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IN SEARCH OF AN ARCTIC CONTINENT.*

By A. H. HARRISON.

IN starting on this expedition into the Arctic ocean, I hoped to achieve results which, however incomplete, might be of some slight service in adding to the knowledge already possessed of the North Polar Regions.

On July 4, 1905, I arrived at Edmonton, which is the most northerly post of the Canadian Pacific railway. After a few days' delay I went on to Athabasca Landing, where I had a skow—that is to say, a flat-bottomed boat—built. We started down the river on the 22nd with two years' provisions, some of which I had bought here and some at Edmonton. From Athabasca Landing to the Grand rapids—a distance of 165 miles—there is a very fine country, which is little known, and doubtless will one day be as thickly populated as any part of Canada. The rapids, which extend for the distance of 87 miles, are somewhat awkward to navigate; but, with the exception of the Grand rapid, no other part of the river offers any difficulty.

After leaving the rapids, a distance of 185 miles is travelled to Fort Chipewyan, after which the Slave river is reached; it wends its course for 312 miles into Great Slave lake. The navigation of the Slave river is very simple, with the exception of 15 miles of rapids, which have to be portaged over at Fort Smith. From Fort Resolution across Slave lake, Hay river is the first harbour, a distance of 70 miles. From Hay river to Fort Providence, which is the first post on the Mackenzie river, the only difficulty is getting into the river, the channel of which is crooked, and in many places shallow. From Fort Providence down to the Arctic Red river, lat. $67^{\circ} 26'$, long. $134^{\circ} 4'$, where I got frozen in, the distance is 900 miles, and the navigation is exceedingly simple for the whole distance.

The country that one passes through from Athabasca Landing down to the Arctic Red river is full of vegetation, and will, in my opinion, one day be settled. In all the mission gardens at the different posts that I passed, I saw wheat and barley growing, potatoes, lettuces, turnips, carrots, and every kind of vegetable that one grows in one's own garden at home. The country is thickly timbered near the banks of the river, and there are few places in which you do not find large patches of prairie. You pass by a great outrush of natural gas, and oil is oozing out for miles along the river bank. An Earth-movement has taken place, resulting in a line of fault, which is marked for more than 100 miles along the bank of the Athabasca river. Out of this, oil has been oozing we do not know for how long, and no one has yet found

* Map, p. 360. Read at the Royal Geographical Society, December 16, 1907.
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the reservoir of oil which may exist there. A German noble, the Count von Hammerstein, has spent a great deal of his own money and time in trying to find the reservoir, and I most sincerely hope that he may be successful. Coal and asphalt are to be seen everywhere, and there are great salt-plains not far distant. If three railways were run on to this great waterway (which could be done with a small outlay in comparison with the value of the country they would open up to the settler), the benefits reaped would be great. I should be an advocate for railways being built to Athabasca Landing from Edmonton, which would give easy access to 165 miles of river in one direction, and 210 miles in another up to Lesser Slave lake. A railway on to the Peace river would open up the whole of that waterway a distance of 600 miles down to the Slave river; while one railway from Prince Albert's to Fort McMurray would open up the Athabasca and the Slave rivers. The navigation on these waterways is effected with ease; any one can build a raft out of the timber which is at hand, place his cattle and farm implements upon it, and drift down the river until he finds the land he requires.

After traversing some 1800 miles of waterway, and taking observations for latitude and variation of compass at every point, I was frozen in at the Arctic Red river on October 4, and my position was that I had either to abandon all my supplies, or remain where I was until open water in 1906, which would mean wasting one year. I at once made up my mind to abandon the supplies and to go on with the dogs to Herschel island, a distance of 240 miles. This was not quite such an easy task as it appeared. After a great deal of difficulty and many journeys over to Fort McPherson, I at last succeeded in persuading two natives to accompany me to Herschel island with two sledges. One of the greatest difficulties that the traveller has in these parts is the economizing of supplies. Taking nothing with me but a Primus cooking-stove, instruments, and food, I could not reduce the weight of the sledges to less than 400 lbs. One sledge had 401 lbs. on it, and the other 405 lbs. There was a team of six dogs to each sledge.

We left Fort McPherson, on the Peel river, on February 14, and after travelling for ten days at an average of 24 miles a day, we got to Herschel island. Here I was in hopes of getting some supplies from the whalers, and making a sledge journey out on the ice, but, unfortunately, I found that they were all bound for San Francisco, and had been frozen in about a month earlier than usual, without any supplies for the present winter. I had abandoned my own supplies for no other reason than to make a trip out on the ice, and when I found it impossible to get anything at Herschel island either for myself or my dogs, I had to abandon the idea of going out on the ice. From what I gathered from the captains, I concluded that they had been out as far from land as any one could get with a properly equipped sledge expedition, on account of

open water, which I think exists off that coast, and I am still of the same opinion.

The position at Herschel island was briefly this: There were two hundred and fifty people on board five ice-bound ships, and of these only two vessels had any supplies at all. They divided up these stores, and, by keeping every one upon half-rations, there was only just enough food to last them until the middle of July. At the time of my arrival—February 24—the Eskimo were killing cariboo in the mountains within a few days' distance of Herschel island, where the deer-meat was most valuable to every one, but to bring it down from the mountains was a matter of great difficulty owing to the scarcity of dogs. Accordingly, I resolved to go into the mountains myself, and to lend my dogs to the whalers to get their deer-meat. I wanted to meet the Eskimo and to learn something about their language, in order that I might make use of them next year.

At the end of April I returned again to the ships, and made a map of Herschel island, which I did by triangulation, measuring my base out on the ice, and extending it over the island. This occupied me until we sailed.

On the 29th, while in the mountains, I saw the first fly—a blue-bottle. On May 31 we got our first geese, and on June 4 the first fish were caught at Herschel island. During this time I carefully noted all such days as were marked by the flight of wildfowl; and for two days early in June saw swan flying north-east true, great numbers of them passing Herschel island at a great height, and all going in the same direction. These were the only birds I saw not flying along the coast.

On June 16 I left the ships again to go over to the south-west sandspit, taking with me an Eskimo called Kokatu and his family. In crossing the bay, we passed over several lanes, which were about 12 feet wide in the narrowest place. On Monday, June 18, there was no sign of open water anywhere, and on Wednesday the 20th it was all open water. On July 1 the ice was full of holes, which rendered travelling quite impossible. I went back to the ships on July 3, going over the island, and on July 10 we put to sea. There was nothing but floe-ice in sight, with several lanes, and, after a great many difficulties and delays, we got to Point Sabine, and there took on driftwood to burn, as the ships had but little coal. We loaded every available space with wood, which, mixed with a little coal, lasted till August 14.

On July 12 we left Point Sabine and steamed round Pullen island, being in the ice most of the time. Whenever we could not go forward, we tied up to a piece of ice. There were plenty of seals and wildfowl in the water; and off the north side of Pullen island we encountered a great deal of old ice, which was drifting to the west. One of the ships tried to anchor, and lost its anchor; another ship injured its propeller. After leaving Pullen island we did not encounter much ice, but steamed

about 10 miles off shore to Cape Brown, afterwards crossing Liverpool bay to the Baillie islands off Cape Bathurst. While here I made a map of these islands, and got observations for latitude, longitude, and variation of the compass. Here we had a few days' delay, on account of a great mass of old ice which lay to the north-east of this point. I went out on this ice from the north end of Baillie island; it was quite stationary, and there were many pieces that I thought were 20 feet high.

On July 27 we tried to get round the Baillie islands. We steamed all day in a north-westerly direction, in heavy old ice all the time, and at six o'clock we tied up to a piece of ice. We were 20 miles off shore, and in 14 fathoms of water, and the ice was drifting to the west. As we were unable to make any headway, and as more ice was coming down from the north, we were driven back to the Baillie islands, where we had to take refuge on the east side of the sandspit.

We started again on August 3, and, after struggling with the old ice most of the day, steamed out into open water, and went straight across to Nelson's head, Banks Land. We got within a mile of Nelson's head, and steamed up the west shore of Banks Land, without seeing a piece of ice anywhere, as far as Cape Kellett. This was on August 5 and 6. On Cape Kellett there were a few pieces of old ice aground, and though I could see with my glasses the pebbles and stones on the beach, I could not descry a vestige of driftwood anywhere on this west shore. It was blowing hard on the 5th and 6th, so we did not anchor. I could not say whether there was a current along this shore or not, but, seeing no driftwood, I concluded that there must be a current from the north or south. If there *were* such a current from the north, and an ice-bound ocean to the north, it must needs bring down ice along the Canadian shore throughout the year; but during the time of open water that I spent on that coast, it was seldom that I saw any drift-ice. After we got away from the ice on August 4, there was really none to speak of within 50 miles north of the Canadian coast; this date agrees well with the date of open water round Point Barrow and Cape Kellett. There seem to be three points where the ice accumulates, and they are all clear about the first week in August. There was one year when the whale ships were unable to get to Banks Land, and this year north-west winds prevailed, and ice of this description extended everywhere from Cape Bathurst to Banks Land 10 miles off shore. A north-east wind prevailed whilst I was cruising in these waters, and on returning to Herschel island, I heard that they had had nothing but north-west winds.

On July 29 Captain Cottle was 50 miles north true of Herschel island. Current was running north-west true, and there were large floes in sight; and it was reported to me that in September Captain Levett was 100 miles north of Herschel island, and killed a whale, with no ice in sight. After leaving Cape Kellett, we steamed out north-west

true, seeing no ice, and came round eventually, after about three days, to Liverpool bay. There was a little ice still off the Baillie islands, about the same amount as there was off Cape Kellett. Between here and Herschel island, we steamed out some 50 miles from shore, and only saw a few floes of old ice, which was at that time drifting west. We had had continual north-easterly winds.

On August 14, 1906, we got back to Herschel island. Here we had expected to find a tender bringing up coal and supplies for the ships to go out with, and I had arranged to get two years' supplies, which would have enabled me to complete the work which I came out to do; but, unfortunately, we received instead the news of the destruction of San Francisco by fires and earthquakes. To the whale-fishers, who all had their homes in San Francisco, and who had just gone through a winter of exceptional hardship, the blow was a hard one, and, after waiting for a week, they gave up all hopes of the tender, and started west on August 21. They offered to take me to San Francisco, nor have I ever received greater consideration from any one than was shown me by these brave fellows during my stay with them. I might also add that, though they have taken a great wealth of whalebone out of these waters, they earn every pound they make. As soon as I went ashore at Herschel island, I engaged two Eskimo and their families for one year to hunt for me and clothe me and keep me. They had a whale-boat each, and I had bought one from the whale-fishers.

On August 29 we left Herschel island; I intended to winter wherever game could be found, and wait in the Arctic for another year or two, if necessary. With this intention, I arranged with a whaling captain to bring me up two years' supplies. I went up the west branch of the Mackenzie river to Fort McPherson with three whale-boats, making a route survey of the river and taking observations for latitude, longitude, and variation of compass whenever possible; here I got some ammunition and rifles which I had left there the year before. I also obtained some supplies from Messrs. Nagle and Hislop, and started down the east branch of the Mackenzie for the Eskimo lakes, where I intended to winter. We got frozen in at the north-east end of what I call the Long lake, and here we left our whale-boats. We were now a party of thirteen, with eighteen dogs. We were in hopes of finding both deer and fish, but we found very few of either until late in November. We had to struggle for existence until October 20, when I decided to push on to the east. We travelled over a height of land, through a valley, for a distance of 27 miles, and came to the first Eskimo lake. After crossing the lake, we found, at the north-west end of it, a little river where there was open water and abundance of fish. We took as many as seventy white fish out of our net every time we went to it. The natives also caught from fifteen to twenty trout every day, and by setting night lines some losche were caught every

night. Finding no deer in the country, I thought this was too good a thing to pass, and so I decided to winter here. I had surveyed the country as far as this, getting observations for latitude, longitude, and variation of compass everywhere along the route, but now I hoped to get a few occultations. We were now near the edge of the timber-line, but there was plenty of wood to build a house and to make fires, so I told the natives to build two houses—one for myself, and one for them. I stayed here until January 19, when I went down to the coast, returning by another route, and reaching camp the second week in February. During this journey we had four cold spells, the thermometer once registering from 50° to 57° below zero for a week. I surveyed the route I took and the route I returned by; the country between my winter camp and the coast is a mass of small lakes and hills, which are often conspicuous for the volcanic appearance they have, but they are not of volcanic origin.

The Eskimo told me we should get no fish after the sun had returned. Even when I left camp fish were not numerous, but when I came back they could not be caught by hook or by crook, nets and hooks being both useless. My scanty supplies having all gone, we had a very hard struggle for existence, and for six weeks we lived on ptarmigan, which the natives snared with twine or shot on the neighbouring hills, and on musk-rats, which were caught on the lakes under the snow in small traps. Needless to say, our fare was a very scanty one, but we managed to keep most of our dogs and ourselves alive until March 25, when we started off in an easterly direction down the great waterway (which I particularly wanted to survey) into Liverpool bay. I took with me two natives, the women and children, and the dogs, which now numbered only twelve, as I had lost some during these hard times from starvation.

I followed and surveyed this great waterway by stations of triangulation, route surveys with a prismatic compass, and observations for latitude, longitude, and variation of compass whenever possible until I got in sight of Liverpool bay, and here, through shortness of food, we had to go to the coast. The country between the Eskimo lakes and the coast is particularly flat, dotted with conspicuous hills rising straight up out of the ground. According to Sir J. Richardson, they are of gravel and mud formation, but the abrupt angle they form with the plain is particularly interesting if this is correct. After five days of starvation, which forced us to kill two dogs to keep the rest alive, we arrived at Kangianik, where an old Eskimo called Tiukpuna treated us with great hospitality. I surveyed this coast-line carefully with a prismatic compass, getting observations whenever possible, and found the sandspits and points to be of a curious length and shape; this is a feature of the whole coast-line. During this time I never heard the natives complain, and they always appeared as cheerful as if they had

plenty to eat. On May 3 we went to the east branch of the Mackenzie river, travelling up it knee-deep through soft snow and slush; nor were we able to put our sledge ashore, by reason of the open water on either side of the river, but had to camp every night on the middle of the ice. However, we managed to get to our whale-boats before the ice on the river broke up, when we again suffered considerable privations on account of the scarcity of food. On May 14 we got our first wildfowl, and after this we enjoyed plenty, such as it was, until I returned to Fort McPherson in June, where I waited for my mail which brought me home. Coming down the Mackenzie river, when in sight of Point Separation, the high ground on the east side does not follow the present course of the river, though the bank is 40 feet high, and thickly timbered; but the hills are some way to the east, and run in a straight line to the south end of the Long lake, and from here they can be traced to Liverpool bay, on the south-east side of the Eskimo lakes.

Where this little river, which we went up in our whale-boats to get to the Long lake, enters the Mackenzie river there is high ground, which you can also follow to Liverpool bay in one direction, and to Richard island in another. From here to Richard island the Mackenzie flows close under the height of land, and in some places the banks are precipitous. The country between the Eskimo lakes and the coast slopes down more gradually from the Mackenzie river into a very flat coast-line, extending 10 miles from the ocean, and is dotted all over with conspicuous hills. They rise out of the flat ground from 100 to 200 feet, and the top forms a round basin 5 to 10 feet deep in the centre. The natives value those near the coast as certain reservoirs of water. In the mountains on the west side of the Mackenzie to the south and east the slopes appear precipitous, and to the north and west more gradual.

The Mackenzie river begins to widen out into a delta at Point Separation, which is 200 miles by water from the most northerly island, and in its widest place is 45 miles broad. The west branch of the river breaks up into many channels, which have cut their way through a plain lying immediately under the mountains. West of this plain you come to Shingle point, and this forms a bay with the sand-bars, which extend in a westerly direction from Tent island.

The main channel of this river wends its way through many islands along the coast between Hooper and Pullen islands. The east branch comes into the ocean by many channels, lying between the north-east corner of Richard island and Toker point; that between the mainland and Richard island is narrow up to Point Encounter. From here it widens, but there are many sandbars in the bay formed by the north-east end of Richard island and Toker point. From the north-east end of Herschel island there is a bank which extends in an easterly direction, and is called the "ridge:" it is over this ridge that there is always a large tidal crack in the ice every year.

Much of the driftwood that comes out of the Mackenzie is caught by these islands and sandbars, but some of it is carried out to sea. For example, after leaving Point Sabine I saw driftwood, on July 12, floating in the ocean 9 miles off shore; off Pullen island, 10 miles to the north, I saw more of it; on July 16 and on July 18, off Toker point, some 10 miles from shore, we passed a quantity of driftwood. The shores of the Arctic ocean from Cape Parry to Herschel island are strewn with this strong timber, which comes down the Mackenzie, the Clarence, the Anderson, and the Horton rivers; there are only two places between these points where wood is not found, and the reason is that the shores are precipitous. These rivers are building up islands on what were submerged banks, and the ocean is receding. In all these islands I found ancient driftwood in the high banks. While making a map of Herschel island, I found in many of the gullies pieces of similar wood, sticking out of the mud in the bank, in most cases 50 feet below the present surface of the islands. The whaling captains who blasted out the ice-houses at Herschel island told me they found quantities of this same wood. The ice-houses are 20 feet below the surface, and go down to sea-level. The wood I saw off Sabine point was drifting to the west, and that off Pullen island and Toker point to the east. What wood I saw is a very small portion of that which is carried out to sea, and it is difficult to understand why a great deal of this *débris* is not drifting on to the western shores of Banks Land. The absence of driftwood upon the western shore of Banks Land would seem to indicate a current that is perhaps being diverted on to that land by other land to the north and west.

In the preceding pages I have told the story of my journey. Although circumstances prevented me from actually going out on to the ice to investigate the Arctic mysteries, I saw enough during my stay of eighteen months on the shores of the Arctic ocean to somewhat justify the conclusion that our data at present are quite insufficient to establish the existence of a vast polar sea. It is true that most competent authorities hold that no extensive land can be found in the unknown region; with this conclusion we may agree from want of further knowledge, but when we came to examine the reasons they advance, to say the least of it, they are not convincing. The real conclusion to be drawn from what is known seems to be that the existence or non-existence of land is as much an open question as ever. Apart from the fact that authorities of the greatest weight draw diametrically opposite conclusions from the same data, does it not seem somewhat premature to describe the geographical condition of an unexplored region from a mere study of its boundaries? Let us take an example. Suppose we did not know of the existence of Australia, who, I ask, from a study of the geographical conditions which obtain between the 5th and 10th degrees of S. lat., could ever have deduced the existence of a great

continent like Australia? Is it not, from first principles, both dangerous and scarcely in accordance with strict scientific methods of reasoning to deduce the existence of any physical fact which has never been put to the test of experience?

I have at the present moment before me a map by Dr. Nansen, showing a deep basin in the unknown area; a map by R. A. Harris, showing a continental mass of land; a map by Commander Peary, showing a land to the north-west of Grant Land, which he has never visited, but has named "Crocker Land." The whole inference is from known facts. How can we be at all sure that we know all the facts?

The Soundings found by the "Fram."—If we consider the known facts, the soundings found by the *Fram* might be taken to denote land at the pole. For example, from where the *Fram* got frozen in to where she got free roughly represents 1000 miles. We know something of what exists south of this line; to the north we know nothing. Now, let us measure 1000 miles in the same drift, along the meridian, from 80° to 63° N. lat. Throughout this distance we know that land exists on both sides of us, east and west, that the deep channel is narrow, and that the soundings are even deeper in places than any found by the *Fram*.

Let us suppose we did not know of the existence of Greenland, and let us suppose some one were to go out on the ice in a westerly direction from the Spitsbergen archipelago, and came back with the soundings of 2600 fathoms, found 175 miles west of Spitsbergen. Could we infer that if he had continued his course for another 200 miles he would have found Greenland?

The Drift of the Ocean.—Nothing that has been put down or got adrift east of Point Barrow has ever been heard of again. Many ships have been wrecked. For example, four vessels were wrecked east of Point Barrow while I was on that coast; nine drift casks were set adrift east of Point Barrow in 1899 and 1900; again, whale ships have been passing every year east of Herschel island since 1889, and there was no part of the Arctic coast that I visited where I did not find among the driftwood derelict belongings bearing the name of these ships. In the case of wrecked vessels, they may have been smashed by the ice and sunk, but there are many things on a ship which cannot sink, and which have the ship's name upon them. Now, I ask, how does it happen that none of the immense quantity of *débris* which, in accordance with the above facts, has been set adrift, has never yet found its way, as far as our present knowledge goes, across the Arctic ocean?

We know that a drift cask did drift from Bering strait to Iceland. In considering the known drift of the ocean, we cannot take the drift of the *Jeannette* and the *Fram* jointly, but the drift of the *Jeannette* and her relics give us fairly safe data from which to estimate the course taken by the buoy.

We may take it for granted, from what we know of the drift of the

Jeannette and her relics, that the speed of the buoy can hardly have been less than 2 miles per day of twenty-four hours. This rate receives further confirmation from the able arguments of Dr. Nansen, respecting the drift of these same relics.* But if the buoy took the shortest possible route across the pole, it scarcely attained a speed of 1·2 miles per day of twenty-four hours. Therefore we may assume that the buoy did not go by the shortest route. But we may go further, it must have gone a longer route than the known route of the *Jeannette* and the *Fram*, for the latter would only give us an average rate of 1·5 mile per day. Therefore, may we not conclude, on the 2 miles a day hypothesis, that the buoy travelled by a longer route even than the *Jeannette* and the *Fram*?

The Ice.—If we assume that this buoy drifted across the Arctic ocean north of the *Fram's* route, as Dr. Nansen suggests,† it is difficult to suppose an extensive land or any mass of palæocrystic ice in the unknown area. This I estimate, taking out all known ice journeys, to be 1,251,874 square miles in extent, and the Arctic ocean has an estimated area of between 4 and 5 million square miles.‡ Now, what is the significance of the six years' drift of this buoy? Does it mean that the polar sea clears itself of ice every six years? If this is the case, what becomes of all this ice? Assuming that the total breadth of the channels leading out of this enclosed sea is 1000 miles, and that the average rate of the current flowing through them is 2 miles a day of twenty-four hours, it would take ten years at least for the 4 million square miles of ice to pass through, even on the assumption that the flow continued for two hundred days every year.

Some slight corroboration of the above argument may be found in Commander Peary's experiences.§ The drift shown by these ice journeys north of Greenland and Grant Land running west to east, does not indicate a current passing over or near the pole and coming from Bering strait, but rather a current running in exactly the opposite direction to the current in which the *Fram* drifted.

In conclusion, I may repeat what I said at the beginning, that the existence of land at the pole is by no means yet disproved. Without attaching too much weight to the arguments I have advanced, they do at least suggest some difficulties in the way of the deep-sea basin theory. There is yet some room for searchers of Arctic continents, and nothing would please me better than to have the means and opportunity of once more trying to solve this great Arctic mystery.

* Dr. Nansen's 'Furthest North,' vol. 1, p. 20.

† *Geographical Journal*, December, 1907, "North Polar Problems."

‡ The *Bulletin* of the Geographical Society of Philadelphia, January, 1906, vol. 4 p. 3.

§ Commander Peary's map, 'Nearest the Pole.'

Before the paper, the PRESIDENT: I have to introduce to you the lecturer of the evening, Mr. Harrison, who has furnished one more instance of the advantages geography has drawn from love of sport. During the last twenty years, or nearly so, Mr. Harrison has been on various shooting expeditions, two of which were into the Rocky mountains, and he passed the winter of 1902-03 in the region of Great Slave lake. On his return home, Mr. Harrison determined to go through a course of surveying, in order to make his future travels more valuable from a geographical point of view. Accordingly, he went through a course under Mr. Reeves of our Society, and, thus scientifically equipped, he started on the journey which he is going to describe to us to-night, and which, I wish to remind you, was done entirely at his own expense. During that journey he has made a very large number of observations for variation of the compass, for latitude and for longitude, with occultations on five or six occasions, and he worked out the results on the spot, some of these observations with the thermometer 50° below zero. I will now invite him to read his paper.

After the paper, the PRESIDENT: I fear that we shall not have a discussion on the interesting points which Mr. Harrison has raised in the last part of his paper, because, so far as I know, there are not present to-night any Arctic experts who are willing to speak. We had hoped to have been honoured by the presence of Dr. Nansen; but he is suffering from a domestic bereavement, in which I am sure this Society will deeply sympathize. But I think that Mr. Harrison's paper can stand very well without discussion. It has been to me, and I am sure to you, extremely interesting, and we tender him our sincere thanks.

THE GORGE AND BASIN OF THE ZAMBEZI BELOW THE VICTORIA FALLS, RHODESIA.*

By G. W. LAMPLUGH, F.R.S., F.G.S.

The upper of the two cataracts is far less impressive, being merely a broad transverse band of comparatively shallow rapids, separated by protruding rocks. Between it and the lower cataract there is a wide basin of comparatively still water with slow eddies, and above it also the river has a slack current, and is bordered on the left by an extensive and exceptionally level flood-platform of rock. Mr. Sykes was informed that at this place "Batoka refugees were in the habit of crossing to the right side of the river in canoes, and thence making their way on foot to the small rocky island below the fall [seen in Fig. 9], which they used as a hiding-place from their enemies." †

Eastward from the Chimamba the country bordering the gorge on the north is so severely dissected that its plateau-character is almost lost; and, with the broadening of the valleys and the breaking down of

* Continued from p. 152.

† There are many stretches of the river in the gorge where a strong well-manned canoe, if skilfully handled, might, I think, be navigated; and the flood-platform might afford a rough but practicable portage where the rapids are too formidable. But the risk would be great, and the presence of crocodile in all parts of the gorge that we visited is discouraging to adventure of this kind.

LIST OF POSITIONS AND VARIATION OF COMPASS.

PLACE.	N. Lat.	W. Long.	Mag. Var. E.	REMARKS.
Mouth of Arctic Red River ...	67° 26' 00"	134° 4' 00"	46° 00'	Lat. by Circum. Mer. Sun. Long. by Chron. diff.
Fort McPherson, Peels River ...	67° 25' 47"	135° 30' 00"	45° 30'	Lat. by Circum. Mer. N. & S. Stars. Long. by Occultation.
WEST BRANCH OF MACKENZIE RIVER.				
Mouth of Peels River ...	67° 41' 00"	134° 58' 00"	45° 40'	Lat. by Circum. Mer. Sun. Long. by Chron. diff.
Camp G ...	68° 7' 00"	135° 7' 00"	45° 30'	Lat. by Circum. Mer. Sun. Long. by Chron. diff.
Camp E ...	68° 15' 00"	135° 35' 00"		Lat. by Circum. Mer. Sun. Long. by Chron. diff.
EAST BRANCH OF MACKENZIE RIVER.				
Point Separation ...	67° 36' 00"			Lat. by Circum. Mer. Star.
Camp S Lob-sticks ...	67° 46' 00"	134° 42' 00"		Lat. by Mer. Alt. of Star. Long. by Chron. diff.
Mouth of Little River ...	68° 3' 00"	134° 5' 00"		Lat. by Circum. Sun. Long. by Chron. diff.
26th Camp ...	68° 15' 00"	134° 16' 00"	48° 54'	Lat. by Circum. Sun. Long. by Chron. diff.
22nd Camp ...	68° 52' 00"	135° 3' 00"	45° 00'	Lat. by Circum. Sun. Long. by Chron. diff.
S.W. Point of Richard I. ...	68° 59' 00"	135° 6' 00"	44° 00'	Lat. by Circum. Sun. Long. by Chron. diff.
THE LAKES.				
S. of Long Lake ...	68° 11' 00"	133° 38' 00"	46° 25'	Lat. by Double Alts. Sun. Long. by triangulation from Winter Camp.
N. of Long Lake ...	68° 16' 00"	133° 31' 00"	46° 48'	Lat. by Circum. Sun & Star. Long. by triangulation.
S. of Eskimo Lake ...	68° 25' 00"	132° 57' 00"		Lat. by mean of 3 obs. Long. by triangulation.
Z. West of Eskimo Lake ...	68° 36' 00"	133° 00' 00"		Lat. & Long. by triangulation from Winter Camp.
Y. West of Eskimo Lake ...	68° 37' 00"	132° 59' 00"		Lat. & Long. by triangulation from Winter Camp.
Winter Camp ...	68° 40' 49"	132° 54' 00"	47° 36'	Lat. by Sun and Stars mean of 4 obs. Long. by mean of 4 occultations.
2nd Camp Observation ...	68° 47' 12"	132° 51' 00"		Lat. by Sun and Stars mean of 4 obs. Long. by mean of 4 occultations.

N. of Long Lake	68 16 00	133 31 00	46 48	triangulation from Winter Camp. Lat. by Circum. Sun & Star. Long. by triangulation.
S. of Eskimo Lake	68 25 00	132 57 00		Lat. by mean of 3 obs. Long. by triangulation.
Z. West of Eskimo Lake	68 36 00	133 00 00		Lat. & Long. by triangulation from Winter Camp.
Y. West of Eskimo Lake	68 37 00	132 59 00		Lat. & Long. by triangulation from Winter Camp.
Winter Camp	68 40 49	132 54 00	47 36	Lat. by Sun and Stars mean of 4 obs. Long. by mean of 4 occultations.
2nd Camp Observation Hill	68 52 00	133 36 00	48 31	Lat. by Circum. Sun. Long. by Lat. and Az. from Winter Camp.
4th Camp	69 00 00	133 5 00	48 49	Lat. by mean of 2 obs. Long. by Chron. diff.
5th Camp	69 6 00	132 38 00	48 51	Lat. by Circum. Sun. Long. by Chron. diff.
6th Camp	69 15 00	132 31 00	50 26	Lat. by Double Alts. Sun. Long. by Chron. diff.
8th Camp	69 28 00	132 18 00	46 33	Lat. by Double Alts. Sun. Long. by Chron. diff.
11th Camp	69 43 00	130 59 00	48 54	Lat. by Double Alt. Sun. Long. by Chron. diff.

THE ARCTIC COAST.

12th Camp, "Nuvuktok"	69 50 30	131 30 00		Lat. by Double Alt. Sun. Long. by Chron. diff.
Island between 13th and 14th Camps	69 51 00	131 46 00	48 42	Lat. by Sun mean of 2 obs. Long. by Chron. diff.
14th Camp	69 43 00	132 18 00	50 22	Lat. by Double Alt. Sun. Long. by Chron. diff.
16th Camp, Toku Point	69 36 00		46 44	Lat. by Circum. Sun.
17th Camp, "Kangianik"	69 22 00	133 44 00	47 36	Lat. by Circum. Sun (mean of 2 obs.) Long. by Chron. diff.

HERSCHEL ISLAND.

Observation Spot	69 32 48	138 57 15		Lat. by Sun mean of 3 obs. Long. by an Officer of the "Thetis."
Pauline Cove	69 34 00	138 50 38	44 26	Lat. by Circum. Sun. Long. by Lat. and Az.
S.W. Sandspit Fish Camp	69 34 00			Lat. by Mer. Alt. of Sun.

THE BAILLIE ISLANDS.

S.W. Sandspit	70 29 40	128 17 39	53 6	Lat. by Mer. Alt. of Sun. Long. by Chron. diff.
Ice Houses	70 30 36	128 18 3		Lat. by Mer. Alt. of Sun. Long. by Lat. and Az.
N.W. Corner of Island	70 35 18		52 15	Lat. by Sun mean of 2 obs.

The Variation of compass was obtained at the different stations by a comparison of prismatic compass bearings with true bearings found by astronomical observations taken with sextant and artificial horizon.

ARC
Surve
MACKE
ADJAC

A. H
Nat. Scale, 1:750,000
10 5 0

Route and Compass

Line of Tim
Depths in F
Heights in
approxima

The latitudes are fr
altitudes of Stars a
The longitudes depe
adjusted to position
as indicated in the
The principal instr
6 inch sextant, arti
watch, prismatic c
tape and aneroid.

Conical Projection with Standard Parallel