The chief reason that induced me to draw up this paper was to bring to your notice the very abnormal conditions of the floating ice, in Barents sea, the Kara sea, in the polar ocean around Franz Josef Land, about Spitsbergen, and away to the eastward of the Yugor straits as far as the mouth of the Yenisei, during the summer of 1897. Curiously enough, on almost the opposite side of the globe, in the polar sea beyond the straits of Bering, the ice conditions appear to have been very unfavourable during the past season. We learn that a considerable part of the American whaling fleet has been caught by the unusually early closing of the ice-pack on the Alaskan shore, to the eastward of Point Barrow, and grave fears are entertained that these whaling ships will be destroyed by the polar pack, though it seems probable that the crews will be saved by wintering with the natives of that coast.

It is a matter for congratulation that during the past season,

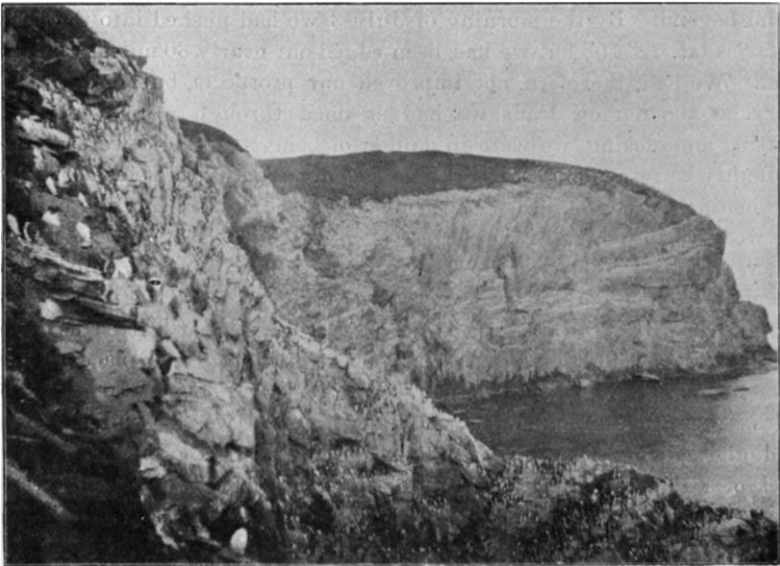
* Read at the Royal Geographical Society, December 13, 1897. Map, p. 461.
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over the great area extending from Spitsbergen to the Yenisei, British explorers, whalers, yachtsmen, and traders have been pursuing their callings at various points, so that we shall rely for a description of this very remarkable ice-season, not on one set of observations, but on many. There are the voyages of the Jackson-Harmsworth yacht *Windward* to and from Franz Josef Land; the Dundee whalers pursuing their business in the same quarter of the polar sea; Mr. Arnold Pike, in the *Victoria*, passing down Hinlopen straits and effecting an easy landing on Wiche's island; Mr. F. W. L. Popham, in the *Blencathra*, conducting a fleet of steamers through Yugor straits to the Yenisei; and Mr. Pearson passing in the *Laura* through the Matyushin shar, finding no ice in the Kara sea and along the east shore of the north island of Novaya Zemlya, as far north as Pachtvssoff island in $74^{\circ} 24'$. But, in order to make it clear to you how abnormal the ice-conditions were in Barents sea this summer, I must ask you to accompany me for a few minutes in our preliminary voyage to Novaya Zemlya in 1895. Mr. Pearson for this trip chartered the English yacht *Saxon*, a small but staunch little steamer of some 50 tons net register and 117 tons yacht measurement. The drawback to this vessel was her small coal-carrying capacity, but she made up for her deficiency in size by the vivacity of her performances; she was certainly the most lively little craft I ever went in. I do not think any of us who sailed in her that summer in Barents sea will ever forget the shakings and knocking about that we received.

I pass over a glorious run through the fjords of the west coast of Norway, which so many of you know well, and those who do not ought to, for it embraces the finest scenery of its kind in Europe, and take you at once to Vardö, merely remarking that the veteran ice-navigator, Captain Johan Kjeldsen, joined us at Tromsö as our ice-master. Leaving Vardö on June 14, our course was laid for the north-west of Novaya Zemlya. Two days after leaving Vardö, on the evening of June 16, we passed through a good deal of loose ice, and at midnight were brought up by heavy pack, which extended north-west, north, and east without a break, and no sign of a water-cloud. Towards those points of the compass an ominous yellow ice-blink hung over the ice-pack. We were then in 72° N. lat. and 45° E. long., the nearest part of Novaya Zemlya being about 120 miles distant. During the two next days we worked along the edge of the ice in a south-easterly direction; every likely bight was entered, and in some places these indentations in the pack-ice were followed up for miles, but invariably they ended in blind leads, and we were brought up by impenetrable ice. On June 17 we reached our nearest to Novaya Zemlya, on the 71st parallel, Goose Land being 80 miles distant. Still working south, and hugging the edge of the pack, we found ourselves on June 19 in lat. 70° N., but the trend of the ice had forced us to the westward some 120 miles from the shores of Novaya Zemlya. At this stage of our

voyage we were confronted with the difficulty always hanging over us, viz. the paucity of our coal-supply. The *Saxon* at this juncture had only enough fuel left to take her back to Vardö, whilst little dependence could be placed in her sailing. Our attempt to reach Novaya Zemlya had to be abandoned; we shaped our course for the Murman coast of Russian Lapland, entered the Ukanskoe river, to the westward of Sviatoi Noss, and went into camp near the Lapp summer settlement of Lutni. In the mean time the *Saxon* returned to Vardö for coal.

We passed a delightful week at Lutni, and, if time permitted, I should like to tell you about the Lapps, and their reindeer, and their salmon-fishing, and their houses, and their modes of living, and of the birds and



AUKERY, NAMELESS BAY, NOVAYA ZEMLYA.

(From a photograph by H. J. Pearson, Esq.)

animals and the natural features of that country, and the flowers, and many other things. On June 28 the *Saxon* had returned from Vardö, and we left Lutni. In the afternoon we were abreast of Cape Kanin, which marks the eastern entrance to the White sea, a low uninviting tundra-land, then streaked with patches of snow. Early the next morning we sighted the island Kolguev, and by 7 a.m. were abreast of its northern extremity. Shortly after we saw the ice-pack on our starboard quarter stretching north and south in a solid mass, and resting on the north end of Kolguev. We kept close to the edge of this pack, working to the north-north-west; a midnight observation on July 1 placed us in $71^{\circ} 3' N.$ lat., our approximate longitude being $49^{\circ} 5' E.$

On July 2, still sailing north-westerly along the edge of the ice, we

2 A 2

met with a broad lane or lead between the ice-fields, opening up in the desired direction. With full steam, and every bit of canvas set, we pressed on, for the wind was also favourable. At midnight the high lands of Novaya Zemlya were visible, and in a couple of hours we were within 8 or 10 miles of the low shores of Goose Land. There our further progress was stopped by a close pack, which stretched some 8 miles wide along the entire length of Goose Land, and joined with the main fields of ice which lay on our port and starboard, and through which we had run some 40 miles.

Some narrow leads and cracks showing in the ice to the north-west, the yacht was worked into the pack in that direction, in the hopes that we might get round North Goose cape, and that open water might be found beyond. By the morning of July 3 we had pushed into the pack as far as lat. $72^{\circ} 10'$, but we had been edged out nearly 30 miles from the land. We had, therefore, not improved our prospects, but, on the contrary, as the narrow leads we had steamed through were constantly shifting and closing, we were in danger of being beset, and we had consequently to retrace our steps. This was done, and after some difficulty in pushing through narrow barriers of ice, which taxed to the utmost the weak steam-power of the *Saxon*, we entered into a large space of open water, which lay between the pack that girdled Novaya Zemlya and the main ice-fields of Barents sea to the westward. For the rest of that day we moved slowly along the edge of the pack that barred us from the land. It was plain that great movements were taking place in the ice-fields of Barents sea. To our westward, a broad channel some 3 or 4 miles wide opened up. Evidently the entire pack was loosening off the land, and moving forth for its annual break-up in Barents sea. Our stock of coal was now reduced to so low an ebb that we had no alternative but to retreat again. With a favouring wind and a full head of steam, we ran down the channel of water to the south-west at a speed of 9 knots, and in three hours had cleared the ice on our starboard, but still kept it on our port side all the way to the island of Kolguev, which we sighted on the evening of July 4.

On July 5, under very favourable circumstances, we ran down the west side of Kolguev, and made a landing near the mouth of the Gobista river. Our camp equipage and stores were put on shore in all haste, but none too soon, for just as the crew and boats returned to the yacht, and the "farewell" had been hoisted and the *Saxon* bore away for Vardö, the wind had arisen, the waves came thundering on shore, and for the next ten days there was never a time that a boat could have communicated with us. During three days of our stay, the ice-pack came down from the northward and surrounded the western side of Kolguev. I should like to give you some account of this dreary, melancholy island, fog-environed and wind-tormented, but time will only permit a few words. In its scenery there is not one redeeming feature, no mountains,

no brawling streams, no woods, no rocky cliffs to ennoble the view. Its entire western shore, from the mouth of the Gusina river to that of the Gobista, is a long straight line of mud and clay bluff, running nearly due north and south. These bluffs rise to a height of about 100 feet at the north-west end of the island, but the beds of which they are composed sink by an almost imperceptible dip from north to south until at the mouth of the Gobista the summit of the bluff is not more than 40 feet above sea-level, and this dip continues in the same direction, for at the mouth of the Kriva river the land almost merges with the sea. Kolguev is, in fact, a recent upheaval of a part of Barents sea, and no doubt gives



DRIFTWOOD, CAPE MATIUSELE, WAIGATS.

(From a photograph by H. J. Pearson, Esq.)

us an accurate representation of the deposits which rest below the waters over a wide surrounding area.

Kolguev is of considerable interest to the naturalist, for, as far as I know, it is the only island of Europe that we can be assured has not had any connection with the mainland since its recent emergence from the surrounding ocean. Consequently its entire flora and fauna must be due to comparatively recent immigration, and the fact that we found earthworms and three species of fresh-water mollusca there is a remarkable proof of how these invertebrates can be transported by natural agencies across the sea. I have a great inclination to linger over this gloomy but to me most interesting island, with its nesting grey plovers,

and little stints, and Bewick's swans, and its delightful flora, but we must hurry on.

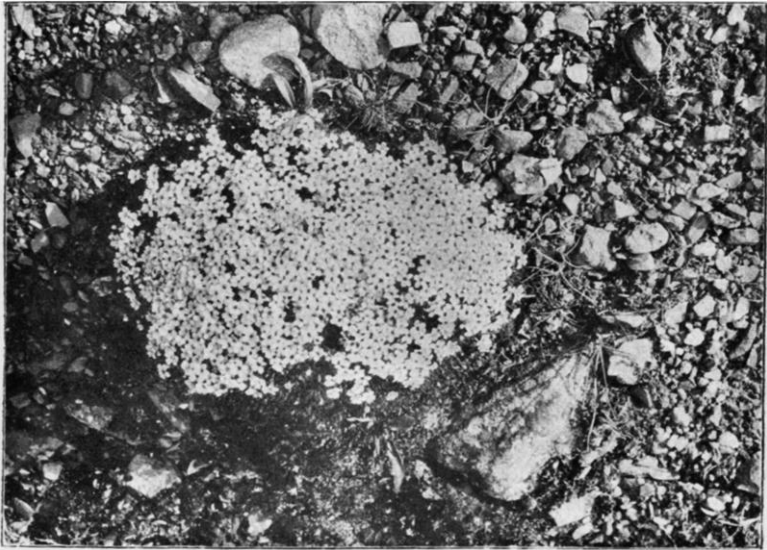
On the morning of July 16 the *Saxon* returned from Vardö and anchored off the mouth of the Gobista river. Three hours after we were again steaming northward on our third attempt to reach Novaya Zemlya. Rounding the north of the island, we found that a marvellous change had taken place during the past ten days. The endless fields of pack-ice which before extended from Kolguev to Novaya Zemlya had entirely disappeared, now and again we passed a sodden dirty fragment of ice rapidly melting, the fog had gone, and in bright sunlight and with a favouring wind we made the northern entrance of the Kostin schar on the evening of July 17.

We spent the next ten days in visiting the islands in the Kostin schar, exploring the inland waters of the lake of Nekwatowa, and in rambles over Goose Land, leaving the shores of Novaya Zemlya on July 27, and returning direct to Norway.

I have inflicted this summary of our 1895 voyage on you with the object of showing the position of the Barents sea ice in an average summer; but all of us who have voyaged much in arctic seas know how uncertain it is to lay down beforehand, with the smallest likelihood of our predictions being verified, the extension or position of the ice-fields in any given summer season. A few words as to the nature of the Barents sea ice: I speak under correction from men of greater experience. It appears to me that the ice I have met in Barents sea has two very distinct characteristics. There is a northern pack of tolerably heavy oceanic ice, which apparently comes down from between Franz Josef Land and Novaya Zemlya. This ice makes a formidable pack, very much the same as that met with to the north and north-east of Spitsbergen. It does not compare, however, in thickness with the ice that comes down the east coast of Greenland and round Cape Farewell, nor with the ice that comes down Smith sound, or which is to be met with in the polar ocean to the north of Greenland and Grinnell Land. The other description of ice is very different in its nature, and I think is the winter's ice that has been formed between Cape Kanin, Kolguev, and the island of Waigats, and along the shores and in the rivers of the mainland of Russia. The floes are not as thick as those forming the northern pack, but the peculiarity about it is its dirtiness; the floes and hummocks of which it is made up are covered with mud, shingle, and earth. We have sailed for miles along the edge of this pack, and noticed the same features. Later on I will refer more fully to this subject, for I cannot but think that this annual transport of immense quantities of land *débris* to the floor of the ocean must have considerable physical effects.

During 1896, Mr. Pearson, contemplating a sea-voyage to the arctic shores of Russia, endeavoured to find a suitable vessel at home, but,

failing in this, went over to Norway and chartered a Norwegian sailing vessel that had been employed in the North Atlantic whale fishery. This ship, about 160 tons register, was thoroughly strengthened, fitted with auxiliary steam power, and renamed the *Laura*. Our old friend Kjeldsen was given the command, and he selected his own crew from amongst the experienced arctic sailors of Tromsø. We sailed under the Norwegian flag. I may here say that the *Laura* proved a most commodious and suitable ship for the service required, and that no one could wish to sail with a better or more obliging crew than our Norwegians. Accustomed to annual trips to Spitsbergen and Novaya Zemlya in their hunting-sloops, these men are thoroughly acquainted



SILENE ACAULIS, WAIGATS.

(From a photograph by H. J. Pearson, Esq.)

with every shift and turn of the ice, and the vicissitudes of arctic work. Captain Kjeldsen's career and character is so well known amongst all those who take an interest in the doings of the brave Norsk skippers who sail from Tromsø and Hammerfest to the icy seas, that no words of commendation from me could add to his reputation.

On June 4 of the past summer we arrived at Bergen, and went on board the *Laura*. Our party consisted of Mr. H. J. Pearson, Mr. F. Curtis of Guy's Hospital our medical officer, and myself. We sailed the next day for Tromsø. On June 12 we let go our anchor in Tromsø harbour. From Tromsø we steamed to the island of Skaaro, where Mr. J. Giæver, our vice-consul, and from whom Mr. Pearson had chartered

the vessel, has a large whaling establishment. There we took in coal from the s.s. *Esk*, direct from England. The steam-petroleum launch which had been supplied to the *Laura* proving quite useless, it became necessary to exchange it for a large steam-launch belonging to Mr. Giæver, which was lying at Skaaro. It was too large to be taken inboard, so it had to be decked over with canvas and towed. Many were the shakings of heads and ominous predictions about this venture. In the end they were all falsified, and the launch returned to Norway in safety, after doing most useful work; indeed, without a steam-launch, not a tenth of the excursions we made could possibly have been accomplished.

Leaving Skaaro on June 17, we essayed to round the North cape, but meeting a stiff north-easterly gale, which we struggled with for twenty-four hours, we had in the end to give in, and take the inside passage between the island of Maagero and the mainland. Calling in at Honnings Vaag, a considerable fishing station on that island, we posted our letters and sent off wires, and then steered our course to the eastward. June 22 opened with a cloudless sky and serene and beautiful weather, the prevailing east wind changed into the south-west. All sail was set. The shade temperature was 60° Fahr., in the sun 80° Fahr. The ship was dressed with every flag we could muster. At mid-day we fired a salute of twenty-one guns on the poop from our small arms. The Norwegian crew of their own accord came aft, and gave three ringing cheers for "the good Queen," which they repeated again and again. They afterwards sat down to a good dinner, and our gracious sovereign's health was drunk amidst great enthusiasm.

Early in the morning of the 25th we sighted Kolguev, the sea calm, weather warm and misty; we were within 3 miles of its south-west end when we picked up the island. During the remainder of the day we coasted along its northern and western shore. Kolguev looked as ugly and forbidding as usual, but there was far less snow lying on it than in July, 1895, and not a speck of floating ice in its neighbourhood.

After rounding the north end of Kolguev we were surprised to see no ice; the weather continued very warm, hardly any wind, with occasional banks of fog. We set our course for the island of Dolgoi. On the morning of June 27 we were abreast of the great range of sand islands that fringe the embouchure of the Pechora river, but too far out—some 30 miles—to have even a glimpse of that low-lying land. The weather was perfect; temperature in shade, 52°; of the surface water, 50°. It was pleasant to wash on deck, for the water was brackish, and of a brown peaty colour. The great river had awakened into life, and was pouring its volumes into the icy sea. All around the ship, trees, branches, roots, the tribute of Russian forests, were floating broadcast. It is difficult to realize, until brought face to face with the fact, the great ameliorating influence which the discharge of the mighty rivers

of Asia, America, and Europe into the arctic sea must exert on the polar ice and over the polar area.

However, there must be an end to sailing on halcyon seas in every part of the world, and at mid-day, on June 27, we came up to the ice, extending north and south on the meridian of 57° . We ran through some stream ice, and, finding the pack beyond quite impenetrable, we tied up to a large floe and filled up our water-casks. Then we moved slowly under steam along the edge of the pack to the south-west, hoping to find a land-water; but the ice continued across the main entrance to the Pechora delta, and was piled up on the Gouliaieff sandbanks, so there was no road for us that way. Being quite satisfied on that point, we retraced our course along the edge of the pack, and by mid-day of June 28 we were almost in the same position as we had been the day before—namely, N. lat. $69^{\circ} 40'$ and $57^{\circ} 12'$ E. long. The ice we encountered was extremely dirty, covered with gravel and silt; many logs, branches, and trunks of trees were scattered over it. It was of no great thickness, perhaps 8 feet at most; but when pack-ice is broken up and pushed into hummocks and ridges, it gets piled up many feet above its real level of flotation, and gives an impression of thickness far beyond the reality. The sea was like a mirror, of that oily character and absolute smoothness which I have never seen save when steaming through ice in a calm. Such a day is one of the great charms of the arctic seas. The large and handsome king eiders were not uncommon, and my companions shot several of them. All of these birds had their gullets crammed with unbroken *Mya truncata* an inch and more long, and in some cases large *Maetra*, as well as crustaceans, not in the least digested, showing that these birds were getting their food on the spot over which they were diving; as there are no soundings of less than 10 fathoms for miles from where the birds were feeding, it seems that these ducks were popping down to a depth of 60 feet or more for every mouthful! In the afternoon we passed beyond the beautiful sunlight into banks of fog; then came a northerly wind and cold grey fog. We kept along the edge of the pack at the distance of a good cast with a salmon rod; the northerly wind was jamming it up like a wall, and as the waves broke over it the ice-fragments swayed and staggered, and rattled with that peculiar gruesome sound that angry ice affects. What contrasts unfold themselves in these arctic seas! One moment nature basking in warm sunlight and perfect repose, the next everything weird, wild, and melancholy. I am puzzled how to account for the extreme dirtiness of this southern pack, for, in addition to the patches of gravel and earth and silt that lay here and there upon it, it was covered broadcast with a dirty mantle. I think that must result from the extreme shallowness of these seas. When a storm arises the bottom is probably churned up, and the muddy water is washed over the broken floes, leaving a coating of sediment.

We continued coasting along this southern pack, hugging each point, and making north-east whenever we could. It was a dirty night, with fog, sometimes dense; then it lifted, at midnight it cleared, and early in the morning of June 29 we saw land, the hilltops rising like black hummocks above the ice-pack. We at once recognized our position, that we were in the entrance of the Kara straits, and that the black hummocks were the islands at the mouth of Dolga bay, in the north end of Waigats. There were 2 or 3 miles of stream ice, then a mile of close pack to push through between us and open water in Dolga bay. Being determined to make land if possible, we put the ship at the ice, and rammed and charged and pushed; all hands with long poles were pushing and shoving, on and off the ship. Finally our efforts succeeded, and we gained the clear water at the entrance of the bay. I have told you that we had a steam-launch in tow, and during this skirmish with the ice the treatment this poor craft received was very comical. It was decked over with canvas like a Noah's ark, and to see the poor thing dragged over hummocks 6 and 8 feet high was very painful to our feeling. Sometimes it was on an even keel, then dragged along on its beam-ends; at times it was half buried in the ice; but, wonderful to relate, the hawser did not part, and our invaluable launch tumbled into the water of Dolga bay like a harried duck regaining a pond.

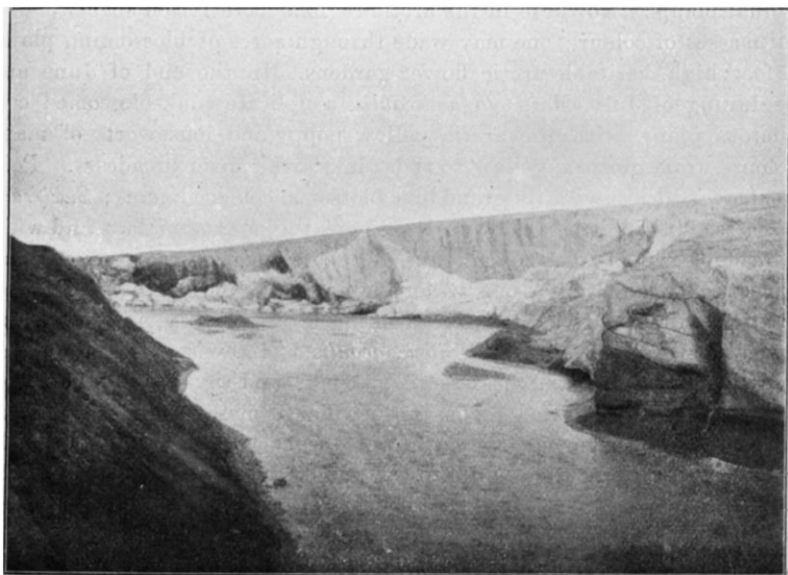
I think we were very pleased to gain a safe refuge in Waigats so easily—certainly as much by luck, owing to the friendliness of the ice, as by good guidance. For I am not aware that along the whole coast-line of that island, with the exception of some bights in the straits of Yugor, there is a single safe anchorage but Dolga bay, when the pack-ice is moving up and down in the early part of the season. Though there are several ice-worn islets, with ugly reefs on both sides of the entrance to the bay, yet the centre is clear of dangers, with 20 fathoms of water, and quite easy to make. We anchored in decidedly the best spot, immediately under the south side of the innermost island on the east side of the bay, in $6\frac{1}{2}$ fathoms, clay bottom. I am somewhat precise in these sailing directions, for neither the English nor Russian charts give any particulars, nor can I find that any exploring ship previous to ourselves has anchored in Dolga bay.

As we had been thwarted in our intentions to make Dolgoi island, and from there pass to the mainland of Arctic Russia, which was Mr. Pearson's object when we left England, it was felt desirable that we should make the best of our alternative landing on Waigats.

It is remarkable how very little is really known about an island that, for the past three hundred years, has had such frequent mention in the annals of north-eastern discovery. Scores of expeditions, Dutch, English, Swedish, and Russian, have touched at its shores, but until Mr. Frederick Jackson, in the autumn of 1894, made the complete circuit of the island in company with Samoyeds, and gave us his interesting

experiences,* I am not aware that any description had been given of the interior of the island.

As we remained for ten days in Dolga bay, and made many trips in the steam-launch to various parts of the coast, and also wandered far and wide inland, we obtained an experience of the north end of the island in summer which may be worth recording, for Mr. Jackson's visit was made in autumn, when the snow lay on the ground, and consequently we had better opportunities for observation than he had. The valleys of Waigats are so well covered with herbage, that in June and July, when the snow has generally disappeared, and only remains in scattered patches on northern slopes or hollows, it is difficult to realize



BEAR BAY GLACIER, LUTKE LAND.

(From a photograph by H. J. Pearson, Esq.)

what a terribly severe winter climate reigns there. Waigats has no glaciers—no attempt, indeed, at any permanent snow deposit. There are no mountain ranges; the highest ridges in the north end may be 300 feet, but the greater part do not exceed 200 feet and less. The island sinks gradually towards the south. The rock formation of Waigats consists chiefly of slates and limestones, which have undergone great upheaval and subsequent denudation. They are nearly vertical, and their strike is from north-west to south-east. Consequently the ridges are formed by the line of strike, and run in the same direction. The

* 'Great Frozen Land' (London : 1895).

troughs or valleys between the ridges are covered with a thick layer of marine boreal clay, containing the shells of *Mya truncata*, *saxicava*, *astarte*, and other mollusca now occurring abundantly in the surrounding sea. Everywhere around we can trace the signs of very recent emergence from the ocean. The modern island of Waigats is, geologically, an upheaval of yesterday. This clay deposit in the valleys and troughs is dotted over with tarns and lakes. Many of these are surrounded with peaty growths. There are consequently three distinct soils—that of the disintegrated rocky ridges, then the predominant marine boreal clay, and the more local peat formations resting on the clay. Each of these divisions of soil have their special flora. The flowers of Waigats make up for the comparative paucity of species by the lavish growth of individual plants. Nowhere in the arctic regions have I seen such wonderful masses of colour; one may wade through acres of blossoming plants a foot high, veritable arctic flower-gardens. In the end of June and beginning of July, *Matthiola nudicaulis*, a delicate pink-blossomed cruciferous plant, with the arctic yellow poppy and louseworts of many colours, from glorious yellow to rich pinks, are spread broadcast. *Polemonium cœruleum*, with its grand blue blossoms, coloured acres; *Saxifraga hirculus*, with its yellow flowers, is perhaps the most abundant and wide-spread of the plants. Buttercups of several species are predominant, carpeting wide areas; one water-loving species, *Ranunculus Pallasii*, floating on meres and tarns like a miniature water-lily, and pervading the air with its fragrance. *Silene acaulis* is likewise most abundant, growing in clumps and bosses on dry spots and the sides of the ridges among the disintegrated rocks, in such dense masses as to give colour to the cliffs. Then comes the alpine forget-me-not, with its lovely colourings, varying from white to the purest cœrulean blue. My words fail, I know, to give any adequate description of the immense charm attaching to this arctic flora. There are no trees, in the ordinary acceptation of the word, growing on Waigats, but two or three species of willow are abundant; they are, however, only stunted bushes, not growing higher than a foot or a foot and a half.

The tarns and lakes I have spoken of are the resort of many wading birds and divers. We found the little stint (*Tringa minuta*) breeding abundantly, and Mr. Pearson added to his collection the finest series of the eggs of this bird that has ever been brought together. We found that singular bird the ruff (*Machetes pugnax*), and the dotterel (*Eudromias morinellus*) makes Waigats its summer quarters and breeds there. The peregrine falcon nests in the cliffs, and so does the large rough-legged buzzard (*Archibuteo lagopus*). These are interesting facts for ornithologists.

During our stay at Dolga bay we met no Samoyeds, but at Voronoff Noss they have a more or less permanent station. We saw there many sealskins pegged out to dry, and accumulations of blubber ready for

transport. Subsequently the Russians of Khabarova told us that small parties of Samoyeds generally winter at Bolvanski Nos and Voronoff Nos, as those are the best stations for winter hunting in the island. On the eastern side of Dolga bay we came across an old sacrificial pile of the Samoyeds; very ancient ice-bears' skulls were the chief garniture of the spot, but a decayed gunstock and other odds and ends showed that offerings had been made there in comparatively recent times.

On July 4 the pack-ice which had been moving up and down the west side of Waigats came swirling into Dolga bay, completely filling it, and packing closely around the ship, but it was not heavy enough to give us the slightest anxiety. It curtailed our launch expeditions, and



LAURA, IN DOLGA BAY, WAIGATS.

(From a photograph by H. J. Pearson, Esq.)

obliged us to drag our boats over the pack to and from the shore. This pack-ice, to a great extent, moved in and out of Dolga bay under the influence of wind and tide. As we scrambled over this dripping, rotting, and melting pack, we took notice of the enormous quantities of detritus deposited on the surface of the floe-pieces—stones, gravel, and mud. As the ice-rafts decay this material is thrown to the bottom. It is impossible to form any estimate as to the amount of material transported annually into Barents sea from the mainland, but it is prodigious, and in the course of ages must have exercised great influence in decreasing the depths of that sea. As the valley muds and clays of Waigats and Novaya Zemlya are precisely of the same character as those which come up in the dredge or on the flukes of the anchor from the bays and fiords,

there can be no doubt that they were deposited by the same process as we see progressing to-day.

On July 8 there was a thunderstorm. The day had been hot and close, with a warm south-east wind; in the evening the rain came down on us as we were walking on the land, large plashing drops. But the rain-storm we encountered was nothing to that which swept down the centre of the bay. The thunder roared, and was accompanied by vivid flashes of lightning. The violent squalls raised the sea and tossed the ice about. A splendid double rainbow shone forth, and the effect was grand. It is a mistake to suppose that thunderstorms with lightning in the arctic regions are always accompanied by hail; none fell that day. July 9 was a perfect day, temperature in the shade 60° Fahr. The floes around us were dripping at a great rate, and much of the pack had been driven out of the bay by the storm. We took advantage of this, heaved the anchor, and steamed out, working along the western side of the bay where the ice was more loose; by midday we had cleared the headlands and off-lying islets, never having less than 12 fathoms of water. Outside we got into loose, heavy-sailing ice, evidently fragments that had drifted from the Kara sea; but for the exception of occasional heavy pieces of floe, the strait was clear to the eastward as far as our vision extended, and I ought to add that the same conditions existed during the entire time we remained in the north end of Waigats. On no occasion were we able to see the land of Novaya Zemlya from Waigats.

During that day and most of the 10th we steamed leisurely down the west coast, in a perfectly calm sea, and through occasional banks of fog; the shade temperature was from 50° to 53° . We let down the dredge in 20 and 17 fathoms. We passed many dead dragon-flies floating on the water. By the evening the fog had entirely lifted, so we headed in for Liamtschina bay, steering for the mouth of the Talata river. This bay is full of rocks and dangers. We were groping our way in, going dead slow; the leadsman called out 7, 6, then $2\frac{1}{2}$ fathoms, and the next instant we slid up on a rock and stuck there. Fortunately, the sea was like glass, there was little or no wind, and the ice-pack on our port side was asleep. We got up steam in the launch, put our chain cables into the boats alongside, put out a kedge anchor astern, and by dint of hauling at her bow with the steam-launch, and going full speed astern, we got the ship off in a couple of hours without the slightest injury, and no coal had to be thrown overboard. As we had no special interest in discovering more hidden rocks, we departed from Liamtschina bay and worked quietly down to Cape Greben, the south-west point of Waigats, which marks the entrance to Yugor straits. Not a speck of ice was to be seen; the strait was absolutely clear. We anchored in a bay to the eastward of Cape Greben, in $3\frac{1}{2}$ fathoms. Early on the 11th our invaluable steam-launch put us ashore at Cape Greben. The shade

temperature when leaving the ship was 60°, on shore intensely hot. Yugor strait lay iceless, calm, and placid. It might have been a summer's day in the Mediterranean. When we landed on the tundra—for the south part of Waigats is far more level than its northern area—we were astonished with the profusion of the flowers: we walked through flower-gardens. Dotterels, little stints, purple sandpipers, with their freshly hatched out broods, ran around us; reeves were fewer in numbers; snow-buntings, shore-larks, and Lapland buntings hopped around; snowy owls sat on the peaty knolls and watched our proceedings with serious interest; the terns were alive with red-necked phalaropes, chasing one another. It was indeed a very delightful experience. One can hardly hope for elysium on this earth, and this



CAPE GREBEN, WAIGATS.

(From a photograph by H. J. Pearson, Esq.)

almost perfect day had one drawback in the myriads of mosquitoes that rose from the tundra. They settled in swarms on our necks and hands, making it necessary to crush the pests every few minutes. Towards evening a dense fog came rolling in from Barents sea; it enveloped us with a pall. The flowers closed their petals, and the birds disappeared, and the mosquitoes as well. Cold and damp, we hurried back to the launch, and made our way to the ship through the dense fog. We found a family party of Samoyeds on board; having seen the ship, they had crossed over from the mainland, and brought with them a large supply of *Salmo alpinus* and *Salmo omul*. The party consisted of an old man and his wife, their two sons, a daughter-in-law, and her two children, the eldest about two years old. These little Samoyeds in their fur-lined caps are pretty creatures; they of course were stuffed

with sugar and chocolate. I brought out a flaring red-checked hand kerchief and tied it round the baby's head. The mother was charmed, and beckoned to one of the young men, who brought up the two largest fish in the boat, some four or five pounds each; these she put into my hands. They asked for vodka, and were refused it; but they left us apparently delighted with a tin of tea, which was given them in exchange for their fish.

On July 13 we crossed the strait, and anchored about a mile from Khabarova, in $5\frac{1}{2}$ fathoms. This little settlement of a few log houses, several Samoyed chooms, a church, and a large store-house, is better known by name than many important towns of Russia. It owes its fame to its unique position. Placed on the shores of Yugor strait, the highway to the Siberian coast-line, it is the last post of civilization on the confines of Europe, and consequently all trading vessels bound to the Yenisei, or exploring ships proceeding to the Kara sea, call in at Khabarova. The settlement is built on a raised beach of gravel; behind is the flat, dreary, monotonous, treeless tundra stretching away for hundreds of miles. The choice of Khabarova for a settlement must, I think, have been determined by the existence of a small lagoon behind the raised beach, into which falls the Nikolski river. The water from this stream keeps open a narrow passage through the bar of shingle, some 30 feet wide, and with some 5 or 6 feet of water at high tide. Through this narrow passage the Russians are able to push their shallow-draught lodjas and karbasses into the lagoon. Once inside they are safe from the ice, no matter how much may be passing through the strait. Most of the Russian traders who summer at Khabarova are natives of the Pechora district, where they pass the winter. In the early spring they leave Pustosesk with their reindeer, and sledge along the shores of the arctic sea to their destination; and when the snows of autumn again make the tundra fit for reindeer-sledging, they return to their homes, with the furs and produce of the chase which their Samoyed employés have collected during the preceding winter. We were cordially received by the chief trader, Ivan Alexandrovich Koshevin and his son, who is well known to several of the gentlemen present here this evening, and indeed by all the Russians at Khabarova. I have no doubt this was in a great measure due to the kindness of Colonel Jule Shokolasky, one of the secretaries of the Imperial Geographical Society of St. Petersburg, who had taken great interest in our expedition, and also informed the Khabarova traders, before they left Pustosesk in the spring, of our contemplated visit to the great Samoyed tundra. We were especially desirous of learning from the Russians what was the likelihood of being able to land from our vessel at the mouth of the Koratoika river, or at any point beyond that to the gulf of Khapidirsk. They one and all expressed doubts, but said, "We cannot be certain, for we know not of any such attempt having been made, not even by our light-draught lodjas. If you

want information about the route by land from here to Pustosesk, we can tell you every verst of the way, and the best places to cross the rivers, but we know nothing about the coast navigation. We believe the shore to be shallow for many miles out, and the ice usually remains late in the gulf of Khapidirsk. Some of us have landed on Dolgoi island, but not further south in that direction." This information was truly disheartening, for the object of the expedition was to land on the shores of the great tundra and study the ornithology of that remote region. I will not occupy your time by recounting our walks over the tundra around Khabarova, for that locality has already been described by better-qualified persons than myself, notably Mr. Frederick Jackson.

The weather continuing remarkably fine, a run into the Kara sea was determined on. We left Khabarova early in the morning of July 18, and steamed through the Yugor strait. No ice visible in any direction, and we passed along the east coast of Waigats, in a blue and tranquil sea. So settled was the weather, that when in the afternoon we got abreast of Cape Matiusela, we did not hesitate to drop anchor about a mile from that iron-bound coast, in $5\frac{1}{2}$ fathoms, and to go on shore for a long run.

Marine boreal beds are very conspicuous on this part of Waigats, and for several miles both north and south of Cape Matiusela. They occur as thick beds of clays and sands, resting unconformably on the fundamental rocks of the island. At the Falushiba river to the northward, they attain the great thickness of 115 feet. I found layers of compressed wood in these beds, almost approaching lignite—no doubt sunken driftwood. Moreover, these marine boreal beds are crowded with erratics, many of immense size, often beautifully polished, and grooved and scratched. Near the coast-line streams and runnels flowing from the inland tundra have eaten out dells through the soft sandy marine beds, and the disconnected areas have worn away into rounded knobs, so that at a distance it appears that a line of low hills fringes this coast. At the time of our visit the land was green and covered with flowers, so that, with the bright blue sea and many birds, the scenery was cheerful enough. Almost at the north-eastern extremity of Cape Matiusela, a considerable mass of rock protrudes from the marine boreal clay, like a nunatak from the ice, and on it the Samoyeds have a holy place. It is a poor modern reproduction compared with those described and figured by the early voyagers to Waigats. A cairn of large stones built on the summit of the rocky eminence had a fir pole 8 feet long wedged in. The point of this pole was sharpened, and stuck on it was the cervical vertebra of an ice-bear, muscular fibre and flesh still adhering to this bone. Piled around were seven reindeer skulls and horns, and the skull of one ice-bear. Numerous offerings in the shape of broken tally-sticks, old powder-cans, scraps of iron, and useless odds and ends, were scattered around. It is evident that a remembrance

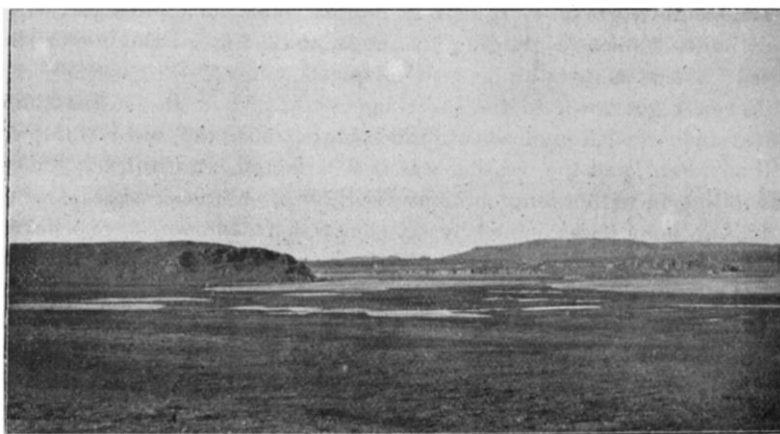
of their ancient heathen worship still lingers amongst the Samoyeds, probably more as an old-fashioned custom to bring good luck in the chase than anything else.

We left Cape Matusela at midnight of July 18, and returned through the Yugor strait to Khabarova, and steamed to the westward with the object of testing the feasibility of making a landing at the mouth of the Korotaika river. After clearing the Yugor strait we steered to the southward, running parallel and some 8 miles off the Russian coast, and heading for Chornoi Nos. The day was beautiful, the sea like glass, with hardly a breath of air. By the evening of July 19, we were in lat. $69^{\circ} 20'$, just on the last line of soundings given in the chart, but we only got 8 fathoms; as we proceeded the depth continued to shoal gradually but evenly. By midnight, some 20 miles further south, the depth had decreased to 4 fathoms; our ship was drawing 10 feet. We were still some 20 miles from the mouth of the Korotaika. We thought of trying to get there in our launch, but the risk was too great, for if a gale happened to spring up, there was no knowing where our ship might be driven to. The coal for the launch would be expended, and we left on an uninhabited shore, supposing it had been possible to make the land. We reluctantly came to the conclusion that our ship's draught was too great for this shallow coast, so we turned back on our course until we were abreast of the island of Dolgoi, and then bore down to it. In the morning of July 20, we came to anchor about a mile from its eastern shore, in 7 fathoms, hard bottom. Dolgoi Ostrov, or long island, is about 17 miles in length, and a little over 2 miles wide at its broadest. It is the largest of a group of five which lie off Cape Medenski Savarot, and stretch into the sea in a north-north-westerly direction. These islets were well known to the navigators of the sixteenth century, and are mentioned several times in the first and second voyages of Barents. Admiral Lutke gives some little information about them, but I cannot find that they have been visited by our countrymen during recent years, nor am I aware of any published information in regard to their geological structure or natural history.

The rocks of which Dolgoi is made are chiefly limestones and conglomerates, and, as far as my observation goes, are unfossiliferous. They dip very regularly at an angle of 45° to the eastward, and this holds good of the rock exposures on both sides of the island. The entire surface has been worn down to nearly a uniform level. The higher elevations are gentle swells, the most considerable not more than 50 feet in elevation. The whole is covered with a layer of the marine boreal clay, of the same character as that of Waigats and the tundra around Khabarova.

Innumerable shallow meres and ponds are scattered over it. So numerous are they, that walking a straight course is almost out of the question. One has to traverse devious peat ridges and wet marshes to

get round the ponds. This Dolgoi is a paradise for birds. Dunlins and red-necked phalaropes flew round and about in scores; the air was alive with divers of two species—red-necked and black-throated; grey plover and their young whirled over their breeding-grounds; reeves, turnstones, shore-larks, snow-buntings, Lapland buntings, red-throated pipits, king eiders, long-tailed ducks, glaucous gulls, and Richardson skuas were all common. The birds seemed to be unacquainted with the murderous propensities of man, for when I shot some ducks the skuas swooped down and battled with me for the prey. I found the botany of the island most interesting; a striking feature was the abundance of *Cassiopeia tetragona* and *Andromeda polifolia*, two of the *ericaceæ* which I



STINT LAKE, WAIGATS.

(From a photograph by H. J. Pearson, Esq.)

had not met with on the tundra around Khabarova, and which are absent from the flora of Waigats and Novaya Zemlya.

On the western shore we came across a Samoyed burial-place. Two weather-beaten old trunks, made of rough-hewn boards, lay under the shelter of a rock. The length of the one was 5 feet by 23 inches, and 13 inches in depth; the other was 5 feet 6 inches long, 24 inches in width, and 14 inches in depth. The boards were put together with wooden pegs and some iron nails. Heavy stones were laid on the lids. On removing these stones and raising the lids, we found that each trunk contained the skeleton of an adult. Judging from the wearing down of the teeth, they might have been elderly folk. But the wearing down of the teeth in savage or semi-civilized races who live by the chase, is not always a safe criterion for age. Both bodies had been buried in all their clothing, and the mouldering remains of their skin "pesks" shrouded the skeletons. By their right side lay several articles of

domestic use, such as broken wooden bowls, a snuff-box, and scraps of old iron. The long black hair still clung to the skulls. Around the graves were three sledges, more or less broken, and the bone gear for the harness lay scattered about; the reindeer-hide harness had disappeared. A rusty and damaged hatchet-head and a broken iron pot were lying close by. That the dead were left on an island had not been forgotten, for a pair of wooden paddles lay by the sledges. Some hundred yards north of these graves was a smaller box, containing the fragmentary remains of a child, likewise wrapped in reindeer-skin clothing. The second teeth were showing in the lower jaw; probably the age of the child was about five years. There is an incident connected with this grave which is almost a counterpart of what Captain Lyon tells us he met with in an Eskimo child's grave at Igloodik. At the Samoyed child's feet was a snow-bunting's nest containing five eggs, and lying on the mouldering "pesk" a dead snow-bunting with outspread wings.

When I got down to the shore opposite to where the steam-launch was at anchor, with my loads of birds, plants, and rocks, the evening was well advanced, and the weather was still calm and beautiful, but the sea was rolling in with a long ominous swell, so often the presage of wind. In half an hour I was joined by my companions, and we at once started for the ship, which lay about 3 miles farther up the coast. By the time we got alongside, a north-easterly wind had sprung up, and blew so strong that I doubt if we could then have landed or got off the island. The waves were rushing in and breaking on the rocky foreshore, tossing great wreaths of spray 20 feet in the air. Kjeldsen, who was rather anxious about our running the stay on shore so fine, was all ready to leave, and in five minutes after we got alongside, the ship was steaming away from this dangerous lee shore. It was midnight before we had cleared the north point of Dolgoi. The following day we sighted Waigats, but we held on our course for South Goose cape of Novaya Zemlya. We had run out of the bad weather and into a sea like glass; no ice was visible in any direction. At evening time we sighted the southern land of Novaya Zemlya.

July 22 was another bright and beautiful day, and for the greater part of it we were coasting along the west side of Meshdusharsky island. To our surprise we saw through our glasses a frame house with flag-staff and glazed windows on shore, and we afterwards learnt that it had been put up by the Russians for the accommodation of their Samoyed employés, who winter there. In the evening we were abreast of the north-west end of Meshdusharsky. Here are some extensive loomerics, and my companions went on shore and brought back a good supply of looms, *Uria bruennichi*, for the use of the ship's company.

We dropped anchor in Belusha bay, South Goose Land, early in the morning of July 23, just abreast of the Samoyed settlement on the west side of that bay. We had anchored here in 1895, and made acquaintance

with the Samoyed settlers of the place, so that we looked forward to renewing our acquaintance with these nice people. We were soon ashore, and went to the settlement. There were the same amount of yelling dogs, and the same amount, if not more, of dirt and filth, that we had met with in our previous visit; but Mrs. Taitaina, the wife of the chief man, was as pleasant and smiling as ever. She recognized us at once, and said, "You are the people who came here two summers ago." Then Mr. Pearson handed to her copies of the photographs of herself and her children, and her choom and her dogs, which he had taken in 1895. She was delighted with them, and her broad honest face illumined with smiles. She told us all the men were inland fishing and



ROSMYSSLOFF'S WINTER QUARTERS, 1768-69.

(From a photograph by H. J. Pearson, Esq.)

hunting, but she hoped they would be back before we left. Then she took us over her establishment, and into a shed where blubber and geese and seal meat and many things were kept. There were long strings of geese-bills hanging up, which she treated somewhat disdainfully, saying, "These are playthings which the children collect;" but when she saw me counting the bills, which I did to see how many belonged to white-fronted geese and how many to bean geese, she begged me to take one of the strings of nebs with as nice manners as one might expect from a great lady in England doing the honours of her house. In this shed, filled with decomposed geese and ill-smelling blubber and reindeer meat, were several glass fishing-floats, which are used by the Loffoden fishermen, and which Mrs. Taitaina informed us are washed up at times on the coast—a very interesting fact, which illustrates that the influence of the Gulf Stream is a real factor on the west coast of Novaya Zemlya.

You may very reasonably ask how we were able to converse so easily with the Russians and Samoyeds; but Kjeldsen can speak Russian fairly well, whilst Petersen, our mate, who had likewise been engaged as interpreter, had resided several years in Siberia, and consequently had an excellent colloquial knowledge of Russian, and an equally good acquaintance with the English language.

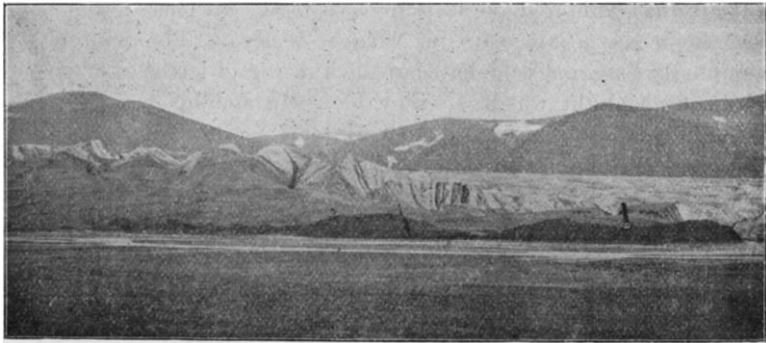
Returning to the ship, Mr. Pearson and Kjeldsen shortly after started for the head of the bay in the steam-launch, with the object of exploring more fully a river which discharges into the north-east angle of Belusha bay, and which we partially examined in 1895, and thought must be a stream of considerable magnitude. We gave it then the name of Saxon river, after our yacht.

Mr. Pearson returned to the ship at midnight. He had taken the launch, with considerable difficulty owing to shallows, as far up Saxon river as our turning-point in 1895. Then he took to the land, and after walking along its banks for less than an hour, and passing a few rapids, the so-called river dwindled into the usual type of Novaya Zemlya streams, which at this time of the year might be waded over in many places, not above the ankle. The river in its lower reach was in reality a creek communicating with the sea. Certainly, in 1895 we had tasted the water at our extreme point, and then pronounced it fresh, but no doubt this must have been owing to a stratum of river-water floating on the sea-water. The party had been fortunate in finding many white-fronted and bean geese at the head of the bay and in the creek. These birds were not able to fly, having lately moulted their wing feathers. They brought back thirty-six fine birds, which proved most acceptable, as we had all been living for some time on preserved and salted meats.

We left Belusha bay early in the morning of July 24. The wind was from the south-east, but when we had cleared the bay we set our square sails and ran out between Meshdusharsky and the mainland, keeping the centre of the strait. It is necessary to give Podvezoff island, lying off South Goose cape, a wide berth, as a dangerous submerged reef runs out from it for two, maybe three, miles in a north and south direction. We were nearly wrecked on this reef in 1895. The wind continued favourable till the afternoon, then it shifted to the northward and blew hard, which brought up such a heavy tumultuous sea that we were glad to alter our course and run to the north-west all through that night. On the morning of July 25 we headed in-shore. By evening we had cleared North Goose cape, and were steering for shelter under Cape Britwin (the Razor cape). The next day turned out fine, with light northerly winds; the sea had gone down, and we steamed northwards at a distance of 3 or 4 miles from the shore. The coast-line from Cape Britwin to Nameless bay is not more than 300 to 400 feet high, sloping, and well covered with herbage; snow lay in patches in far

greater quantities than on Goose Land farther south. The marks of elevation along this coast are quite distinct; the land runs in parallel lines of grass-covered slopes. We could distinctly trace them to an elevation of not less than 200 feet. At mid-day Nameless bay opened up; we stopped and sounded 3 miles from shore, and got 20 fathoms. Thousands of Bruennich guillemots were passing and repassing to their rock-nurseries in this bay.

In the neighbourhood of the Matyushin shar, and on both sides of that strait, the mountain ranges of Novaya Zemlya rise in series of bold and lofty peaks, snow-clad and entwined by glaciers. Through this alpine region passes a narrow but deep channel connecting the waters of the Barents and Kara seas, and separating the island of Novaya



IBIS GLACIER, ZIWOLKA FIORD.

(From a photograph by H. J. Pearson, Esq.)

Zemlya from the north island, which has been very appropriately named Lutke Land for its southern part, and Barents Land for its northern half. We entered the Matyushin shar on the evening of July 26, and anchored in Cairn bay. The night was gloomy, and the mountains were shrouded in mist. At the head of this bay we were surprised to see a couple of good houses and signs of a permanent settlement.

Very soon after we dropped anchor, the headman of the settlement, a Samoyed, and half a dozen men and boys came off to interview us. We found the chief man extremely intelligent. He was dressed in a coarse cloth great-coat, and wore a Russian decoration; his followers were clad in the ordinary Samoyed dress.

Returning with them on shore, we were assailed as usual by a pack of hungry curs, but the ladies and children rushed out from the house armed with sticks, and belaboured the poor brutes into the semblance of good behaviour; one or two sulky ones were tied up in a trice, and in a few minutes amicable relations existed between us and the dogs.

The larger of the two houses at Cairn bay is an excellent one, built

of logs brought from Russia, and boarded over in front. A staircase leads up to the door, which opens into an entrance hall, beyond that a nice room with glazed windows, and a large well-built brick-and-tile stove. A sloping bed of planks occupied one side of the room, which was lined with pine boards. On the walls hung an Ikon, coloured prints, and photographs. Everything was scrupulously clean. In a few minutes the kind mistress placed on the table an immense dish of raw chopped fish and brown bread, which our Norwegian companions discussed with great zest. As Mr. Pearson and I did not join, we were each handed a fine *Salmo alpinus*, a most delicious red-fleshed char, to take away with us.

Our host informed us that this year the ice opened in the strait in May, an unparalleled event in the experience of the Samoyeds; that he and his family had wintered the last three years at Cairn bay; that he had been nine consecutive years in Novaya Zemlya. The winters were undoubtedly long and cold, but that the hunting of ice-bears during the periods of moonlight was most enjoyable. He and his men had killed thirty-nine ice-bears during the past winter. A week before our arrival the Russian trading steamer had called in and taken the skins away. I inquired what price he was given for them, but he could not say until the accounts came back from Russia. He had been credited with fifty-three roubles a skin for the ice-bears he had sold the year before. He told us, also, that year by year animals were getting scarcer, and that the Samoyeds had to keep pushing their hunting-stations farther north. He was just on the point of despatching a party of his men, who would winter at Admiralty peninsula for the purpose of hunting.

We left Cairn harbour the following day, and steamed through this wonderful Matyushin shar to the eastward. The weather was perfect, and we were lost in admiration of the superb scenery through which we passed. I have seen it stated that the towering precipices on either side of this strait crowd together and form a narrow gulf, with only a streak of sky visible between the frowning masses. This is an exaggeration, but all the same the reality is very grand. Nowhere is this strait 2 miles wide, and in some places it contracts to a quarter of a mile; seldom is there any stretch where the water is not lost to view by the closing in of the headlands, and one appears to be passing through a series of lakes surrounded by lofty mountains and overhanging precipices. Many glaciers pour down from the mountains almost to the water's edge, but I do not think that a single one actually discharges into the sea in the whole length of the strait. In the afternoon we steamed into Belusha bay, on the north side of the strait, towards the eastern or Kara sea entrance, and anchored in Seal bay, a most perfect and snug little cove, so small that we had to moor the ship, there being no room for her to swing, and with an entrance between two flat gravel spits just large enough to admit our ship; inside we got 3½ fathoms. As far as

protection from the sea or floating ice is concerned, we might have been in a dock.

We remained in Seal bay from July 27 till August 5. During this time the weather on the whole was very good, though on one occasion it blew with great fury for some hours over our anchorage. This fierce wind was, I believe, strictly local. Originating in the lofty snow and ice-covered interior, it came tearing down Belusha bay like a draught through a funnel. Apparently this tempest did not extend to any width, for whilst the entrance to the bay was lashed into foam, the straits both east and west were comparatively tranquil. The tide flows from the Kara, and the rise and fall in Seal bay at neap is about 2 feet. A great amount of Siberian driftwood is stranded on the shores of Belusha bay.

We made almost daily excursions in the steam-launch to various points on both sides of the Matyushin shar, and took long walks into the interior, but time will not permit me to give even a slight account of these pleasant expeditions. We botanized, studied the geology of those parts, collected the birds, and made many observations, the results of which will be published in the future. Perhaps the most interesting series of facts I have to record are the universal proofs of the secular elevation of these lands. Around Belusha bay stretch vast lines of old sea margins. The highest I could locate there with absolute certainty was 500 feet above present sea-level. In places where streams had cut through at that altitude, I found sections replete with the shells of *Mya truncata* and *Saxicava arctica*, then, as now, the commonest mollusk of these arctic seas. Equally significant of the marine origin of these beds is the presence of the tests of foraminifera of the same species as now abound in the surrounding seas. Mr. Joseph Wright, our greatest living authority on the subject, and who has taken in hand the investigation of the samples I brought back, writes me that a specimen of clay weighing 3 oz. troy, that I took from a shell bed at an elevation of 300 feet in the neighbourhood of Belusha bay, contained between two and three thousand specimens of foraminifera of thirty-five different species! Nor are signs of recent elevation confined to a limit of 500 feet, for I found on the summits of mountains 800 feet high, erratic boulders of granite and foreign rocks, the presence of which I cannot refer to the action of terrene, but to floating ice. These marine terraces likewise fringe the shore-line of to-day, a very notable one about 100 feet in height girdling the entire east side of Belusha bay. Subsequent stream-erosion has in some places effected great denudation, but outliers in the shape of rounded isolated hills, which remind one of eskers, are common enough. One of these has been dignified by von Heuglin in his chart* of Belusha bay as Albert peak.

* Special plan, Chart No. 318, published May, 1872 (Hydrographical Office, Washington, D.C.).

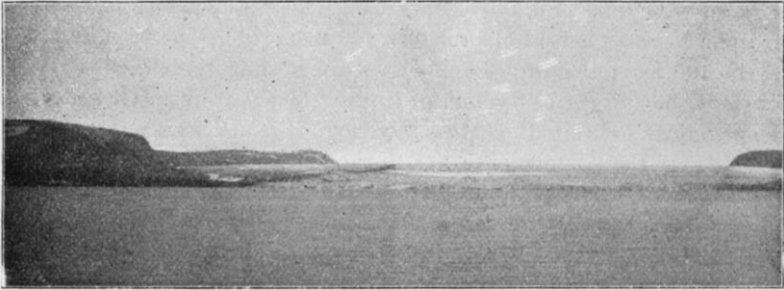
Can it be that this comparatively recent emergence from the sea, of the Russian tundra bordering the arctic ocean, of Waigats, of Novaya Zemlya, of Lutke and Barents Lands, has caused the withdrawal of the glacial period from Lapland, Scandinavia, and possibly Great Britain? This is certainly a startling theory for me to advance. But I found evidences which seem to me convincing, that the Russian tundra bordering the arctic sea, Waigats, Novaya Zemlya, and the North island were submerged in post-pliocene times 1000 feet below their level of to-day. This submergence must have permitted the ice of the eastern arctic seas to press down on Lapland and Scandinavia. What was the decrease at the shore-line in the mean annual temperature of Lapland and North Scandinavia under those conditions, is a matter for calculation, but it must have been very great.

Then came the secular upheaval of the lands I have mentioned, to a height of 1000 feet, and a nearly continuous breakwater of 600 to 700 miles long was raised, running nearly north and south into the polar sea. The results arising from this interposition of land we can see for ourselves. On the one side is the "ice-cellar" of the Kara, on the other the comparatively warm waters of Barents sea. A certain amount of the Kara sea ice now pushes through the straits of Yugor and the Kara strait, but this volume of ice has little effect in lowering the temperature of the waters of Barents sea. How different would be the result if the stupendous accumulation of ice, which is now fended off by Waigats and Novaya Zemlya, was pressed upon the shores of Lapland and North Norway! It would be an ice-drift equalling, if not exceeding in magnitude, the great polar drift which, sweeping down the east coast of Greenland, glaciates that island-continent, to nearly the same parallel as the Shetlands. This question, however, if it were dealt with in detail, would lead us rather beyond the science of geography, and I have discussed it fully in a paper which I hope to read in a few weeks' time before the Geological Society of London.

I think it ought to be mentioned that one of our excursions was to a bay on the south side of Matyushin shar, immediately west of Gubin bay, into which runs a stream marked in charts under the name of Farassowa. The sides of the mountains on both flanks of this valley are largely composed of iron ore for a thickness of some hundreds of feet. The bottom of the valley is filled with fragments that have been washed down or fallen. I also obtained traces of copper ore. This valley is well worthy the attention of a Russian mineralogist.

We did not realize, until near the close of our stay in Seal bay, that this was the same Seal bay where the celebrated Russian explorer Rosmysloff passed the winter of 1768-69, and but for a fortuitous discovery of some graves, we should have left the place oblivious of the fact. Those who are acquainted with the history of Russian scientific discovery in Novaya Zemlya, may remember that when Rosmysloff

determined to winter, his resources were so inadequate, and his means of housing his party so limited, that he divided it, one portion under the pilot Gubin settling at Cape Wood (Drowanoi Myss), on the south side of the channel, and he himself and the rest of his men putting up their hut in Seal bay. The ruins of Gubin's hut on Cape Wood are still quite recognizable, and the remains of bears' bones, crumbling and lichen-covered, are strewn around. Lately (1889) the Russians have erected at this spot a wooden cross with an inscription, to commemorate the wintering of Rosmysloff's party. Whilst examining the rocky promontory that forms the western side of Seal bay, we came upon a cairn of large stones inside of it was a coffin. Some of the stones had fallen down and bulged in the lid; we removed these, and inside lay



IBIS GLACIER, ZIWOLKA FIORD.

(From a photograph by H. J. Pearson, Esq.)

the perfect skeleton of a very tall man. The coffin had been made with much labour out of hewn boards, probably from driftwood. The care which had been taken in the burial showed that it must be that of a person of some importance, for close by was another skeleton simply covered over with a cairn; a further search showed five more graves of the same description. Then we felt sure that these graves must have some connection with the ruins of a Russian hut built on the gravel spit immediately below. And it dawned on us that Rosmysloff's party lost seven of their number, and that the second in command, the pilot Tschirakin, died after great suffering on November 17, 1768. We therefore feel tolerably sure that the skeleton of the tall man in the coffin is that of the pilot. But at some little distance from the grave a portion of an inscribed head-board was found lying among the rocks, which we brought away, and if decipherable will settle the point. Then we mended the lid, re-covered the coffin and re-built the cairn, placing great stones as supports across the side walls to protect the coffin, and reared up a cairn, so that the pilot's remains may rest undisturbed by the elements for centuries to come. The ruins of Rosmysloff's hut stand on the flat stretch of shingle at the entrance to Seal bay, about 2

feet above high-water mark, and some 50 yards from the shore. The roof, which had been made of logs simply laid across the side-walls and covered over with shingle, had fallen in; the timbers have nearly mouldered away. The foundations of the hut are easily traced—only two rooms leading the one into the other, the larger 14 by 14 feet, the outer 12 by 12 feet; the brick stove was built in the larger room. After shovelling out the gravel and coming to the floor of the hut, we came across many articles that had been left by these Russians; some of them we brought away.

We left Seal bay on August 5, and entered the Kara sea. The weather was most beautiful, a light easterly wind, and a long rolling swell; temperature 45° to 50° . The height of the land rapidly decreases from Belusha bay to the eastern exit of Matyushin shar. Both sides of the straits are faced with lines of old sea margins. These stupendous terraces rise tier upon tier to a height of probably 600 feet; the slope of each terrace may be 100 feet; the angles and slopes are so sharply defined that they look as if they might be Cyclopean lines of fortifications. These terraces are splendidly exhibited on Myss Wychodnoy (Cape Exit), the northern extremity of the eastern entrance to the Matyushin shar. It was from this point, on April 8, 1835, that Ziwolka, the able lieutenant of the celebrated Pachtussoff, started on his sledge journey to explore the eastern coast of Lutke Land. Taking provisions with them on their sledges for a month, they pushed northward over the billowy shore-ice. They passed several bays, which the party had not time to explore, but which Ziwolka named in the following order: Cancrin bay, Unknown bay (Saliw Nesnaemy), and Bear bay (Saliw Medweshji). On April 24 the party reached Flotow peninsula, round Five Finger cape (Myss pätj Palizow). Here the loosening of the ice to the north, and their provisions running short, compelled them to return. Ziwolka there erected a cross out of driftwood with the inscription, "This cross was erected by Ziwolka, captain of the company who penetrated thus far through the ice on a coast survey, April 24, 1835." They then beat a retreat. On the 30th he reached Cape Wood (Drowanoi Myss); on May 6 he again entered Pachtussoff's winter quarters in the Matyushin shar. That indefatigable explorer, having failed in the summer of the same year to circumnavigate Novaya Zembla from the westward, now determined to try if it would be possible to reach the north point of Barents land by the east coast. For this purpose he sailed eastward through the Matyushin shar in a small karbasse with a surgeon and five sailors. On August 15, 1835, he reached Cape Wood, worked his way through the drift-ice to the east entrance, and began the survey of the coast to the north. He was often obliged to take shelter behind stranded icebergs, jutting spits of land, and in inlets. In this way he succeeded in reaching the island which has since been named for him Pachtussoff island, in N. lat. $74^{\circ} 24'$, 35 versts beyond Ziwolka's

extreme point. It was impossible to push further, in consequence of the masses of coast ice. So, returning on August 28, he reached the mouth of the Matyushin shar, and from there his winter settlement.

How very different were our experiences this past summer to those of Pachtussoff! In the same month of the year as he met with almost impenetrable obstacles from the ice of the Kara sea, we were steaming along that shore in waters that would not have disgraced the Caribbean. During the evening of August 5 we were abreast of Cancrin bay. Near the shore the land is a low flat tundra rising in terraces to 500 or 600 feet; behind are the lofty interior snow-clad mountains. August 6 ushered in as beautiful a day as the preceding, and we



NEST OF LITTLE STINT, WAIGATS.
(From a photograph by H. J. Pearson, Esq.)

steamed northward within a mile or two of the shore. The first icebergs we had seen, either in Barents or the Kara sea, lay grounded on the foul ground and islets and reefs at the entrance of Bear bay. By evening we reached Pachtussoff island, and anchored on its western side in 5 fathoms of water, about a quarter of a mile from shore. We soon landed, and were scouring over the islands; for, though it is put on the chart as one, in reality there are several islands close together, with narrow and deep channels between, which might afford safe anchorage but for the risk of being sealed up by the ice of the Kara sea. The rocks of the island are hard grey limestone, but varying to yellow. The strata dip at a high, almost vertical angle from the east to

west. There are fossil organisms in much of the grey limestone—very imperfect, however, but sufficient, I think, to be determined. I put them down as of Silurian age. The surface geology shows the usual characteristics of gradual emergence, in the shape of terraces round the bays, and on the slopes, beds of marine clay with shells, and erratic boulders. Between thirty and forty species of flowering plants were gathered on these desolate islets. There is a conspicuous cairn placed on the most western of the islets, at an elevation of 130 feet. We searched it for a record, thinking that Pachtussoff might have left one there in 1835. Our search proved fruitless, but we carefully restored the cairn and placed inside of it a notice of our visit.

From the highest point of Pachtussoff islands, no ice, nor any appearance of ice, was visible, save a few small bergs. The next day we proceeded up the fiord that runs into the interior directly opposite Pachtussoff island. We steamed up this noble indentation for a distance of about 12 miles, until we got within a quarter of a mile of the glacier at its end; we sounded there, and found 40 fathoms. The sea-ice had entirely cleared out of the fiord, but over its blue surface were scattered huge blocks of glacier ice, and bergs of considerable size were stranded at many points. Mr. Pearson and Mr. Curtis, on landing, ascended the glacier from its flank, and travelled a long way over it, reaching an elevation of 650 feet. Down its centre is a medial moraine, in which occur most perfectly rounded water-worn stones. In company with one of the crew, Daniel Johannssen, who generally attended me in my walks, we ascended one of the hills that bordered the south side of the glacier. We found it a somewhat arduous climb, which took us over two hours to accomplish. We reached the summit at midnight; the temperature was 40° , and we threw ourselves, our clothes saturated with perspiration, on the ground. I had forgotten my aneroid. Daniel estimated the height at 2000 feet. I think 1400 feet would be within the mark. Phanerogamic vegetation entirely ceased at 400 feet from the top, and is replaced by a rich growth of lichens and mosses. *Cardamine bellidifolia* was the highest growing flowering plant. We were well repaid for our climb, as we looked upon a scene of rare beauty. The sun had disappeared behind the opposing hills that form the northern side of the fiord and hem in the glacier. They rise to about the same altitude as that on which we stood, and for miles look down upon the fiord, almost sheer for half their height, then as very steep scree to the water's edge. Amber-tinted fleecy clouds floated in the northward, against a background of pale cold blue sky, so characteristic of polar regions, whilst rosy tints tipped the mountain tops of the interior. Immediately below us lay the glacier some 3 miles across, but narrowing to about a mile where it discharges. Looking inland, the glacier seemed smooth, but at the contracted outlet it was greatly crevassed transversely.

To seaward the Pachtussoff islands lay like a network of reefs; and, looking beyond them, the Kara sea stretched north, east, and south without a sign of ice, save a few stranded bergs along the coast. About 10 miles inland five lofty nunataks rose from the centre of the glacier. They are black in colour, though streaked with patches of snow or ice. From each of these descended moraines, which, coalescing, formed the great medial one. Beyond stretched, as far as our range of vision, the *mer de glace*, broken here and there by lofty snow-clad mountains, but extending inland until its convex horizon merged into the pale blue sky. I think we may safely assume that the interior of Lutke land and Barents land is occupied by a *mer de glace*. As this grand fiord is unnamed on the charts, and we were the first to explore it, we desire to give to it the name of Ziwolka, in remembrance of Pachtussoff's able lieutenant; and to the glacier the "Ibis," in compliment to our brethren of the British Ornithological Union.

As we descended the hill, we saw the front of Ibis glacier calve. An immense mass of the ice-cliff fell forward from a line of crevasse into the water. We first saw a portion of the face of the glacier move, rock, and then fall forward, then clouds of vapour, then a dull roar as of thunder, and then the circling waves rolling outwards. Though several great masses of the calf remained apparently stranded at the edge of the glacier, yet fragments showing as large as big cottages floated away, and a fan of these ice-blocks soon spread for a mile or so around.

Our voyage had been so pleasant, and the weeks had passed so swiftly, that it was hard to realize that the limit had been reached for further progress, more especially as there would, in my opinion, have been no physical obstacle to exploring the unknown coast-line from Pachtussoff island to Barents winter-quarters. The coal left, however, was barely sufficient to take the *Laura* back to Tromsö, in accordance with the date fixed for the termination of the charter party.

On our way south we steamed into Bear bay, and photographs were taken of the glacier at its head. By midday of August 9 we were back in the Matyushin shar. The weather continued to be fine and warm; we literally basked on deck in the heat of the sun. Before quitting the strait, the ship was stopped for a few hours, and Mr. Pearson ascended a mountain on the north side to an altitude of 2000 feet, from whence a series of photographic views were obtained, which illustrate the character of that part of the interior of the south and north islands. We put into Cairn harbour to say good-bye to our pleasant Samoyed acquaintances. Then we steamed down the coast to Nameless bay to have a look at its immense rock-nurseries of the arctic loom (*Uria bruennichi*). These wonderful breeding-haunts, with their countless numbers, have been well described by Admiral Markham.* He tells us that none

* 'A Polar Reconnaissance,' p. 151.

of the "loomeries" that he has visited in Greenland and other parts of the arctic regions can be compared with those of Nameless bay. I quite agree with him. But it was early in the season when he visited the place, and the birds were sitting on their eggs. As we saw the cliffs later in the year, when the entire progeny had hatched out as well, and the myriads of the rising generation were huddled together along with their parents on the ledges, it is truly a wonderful sight which baffles description. We killed sufficient of the birds to supply our crew with ample fresh food for the return voyage to Norway, and on the evening of August 12 we left the shores of Novaya Zemlya, and set a course for Vardö. Though the primary object of the expedition had failed, namely, to land on and investigate the great Samoyed tundra, yet the alternative trip had turned out most interesting and delightful. We had a splendid run across Barents sea to Vardö, where we called for our letters, and then on to Tromsö, which we reached on August 20. There we took the mail steamer to Bergen, reaching Hull on the 30th.

A few words as to the scientific results of the voyage.

The ornithology of Waigats, Novaya Zemlya, and the North island is, I think now, practically worked out. The results of our observations, along with those of our predecessors, have been embodied in a paper by Mr. Pearson, which will shortly be published in the *Ibis*.

The botanical collections are satisfactory. They embrace at least three-quarters of the phanerogamic flora already recorded from the Novaya Zemlya group of islands, and I have added several interesting plants to those already observed there. But by far the most important discovery was my finding what has hitherto been considered the rarest and most inaccessible of flowering plants, growing in the greatest profusion both in Novaya Zemlya and Lutke Land. The localities where this beautiful little grass, *Pleuropogon Sabinii*, has been obtained were recently enumerated by Mr. Fisher, the botanist to the Jackson-Harmsworth expedition, before this Society.* I may say that von Baer found it in Novaya Zemlya in 1837. Prof. Aagard, who took part in von Heuglin's expedition to the same island in 1871, brought back a single example; and in later years a few specimens have been found there by Russian explorers. Now I have to tell you that I found this plant growing abundantly at Belusha bay of South Goose land, at Nameless bay, and in every valley I visited on both sides of the Matyushin shar, Silver bay, and many other localities. In the neighbourhood of Belusha bay of Lutke Land, I found it in great quantities around meres and over wide areas of wet ground, to an elevation of 700 feet. I consider it to be the commonest grass of Novaya Zemlya and Lutke land.

The examination and description of the large series of rocks that I collected at each locality visited has most kindly been undertaken by

* *Geographical Journal*, vol. viii. p. 560.

Prof. Bonney, and his report will undoubtedly largely add to our knowledge of the rocks composing Dolgoi island, Waigats, and Novaya Zemlya. In stratigraphical geology a not unimportant fact brought to light is the knowledge that on the eastern shore of Lutke land, in N. lat. $74^{\circ} 24'$, there are rocks of Silurian age. Since writing this paper, I have obtained from Mr. E. T. Newton, F.R.S., who has been so good as to examine the fossils I brought back from Waigats and Novaya Zemlya, the following preliminary report: "The series of fossils from Cape Greben, Waigats, are without doubt Upper Silurian; but the specimens from Pachtussoff island are not so certain. I think that in all probability they also are Upper Silurian, but as there is a possibility, according to Lindström, of some of Nordenskjöld's fossils (*i.e.* from Cape Greben) being from passage beds between Upper Silurian and Devonian, there is just the same possibility with yours; the forms of *Favosites* and *Syringopora* not being distinctive."

The collections of insects, marine invertebrates, and soundings have been placed in the hands of specialists.*

A CRUISE ON THE EAST OF SPITSBERGEN.†

By ARNOLD PIKE.

TOWARDS the end of last July, after a quick passage from Norway, without seeing ice, we steamed up Stor fjord on the east coast of Spitsbergen. Stor fjord was ice-free except for a small quantity of broken-up stuff at the north end.

Wishing to reach the east coast of North-East Land, we steamed through Freeman's straits. At the east end some large floes were drifting about, lanes between them opening and shutting very quickly, so we returned and tried Helis sound. Violent currents rush through this sound at, I judge, a speed of ten knots per hour. After steaming through the sound we found much open water to the eastward, but there was enough light stuff to prevent us from reaching Kong Karl's Land. The ice was fast to Cape Mohn. None of it was heavy or badly packed; indeed, it seemed to be mostly ice of the year. With the intention of returning later, we steamed up Hinlopen straits. Northerly winds had been and were prevalent, but we were not prepared to find the big bays on the east side of the straits entirely free of ice; neither was there any ice in the straits. Old walrus-hunters said they had not seen the like before. Curiously enough there was also much open water along the north coast, and we reached Charles XII. island with but little difficulty. North of this point there was some heavy ice, apparently tight, but to the eastward it was lighter, and evidently

* For discussion, see p. 370.

† Read at the Royal Geographical Society, December 13, 1897. Map, p. 464.
No. IV.—APRIL, 1898.]

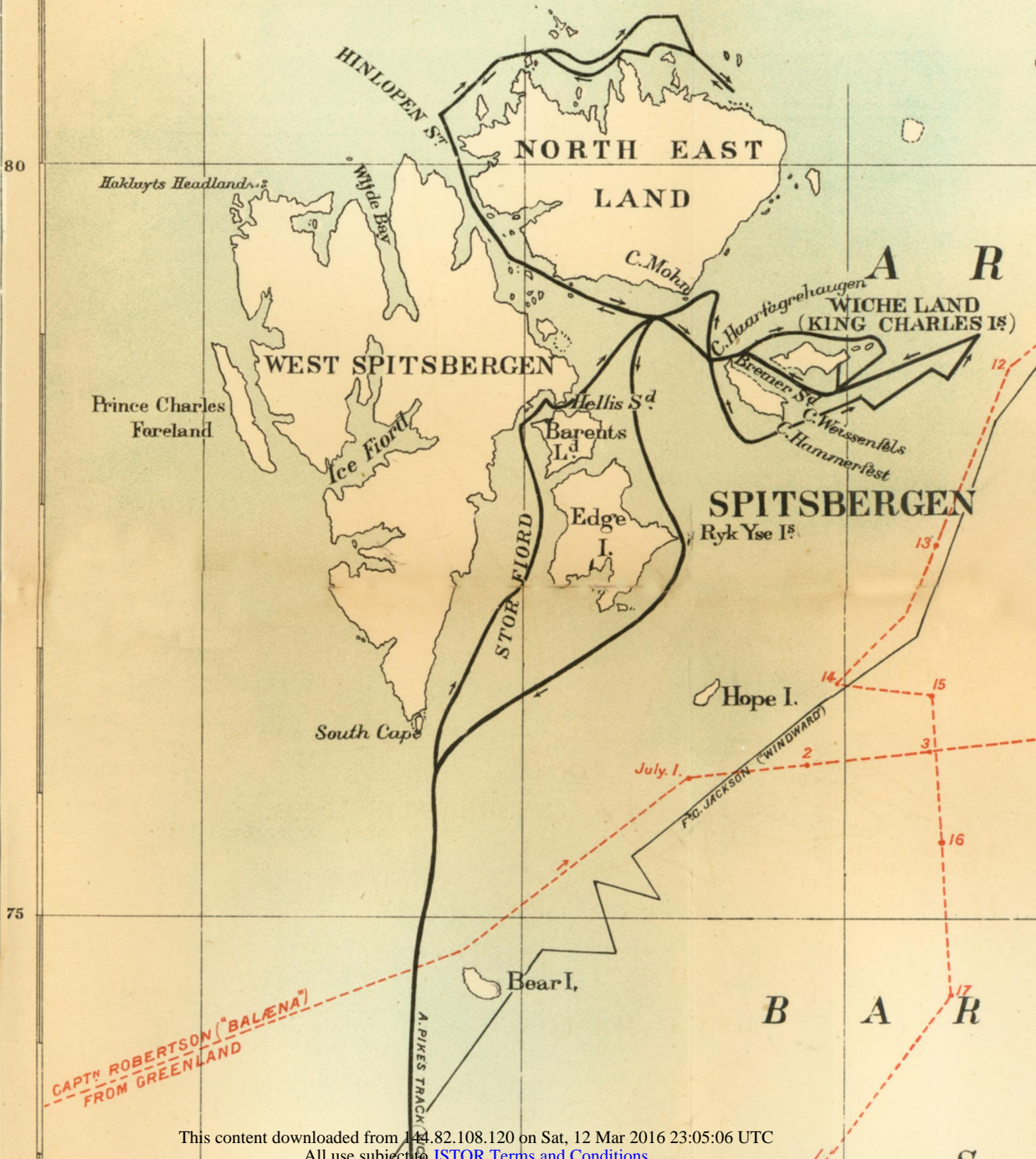
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ROUTES in the SPITSBERGEN - NOVAYA ZEMLYA SEAS.

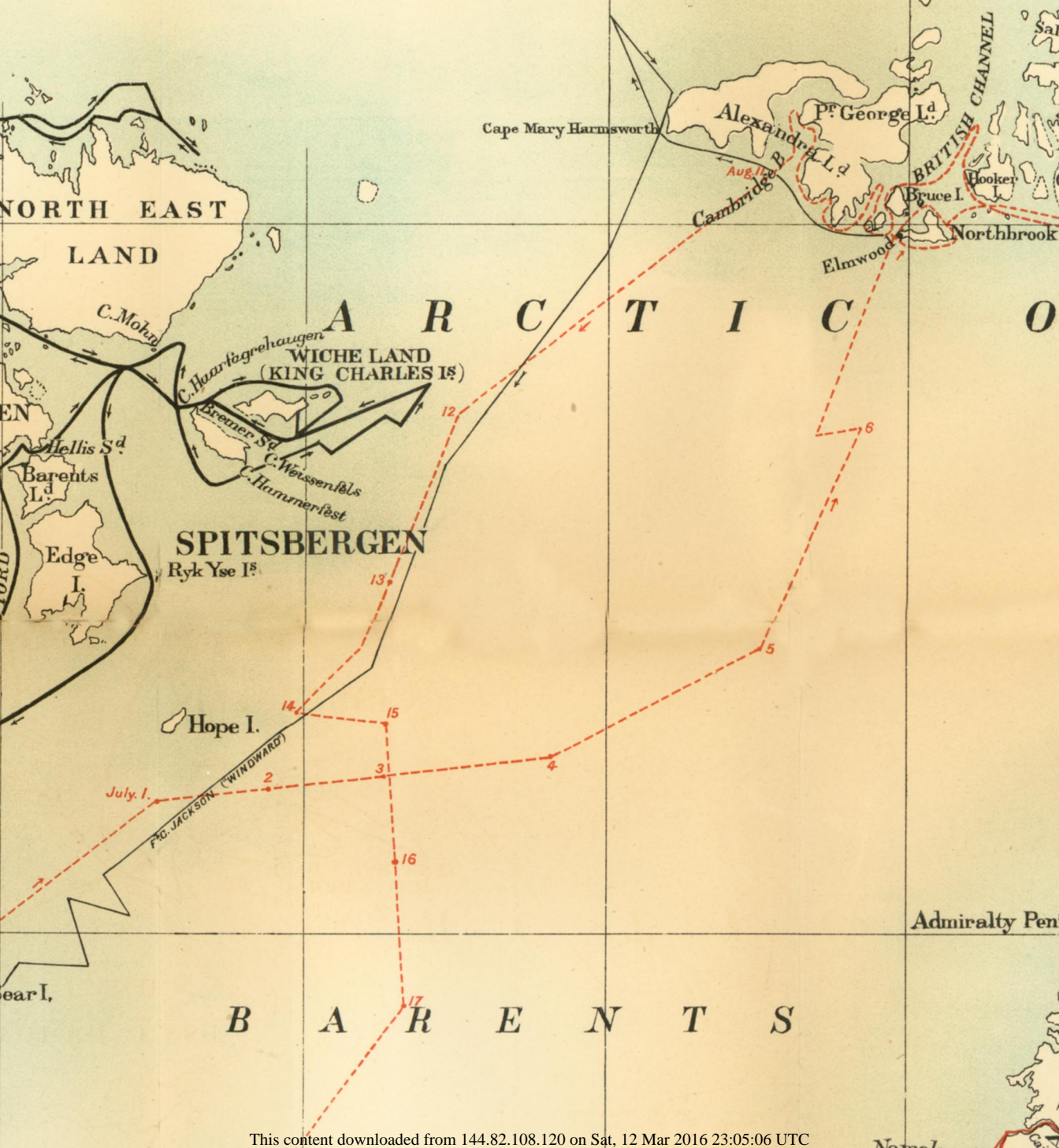
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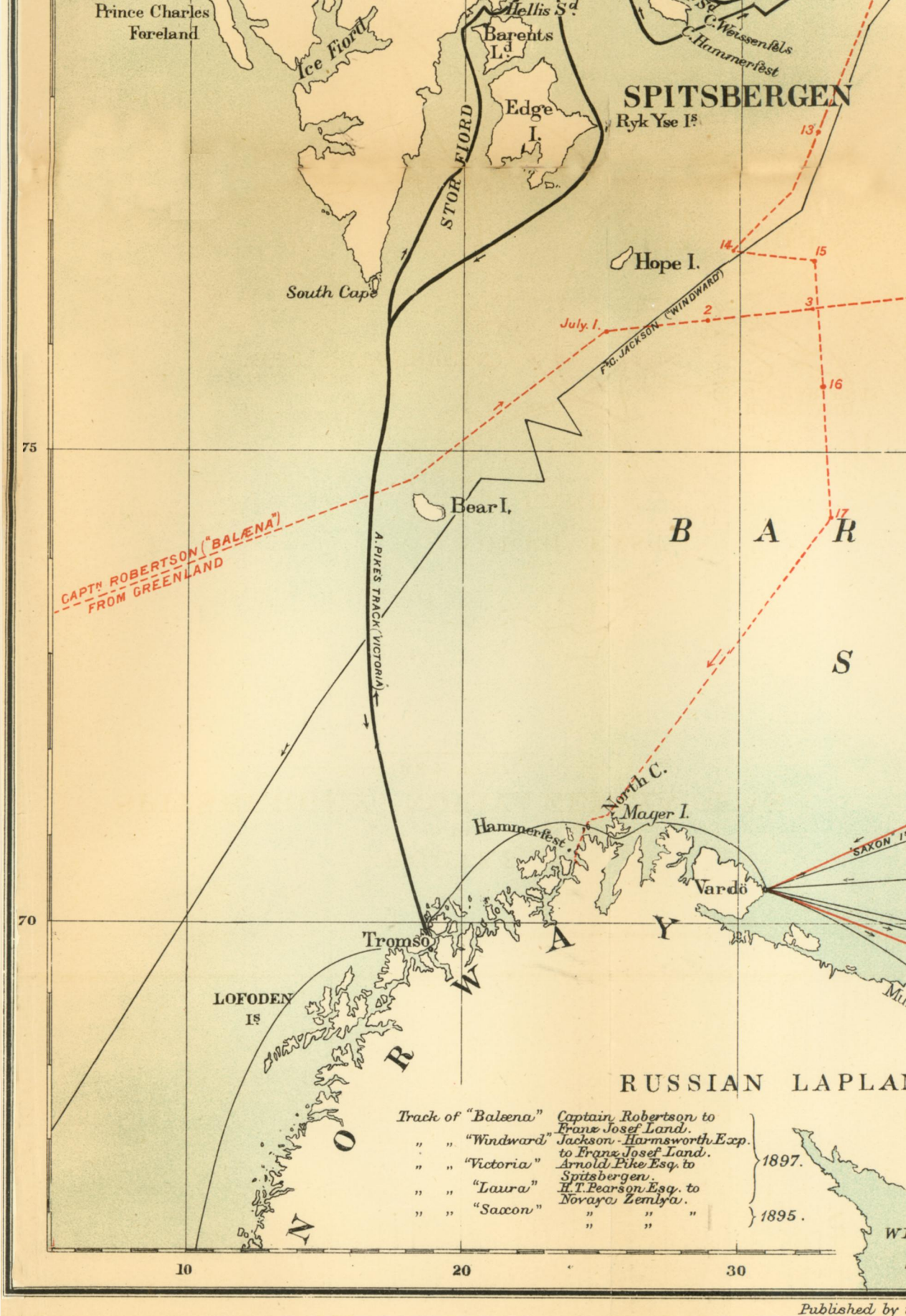
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the
FRANZ JOSEF SEAS.

1897.

FRANZ JOSEF
LAND







Track of "Baleena"	Captain Robertson to Franz Josef Land.	} 1897.
" " "Windward"	Jackson - Harmsworth Exp. to Franz Josef Land.	
" " "Victoria"	Arnold Pike Esq. to Spitsbergen.	} 1895.
" " "Laura"	H. T. Pearson Esq. to Novaya Zemlya.	
" " "Saxon"	" " "	

