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Three Years' Exploration in Franz Josef Land

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# The Geographical Journal.

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## THREE YEARS' EXPLORATION IN FRANZ JOSEF LAND.\*

By FREDERICK G. JACKSON.

It was in August, 1873, that the island group afterwards known as Franz Josef Land was first accidentally discovered by the Austro-Hungarian Expedition under the leadership of Weyprecht and Payer. In endeavouring to pass round the northern end of Novaya Zemlya to discover the North-east Passage, their ship, the *Tegetthoff*, became beset in the ice, and, after drifting for twelve months, they came in sight of an entirely new land, and the floe upon which the ship had been crushed up was frozen to the land-ice of Wilzeck island. The following spring Payer made three plucky and adventurous journeys up and in the neighbourhood of what he then named Austria sound. After a hard and perilous journey, they were able to beat a retreat to Novaya Zemlya in boats, leaving the ship to its fate on the shores of Franz Josef Land, being quite of opinion that the country was unapproachable by ordinary methods. Payer had reached the latitude of  $82^{\circ} 5'$  north, and was under the impression that he had seen land still further to the north in and beyond the 83rd degree, and land to the north-west reaching almost as far. It was upon these observations that arctic authorities advocated this route as the best for exploring to the northward, and upon which I based my plans in the latter end of 1892. Unfortunately, our expectations in this respect were fated to disappointment by the non-extension of land to the north, and we had not been long in Franz Josef Land before we discovered that, instead of this region being of continental dimensions, as many supposed it to be, it is only an archipelago of comparatively small islands; and this

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\* Paper read at the Royal Geographical Society, November 8, 1897. Map, p. 212.  
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unfortunately quite upset the basis upon which my plans for pushing north were founded, which were to follow the land, and form depôts of provisions as far as it extended.

Mr. Leigh Smith, in 1880 and 1881, visited Franz Josef Land, and continued Payer's discoveries westward; but all this is well known.

It was in the latter end of 1892 that I first published my plans, which, I am glad to say, met with the approval of most arctic authorities. These embraced not only an advance in a northerly direction, but mapping-in of the coast-lines of Franz Josef Land, a thorough examination of that country, taking scientific observations, and making collections generally. These plans we have been able to carry out; and scientific observations, which I think I may be excused for describing as valuable, have been carried on uninterruptedly for three years. We have also practically completed the map of Franz Josef Land, and settled the Gillis Land question.

For some time the sinews of war were conspicuous by their absence, and little encouragement given to my expedition. Consequently, in 1893 I determined to take a journey to Yugor straits, with the object of exploring Waigatz island, and the Bolshoya Zemelskja tundra country to the south of it, and at the same time thoroughly test the equipment which I intended to use in Franz Josef Land. This I accomplished, extending my journey round the White sea and through Lapland, to enable me to see something of the methods of the Lapps, in addition to those of the Samoyeds, with whom I had been travelling. It was on this journey that I became acquainted with reindeer as draught animals, and also fell in with the hardy Russian ponies which did us such sovereign service in the Franz Josef Land expedition, and I should consider the trouble of that former journey amply repaid if meeting with these horses had been its only result. Horses can be used to very great advantage in arctic exploration, and I am more than satisfied with the results of my experiments with them. At Archangel I received a telegram to return immediately, as Mr. Alfred Harmsworth generously offered to provide the necessary and long-sought funds for my proposed expedition. I considered, however, that I was serving the interests of the expedition best by returning by the rather longer way, *viâ* the White sea and through Lapland.

The next five months were spent in hurried preparations. After my return to London, the *Windward* was bought and alterations effected. A log-hut was ordered and erected at Archangel, and furs purchased there for us by the energy and kindness of Mr. Henry Cooke, H.M.'s vice-consul. Sledges, ski, etc., and more furs were obtained for us in Norway by Mr. Alexander Nansen, the brother of the explorer, and Mr. Joseph Jeaffreson. Tinned foods of all kinds were selected with the help of Mr. Harkness, of Somerset House, and examined by me; but I

relied largely upon obtaining fresh meat in Franz Josef Land by shooting bears and walrus, as I consider fresh meat to be one of the greatest factors in procuring health. This expectation, I am glad to say, has been entirely fulfilled. With the help and advice of our medical man, Dr. Koettlitz, I am glad to be able to say that in three years not one of us had an hour's illness, and I never knew a single man knock off work on account of indisposition during that time. Through the help and advice of Dr. Koettlitz, all tinned meats used were carefully examined, either by him or myself, before being placed on the table, and anything in the least degree tainted was rejected, and placed on the roof to be out of the reach of the dogs. All water used for drink or in food was boiled, exercise was regularly taken daily, and, in addition to all this, we were always busy.

There is a popular impression that people in the arctic lead a life of hibernation, except when actually engaged in sledging; but such was certainly not the case with us, and I can safely say we were as busy, with scientific observations of all kinds, and work incidental to our life, as any men could be. It is to this I attribute our good health, and the happiness and cheerfulness of the party. I do not propose to dwell on our first two years in Franz Josef Land, as an account of the work done during these years has already been published in the *Geographical Journal* by Mr. Montefiore Brice.\*

We left the Thames on July 12, 1894, in the steam-yacht *Windward*, calling at Archangel for our hut and furs, meeting with great kindness from everybody, from the governor downwards. Then we proceeded east, skirting the northern shores of Kolguev island to Khabarova, a Samoyed settlement on the Yugor straits, to take on board some fresh reindeer meat and our thirty dogs, which had been procured and brought there by a German named Ravin from the Obb river in Western Siberia. We then steamed north through the Barents sea, making for Bell island, Franz Josef Land. We found the ice lying exceedingly close to the eastward; but by keeping along the edge of the tight pack we followed a wide lane of water trending north in the direction of Cape Grant. On August 25 we sighted land in the neighbourhood of Cape Grant, being about 40 miles distant, but there our lead of water came to an end. Nothing but a tight pack, without a streak of water in it, lay between us and the land. For a fortnight we dodged about, endeavouring to get round to the back of the pack, but without success. Winter was rapidly coming on, bay ice was forming upon the sea, and we were being drifted to the westward. Things looked anything but promising, owing to the lateness of the season. However, fortunately a south-westerly gale sprang up, which opened up the ice, and on September 7 let us through into the land-water.

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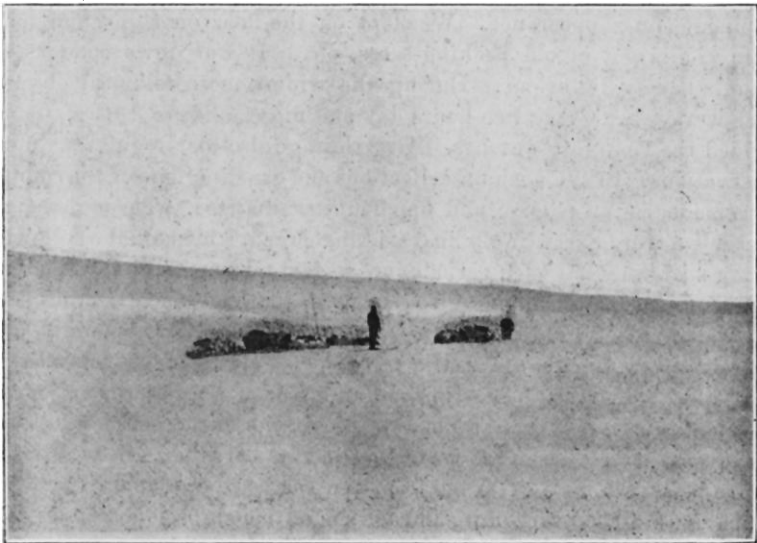
\* *Geographical Journal*, vol. vi. p. 499; vol. viii. p. 543.

Meteorological, zoological, and other observations had been taken throughout the voyage. Eira harbour we found full of ice, so we steamed up Miers' channel, and looked for a suitable spot for putting up the hut and passing the winter. We here discovered a small island, a mile in length and half a mile in breadth, separated by half a mile of water from Bruce island, and consisting chiefly of weathered basaltic rocks. This I named Windward island—after our ship. Finding no suitable spot in this direction, we then steamed past the floe-edge to Cape Barents, which proved equally inhospitable. Here the rock consists mainly of columnar basalt. Collections of everything of scientific interest and observations of all kinds were made, and taken whenever possible; and our botanist, Mr. Harry Fisher, first found the curious vegetable life the alga, popularly called "red snow."

At this point I will endeavour to describe to you the general appearance of Franz Josef land. The mass of islands of which it is comprised consists of high glacier-land, rising to 2000 feet, covered with an ice-cap some hundreds of feet in thickness, and fronted along the shore by high perpendicular glacier faces, from 30 to 80 feet in height. At rare intervals high black basaltic rocks jut out of the ice near the shore, forming the only conspicuous landmarks. In front of these rocks the broken-down *débris* from the cliffs has formed a plateau or shore, upon which a certain amount of stunted arctic vegetation exists. Here may be found a few poppies, saxifrages, mosses, lichens, etc. Nothing grows higher than 6 inches from the ground. Everywhere else, with the exception of a few low islands, the ice-sheet dominates. Thick mists generally overhang this land; violent gales are frequent, combined with heavily falling and driving snow.

Finding no suitable site for our hut, we returned to Cape Flora, a high basaltic cape 1400 feet high, beneath which we pitched our camp, as being the most favourable spot we had yet seen, one of the strongest inducements being the presence of a large loomery in the high rocks, and the known presence of bears and walruses throughout the year. On September 8, after selecting as favourable a position as possible for the ship, we set to work to get our stores, etc., ashore, all hands working sixteen hours on and eight hours off, as I was anxious, if possible, to get the ship away again that autumn. The winter, however, came on with great rapidity, and three days afterwards the *Windward* was effectually frozen in for the winter. She was lying well out of reach of the driving pack, moving to the east with the flood-tide, and the west with the ebb. The current constantly moves in a westerly direction; the rise and fall off Cape Flora is about 17 inches, with a 3 to 4 knot flood-tide. She was also protected by two grounded bergs and an old floe to the eastward, together with a projecting rocky point. I did not, however, look upon her position as being too safe; but it was "Hobson's choice."

We at once set to work to shoot bears and walruses for the winter, to put up our log-hut—which I named “Elmwood”—and to make ourselves as comfortable as circumstances would allow. Our dogs, once landed, soon gave evidence that they had been on company behaviour when on board the ship. Carlo, a big retriever given me by Mrs. Harmsworth, opened the ball by killing one of the Ostiak dogs. He swaggered about among the pack, and exhibited all the supposed characteristics of the Britisher abroad. To check his homicidal, or rather canicidal, proclivities, I tied the dead dog round his neck. This, however, he evidently viewed as an excellent arrangement, especially devised for the arctic, where the food-supply is defective, and at once



WESTERN SIDE OF BRITISH CHANNEL. MARCH, 1897.

proceeded to make a cold lunch off his late adversary, looking up to me with grateful eyes, evidently thinking that it was very considerate of Jackson thus to provide him a larder right at hand. After this the dead dog was removed, and Carlo was always decorated with a muzzle. I afterwards made a good sledge-dog of him, but he could not stand the severe climate; and although the doctor made a blanket-coat for him, the poor old chap died sledging during the first fortnight in spite of it.

The rest of the pack were hardly less bellicose, but conducted their battles on lines hardly in accordance with civilized warfare. With the exception of two or three dogs, I always had the entire pack chained up, having taken out a large supply of English chains; but I found these quite inadequate to restrain these comparatively small dogs. One dog

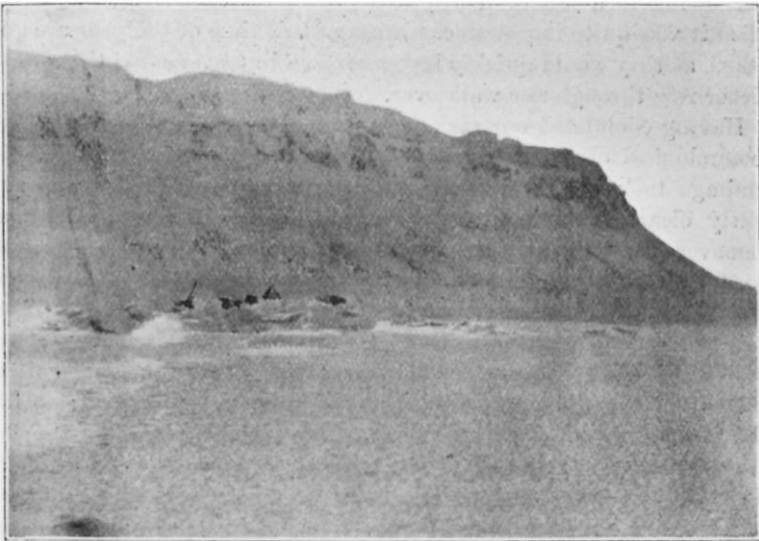
would break loose, and then commence a fight with another. The whole pack would become wildly excited, and one chain after another would snap, and all would then fall upon the losing combatant. The result would be another dead dog.

Our first anxiety, after putting up the house and getting the provisions ashore, was to obtain a sufficient quantity of fresh meat to keep ourselves and the crew of the *Windward* supplied throughout the winter. This we were fortunately able to do, and soon after the darkness closed in our larder was stocked with bears and walruses. Our hut was 20 feet long by 20 feet broad, 7 feet in height, double windows and roof, and consisted of pine logs a foot in diameter. Having some green baize with us, we used it for lining the walls, which gave the house an exceedingly snug appearance. We slept on the floor on skins, and made extra chairs out of old packing-cases, etc. It was quite comfortable, though hardly luxurious. During the winter meteorological observations were taken every two hours day and night, and for this reason we divided the time into watches. Mr. Armitage also took regular magnetic observations. In the autumn collections and examinations of the country were made, so far as time and opportunity admitted. Throughout the winter we were exceedingly busy making preparations for the following spring sledging, and with various jobs incidental to our life in the arctic, such as feeding and attending to the horses and dogs, and skinning bears and walruses, washing our clothes, and domestic duties generally. On the return of the sun, about the middle of February, we got ready to start, and on March 9 Mr. Armitage and I took a preliminary journey with the object of making a depôt of provisions to the north, and ascertaining the character of the travelling in that direction. Soon after our return, a severe gale of wind from the eastward broke up the ice in which the ship was frozen in, and for some time she was in considerable peril. This and other circumstances somewhat delayed our second departure. In the beginning of April, however, we started on our first march with three ponies and a number of sledges, being accompanied for the first week by Dr. Koettlitz and young Hayward, with one pony and sledges. But for details of this and subsequent journeys in 1895, I must again refer to the *Journal* of 1895, vol. vii. p. 499 *et seq.*

Returning from our summer journey, we reached Cape Flora on August 12, after being away thirty-three days, just in the nick of time, as on the following day the sea had become so full of ice that it would have been exceedingly difficult, if not impossible, to take the boat from Bell island. Observations for latitude and longitude were taken on all spots landed upon, and geological, botanical, and other collections and examinations were made. Meteorological observations were also taken throughout the journey, the heights of the various capes determined, and Cambridge bay and a little new country to the west were mapped in. As soon as we returned, we devoted our attention to getting ready for the

winter. I shot nearly 1300 looms, which we hung up round the house, and which remained frozen for the next nine months. A quantity of scurvy-grass was collected, which was placed in a berg, and also frozen, thus providing us with fresh salad twice, and sometimes three times, a week throughout the winter. The winter was passed comfortably and happily. We were busy the whole time with meteorological and other observations, which were taken every two hours day and night, in working out our bearings, etc., mapping and plotting out the map, and making preparations for the spring sledging.

Early in the following March (1896), Armitage, Blonkvist, and I again got under way, taking a team of dogs and one pony, for the latter



CAPE WILLIAM BRUCE AND CAMP. MARCH, 1897.

of which we had made snow-boots, which I found exceedingly satisfactory, keeping her from sinking into the snow. We pushed north through what I decided to name the British channel, correcting and adding to our map of the previous year, and mapping in Koettlitz island. I must again refer, for the details of this year's work, to the *Geographical Journal*, vol. viii. p. 543 *et seq.* For the first week, I may say, we advanced at a good rate of speed, and we—that is, Blonkvist, Armitage, and I—were all jubilant at the prospect of reaching a high latitude. Our hopes, however, were short-lived, for on the morning of April 6, after moving half a mile from camp in dense mist and snow, we were suddenly confronted with a large open sea of water, with nothing but exceedingly thin bay ice upon it. To endeavour to get round this we edged away to



the south-east, and when the sky cleared on the following morning we found ourselves encamped close to Cape Richthofen, in Alec Tweedie bay. This cape Mr. Armitage and I ascended. Again no Richthofen peak was visible in any direction, or anything approaching to the dignity of a mountain. Open sea lay before us, reaching from the high glacier-face below us to the western side of the British channel, where the water washed the ice precipices on that side. No ice could be seen except one solitary floating berg, the pack-ice having been driven off shore and clean out of sight by south-west winds. This endorsed my previous opinion that no land of any size lay to the north-west, and quite put out of my mind that King Oscar Land would be of any service as a means of getting north. A portion of this open sea near the land a few weeks later, owing to a fall of temperature, became frozen over, but at this period it was quite impassable. Boats at this time of the year are quite useless, as they would quickly become frozen in amongst ice that one can neither row through nor walk over.

Having completed our task, we returned to the hut on Cape Flora. Meteorological observations were taken throughout the journey. Mr. Armitage took observations for position whenever the sky was sufficiently clear. Botanical, geological, and other collections were made whenever possible, and a considerable amount more coast-line was added to the maps. Franz Josef Land being chiefly basaltic, local attraction of the magnet was often considerable. The country in the neighbourhood of Markham, Vesey Hamilton, and Allan Young sounds consists of high basaltic cliffs, with high country behind entirely covered with ice. Scott Keltie island is quite devoid of ice; so likewise is a portion of Koetlitz island. Here and there, where the land is low and out of the sweep of the glaciers, the country is bare of ice; but, with the exception of these isolated spots, the whole country is glaciated, and a more arctic-looking country it is impossible to imagine. The western side of the British channel is one large glacier, and from Cape Forbes, Nightingale sound, to Cape John Murray, not even an isolated rock can be seen.

On our return to Cape Flora, we set to work to sledge driftwood from Cape Gertrude, 4 miles distant, most of which was very old, and had probably lain there some thousands of years, to judge by its position above sea-level. Our coal was running short, we only had a little dust remaining; so the driftwood mixed with blubber did good service for the stove.

Throughout the following autumn and winter we were always busy with our scientific work, preparing for the spring journeys and other tasks incidental to our life in the arctic. Tents were made, a canvas canoe, pony snow-boots, and so on.

In March, 1897, Armitage and I started with a team of thirteen dogs, the remnants of our pack, and our surviving pony. Our draught-

power had become reduced to a low ebb, and we greatly regretted we had not more dogs or ponies at our disposal. We pushed north up the British channel to go round the western land, to determine its limits, and, if possible, to settle the Gillis Land question. At an early stage in our journey our difficulties began. The pony broke loose the second night out, and, unfortunately, gorged herself with dried vegetables. These, together with dog-biscuits and a few pounds of oats saved from the previous sledging, were her usual fodder, owing to the lack of legitimate horse-food, which had quite run out more than twelve months before. As I expected, the surfeit of dried vegetables brought on a serious illness, to remedy which Armitage and I clubbed together the small supply of pills which we had with us. He produced, I think,



CAPE CECIL HARMSWORTH (AFTER LOSS OF PROVISIONS). MAY, 1897.

two varieties of pills, and I had a number of podophyllin; so we made up a dose of twenty-two in all, which I administered to our invalid pony, mixed up in some frozen fat from our frying-pan. This, I am glad to say, had the desired effect of, at all events, partly restoring her to health; and if I could have fed her upon oats or any legitimate horse-food, she would, I think, be alive now. The weather from the very outset was remarkably bad. Gales of wind, dense mist, and driving snow were almost constant. The floes were very heavy with deep snow, which, together with crushed-up, trappy ice, made travelling bad. Even at this early stage of the journey we had to go three times over the ground. Our pony, poor animal, owing to her illness, went very badly, and frequently lay down in the snow and refused to move. Armitage and

I would then take on separate loads with the dogs, and return for the others. During a very clear interval we found that Peterhead curves round further west than I had previously supposed. Nothing but glacier-face lined the coast, and the ice flowed down in curving lines as far as the eye could reach. Not even a bare stone was visible.

On the march we rounded Cape John Murray, which is about 300 feet in height, in a fresh gale. This I ascended, and found strewn with boulders, indicative of a raised beach. On that day we used sails on our sledges; it was the only day throughout the journey that we got a wind in our favour. On March 27 a new fjord appeared in view, with high basaltic rock, chiefly consisting of columnar basalt, jutting out of the glaciated land at its southern entrance. This I named St. Chad's Head. The cape appeared to consist of nothing but basalt. It is 400 feet high. I carefully searched, so far as the time of year would allow, for anything of botanical, geological, or other interest; but only found a few mosses and lichens, and a single saxifrage. Leaving Mr. Armitage to form a camp, I went off on my ski and took bearings from the summit and a number of photographs. At the western end of the bay the water appeared to run out, which observation was further strengthened by a view which we got some days later on the northern side, thus making an island of the land to the north, which I named after Albert Armitage, our astronomical observer. We then pushed on to a bold headland, which I named Cape William Bruce, after our zoologist. Capes Richthofen, Albert Markham, and Fisher were visible in the distance, and Cape McClintock dimly so. The position of Capes Richthofen and Fisher, being fixed astronomically by us previously, were of great help to me in mapping out this western coast-line, as they gave exceedingly good cross-bearings.

On March 28 we rounded Cape William Bruce, which also consists of basalt, some of which is columnar, and is 500 feet high. I ascended this cape while Mr. Armitage struck the camp, taking my camera, prismatic compass and stand, and other instruments with me. On the summit I took a round of angles and a number of photographs. I also made a cairn of stones, placing among the rocks a tin containing a record, a Union Jack, and a penny-piece, and on the top of the cairn another "Jack" on a bamboo staff. From the summit I could see plainly Mary Elizabeth island, Cape McClintock, and the surrounding coast. To the north I could make out two islands and a portion of a third, which appeared to be entirely ice-clad. To the west-south-west the land was very ill defined, which I found later was due to the exceeding lowness of the northern coast. It was, moreover, misty in that direction, and thus obliterated any definite view. To the north-west I could see the flocs in a broken-up condition, with large pools of open water.

When detained by bad weather off Cape William Bruce, our second dog died, being simply frozen to death. I had examined them all an

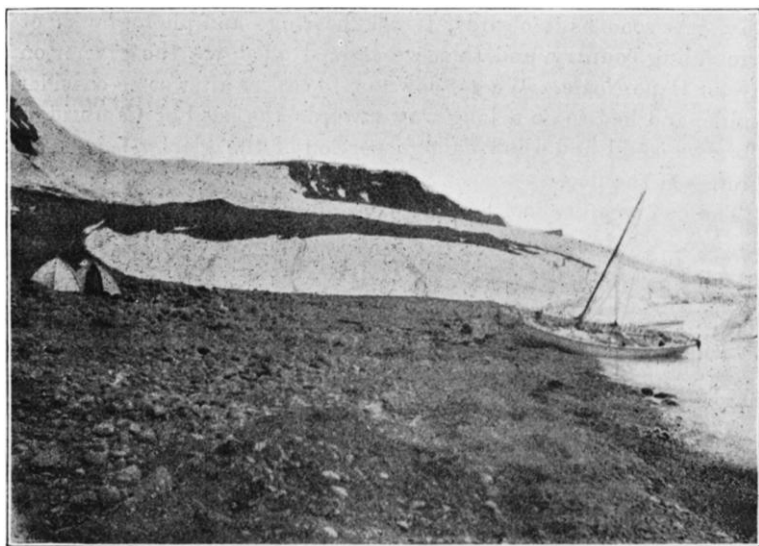
hour or two previously, and they appeared to be all right. A little later I found one dog frozen as hard as a rock, and another one frozen down, which I had to hack out of the ice to get free. The weather became, if possible, worse than ever. Gales of wind and driving snow gave us no rest, with dense mist and temperatures as low as minus 46°. I saw a few rotges and dovekeys flying about these rocks; collected a few mosses and lichens and one saxifrage, and in the tide-crack a piece of laminaria. The isolated bare spots of this side of the British channel appear to be very barren, scantily supplied with vegetation, and bird and animal life deficient. Since leaving Elmwood we had only seen one track of a bear. After being detained three days by persistent gales, we marched towards the neck of low land connecting the two portions of Albert Armitage island, but, finding the travelling over this land less favourable than I had anticipated, we determined to retrace our steps a few miles, and go to the north of it by rounding Cape Battenberg. We continued our march along the north-western coast, which we soon found to be low, without the high basaltic rocks which are such a conspicuous feature on the southern coast. On April 7 we reached the head of what we soon discovered to be Cambridge bay. We had been travelling along low undulating ground, which bore evidences of being an old beach, and had driftwood upon it. At this point the severe weather had killed all our dogs but five, and these were in a weak condition. The following morning I went on ski on to the ice of Cambridge bay, and took bearings and photographs of conspicuous points. Cambridge bay, I believe, runs out at its north-east corner, although I could not absolutely see the ice right through the narrow straits, but there is little doubt in my mind that it does so. Armitage took here an observation for double altitudes; and after packing up we continued our march with the pony—which was very weak and went badly—and our five remaining dogs. We still continued our march along the low land, and on the 10th were confronted by open water coming right up to the glacier face, which at this point began again. This obliged us to take to the high glacier land, and on the following morning we commenced what was a very laborious task, that of dragging the sledges up the steep incline on to the glacier itself. This day we nearly lost our pony and two sledges. Suddenly, without warning or any indication on the surface to show its presence, the pony dropped all four legs into a crevasse, and lay suspended over a deep black abyss upon a bridge of snow. Fortunately, she was too frightened to struggle, otherwise both she and the sledges would have disappeared. But luckily she did not move a muscle. Armitage, seeing what had happened, at once came to my assistance, but unfortunately stepped off his ski to give me a hand, and at once dropped in above his hips. Fortunately, he got out while I was endeavouring to hold the pony up. We passed a line round her neck, and managed to extricate her from her

perilous position. She had hardly gone another hundred yards before she dropped both hind legs down a similar chasm. There was nothing whatever on the surface to indicate the treacherous character of the glacier we were travelling upon—not even a slight depression in the snow. When we pitched our camp for the night, I carefully sounded all round the immediate neighbourhood, to endeavour to ascertain the presence of crevasses.

The bad weather still pursued us, and kept us in camp for the next three days. This gave the finishing touch to our poor pony. On the evening of the second day, when in the tent, I heard her struggling to get upon her feet. I went out to render assistance, in which Mr. Armitage shortly afterwards joined me. We tried for an hour to get her upon her legs, but found her too weak to stand. I then knew it was all over with her. We tucked her up as comfortably as we could in her blanket-coat, and gave her the last handful of oats, kept for an emergency. This was the end of her. Next morning I found her quite dead, and frozen hard. We both of us felt very sad about it. The old pony had become a great pet with us, and at the hut we viewed her as quite one of the family. In addition to that, with her died more than half our draught-power.

When the weather had cleared, we set to work to pick out the most necessary articles for our journey, and discarded everything not absolutely essential. Three sledges were left behind, in addition to a quantity of our equipment. We then continued our march, struggling up the steep glacier-slopes; but soon found that we were obliged to go at least three times over the ground to get along at all, and that with considerable labour. I hauled in front of the dogs, and led the way. Armitage urged them on by shouting and yelling, and, whenever there was a check—which occurred every 5 or 10 yards—by hauling and tugging at the sledges to start the team again. We had at this period two canoes, in addition to our tent, other equipment, and food, and with only five dogs it was not easy to get along at all. The mists now became exceedingly dense, so much so that I do not exaggerate when I say that on many occasions we could not see beyond the points of our ski with anything approaching distinctness. The frost-rime was also exceedingly troublesome. It coated our equipments and clothes with ice, and every morning before we broke up camp we had to remove ice 3 to 4 inches in thickness from our belongings. Our furs, too, and clothes got wet from the great fluctuations in temperature. When sitting in our tent with furs on, all this ice turned to water, and as soon as we went outside, our clothes became as stiff as sheets of iron. Occasionally we would get exceedingly clear intervals of an hour or two, and from an altitude of 1450 feet I could see no land whatever off the coast. Gillis Land, I was convinced, does not exist anywhere near the position assigned to it on the charts.

We would march for half a day, or possibly one day; then would come a driving gale and dense snow from the south-east, which would no sooner cease than back the wind would come from the north-west. This would go on for three, or even four, days at a time, when we would start again, and after another similar interval of fine weather the dose would be repeated. On the 19th we endeavoured to reach the sea-ice, being utterly tired of the charming conditions we found at the high altitude of the glacier. I ran down on ski to the head of Nordenskjöld bay, having crossed behind Cape Mary Harmsworth, which we found to be the most westerly point of Franz Josef Land. I, however, found that the sea-ice was in a broken-up condition, so we had to con-



CAPE CROWTHER: CAMP AND BOAT. JULY, 1897.

tinue our march over the top of Cape Lofley, when I again went forward to reconnoitre. We fortunately found a certain amount of fast ice at the head of Weyprecht bay, and that night we camped at the edge of the glacier-face, heartily glad to be off that horrible glacier country. The next two days were occupied in crossing this bay, the ice of which was in an exceedingly tumbled-up condition. We soon found, however, that it was impossible to round Cape Ludlow, owing to the broken-up state of the ice right up to the glacier-face. There was nothing for it but to strike up Weyprecht bay, and take to the glacier again. This we did by hauling our sledges by purchase up the perpendicular glacier-face, aided by a snowdrift. Here again bad weather promptly checked us. For three days we were camped on the top of Cape Ludlow, and here we got the first bear that we had seen since we

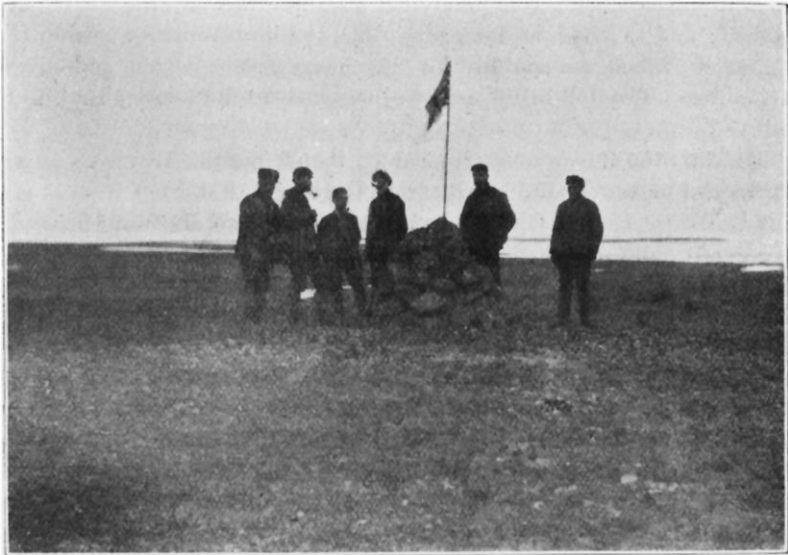
left the hut six weeks before. The blubber came in very handy in a fat-lamp which I made out of a tin for cooking purposes. We were glad of the kill in many respects, for we were uncomfortably short of many things. Our spirit, which we used as fuel, was almost exhausted; and the meat itself was a great addition to our larder. The dogs, too, were all the better for the feast they now enjoyed. We continued our climb up the glacier, and after travelling for a day we were again stopped by a gale of wind which blew to the strength of a whole gale, cutting the snow off the cloth of the tent, and blowing up one side of it, and so filling the tent with snow. We had to put up with this unpleasant condition of things the greater part of one day, as we could not open the tent to go outside and make it fast, lest it should be blown away. As soon as it cleared, I took bearings and photographs of the surrounding country, and then we started off down the glacier on our way for Cape Neale. We got down on to sea-ice after some considerable trouble, and had to go a long way towards the head of Cambridge bay before we could find a low-enough portion of the glacier-face to enable us to reach the floe.

The bad weather had been so exceedingly persistent that I found it was necessary to utilize every fine moment accorded us, and on many occasions we marched for twenty-four hours at a stretch, and on one or two occasions literally from the time one gale ceased until another one began. In Cambridge bay and all round Capes Neale and Crowther, we met with the roughest and most crushed-up ice that I had ever seen anywhere. Taking on single sledges and retracing our steps was the constant order of the day. We left behind one of the canoes in Weyprecht bay, as we found it quite impossible to get along with it, and we had to trust to not requiring it.

Upon Cape Neale, in 1895, we had placed no less than four cairns with records, but we found, on visiting them again, that the bears had broken off all the flags that had flown above them. We left another record, and a "Jack" enclosed in a tin in a cairn on the shore, and then continued our journey. At Cape Crowther we were again detained for three days by bad weather, and then pushed across Gray bay. We again found ourselves cut off by open water on nearing Cape Grant, and it was not until we neared the head of Gray bay that we found even a possible drift to help us up the steep glacier-face of 50 feet. We hauled our sledges up by purchase with great difficulty, and again began our climb up the steep glacier behind Cape Grant. The following day we descended on to the ice at the head of Josephine Peary bay. Open water extended some distance into Nightingale sound. Upon Cape Stephen we stopped for a few minutes for lunch, and after a march of twenty-four hours reached Eira House, which Mr. Smith had erected upon Bell island in 1882. We arrived here at 11 a.m. on June 5. Four hours afterwards we were joined by Dr. Koettlitz and Messrs.

Bruce and Wilton, who, having become uneasy through our being ten days overdue, had started off to meet us with a sledge of provisions. We had succeeded in defining the extent of western Franz Josef Land, mapped in its shores, and had established the non-existence of Gillis land. Mr. Armitage had been most assiduous in taking regular meteorological observations throughout the journey, and had taken astronomical observations of position whenever the conditions were at all suitable. We were away for two months, but only got thirteen and a half tolerably fine days.

After staying for ten days at our hut to refit and break in two puppies and three small bitches for sledging (I was obliged to press



CAIRN ON SPIT OF CAPE MARY HARMSWORTH. AUGUST, 1897.

these very unsuitable animals into the service owing to the dearth of draught-animals), my intentions were to go east as far as Brady island and complete the odds and ends of unmapped coast in that direction. On nearing the high cape at the south-east corner of Hooker island, the ice became exceedingly thin; but, owing to the fact that it was, and had been, snowing heavily all day, the extremely treacherous nature of the ice was not clearly discernible. When within 400 yards of the shore, our sledge broke through the ice from stem to stern. I attempted to step off my ski to get a better purchase in hauling it out, but found that the ice was so thin that it would not bear my weight without them, and when trying to haul in my snowshoes the extra pressure so weighed down the ice that I had to desist. We had brought no canoe or boat,



as we had insufficient draught-power to haul it. Mr. Armitage and I managed to get a few things from the rear of the sledge by cutting open the sledge-bags; but the provisions, being in bags weighing from 50 to 70 lbs. apiece when dry, had now become exceedingly heavy, owing to the water in them. The sledge finally turned over, and all the provisions, with the exception of a handful put out for lunch, went to the bottom, and all our cartridges were soaked with water. I was still reluctant to be defeated at the last moment, and endeavoured, by approaching Hooker island further to the westward, to reach the glacier, and thus ascend Cape Cecil Harmsworth, and map in the surrounding country from there. We soon found, on approaching the shore, that rotten ice intervened and stopped us. Having no provisions, and the road to the east being completely cut off, there was nothing for it but to return; and to avoid, as far as possible, the inconvenience arising from shortness of food, we marched for  $25\frac{3}{4}$  hours at one stretch, and covered  $41\frac{1}{2}$  miles. The following day we marched 20 more miles back to the hut.

In July the *Windward* arrived, and I then found that it was impossible for any of us to remain longer, as Mr. Harmsworth did not wish to send out the ship again. On our way home, owing to the enterprise and good nature of Captain Brown, we were able to steam round Cape Mary Harmsworth, where, on the spit beyond the icy portion of the cape, we discovered a large breeding-place of the ivory gull, where literally they were nesting in hundreds upon the ground. We here made many collections of scientific importance, and then steamed 50 miles to the north-west of Cape Mary Harmsworth without seeing a sign of land. I also took photographs of the whole coast-line, including Cape Ludlow, Cape Lofley, and Cape Mary Harmsworth. I was anxious to endorse the opinion I had formed during the spring sledging of 1897 that Gillis Land does not exist, knowing how hard land dies supposed to have been once seen. However, in addition to no land being seen at our furthest point to the north-west, we obtained soundings in 223 fathoms. We then steamed through open water, with no land in sight, towards the easternmost of the Johannessen islands, passing within 10 miles of the supposed coast. We could still see no land; neither is there a chain of islands, as has been supposed in some quarters, reaching from Franz Josef Land to Spitsbergen. This, I think, will set at rest any doubt as to the superiority of Spitsbergen, when compared with Novaya Zemlya, as a line of retreat from Franz Josef Land to civilization.

We continued our voyage to London, passing to the east of Hope island and Bear island. There was exceedingly little ice in the sea, and nothing whatever to stop even the *Windward* passing through. Such an open year I had never before seen.

So far from viewing Franz Josef Land as a favourable route to the pole, my experiences now lead me to believe it to be one of the worst,

and although I have, in common with other arctic explorers, the greatest desire to stand upon that mathematical point, still I have no sympathy with an attempt to reach the pole as a mere athletic feat alone, but consider that geographical and other scientific work should always be included in the plan. Whatever our success may be, I will leave others to judge; but whatever success we have attained is entirely due to the hearty goodwill and devotion to duty of my companions. Mr. Armitage was our astronomical observer, and was also in charge of the meteorological observations. To him, also, is due the magnetic work. A better fellow in every way I could not have met with. Mr. Bruce was our zoologist, a work which, in that part of the world, is frequently carried on under circumstances the reverse of agreeable. It is no pleasant job to dabble in icy-cold water, with the thermometer some degrees below zero, or to plod in the summer through snow, slush, and mud many miles in search of animal life, as I have known Mr. Bruce frequently to do. Mr. Fisher, as you know well, is a most ardent botanist. To him are entirely due the satisfactory results in the botanical section. In many other ways, outside his special department, Mr. Fisher gave evidence of goodwill and energy. Dr. Koettlitz, in addition to being our medical man—to whom we owe the remarkable record of good health—was our geologist. In this, as in every other duty that Dr. Koettlitz had to perform, he was most untiring and conscientious. Mr. Wilton was our master of hounds. In this duty, as in every other, scientific or otherwise, he was most willing and hearty. Hayward undertook the arduous duties of cook at the hut, which office was anything but a sinecure. These gentlemen are present here to-night, and I have asked them each to say a few words with reference to their particular departments,\* which I have barely myself touched upon, as I consider that men who do good work should be allowed to speak for themselves and share any honour there is.

I trust you will excuse the sketchy outline of this paper, but it is quite impossible to give, in the short space of an hour and a half, anything like an accurate idea of the journeys extending over a space of more than three years.

Our immunity from scurvy I attribute to the use of fresh meat, and to the care with which all tinned provisions were examined before being used. With proper precautions, I consider that any intelligent body of men may keep in good health in the arctic—at all events, for a certain time. The thing most to be dreaded is the peculiar mental effect that total seclusion from mankind produces. Although we were all as jolly and happy a party as ever went to the arctic, still we were all aware of the effect that the long cutting-off from civilization produces.

I cannot close this paper without referring to the good advice and

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\* These are printed as an Appendix to the paper.

assistance rendered to the Expedition and myself, from what I may be forgiven for describing as the "Old Guard of the Arctic," who in times past have so gallantly upheld British prestige within the polar area. To Sir Clements Markham, Sir Erasmus Ommanney, Sir Leopold M'Clintock, Admiral Markham, Sir Allen Young, Sir Vesey Hamilton, Mr. Leigh Smith, and many others whom I could mention, but time will not admit, I am indebted for much kindness and help; to Dr. Neale, who was with Mr. Smith on two of his voyages, for valuable assistance he has given me in many ways. I do not intend this as a list of acknowledgments, for I hope to be able to thank many others at no distant date.

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The PRESIDENT: It now only remains for us to express our admiration of the way in which this expedition has been conducted, and more especially of the journey that was made by Mr. Jackson and Mr. Armitage in the present year. I think, and I believe that Sir Leopold M'Clintock and Sir George Nares will agree with me, that the journey round the western island of the Franz Josef group is amongst the most important that have been made in recent times. I do not exactly remember the greatest distance that Mr. Jackson walked; I think 41 miles in one day, and 20 in another. I recollect few marches of the kind in other arctic expeditions, although it is true that Jackson had not a very heavy weight to drag with him. I am sure you will carry with acclamation a vote of thanks to all connected with this expedition. I desire first to mention the name of Mr. Harmsworth. In the reign of Queen Elizabeth, when we had such long lists of men who did admirable work for their country, those who stood in the front rank of patriots were the men who sent out the arctic and other expeditions, like Sir Thomas Smith, the first chairman of the East India Co.; like Sanderson; like Sir Dudley Digges; and like Sir Felix Booth, who enabled the Rosses to discover Boothia. Mr. Harmsworth is a worthy successor of these patriotic merchant princes, and to him, first of all, our thanks are due. I must also mention the name of Mr. Montefiore Brice, who did such hard work in equipping and organizing the expedition; but above all our thanks are due to the gallant explorers. I now ask you to pass with acclamation this vote of thanks to Mr. Jackson and his companions, and also to Mr. Jackson himself, for the trouble he has taken in preparing his interesting paper, and showing us the series of views on the screen.

I beg to convey the thanks of the meeting to you, Mr. Jackson, and to your companions, the members of the expedition.

#### APPENDIX TO MR. JACKSON'S PAPER.

##### METEOROLOGICAL, MAGNETIC, AND ASTRONOMICAL OBSERVATIONS.

By Lieut. ARMITAGE.

OF course the results of the meteorological and magnetic observations have not yet been worked out by experts in those sciences, and I will confine myself to our practical work. During the whole of our stay in the north, we took four-hourly meteorological observations from 8 a.m. to 8 p.m., with the exception of the first two winters, when we made continuous two-hourly observations, which consisted of barometer, thermometer, and anemometer readings; observations of clouds,

snowfall, the general appearance of the weather, and any phenomena that might occur. For the last year, at Mr. Bruce's suggestion, so long as the sun was above the horizon, he and I made observations of the rainband every day at noon, and generally found it conspicuous by its absence.

The movements of the ice, the opening and closing up of streams of water, their direction, and the extent of open water were also noted in the meteorological record. The prevalent winds were from an easterly direction, generally east by south, and east-south-east.

On only one occasion did we have more than light airs or winds from the south-west at our level at Elmwood, and that was in the summer of 1896, although I have frequently heard the wind from that direction blowing strongly among the cliffs 700 to 900 feet above us. Gales were unpleasantly frequent from every other direction, especially during the late autumn and winter months. On several occasions, after four or eight hours of light south-westerly airs, we would experience a furious blow from the north and north-east, as though the powers that be at the pole were determined that no intruder should invade their dominions. During our sledge journey, in the spring of this year, we experienced gales from the south-west on two occasions, while at Elmwood, some 40 miles south of us, they had calms and light airs.

On comparing some of my observations with those of Dr. Nansen, taken at his winter quarters 80 miles north of us, I found that he had often similar weather to us. We never had such low temperatures as many other expeditions; but with us wind was no respecter of cold, and it was not very uncommon to have a gale when the thermometer showed over 70° of frost. The temperatures were most erratic, and although the mean temperatures were, with one or two exceptions, fairly regular for the same months in different years, we have had differences of 60° in forty-eight hours. Our highest registered temperature was +43° Fahr., the lowest -54° Fahr.

I made a point, during the winter months, of noting down observations of the aurora borealis at the same time as I made my weather observations. From what I had read and heard of the brilliant northern lights, I must confess that, on the whole, I was disappointed by their display at Elmwood. As a general rule, the aurora consisted of faint straw-coloured bands or arches of light, stretching from the east through various altitudes to, or nearly to, the western horizon, often with streamers rising from them towards the zenith. Of course, on some occasions we had exceedingly brilliant displays, with a corona in the zenith, from which long streamers of many hues radiated, circling round the heavens, first in one direction and then in the other, gradually disappearing, and again approaching us, forming into many different fantastic shapes, until the eye was dazzled and the brain bewildered by what the poor Esquimaux may well have thought to be the shades of the departed. The most brilliant auroras occurred during calms or gales of wind. I have often listened intently to distinguish some sound from the aurora, but have never been able to do so, though on a very calm night the movements of the ice, the slightest sound being so audible, would lead one to believe that there was some. I have seen the aurora apparently so close as to be between the cliffs at the back of the house and myself, and have occasionally seen it bright enough to cast a shadow, and to eclipse stars below the third magnitude. On the latter occasions it also appeared very dense. It has also appeared to struggle up against a gale of wind, and be driven back to that point of the horizon from which it ascended, although at other times it has quickly covered the heavens, rising against a furious gale.

I made my magnetic observations in a wooden structure which had been

specially built before our departure from England. It was warmed with lamps before I commenced work in it, for I found that the condensation of my breath on the instruments seriously interfered with the observations. The observations with the dip-circle for inclination were fairly regular and steady; but when observing for the horizontal force and declination, the needle was often most erratic in its motions—so much so, that I have sometimes had to discontinue the observation. This most frequently occurred when there was much display of aurora, and has, on occasion, been succeeded by a violent gale of wind. With regard to my observations for position, I will only say that, in my opinion, a small theodolite is most necessary for travelling in those latitudes, and that all instruments should be specially fitted with a view to keeping the mouth and nose as far away from them as possible.

I cannot speak too warmly about the very enthusiastic assistance, often at inconvenience to themselves, given me by my comrades whenever I required it, and also of the pluck and perseverance of my leader. I wish to express my admiration of the way in which Mr. Leigh-Smith has laid down the positions of those parts of southern Franz Josef Land which he visited. Before I sit down I feel that I must pay homage to the many gallant men who have striven in the polar regions before us; to those of all the nations who have helped to make the world known to us as an open book; and more especially to those heroes of our own country who have made us proud of the name of Briton, and to him with whom we claim a common descent from the Norsemen. I would also give my heartiest thanks to Sir Clements Markham and his colleagues in the Royal Geographical Society, for their great kindness and encouragement to a young and unknown man like myself. It is such encouragement which makes us endeavour, no matter how difficult the circumstances which we may work under, to deserve success.

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#### BRIEF SKETCH OF THE GEOLOGY.

By Dr. REGINALD KOETTLITZ.

WHEN news first reached the world that a new land had been discovered in the arctic regions to the northward of Novaya Zemlya and Spitsbergen, this land was described by its discoverers, Payer and Weyprecht, as being of large if not continental proportions. Julius Payer judged this to be the case for two reasons: firstly, because all the land he could see—and he had extensive views from the heights he ascended to—had every appearance of being, in his judgment, of great size; and, secondly, because of the large size of the icebergs he thought he saw and described, that these bergs could only be shed by glaciers coming off an extensive tract of land. It will be remembered he compared them, both in size and shape, to the antarctic bergs seen and described by voyageurs to the south.

Mr. Leigh Smith was the next to visit this land, and if he does not agree with these conclusions of Payer, he at least does not disagree with them in anything published by or through him.

It is on account of these supposed proportions of this newly discovered land that Payer goes so far as to recommend it as a likely route polewards, for he presumed that the land stretched for an indefinite extent in that direction.

Upon these reports as a foundation, this route towards the pole was also recommended by several arctic authorities, and it was for the same reason that Mr. Jackson planned his expedition to Franz Josef Land. You can, therefore, judge of his dismay when we found, on the first journey northward, that this report of Payer's

had no foundation in fact, and upon that and subsequent sledging expeditions saw that this land was nothing more than a broken-up mass of land forming a group of islands; so that we may say that the discoveries of Dr. Nansen, taken in conjunction with those of our expedition, conclusively prove that this supposed continental land is merely an archipelago of small islands, not extending far north.

Again, in the course of, I think I may say, a continued series of observations, such as no men have ever had the opportunity of making here before, we never, also in the remotest sense, ever saw anything like the large-sized icebergs described by Payer so graphically as being of such great proportions.

We can, therefore, now say that Franz Josef Land is formed of the fragments of an old tableland which was once of fairly large size, and which was no doubt connected with other lands from which it is now separated by considerable tracts covered by the sea.

The earliest geological history of this land, which we learn by what can be read in the rocks, is that, at least in the more southern part, it formed part of the shore of a land which has now disappeared, and that the time when such was the case was the Lower Oxfordian of the Jurassic period, for sandstones and shales containing plant remains, beds of lignite, and other evidences of littoral and estuarine conditions are among the lowest of the beds of stratified rock which I found there. Evidence of oscillations of level now show themselves, for such beds as those described are succeeded by those of purely marine origin, the age of which can be plainly stated, because ammonites so well known and so limited in zone as *Ammonites Macrocephalus* and *A. Modiolaris* were found in them.

I cannot do better than here quote what Messrs. Newton and Teall, who have so ably examined and reported upon the geological specimens I sent home last year, say upon this point, in a paper read before the Geological Society on June 23 last, and to be published shortly in the *Geological Journal*, and that is: "Owing mainly to the brilliant researches of Neumayer, it is now generally recognized that the Jurassic sea reached its greatest extension in the present land areas during the Callovian and Oxfordian periods. Hydrocratic and geocratic movements alternated during Jurassic times, with a decided balance in favour of the former, and a recession of the coast-line towards the north. Even in the north of Scotland we find no decided evidence of the proximity of land during the Oxfordian period, although the lower portions of the Jurassic formation are represented by littoral and estuarine deposits.

"Under these circumstances, the discovery of *Macrocephalus* beds in Franz Josef Land, in association with plant-bearing strata, is of special interest. It extends the range of this ammonite several degrees towards the north, and shows, in all probability, that during the period of its existence a coast-line lay somewhere in this direction. Marine deposits of Callovian and Oxfordian age are now known to range from Sutherland to Cutch, and from Franz Josef Land to the north of Africa, and *Ammonites Macrocephalus* is one of the most widely distributed of all Jurassic ammonites."

The oscillations of level above mentioned are shown by the extraordinary number of different-coloured thin strata of clay, shale, and sand, which latter is often false-bedded, and frequently has many rounded water-worn pebbles of all kinds embedded among it. Other ammonites, as well as belemnites, pecten, and avicula remains were also interspersed among these marine strata, which were found in places to continue in an unbroken series for quite 500 feet above sea-level.

Now succeeds a rock through which the distinctive character of Franz Josef Land is formed—that is, the plateau or tableland formation, which so strikes the observer, namely the basalt or dolerite, which forms its principal feature, and which largely,

through the rocks *in situ* and the *débris* falling from it, masks and covers over as well as preserves the stratified rock underneath it. Mr. J. J. H. Teall, of the Geological Survey, has made a most exhaustive microscopical and chemical examination of the specimens sent home last year, for details of which I would refer any one interested to the next published number of the *Geological Journal*. I will, however, quote his conclusion, in which he says:—

“It is evident, therefore, that the basalts of Cape Flora and Hooker island are similar to types widely distributed in the Brito-arctic volcanic province. They differ from the more common holocrystalline opitic dolerites in containing a small quantity of interstitial matter. The general result of this examination is to confirm the conclusions of Payer, Etheridge, and others, that Franz Josef Land belongs geologically to an extensive region of plateau-basalts, including such widely separated localities as Jan Mayen, Iceland, Greenland, the Faroe islands, the west of Scotland, and the north of Ireland.”

This basaltic rock formation is of considerable thickness, namely, from 500 to 600 feet or more in perpendicular height, and, when viewed carefully, can be seen to be composed of successive tiers to the number of seven or eight or more, between which tiers one can frequently find thin layers, or strata, of clay, sand, and sandstone, generally from 1, 2, to 4 feet in thickness, similar in every respect to those one finds underneath. In one of these strata, between the second and third tier of basalt, and quite 100 or more feet above the lower edge of the basalt formation where it is in contact with the main stratified rocks below, I found more of the plant fossils which Dr. Nansen speaks about in his book as having been found on a nunatak protruding from the glacier to the north-west of Elmwood, and which he sent to Dr. Nathorst, who considers them of Upper Jurassic age. This stratum was a continuation of the bed on the nunatak, which I had also found and shown Dr. Nansen, and I afterwards found and traced it for several hundred yards on about the same level as the nunatak bed, and quite a mile away, proving to my judgment conclusively that the bed on the nunatak, which Dr. Nansen and I were doubtful as to whether it had been moved from its bed by the lava-flow, had not been, but was *in situ*, and was part of this stratum, which was 2 feet in depth, and undisturbed. This fact, together with other considerations, which I will detail shortly, have an important bearing upon the probable age of these basaltic lava-flows, and also upon the question as to whether they are intrusive sills or not. Mr. Teall, I know, leans to the opinion that the basalt of Franz Josef Land is of Tertiary date, in the same way as similar formations in Scotland, Ireland, and other places, and that the apparent interstratification is due to intrusive sills. I must say, however, after considering the points he has raised, that the balance of evidence is unquestionably in favour of Jurassic date. My reasons briefly are: (1) that the strata which I saw between the tiers of basaltic rocks are so thin and level, and show so little evidence of displacement by lava having been intruded between them; (2) we cannot see that heat has materially altered these strata; (3) upon or among the middle tiers of basalt I have found fair-sized and intact branches of wood, which have undoubtedly been charred into charcoal, which is almost as light as though recently burnt, and which must have been growing in the sedimentary rock, among which I found it, upon the upper surface of the first or lowest tier of basalt, and been charred by being overwhelmed in a surface-flowing mass of lava; and (4) because, unlike what is usually found among intrusive sills, this basalt is vesicular or amygdaloidal on the upper and lower borders of a tier, at which position it is generally more compact in intrusive sills, and thus agrees more with the conditions of a surface-flow.

It is upon these grounds that I base my belief in thinking the date of some, at least, of these basalt-flows to have been in Jurassic times.

If the above is correct, then there is no evidence of any rock *in situ* being of later times, and therefore any strata that may have been laid down after this has disappeared through denudation, or is lying under the perpetual ice-sheet that covers these islands.

At this time, therefore, if I am correct, this land was above sea-level; trees and plants were growing upon it; the climate was very different to what it is now, for verdure, and that luxuriant, clothed the surface, much of which was also woody. In fact, we can see that, judging by the species and genera of plants which have been recognized, the climate was a cool, mild, and genial one. It was at the same time connected, in all probability, with other lands—most likely, judging by the similarity of the basalts, with Spitsbergen, Scotland, Ireland, the Faroe islands, Iceland, Jan Mayen, and Greenland. There is also evidence, it appears to me, judging by the fossils found—both plant and animal—of the land having been once or more connected with Northern Europe and Siberia.

The results, which may be obtained when the examination of the specimens which I brought home this year is completed, I cannot of course give you at present, but what I have here given you are in brief a few of the facts which, up to the present, we are in possession of.

#### FLORA OF FRANZ JOSEF ARCHIPELAGO.

By HARRY FISHER.

IN the *Geographical Journal* for December, 1896, pp. 560–563, I made some remarks on the above. Since the publication of that account I have had opportunities of studying this flora, and of comparing the results with those of almost every other known arctic region. A full account will shortly be presented to the Linnean Society. Mr. Armitage has told you that south-westerly winds are almost unknown in Franz Josef Land. I believe this will account, to some extent, for the flora being more scanty and stunted on the whole than that of almost all the other arctic regions. The summer temperatures are lower than elsewhere. There is no doubt that the presence of the Gulf Stream on the west and north-west coasts of Spitsbergen will account for the luxuriance of the flora up to Brandewjne bay, whereas the east coast of North-East Land resembles Franz Josef Land. The Gulf Stream, however, will not account for the comparative richness of the flora of Melville island, of Grinnell Land, and of Port Foulke, the last named being on the Greenland side of Smith sound; these are separated by channels of inconsiderable width from the mainland. To the north of Port Foulke is the great Humboldt glacier, which has been considered to form a barrier\* to the northward progress of the flora on the west side of Greenland. We know next to nothing of the plant-life on the lands to the north of Peary channel; but I expect an extension of the Grinnell Land flora will be found there, and probably an arctic Siberian type also. The most northern land in Asia, Cape Chelyuskin, has a smaller flora even than Franz Josef Archipelago (and most of the plants are as dwarf), notwithstanding that it is on the mainland of a vast continent. This can only be accounted for by supposing it to have been submerged until comparatively recent times; but the flora of arctic Siberia is generally poor in species.

See Sir J. D. Hooker's 'Outlines on Distribution,' etc.



There is one zoological fact of interest to the botanist. Young snowy owls visit Franz Josef Archipelago every summer; two of these handsome birds were killed on Cape Flora, and I found pellets and feathers of this species on all the capes which we visited. Several birds were seen, besides the two which we killed. Does not their presence indicate the existence of the lemming, and therefore the willow, in recent times?

It is difficult to understand why some of the plants maintain an existence under such unfavourable conditions as the present, unless they are, as they appear to be, dying-out remnants of a typical arctic flora. I am thinking of the starved colony of *Graphophorum Fisheri* Asa Gray (a grass), composed of about twenty lifeless-looking individuals on Mabel island, and not seen elsewhere; and also of *Stellaria longipes* and Goldie, which presents a similarly lifeless appearance. Of this two flowers only were seen; they were on Cape Neale. Even flower-buds were not found elsewhere. The bald-leaved *Cerastium* makes no attempt at flowering. A few other plants merely exist. Unless the conditions improve, most of these plants will disappear; not, as in warmer climes, to be replaced by others, I fear, there being already abundance of spare ground untenanted by any plant. It is very remarkable that I should have found seedlings of the poppy (*P. nudicaule* L.), the scurvy grass (*Cochlearia fenestrata* Br.), and *Draba leptopetala* Fr. This was quite unexpected, for I know of nothing of the kind from similar latitudes. The anthers and stigmas of the poppy, so far as I had time for observation, were ripe at the same time. There are no insects which are likely to have assisted in fertilization in this case; but, as regards the scurvy grass, my observations lead me to the conclusion that diptera may occasionally assist, but at the same time they are more certainly foes than friends, inasmuch as their larvæ feed ravenously on the floral organs of this species. Seedlings of the scurvy grass were found on Gully rocks and on Cape Flora, sparingly. Those of the poppy were seen in one place on the latter cape. Seedlings of the *Draba* were found on Cape Flora, but in such limited quantity that they only occupied half a square inch. I look upon this last rather as an accidental result. The case of the poppy is a little stronger, and *Cochlearia* (scurvy grass) probably increases to some extent by seed in most summers. All attempts at solving the problem of the derivation of this flora are purely theoretical. The depth of the sea between Novaya Zemlia, Spitsbergen, and Franz Josef Archipelago only throws a little light on the subject. Geology and ocean currents render little service; possibly the working out of the driftwoods may throw some light on this obscure subject.

A large number of specimens of driftwoods were collected, and have been entrusted to Prof. Carr, M.A., F.G.S., F.L.S., of the University College, Nottingham, for examination. Of all of these numerous microscopical sections have been made, which will be compared with similar sections of known woods from Siberia, arctic Europe, and North America (prepared from specimens kindly supplied by the director of Kew gardens, supplemented by some in the Fisher collection in Nottingham Natural History Museum from the Russian Empire, all of which are authenticated by Dr. Regel and Herder). These driftwoods are mainly coniferous, but a few are non-coniferous, and it is hoped that the exhaustive examination to which they will be subjected will prove their identity and probable place of origin. The labour of collecting and sledging these woods, many of which were huge trunks, was borne by Messrs. Jackson and Armitage and Dr. Koettlitz; some few were collected by Mr. Child and myself, my own task being a light one, consisting of cutting suitable pieces for examination and for specimens, etc., chiefly from the heaps which three of us made on Capes Gertrude and Flora. On Cape Mary Harmsworth Dr. Koettlitz collected woods, and Mr. E. Else brought a fine piece

also. These are now in Prof. Carr's hands. A fine section was made on ("Tween") Cook's rocks by Mr. Child; this is with the others.

There are certain plants in Franz Josef Archipelago which give a colour to the landscape, occurring as they do in patches or carpets up to an altitude of 500 feet. The poppy is the most showy, but several mosses rival this flower in brilliancy. I have previously mentioned in this *Journal* the bright colour of these plants, but I did not specify them. There are four species which I ought to particularize: *Splachnum Wormskiöldii* Hornem., brilliant green; *Aulacomnium turgidum* Schwgr., pale yellow-green; *Bryum obtusifolium* Lindb., red to crimson and purple; *Orthothecium chryseum* Lorenz, golden yellow. It is interesting to find that these mosses flourish in the neighbourhood of loomeries, and that in their absence they become quite scarce. This is particularly the case as regards *Splachnum*. "The *Splachnum* family are remarkable amongst mosses for the preference they exhibit for growing in bogs, on the droppings of animals such as sheep, cattle, or foxes, sometimes occurring also on the bones of dead animals."

I have submitted these characteristic mosses mentioned above to Mr. E. M. Holmes, the curator of the Pharmaceutical Society's Museum, who is well known as an accurate bryologist, and I am indebted to him for the names cited above. I have previously mentioned the lichens which give a colour to the rocks, boulders, etc.

May I here express my admiration of the botanical work of Englishmen in the polar American islands?—notably, Captain Sabine and his companions of the Parry Expedition in Melville island, Dr. Richardson, the naturalists of Nares' Expedition, and also Sutherland, Taylor, Markham, Scoresby, Walker, and others; and in the arctic regions of the eastern hemisphere one cannot fail to appreciate the grand work of the Scandinavian and Russian botanists. Such names as Fries, Cleve, Malmgren, Kiehlman, and others will always stand as authorities on arctic plants.

Dr. Nansen's botanical work on the ice-floes in the farthest north yet reached by man is not yet published, but I have had the pleasure of seeing his beautiful drawings of a most interesting microscopical flora. I look forward with deep interest to the publication of his scientific work. Dr. (now Sir Joseph) Hooker's work in, and writings on, the antarctic flora are a boon to the future student in that region. I trust the time is near when we shall have an appendix to the unique and renowned 'Flora Antarctica' of our illustrious botanist.

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#### THE ZOOLOGY OF THE EXPEDITION.

By W. S. BRUCE.

THE zoological collection promises to be very interesting, but at present it is difficult to say much, since the preliminary work of assorting is not yet complete, and that of identification not more than begun. Any list, therefore, is merely provisional. The collection chiefly consists of smaller vertebrate and invertebrate forms. Richest of all will perhaps be the micro-organisms, upon which a considerable time was spent all through the winter months, many specimens having been drawn from living or freshly mounted preparations.

Among Protozoa, the Infusoria are well represented. There are sponges and ctenophores, the latter including hydrozoa, scyphozoa, and ctenophora. Worms are rich in the number of species, and include sipunculids, rotifers, polyzoa, leeches, chaetopods, nematodes, etc. Sea-urchins and brittle stars were very plentiful, and the collection also includes several starfish, sea-cucumbers, and feather stars. The sea-cucumbers were mostly obtained from the stomachs of walruses, in which were also found the interesting worm known as *Priapulidus*, and various molluscs. Crustacea were

obtained in large numbers; insects are but poorly represented. There are no moths or butterflies. Five or six species of acarina and spiders were obtained; sea-spiders, or pycnogonida, are well represented. To this invertebrate list has to be added a considerable number of bivalves and gasteropods. Among vertebrates, sea-squirts, appendicularia, and probably four or five species of fish complete the series, apart from birds and mammals. Of birds, it may be stated there are at least three new species for Franz Josef Land. It is interesting to note that the only land mammalia are the bear and the fox.

The collection was mostly marine, and was obtained from all depths down to 234 fathoms; the greater proportion, however, consists of animals obtained near the shore at depths varying down to 18 and 26 fathoms. The interesting discovery of bones of walrus, cetaceans, and deer on the gigantic raised beaches will be dealt with by the geologist.

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## A VOLCANIC CRATER IN NORTHERN SOMALILAND.

By ALFRED E. PEASE, M.P.

ON February 5, 1897, after leaving Horoabduallah, we ascended the hills to the west of the Tug Sulul. These hills are not very dissimilar in conformation and appearance from those that border the Tug Milmil between Hagal and Gagab. Their sides are faced with jagged rocks and low cliffs, whilst on the tops you find amongst the bush large bare slabs or tables of rock, for the most part covered or sprinkled with loose stones—the rock for the most part is of a light yellowish to reddish buff, here and there in watercourses a deep grey. For about four hours after reaching the summit, we passed over a plateau, covered like the rest of the hills with scrub and the usual Somali vegetation (still rocky and stony). Then we descended (still travelling west) a ravine, which led us down to a narrow valley, perhaps a mile in width at this point. On leaving the eastern rocky hills, we continued nearly half a mile down a very gentle plane to a river-bed, which was walled in with basaltic-looking rocks, which were very black or dark red-brown, and which in places went down in steps of about 6 to 10 feet; the river-bed was paved with the same rocks in slabs and steps. The ground between the hills we had just left and the river-bed was very peculiar, the soil being powdery and of a different consistency to any we had passed over or met with subsequently; it was of a similar red tint to the ordinary soil, but dirtier and very heavy walking, and my wife complained of it and remarked on it. On this (the east) side of the river-bed, up to the crater from the river-bed, the bush was especially luxuriant, and several shrubs we seldom met with were common. The dirty powdery soil from A to the crater was practically devoid of vegetation; such as there was had a poor and sickly appearance. We returned on our tracks about 300 yards into the bush, and whilst hunting for a good shade for "tiffin camp" and awaiting our caravan, we discovered an old crater shut in and overhung on one side by the bush. It is very distinct. The mouth is to the eye perfectly circular, the diameter of the mouth not more

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# MAP OF FRANZ JOSEF LAND.

Showing  
**JOURNEYS AND DISCOVERIES**  
 of  
**FREDERICK G. JACKSON, F. R. G. S.**  
 Leader of  
**THE JACKSON - HARMSWORTH  
 POLAR EXPEDITION.**  
 1894 - 7.

Scale of Miles.  
 0 10 20 30 40 50  
 Natural Scale, 1 : 1000,000 or 15.78 Miles = 1 Inch.

1895    1896    1897  
*Author's routes in red.*  
*Heights in English feet*  
*White = glaciated land and fast ice.*

QUEEN

Albert Edward I

Ha

c. I

Albert Armitage I

C. Geo. Thom

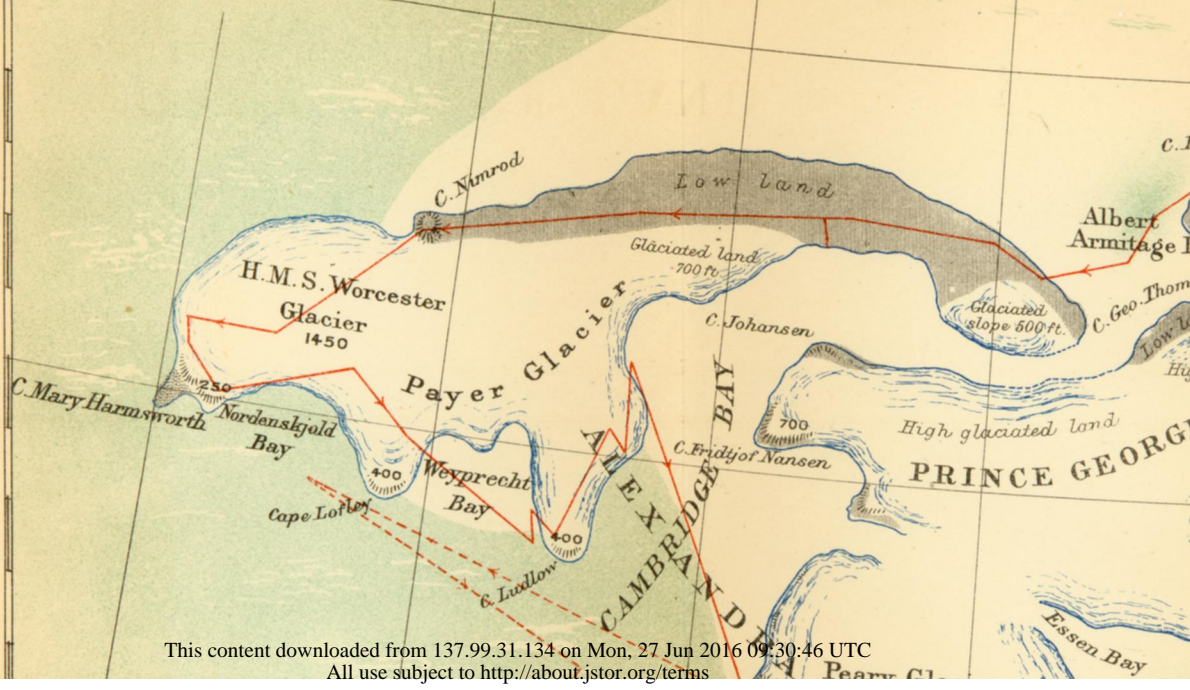
Low L

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PRINCE GEORGE

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Fearn Cl













THE JACKSON - HARMSWORTH  
POLAR EXPEDITION.  
1894 - 7.

Scale of Miles.

Natural Scale, 1:1000,000 or 15.78 Miles = 1 Inch.

1895 ----- 1896 ----- 1897

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