PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

MINES BRANCH

Honorable HONORE MERCIER, Minister; S. DUFAULT, Deputy-Minister;
THEO. C. DENIS, Superintendent of Mines.

EXTRACTS FROM REPORTS

ON

THE DISTRICT OF UNGAVA

RECENTLY ADDED TO

THE PROVINCE OF QUEBEC

UNDER THE NAME OF

THE TERRITORY OF NEW QUEBEC

QUEBEC:
PRINTED BY E. CINQ-MARS
PRINTER TO HIS MOST EXCELLENT MAJESTY THE KING

1915

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PROVINCE OF QUEBEC

Department of Colonization, Mines and Fisheries

The Honourable HONORE MERCIER, M.P.P.,

Minister of Colonization, Mines and Fisheries,

QUEBEC, P.Q.

SIR,—

I have the honour to transmit to you a Report on the territory recently added to the Province of Quebec under the name of New Quebec Territory. This report was compiled from various sources of information and edited by the Superintendent of Mines.

I remain,

Yours obediently,

S. DUFAULT,
Deputy-Minister.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

MR. S. DUFAULT, Deputy-Minister,

Colonization, Mines and Fisheries,

QUEBEC, P.Q.

DEAR SIR,—

The report which I have the honour of transmitting to you is a compilation of extracts from various reports on the Northern Territory recently added to the Province under the name of New Quebec Territory.

A first edition of this report was published in 1913, but the demand for the volume having exhausted the supply, a second edition has become necessary.

The geological information on the map is also a compilation from published sources These sources are mainly, not to say exclusively, the publications of the Geological Survey. Our thanks are due to Mr. R. W. Brock, Director of the Geological Survey, for his kind permission to reproduce the illustrations which are given in the report.

I remain,

Yours obediently,

THEO. C. DENIS,

Superintendent of Mines.

QUEBEC, April, 1915.

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PROVINCE DE QUEBEC

MINISTÈRE DE LA COLONISATION DES MINES ET DES PÊCHERIES

BUREAU DES MINES

Nous avons préparé la carte ci-jointe pour accompagner un rapport sur le territoire de l'Ungava. Ce rapport est un travail de compilation de données sur ce territoire, puisées dans les divers comptes-rendus d'explorations et de missions, qui sont disséminés dans les nombreux volumes publiés par le Service Géologique du Canada, dont les éditions d'un certain nombre sont épuisées.

A cause de retards inévitables dans l'impression de ce travail, ce rapport ne sera pas prêt à être distribué avant quelque temps d'ici. La carte étant prête, nous croyons utile de la mettre dès maintenant à la disposition du public.

BUREAU DES MINES.
QUÉBEC, NOVEMBRE 1912.

PROVINCE OF QUEBEC

DEPARTMENT OF COLONIZATION MINES AND FISHERIES

MINES BRANCH

The enclosed map was intended to accompany a report on Ungava. The report was prepared from reliable sources and is a compilation of data and extracts from published information, mainly scattered through the publications of the Geological Survey of Canada, some of which are now out of print.

Owing to unavoidable delay, this report which is in the printer's hands shall not be ready for some time to come. As the map is now ready, it is thought advisable and useful to distribute it ahead of the report.

MINES BRANCH,
QUEBEC, NOVEMBER 1912.

THE TERRITORY OF NEW QUEBEC

FORMERLY CALLED

DISTRICT OF UNGAVA

The present volume is, in the main, a compilation of extracts relating to Ungava from the Publications of the Geological Survey of Canada. Some of these reports are now out of print and are only available to those who possess a complete set of the Survey publications. Moreover, it is thought that a presentment in one book of the more important information regarding this territory, scattered through numerous bulky volumes, will be welcome by persons interested in that northern country.

In November, 1912, a bill was passed by the Legislative Assembly of the Province of Quebec, entitled, "An Act respecting Ungava and erecting that territory under the name of New Quebec".

The territory of New Quebec, therefore, comprises the district of Ungava, which lies immediately north of the Province of Quebec, as previously delineated. It embraces the mainland approximately between latitudes 53° and 62°30′, and between longitudes 56° and 79°, with the exception of the narrow strip of the North-East coast, which under the name of Labrador, falls under the jurisdiction of Newfoundland.

Special attention is called to article 3 of the bill above mentioned, which enacts that:—

> 3.—"All grants of lands, or other rights whatsoever in New Quebec, before the 15th day of May, 1912, the date of the coming into force of the proclamation of the Governor-General in Council,—except those relating to the Hudson's Bay Company, or to the rights of the Indian inhabitants, if such rights exist, the whole as mentioned in the Act of Parliament of Canada, 2 George V, Chapter 45,—shall be notified to the Provincial Secretary, within twenty-four months of the coming into force of this act, under pain of absolute nullity.
>
> "Such notice may be given by registered letter, and shall be accompanied by a copy of the title, if any, evidencing the grant."

The following acts give for themselves a history of the legislations respecting the annexation of the Territory of Ungava to the Province of Quebec:—

THE QUEBEC BOUNDARIES EXTENSION ACT OF 1912

WHEREAS on the thirteenth day of July, one thousand nine hundred and eight, the House of Commons resolved that the limits of the Province of Quebec should be increased by the extension of the boundaries of the Province northwards so as to include the territory hereinafter described, as in the said resolution is

more particularly set out, upon such terms and conditions as may be agreed to by the Legislature of Quebec and by the Parliament of Canada. Therefore, subject to the consent of the said Legislature, His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1.—This Act may be cited as the Quebec Boundaries Extension Act, 1912.

2.—The limits of the Province of Quebec are hereby increased so that the boundaries thereof shall include, in addition of the present territory of the said province, the territory bounded and described as follows:—Commencing at the point at the mouth of East Main River where it empties into James Bay, the said point being the Western termination of the Northern boundary of the Province of Quebec, as established by chapter 3 of the Statutes of 1898, intituled, "An Act respecting the north-western, northern and north-eastern boundaries of the Province of Quebec"; thence northerly and easterly along the shores of Hudson Bay and Hudson strait, thence southerly, easterly and northerly along the shore of Ungava Bay and the shore of the said strait; thence easterly along the shore of the said strait to the boundary of the territory over which the island of Newfoundland has lawful jurisdiction; thence south-easterly along the westerly boundary of the said last mentioned territory to the middle of Bay du Rigolet or Hamilton Inlet; thence westerly along the northern boundary of the Province of Quebec as established by the said Act to the place of commencement; and all the land embraced by the said description shall, from and after the commencement of this Act, be added to the Province of Quebec, and shall, from and after the said commencement, form and be part of the said province of Quebec upon the following terms and conditions and subject to the following provisions:—

(a) That the population of the territory hereby added to the province of Quebec shall be excluded in ascertaining the population of the said province for the purposes of any readjustment of representation of the other provinces consequent upon any census;

(b) That in the general census of the population of Canada which is required to be taken in the year one thousand nine hundred and twenty-one and in every tenth year thereafter, the population of the territory hereby added to the province of Quebec shall be distinguished from that of the said province as heretofore constituted, and the representation of the said territory in the House of Commons shall be determined according to the rules enacted by section 51 of "The British North America Act, 1867", regulating the representation of the provinces other than Quebec;

(c) That the province of Quebec will recognize the rights of the Indian inhabitants of the territory above described to the same extent, and will obtain surrenders of such rights in the same manner as the Government of Canada has heretofore recognized such rights and has obtained surrender thereof, and the said province shall bear and satisfy all charges and expenditure in connection with or arising out of such surrenders;

(d) That no such surrender shall be made or obtained except with the approval of the Governor-in-Council;

(e) That the trusteeship of the Indians in the said territory, and the management of any lands now or hereafter reserved for their use, shall remain in the Government of Canada subject to the control of Parliament.

3.—Nothing in this Act shall in any way prejudice or affect the rights of properties of the Hudson's Bay Company as contained in the conditions under which that Company surrendered Ruperts Land to the Crown.

4.—This Act shall come into force on a day fixed by proclamation of the Governor in Council published in the *Canada Gazette*, but such proclamation shall not be made until after the Legislature of Quebec shall have consented to the increase of the limits of the province herein provided for, and agreed to the terms, conditions and provisions aforesaid.

By an act assented to on April 3rd, 1912, the Quebec Legislature consented to the increase of the limits of the Province as set forth in the above schedule.

Whereas the act 34-35 Victoria, chapter 28, of the Parliament of the United Kingdom of Great Britain and Ireland, intituled: "An Act respecting the establishment of provinces in the Dominion of Canada", enacts that the Parliament of Canada may, from time to time, with the consent of the Legislature of any Province, increase, diminish or otherwise alter the limits of such Province, upon such terms and conditions as may be agreed to by the said Legislature, and may, with the like consent, make provision respecting the effect and operation of any such increase, diminiution or alteration of territory;

Whereas the Parliament of Canada has passed an Act reproduced in the schedule to this Act, by which it has declared that the province of Quebec comprises the territory therein described in addition to its present territory subject to acceptance by the Legislature of Quebec, of the terms, conditions and provisions set forth in the said act;

Whereas in the said act of the Parliament of Canada it is declared that the provisions thereof shall come into force on a day to be fixed by proclamation by the Governor-General of Canada in Council published in the *Canada Gazette*; but that such proclamation shall not be made until after the Legislature of Quebec shall have consented to the increase of the limits of the Province upon the terms and conditions and subject to the provisions therein stipulated;

Whereas it is expedient to consent to the change of the limits proposed and to accept the terms, conditions and provisions to which this increase of the said limits is subject;

Therefore, His Majesty, with the advice and consent of the Legislative Council and of the Legislative Assembly, of Quebec, enacts as follows:—

1.—The Legislature of the Province of Quebec consents that the territory described in the act of the Parliament of Canada set forth in the schedule to this act, do form part of the Province of Quebec; the whole on the terms and conditions and subject to the provisions therein set forth, and that proclamation to that

effect be made by the Governor-General of Canada in Council, fixing the day on which this change in the boundaries of the Province shall take effect.

2.—This act shall come into force on the day of its sanction.

The final step to the annexation of Ungava was taken by a proclamation issued by the Governor-General of Canada on May 10th, 1912, by which the "Act to extend the boundaries of the Province of Quebec" came into force on May 15th, 1912. Therefore, since this latter date, the territory of Ungava is under the jurisdiction of the Province of Quebec.

It is also to be observed that the territory thus annexed only includes the mainland and does not extend to the islands in Hudson Bay, Hudson strait or Ungava Bay, which remain under the jurisdiction of the Federal Government.

The name Ungava is derived from an Eskimo word, meaning "far away". It is not likely that this name was used by the Eskimo, for, from their standpoint, this territory was not "far away". In all probability it was given by some of the early explorers or missionaries, but it has not been possible to trace the word back to its origin.

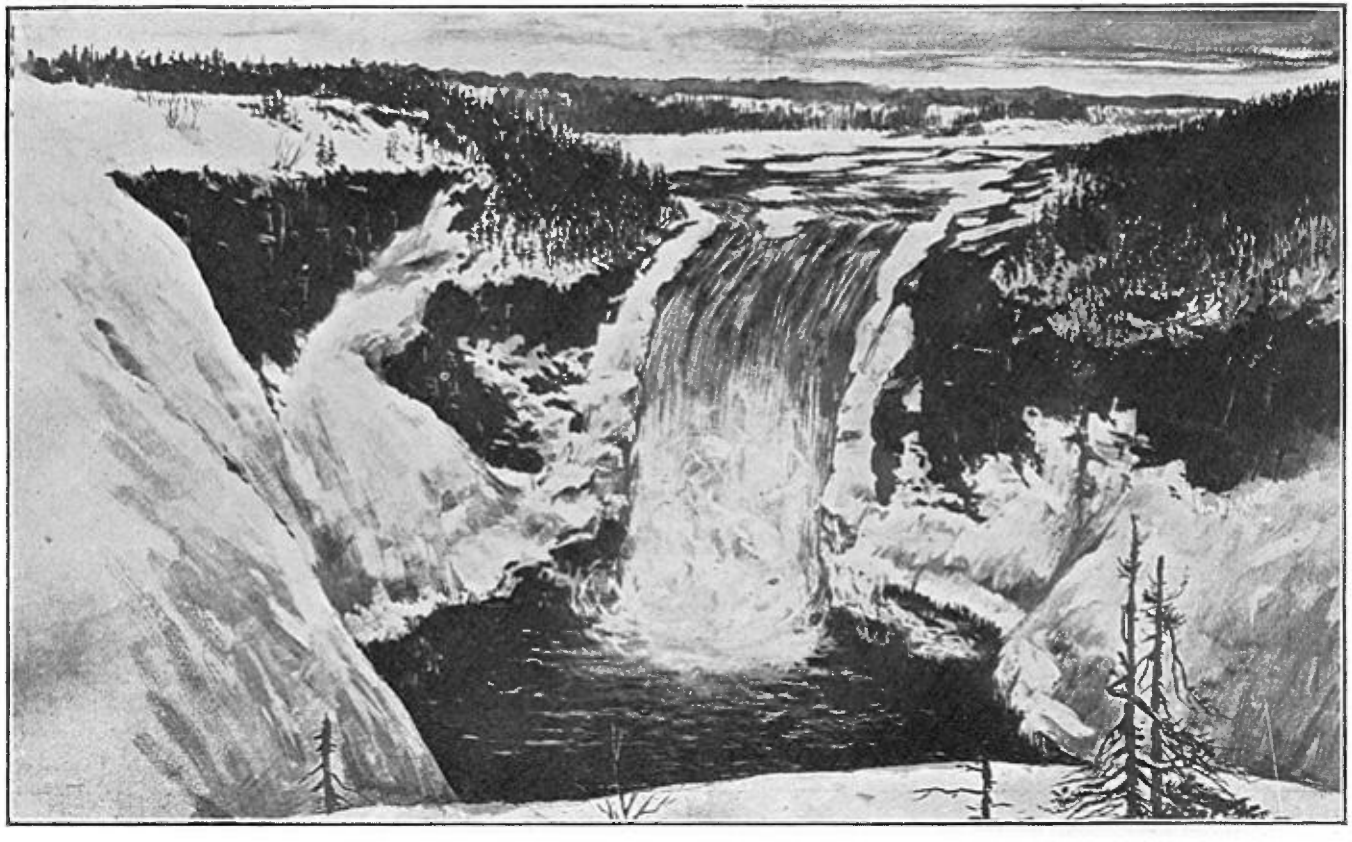
The area of the territory thus transferred from the jurisdiction of the Federal Government to that of the Government of the Province of Quebec embraces some 351,780 sq. miles, which, added to the previous superficies of the Province, makes it comprise a total area of 703,653 sq. miles. The Province of Quebec is thus by far the largest province of the Dominion, Ontario being second with 407,262 and British Columbia third with 357,600 sq. miles.

As at present constituted, therefore, the province of Quebec is bounded on the South-West and West by the Province of Ontario, James Bay and Hudson Bay, on the North by Hudson strait; on the East by the narrow strip of coast which from Cape Chidley to Blanc Sablon is under the jurisdiction of Newfoundland, and on the South by New Brunswick and United States.

It has a coast line which, on the South from Quebec city to Blanc Sablon, measures 1160 miles; on Hudson strait from Cape Chidley to Cape Wolstenholme, 1170 miles, and from this latter point to the head of James Bay, 1380 miles.

The present compilation of information relates exclusively to the new territory added, which forms the Northern part of what has been called, for convenience, the Labrador peninsula. This new territory lies almost entirely North of the 53d parallel of latitude. It may be mentioned that this latitude is very nearly that of the city of Liverpool, England.

A great deal of information, resulting from various explorations, has been published concerning Ungava territory or New Quebec, but it is scattered throughout various reports which can only be found together in libraries and many of which are out of print. The object of the present report is to afford easy reference to the more important information which has been published. A bibliography of the sources of information has been added, as well as of reports which have not been drawn upon in the compilation of the extracts which follow.



" GRAND " or " McLEAN " FALLS—Hamilton River.

WATER-POWERS

The interior of Ungava or New Quebec is a huge plateau which rises somewhat abruptly within a few miles of the coast line to heights of 500 to 2,500 feet. The various streams, therefore, afford numerous water-powers, more especially where they leave the interior plateau to flow through the strip of low lands, a few miles wide immediately adjoining the coast. For instance, on Great Whale river, within 20 miles of the mouth, thre are three falls 150 feet, 230 feet and 65 feet respectively. On the South branch of this same river, a few miles from its mouth, a fall of the river gives 136 feet. Nastapoka Falls near the coast has falls 170 feet. Near Richmond Gulf, the Wyachuan River falls give a head of 315 feet. A remarkable case of very high water-falls in the interior is that of the Hamilton River. The Grand Falls of this river are situated some 300 miles from Rigolet. These falls were first viewed by a white man, John McLean, in 1839. McLean was in charge of the Hudson's Bay Co.'s post at Fort Chimo and crossed overland from that post to Hamilton Inlet.

The falls themselves have a sheer drop of 302 feet, and Low estimated their discharge at 50,000 cubic feet per second. For twelve miles above the falls, the river rises rapidly, so that in that distance the difference of level, including the falls proper, is 760 feet. Adopting the discharge estimated by Low, these figures would give approximately 1,500,000 H.-P. for the falls proper and 3,660,000 H.-P. for the twelve miles of falls of the river. However, Dr. Low only saw the river during a period of high water and the above figures are probably much too high. In the data compiled by the Commission of Conservation and published in the "Report on Water-Powers in Canada", the possibilities of Grand Falls are based on a low-water drainage of 0.4 c.f. per second per square mile of drainage area, which is the quantity generally adopted under the climatic conditions of the country. Under these conditions, the estimated H.-P. of the falls would be 120,000 and of the total fall for a distance of twelve miles 300,000.

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EXTRACTS FROM

REPORT ON EXPLORATIONS IN THE LABRADOR PENINSULA

ALONG

EAST MAIN, KOKSOAK, HAMILTON AND OTHER RIVERS

GEOLOGICAL SURVEY OF CANADA, A. P. LOW, 1895.

NOTE.—All bearings mentioned in this Report refer to the true North. The magnetic variation at the mouth of the East Main River is 17° west and increases as the river is ascended till at Lake Nichicun it is nearly 30° west. From Nichicun to Fort Chimo the variation increases gradually to 45° west at the latter place. At the mouth of the Hamilton River the variation is 38° west, and along the river it ranges between 30° and 38° west, while along the Romaine River it is about 30° west, and at Lake Mistassini about 20° west.

PHYSICAL GEOGRAPHY

The eastern coast of the Labrador Peninsula extends north-north-west, from the Strait of Belle Isle to Cape Chidley, a distance of about seven hundred miles, or from latitude 52° to latitude 60° 30′, fronting the North Atlantic. The northern boundary from Cape Chidley to Cape Wolstenholme, at the entrance of Hudson Bay, in a straight line, is nearly five hundred miles long, and runs about west-north-west in direction, forming the southern shore of Hudson Strait, including Ungava Bay. A line drawn from Cape Wolstenholme to the bottom of James Bay, runs nearly north and south for eight hundred miles, and corresponds closely to the eastern shore-line of the peninsula. The southern boundary is arbitrary, but has been taken as a straight line extending in a direction nearly east from the south end of James Bay near latitude 51°, to the Gulf of St. Lawrence near Seven Islands in latitude 50°. This line is nearly six hundred miles long, and passes close to the south end of Lake Mistassini. From where the line reaches the Gulf coast, in the neighborhood of Seven Islands, the shore-line forms the southern boundary to the Strait of Belle Isle, with a length of somewhat over five hundred miles.

The Atlantic coast is exceedingly irregular, being deeply cut by many long narrow bays, or fiords, so that the coast-line exceeds many times the direct distance from Belle Isle to Cape Chidley. Hamilton Inlet is the largest and longest of these inlets, extending inland over one hundred and fifty miles from its mouth. Among others, Sandwich, Kaipokok, Saglek and Nachvak bays are from thirty to fifty miles deep. These narrow fiords are surrounded by rocky hills that rise abruptly from the water to heights ranging from 1,000 feet to 4,000 feet. The water of the inlets is generally deep and varies from ten to one hundred fathoms.

A fringe of small rocky islands extends almost continuuously along the coast, with a breadth of from five to twenty-five miles. Outside the islands, the inner banks extend seaward for an average distance of about fifteen miles, and on them the water is rarely over forty fathoms deep. From this it will be seen that the fiords, as a rule, have greater depths than the banks outside the island fringe.

Hope's Advance is a western extension of Ungava Bay, as yet unexplored. The navigation of Ungava Bay and Hudson Strait is rendered dangerous to sailing craft by the strong currents and exceedingly high tides, the latter having a mean rise in Ungava Bay of nearly forty feet, and at exceptional spring-tides they have been known to rise sixty feet.

The eastern shore-line of James Bay is generally low, and the waters of the bay are very shallow and dotted far out with rocky islands and bouldery reefs, between which there is a perfect labyrinth of channels, navigable with small craft, but dangerous to approach with large vessels.

The peninsula of Labrador is a high, rolling plateau, which rises somewhat abruptly, within a few miles of the coast-line, to heights between 1,500 and 2,500 feet, the latter elevation being somewhat greater than the watershed of the interior. The interior country is undulating, and is traversed by ridges of low rounded hills, that seldom rise more than 500 feet above the general surrounding level. From the barometer readings, taken during the season of 1894, in conjunction with stationary barometers at Hamilton Inlet and Anticosti, the general level of the interior plateau, about the Upper Hamilton River and Lake Michikamau, near the central watershed, varies from 1600 feet to 1800 feet, and this may be taken as the general height of much of the interior of the peninsula. The highest part of the main interior mass is near the high granite area between the headwaters of the Peribonka, Manicouagan and Outardes rivers, flowing into the St. Lawrence, the East Main and Big rivers, flowing into Hudson Bay, and the Koksoak River flowing into Ungava Bay. The general elevation of this area exceeds 2,000 feet.

The only portion in which the general level is attained by a gradual slope, is the part facing James Bay, where the land along the coast is low, and the rise eastward towards the interior is so light that one hundred miles inland it is only about 700 feet above sea-level.

Along the Atlantic coast, the land rises abruptly inland, almost everywhere, to altitudes varying from 1,000 feet to 1,500 feet, from the Strait of Belle Isle to the vicinity of Nain. To the northward of Nain the coast range is much higher, and, in the neighbourhood of Nachvak Bay, ranges of sharp, unglaciated mountains rise abruptly from the sea to heights varying from 2,500 feet to 4,000 feet; while farther north they are reported to culminate in peaks of 6,000 feet, a few miles inland. With a slight decrease in height, this range continues northward to the barren islands at Cape Chidley. This mountain range appears to be confined to the coast region and probably is under fifty miles in width, the country on the western side sloping rapidly down to the level of the interior plateau.

The land fronting the Hudson Bay coast, as far south as Cape Jones, reaches the 1,000 feet level within a short distance from the sea, and then rises quickly to a general level between 1,500 to 2,000 feet, the latter being the maximum of elevation in this region, as determined by the few explorations in this portion of the

peninsula. The gradual rise from the seaboard of the country to the east and south-east of James Bay, has already been mentioned.

To sum up the foregoing statements of levels,—the interior of the peninsula is almost flat, so that in an area of 200,000 square miles, there is not a difference of general level of more than 300 or 400 feet, and the highest general level of the interior is under 2,500 feet.

Like the other portions of northern Canada underlain by glaciated Archaean rocks, the interior of the Labrador Peninsula is covered with myriads of lakes that occupy, at a moderate estimate, at least one-fourth of the total area. In size, these vary from small narrow ponds, to lakes with surfaces hundreds of square miles in extent.

On the western watershed, Clearwater Lake is one of several large lakes lying in an area between the sources of the Stillwater branch of the Koksoak River, and the Nastapoka, Clearwater, Little and Great Whale rivers flowing into Hudson Bay; all of which rise and flow through a number of large unexplored lakes.

Lake Nichicun is near the headwaters of the Big River and is drained by that stream. The Mistassini lakes discharge into the Rupert River, while the Nottoway River, which discharges into the southern part of James Bay, drains, among others, lakes Waswanipi and Chibougamau.

Besides the lakes mentioned, there are hundreds having a surface area between 20 square miles and 100 square miles, while smaller lakes are numberless. The only portion of Labrador not thickly covered with lakes, is the low country extending inland for about 100 miles from the east coast of James Bay. This area has been covered with a deep mantle of marine sands and clays, which has filled up the inequalities of the surface, and prevented the formation of lakes; it is covered instead by a net-work of small streams, with deep channels cut out of the stratified drift.

It follows, from the great number of lakes, that the country must be covered with a perfect network of streams discharging them. The discharges and lakes interlock so closely that, with a knowledge of the country, it is possible to travel with canoes in any direction, the longest portages never exceeding two or three miles.

There are four principal watersheds to the peninsula: of these the southern is the smallest, its rivers rarely exceeding 300 miles in length; the most important are the Saguenay and its branches, Bersimis, Outardes, Manicouagan, Moisie, Romaine, Natashquan and St. Augustine. The eastern watershed drains chiefly into Hamilton Inlet, three large rivers flowing into its head. Of these the Hamilton River is much the largest, taking its rise near the middle of the peninsula and draining an area extending from latitude 52° to latitude 54° covering seven degrees of longitude. Its longest branch rises nearly 600 miles from its mouth. The other rivers of Hamilton Inlet are the Northwest and Kenamou, the former draining a large area to the north of the Hamilton River, the latter flowing in from the south-west. Apart from these three large streams, no other rivers of importance are found along the Atlantic coast, on account of the high lands of the coast cutting off the drainage of the interior and forcing it to flow northward into Ungava Bay.

The Koksoak River is the largest stream flowing northward, and is probably the largest river of Labrador. Besides the main stream, there are a half dozen tributaries, each of which drains an important basin. The longest branch flows out of the northern end of Summit Lake, on the 53rd parallel of latitude, while a branch of the Manicouagan River flows out of the southern end of the same lake, thus connecting by water the Gulf of St. Lawrence with Ungava Bay. The total area drained by this river and its tributaries is about 60,000 square miles. The George River is another great stream which rises in large lakes close to Lake Petitsikapau on the Hamilton River, and drains a wide area westward of the Atlantic coast range. The Whale River is a smaller stream lying between the George and Koksoak rivers.

The western drainage basin is the greatest in Labrador and is emptied by large rivers, that rise far inland, close to the head-waters of the Koksoak and Saguenay rivers. Proceeding from the northward, the larger rivers flowing into Hudson Bay are:—The Nastapoka, which flows out of several large lakes to the eastward of Clearwater Lake and near the head of the Stillwater branch of the Koksoak River; the Little and Great Whale rivers, that rise close to the western branches of the Koksoak; the Big River which rises in the mountainous area south and east of the head of the East Main River, in about latitude 52°, and close to the sources of the Peribonka, Manicouagan and Outardes rivers tributaries of the St. Lawrence. From its source the Big River flows northward nearly one hundred and fifty miles, passing through Lake Nichicun, and then turns westward four hundred miles, emptying into James Bay, near latitude 54°.

The East Main River takes its rise in a number of lakes close to Lake Nichicun and flows nearly west, discharging into James Bay a short distance north of latitude 52°. The Rupert River forms the discharge of the Mistassini lakes, and, having such large reservoirs at its head, is not subject to the same fluctuations of volume, as the other rivers.

CLIMATE

The climate of Labrador ranges from cold temperate, on the southern coasts, to arctic on Hudson Strait and the high lands of the northern interior, and is generally so rigorous that it is very doubtful if the country will ever be fit for agriculture north of latitude 51°, except on the low grounds near the coast. Along the east coast of James Bay, good crops of potatoes and other roots are grown as far north as Fort George—about latitude 54°—while on the Atlantic coast of the peninsula, about the head of Hamilton Inlet, similar crops are easily cultivated. On the outer coast the climate is more rigorous, and appears to be much affected by the northern current, with its numerous floating icebergs, which lowers the mean temperature and renders the growth of root crops slow and uncertain at Rigolet in latitude 54°. Garden vegetables are, however, grown at Nain in latitude 56° 30′; but extra precautions are taken with them, such as the building of walls to protect them from the east wind, and covers put over them when in danger from summer frost. At Fort Chimo, near the mouth of the Koksoak River in latitude 58°, with care small patches of turnips, lettuce and radishes are grown.

In the interior, at the Hudson Bay's post of Mistassini, in latitude 50° 30′, a crop of potatoes is raised annually, but, owing to the shortness of the season and

the prevalence of summer frosts, they rarely mature without the tops being frozen. No other vegetables are cultivated here at present. At Nichicun attempts are made to grow potatoes, but they have always proved more or less failures, owing to frosts in July and August. It will thus be seen that the prospects of the settlement of the central portion of Labrador, for purposes of agriculture, are by no means bright; and, if settlements are made for other purposes, the inhabitants will have to depend largely on more southern localities for their vegetable food. Owing to the absence of grass plains, and to the mantle of moss and lichens that covers the surface of the ground almost everywhere, there is little likelihood that it will ever be a grazing district. The high lands of the interior have only two seasons, winter and summer. The summer season begins almost simultaneously throughout the interior, and the jump from winter into summer, occurs as a rule during the first two weeks of June, when the snow disappears, and the ice leaves the rivers and lakes, except the largest, where it often remains until July. With the disappearance of the snow and ice, the temperature during the day rapidly increases, and the leaves are almost immediately put forth by trees and bushes. During 1894, frosts were of almost nightly occurrence until June 28th, when a thin sheet of ice was formed in the vessels about camp, and slight flurries of snow fell in the morning. After this date no frost was noted, but, thermometers having unfortunately been broken, the exact temperature could not be taken. To the north of latitude 52°, snow falls and ice begins to form in the small lakes about the middle of September. From early in October the snow remains permanently, and all the smaller lakes are solidly frozen, so that, for the greater part of the interior plateau, there is at most only three months of summer. The temperature during the winter season is often very low on the interior high lands, away from the influence of the sea. The coldest months are December, January and February.

According to reports of the Indians, the ice in Lake Michikamau is 7 feet 6 inches thick on the average, and the amount of continuous frost to form such a thickness must be very great. The ice in Lake Winokapau, in the deep valley of the Hamilton River, was from actual measurement found to be 4 feet 9 inches. From the journal kept at the post on this lake, between 1866 and 1874, the first snow generally fell about September 20th and continued until June, the latest record being June 10th. The lowest temperature recorded was 55° below zero. Geese and summer birds arrived on or about May 10th. From the journals at Northwest River post, the lowest temperature recorded from 1867 to 1893, was 53° below zero. There are several observations of 45° below zero, which appears to be the minimum winter temperature of most years. At Rigolet, where the temperature is moderated by the open sea, the thermometer rarely registers 40° below zero. At Fort Chimo, where the open sea is not far distant, 45° below zero is said to be the lowest temperature registered. The summer temperature of the Atlantic coast region is considerably lower than inland or along the western coast. As a rule the thermometer in the interior—north of Mistassini—rarely rises above 80° during the middle of the day on more than a few days during the summer season.

The temperature depends greatly on the direction of the winds. During the summer, south and south-west winds prevail in the interior, and are accompanied by higher temperature and often overcast sky, with drizzling rain. The west and

northwest winds bring clear weather with lowering temperature, especially during the winter season. North and north-east winds are usually accompanied by heavy storms of rain and snow, with cold moist atmosphere. East and south-east winds, as a rule, blow with clear pleasant weather.

The precipitation of moisture over the interior area is not great. During the winter the snowfall varies from three to six feet, and the greater part of it descends during the periods of north or north-east wind, which are not common; the north-west wind, blowing at least three-quarters of the time during the winter season, is accompanied by a bright clear atmosphere. During the summer season the precipitation, if not great, is constant, as a day rarely passes without drizzle, or thunder showers, which lower the temperature.

At Northwest River, the head of Hamilton Inlet freezes completely over between the 1st and 15th of December, and opens again between May 15th and June 15th. Snow falls early in October, and from that date to about the first week in May, the latest record being July 2nd. At Rigolet, the outer part of Hamilton Inlet rarely or never freezes solid before the middle of January, and in some winters does not close at all. This is due to the strong currents in this part of the inlet. Sandwich Bay, nearly one hundred miles farther south, generally freezes over in the end of December, and the same time may be taken as that of the closing of most of the larger fiords of the Atlantic coast. About Fort Chimo, the lower grounds are permanently covered with snow by the 1st of December, this covering remaining until the 10th of June. The higher hills retain snow until the last of August, and by the middle of September snow again covers the tops of the distant high hills.*

SOIL

The soil of the greater part of the peninsula is derived from the underlying Archaean rocks, and is mostly in the form of glacial till, mixed with boulders of various sizes. The till is a mixture of sand and clay in which the former greatly predominates. In many large areas which have been traversed by fire, much of the vegetable matter of the surface has been destroyed, and the remaining soil supports only a scant growth of small trees. Along the sides of the river-valleys the drift has been re-arranged and mixed with sediments. Here the soil, though generally light and sandy, is richer than the unmodified till; and the size and variety of trees growing on it are consequently greater. Within the limits of the marine deposits, about the margins of the peninsula, the stratified sands are underlain by bedded clays, and as the coast is approached, the overlying sands thin out, leaving the clays near the surface, thus producing a light soil with a heavy subsoil, on which the vegetation is much better than anywhere else, except on the lower banks and islands in the rivers near the coast, where the sands and clays are topped with deposits of alluvium. The soil covering the areas of Cambrian rocks, being made up of the debris of limestone, shale and other rocks of this formation, is of a heavier nature than that formed from the Archaean rocks; and the change from one to the other is marked by the better growth of trees on the former.

* Annual Report U. S. Bureau of Ethnology. 1889-90.—Ethnology of the Ungava District. L. M. Turner, p. 172

TREES AND OTHER PLANTS

The southern half of the Labrador Peninsula is included in the sub-arctic forest belt, as described by Prof. Macoun.* Nine species of trees may be said to constitute the whole arborescent flora of this region. These species are:—*"Betula papyrifera"*, Michx.' *"Populus tremuloides"*, Michx., *"Populus balsamifera"*, Linn., *"Thuya occidentalis"*, Linn., *"Pinus Banksiana"*, Lam., *"Picea alba"*, Link., *"Picea Nigra"*, Link, *"Abies balsamea"*, Marsh, and *"Larix Americana"*, Michx.

The distribution of the forest areas and the range of the various trees depend on several factors, among which may be mentioned, position as regards latitude, height above sea-level, distance from sea-coast, and character of the soil, all of which are important.

The forest is continuous over the southern part of the peninsula to between latitudes 52° and 54°, the only exceptions being the summits of rocky hills and the outer islands of the Atlantic coast. To the northward of latitude 53°, the higher hills are treeless and the size and number of the barren areas rapidly increase. In latitude 55°, more than half the surface of the country is treeless, woods being only found about the margins of small lakes and in the valleys of the rivers. Trees also decrease in size until, on the southern shores of Ungava Bay, they disappear altogether. The Leaf River, which empties into the bay a few miles north of the mouth of the Koksoak River, is the northern limit of forest trees on the west side of Ungava Bay.

Along the east coast of Hudson Bay, Dr. Bell found trees growing a few miles beyond the north end of Richmond Gulf.†

In the neighbourhood of Clearwater Lake, the writer found many clumps of black spruce and larch, and, according to Indian reports, small patches extend to the Nastapoka River latitude 57°. So that a line drawn a little south of west, from the mouth of the Leaf River to the mouth of the Nastapoka River on Hudson Bay, would give a close approximation to the northern tree limit of western Labrador.

The tree-line skirts the southern shore of Ungava Bay and comes close to the mouth of the George River, from which it turns south-south-east, skirting the western foot-hills of the Atlantic coast range, which is quite treeless, southward to the neighbourhood of Hebron, in latitude 58°, where trees are again found in protected valleys at the heads of the inner bays of the coast. At Davis Inlet, in latitude 56°, trees grow on the coast and high up on the hills, the barren grounds being confined to the islands and headlands, which remain treeless to the southward of the mouth of Hamilton Inlet. These barren islands and bare headlands of the outer coast, along with the small size of the trees on the lowlands, have caused a false impression to be held regarding much of the Atlantic coast, which from Hamilton Inlet southward is well timbered about the heads of the larger bays and on the lowlands of the small river-valleys.

The distribution of each of the several species of trees depends on conditions similar to those affecting the forest areas in general.

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* The Forest Trees of Canada. John Macoun.—Trans. Royal Soc. of Canada, Sec. iv, 1894, pp. 5-7.

† Report of Progress, Geol. Surv. Can., 1877-78, p. 256.

"*Betula papyrifera*" Michx. (White Paper, or Canoe Birch) is found everywhere throughout the southern portion of the peninsula. Except in the district to the southwest of Lake Mistassini, drained by the Nottaway River, and on the southern watershed, the trees do not grow sufficiently large or straight to afford bark for canoe building, and the Indians of the more northern portions have to depend upon bark imported by the Hudson's Bay Company for their canoes. About Lake Nichicun and on the upper waters of the Hamilton River, the largest trees rarely exceed eight inches in diameter. The trees are found in thickets of second-growth, on the hillsides which have been traversed by fire; they also grow sparingly in unburnt portions. Northward of Nichicun, the white birch becomes rapidly smaller and along the upper Koksoak River does not average three inches in diameter. At Cambrian Lake, where the limestones are encountered and the river-valley is deep and protracted, the size of the trees improves, and birches six inches in diameter are not uncommon. Below the junction of the Swampy-bay River, the trees again become small, and finally die out on the Koksoak River a few miles above Fort Chimo. On the Hudson Bay side, the northern limit of white birch is near the mouth of the Great Whale River, while inland it is found, in small straggling clumps, at the head-waters of the south branch of that river. About Hamilton Inlet, birch is common, and, at the head of the inlet, trees up to ten inches in diameter are not uncommon.

"*Populus tremuloides*", Mich. (Aspen). The range of this tree depends, to a great extent, on the nature of the soil. In the southern portion of the peninsula, it is found as a second growth along with the white birch, and also in clumps in the original forest. It appears to be most plentiful on the western half of the peninsula, where it grows most abundantly on the unmodified glacial till of the drift ridges. At Lake Mistassini, this tree is abundant and is often ten or twelve inches in diameter about the southern portion of the lake. Along the upper East Main River, only small clumps of bent and twisted trees are seen, while about Nichicun it is exceedingly rare. To the northward of Nichicun, this tree was not seen along the route followed to Ungava Bay. On the Hudson Bay coast, the neighbourhood of Cape Jones is the northern limit of the aspen; while inland it is found on the portage-route, between the lower and upper parts of the Big River, in latitude 54°. About the head of Hamilton Inlet, and along the river below the Grand Falls, clumps of aspen are frequently met with. But above the Grand Falls this tree was not seen anywhere on the waters of the Hamilton River, its first occurrence on the route southward being near the portage route leading to the Romaine River from Lake Attikonak. Along the Romaine River, it soon becomes common as the stream is descended. On the Manicouagan River aspen is found in the deep river-valley to beyond latitude 52°, but does not grow on the surrounding table-land.

"*Populus balsamifera*", Linn. (Balsam Poplar) is met with farther north than the aspen; but it appears to confine itself to the heavy clay soil of the river-valleys, or to the modified drift of the Cambrian areas. It is met with along the Big and East Main rivers, flowing into Hudson Bay, and its northern limit on this side of the peninsula is the Bishop Roggan River, the next stream north of the Big River. Along the rivers of this coast, balsam poplar was only met with for about

one hundred miles inland from the coast, where its limit was that of the stratified marine clays of the river-valleys. On the upper East Main River, it was nowhere seen, and it does not appear to grow northward of Lake Mistassini in the western interior. After passing through an area of several hundred miles from Mistassini to Eaton Canyon, on the Koksoak River, balsam poplar is again found growing in the valley of that river and continues to be found at intervals, to within twenty-five miles of Fort Chimo. At the head of Cambrian Lake, large clumps of trees of this species, ten inches in diameter, were observed growing on the low terraces, but elsewhere they were small and straggling. On the lower Hamilton River, balsam poplar is common. Above the Grand Falls it is not found along the river, for upwards of a hundred miles, until the Cambrian area about Birch Lake is reached, when small trees of this species become common, and continue along the Ashuanipi Branch to the end of survey. On the Attikonak Branch, a few small trees were noted between Sandy Lake and the height of land to the southward.

"Thuya occidentalis", Linn. (Cedar) hardly enters the southern limits of the peninsula. It occurs just south of the mouth of the Rupert River, at the foot of James Bay, and does not cross that stream in the eastern course of its northern limit. It is only found about the south-western bays of Mistassini Lake, from which it extends south-east, crossing the St. Lawrence to the westward of Seven Islands. No cedar trees were seen along the Manicouagan River from its mouth upward.

"Pinus banksiana", Lam. (Banksian pine, Jack-pine, Cypress) is limited in its extension by an eastern as well as a northern boundary. It grows freely over the western half of the peninsula, and appears to prefer the dry, sandy drift ridges and rocky hills, where it is often found along with black spruce, as a second growth, covering areas devastated by fire. Its northern limit is the south branch of the Great Whale River, south of which it occurs abundantly to the shores of the St. Lawrence, but does not come quite to the coast on Hudson or James Bay, probably on account of the shore being generally low and swampy. Inland, it is met with abundantly, along the East Main River, to the Long Portage Creek, near its head, in about longitude 71° W. Here a line running nearly north and south terminates the eastern extension of the Banksian pine. About Nichicun only a few clumps are found to the westward of the lake, and it is unknown to the Indians to the eastward. In the southern extension of its eastern limit, the line runs somewhat east of south and reaches the St. Lawrence in the neighbourhood of the mouth of the Moisie River, being everywhere common along the main branch of the Manicouagan River.

"Picea Alba", Link. (White Spruce) is found throughout the wooded area of the peninsula, but it is not everywhere common, and there are several areas where it is rarely found. Its distribution is but little affected by climate or by height above sea level; it appears to depend altogether on the soil. North of the southern watershed, it is confined to the areas of re-arranged drift of the river-valleys and marine deposits along the coast, or to the heavier drift of the Cambrian areas of the interior. Along the western coast, the interior limit of this tree, on the East Main and other rivers flowing into Hudson Bay, coincides closely with the margin of the marine deposits, and consequently does not extend one

hundred and fifty miles eastward from that coast. From Lake Mistassini, along the route to Nichicun, no trees of this species were met with, but it is said to grow sparingly about the latter place. A few small trees were observed on terraces between Nichicun and Lake Kaniapiskau. Along the upper Koksoak River, small trees were seen occasionally on its terraced banks to Eaton Canyon. Below this place, the number of trees and their size increased rapidly in the river-valley, and from here to the forks of the Stillwater many of them exceeded eighteen inches in diameter three feet from the ground and were over fifty feet in height. Below the Stillwater, their size rapidly decreased, and the trees died out near the mouth of the Koksoak River, along with the black spruce and larch, of which the northern limit is about co-terminous with that of the white spruce. About Hamilton Inlet, white spruce is abundant on the lowlands, and at the mouths of the Kenamou and Hamilton rivers, many large sticks have been taken out for spars and masts for schooners. Here, and along the Hamilton River valley, where unburnt, this tree often exceeds eighteen inches in diameter, and grows sufficiently tall to allow of three good twelve-foot logs being cut out of a single tree. Above the Grand Falls, white spruce is found along the river banks, but is generally small and scattered until the Cambrian area of the upper waters is reached, when it becomes more abundant and grows well up the hillsides. Many of the trees of this region are very stout at their bases, but being short and branching would make poor lumber. To the southward of the Cambrian area, on the Attikonak Branch and the upper Romaine River, very few trees of this species are seen until the latter stream enters its ancient valley, when they become more abundant. They are found everywhere in the valley to the St. Lawrence. In the valley of the Manicouagan River, trees of this species attain a large size and are very abundant to Lake Mouchalagan, above which they gradually become fewer and smaller, and die out near the mouth of the Attikopi River.

"*Picea nigra*", Link. (Black Spruce) is the most abundant tree of Labrador and probably constitutes over ninety per cent of the forest. It grows freely on the sandy soil which covers the great Archaean areas, and thrives as well on the dry hills as in the wet swampy country between the ridges. On the southern watershed the growth is very thick everywhere, so much so that the trees rarely reach a large size. To the northward, about the edge of the semi-barrens, the growth on the uplands is less rank, the trees there being in open glades, where they spread out with large branches resembling the white spruce. The northern limit of the black spruce is that of the forest belt; it and larch being the last trees met with before entering the barrens.

"*Abies balsamea*", Miller. (Balsam Fir, or Spruce), is another species that grows only on suitable soil. It is found nearly to the edge of the barren grounds. Throughout the wooded regions it grows more or less plentifully about the margins of the larger streams and lakes, apparently preferring soil containing considerable moisture and alluvium. Northward of the southern watershed, it is rarely found away from the edges of rivers and large lakes, and is wanting along the portage routes connecting the larger streams. On the Hudson Bay coast, its northern limit is near the Great Whale River. On the Koksoak River a few trees were seen below the junction of the Stillwater. Along the Hamilton River

it grows everywhere and was also found growing about the shores of Lake Michikamau.

"Larix Americana", Michx. (Larch, Tamarack, 'Juniper'), is probably the hardiest tree of the sub-arctic forest belt; it grows everywhere throughout the Labrador Peninsula, and is probably next in abundance to black spruce. Throughout the interior it is found growing in all the cold swamps, and is always the largest tree in the vicinitly. Along the northern margin of the forest, the larch continues as a tree to the very edge, where the black spruce is dwarfed to a mere shrub. The larch of the southern region has been almost totally destroyed by the ravages of the imported European larch-saw-fly (*Nematus Erichsonii*). The present range of this pest extends northward from Lake St. John to beyond Lake Mistassini, and appears to be yearly spreading northward and eastward, but has not yet reached the St. John or Romaine rivers flowing into the Gulf of St. Lawrence.

Areas of forest of sufficient size, with trees large enough for commercial purposes, are confined to the southern watershed and to the lower courses of the streams flowing into the Atlantic or Hudson Bay. It is very doubtful if such areas occur along these coasts to the north of latitude 54°. Much of the timber of the more southern regions is not of the best and would afford only spruce deals, while the greater part could hardly be profitably worked in competition with the western pine; but the time will probably come when the trees of the more favourable portions of Labrador will be profitably worked into lumber, especially if the smaller growths are cut at the same time for the manufacture of paper pulp.

At least one-half of the forest area of the interior has been totally destroyed by fire within the past twenty-five or thirty years. These fires are of annual occurrence and often burn throughout the entire summer, destroying thousands of square miles of valuable timber, to the south of the central watershed. The regions thus devastated remain barren for many years, especially towards the northern limits, and the second growth of black spruce, Banksian pine, aspen and white birch is never as good or as large as the original forest. These fires are due to various causes, but the majority of them can be traced to the Indians, who start them either through carelessness or intentionally. The Nascaupee Indians of the semi-barrens signal one another by smoke made by burning the white lichens that cover most of the ground in the interior, and these signals cause many of the fires. The southern Indians signal in a similar manner, but do not practice it to such an extent as their northern brethren, having found that they are rapidly destroying their hunting grounds. Careless camp fires in dry seasons are another common cause of these forest fires, and many of those ascribed to lightning, if closely traced would be found to have been set by wandering Indians, who are only careful on their own hunting grounds. From what is seen on the explored routes of the southern watershed, it would appear that at least one-half of the forest has been removed by this cause.

The greatest fire of modern times occurred in 1870 or 1871, and swept the country south of the height of land, from the St. Maurice to beyond the Romaine River. The second growth is just beginning to cover up the traces of this great conflagration, which ruined the pioneers of Lake St. John, and it will be years be-

fore the country is generally again well wooded. The upper Romaine river-valley has been totally burnt over within the last ten years, and the margin of this great burnt area has been extended southward during the summers of 1893 and 1894, so that now practically no green woods exist along the course of this river from the St. Lawrence to its source. The country surrounding the Hamilton River is in a similar state; except patches of original forest, along the lower part of the river-valley and about Hamilton Inlet, only blackened stumps or a small second growth are seen along its course, with an occasional oasis of large green wood to break the monotony. In this region great fires occur annually; that of 1893 covered hundreds of square miles of the table-land between the Hamilton and Northwest rivers. Similar remarks apply to the forests of the western watershed, more than half of which have been burnt.

Throughout the forest belt, the lowlands fringing the streams and lakes are covered with thickets of willows and alders. As the semi-barrens are approached, the areas covered by these shrubs become more extensive, and they not only form wide margins along the rivers and shores of the lakes, but with dwarf birches occupy much of the open glades. The willows and birches grow on the sides of the hills, above the tree line, where they form low thickets exceedingly difficult to pass through. Beyond the limits of the true forest, similar thickets of Arctic willows and birches are found on the low grounds, but on the more elevated lands they only grow a few inches above the surface. In the southern region, the undergrowth in the wooded areas is chiefly Labrador tea (*"Ledum latifolium"*) and "laurel" (*"Kalmia glauca"*), which grow in tangled masses, from two to four feet high, and are very difficult to travel through. In the semi-barrens this undergrowth dies out, and travel across country is much easier in consequence. In the southern regions the ground is usually covered to a considerable depth with sphagnum, which northward of 51° is gradually replaced by the white lichens or reindeer mosses (*"Cladonia"*), which grow freely everywhere throughout the semi-barren and barren regions.

POPULATION

With the exception of the white settlements along the north shore of the Gulf of St. Lawrence and on the Atlantic coast, and the few whites employed by the Hudson Bay Company in the interior and on Hudson Bay, the inhabitants of the Labrador Peninsula are either Indians or Eskimo.

From the returns given in the reports of the Department of Indian Affairs, the Indians of the Gulf of St. Lawrence, including those of Lake St. John, numbered 1,919 in 1888, and 1,725 in 1893. These figures exclude 2,860, under the heading of the "Nascopies of the Lower St. Lawrence", which number is the same in both returns. According to the same source, the number of Indians of Eastern Rupert Land is 4,016; that of the Labrador (Canadian Interior) 1,000, and that of the Atlantic coast 4,000. The last probably refers to the Eskimos, but is not so stated. These returns would give a total native population of more than 13,000 persons, if the Indians of Eastern Rupert Land are those of the east coast of Hudson Bay.

The Eskimo inhabit the coast of the peninsula from Hamilton Inlet northward along the Atlantic coast to Hudson Strait, the east shore of Hudson Bay as far south as Great Whale River, while a few families live on the islands of James Bay.

From the meagre returns available, only an approximate statement of their numbers can be compiled. The following estimate of the Eskimo population living on Hudson Strait and the east coast of Hudson Bay was supplied by Mr. R. Gray, who was for upwards of ten years clerk at Fort Chimo, and is well acquainted with the Eskimo of Ungava Bay:—From Cape Chidley to Hope's Advance, 51 families; about Hope's Advance, 30 families; from Stupart Bay to Cape Wolstenholme, 80 families; from Cape Wolstenholme to Great Whale River, 80 families. The average Eskimo family is small and rarely exceeds five persons. Taking this as the average, the total population of the west of Cape Chidley would be 1200 persons. This estimate is probably excessive, and 1,000 persons would be nearer the number, if not still above it.

According to the Canadian census (1891), there is a white population of 5,728, scattered along the north shore of the Gulf of St. Lawrence, to the eastward, and exclusive of those living about the mouth of the Saguenay River, who number 2,440.

To sum up, taking 3,500 Indians, 2,000 Eskimo and 8,800 whites, the total population of the Labrador Peninsula is 14,300, or, roughly, one person to every thirty-five square miles.

The white population along the gulf coast consists largely of French-Canadians who obtain a livelihood chiefly from the fisheries, with slight help from fur hunting during the winter. On the Atlantic coast the whites, northward from the Strait of Belle Isle to Sandwich Bay, are largely English-speaking, and are either immigrants from Newfoundland, or the descendants of English fishermen formerly engaged in the salmon fishery. Northward of Sandwich Bay, the white inhabitants are, for the most part, descended from Hudson's Bay Company servants, who married Eskimo women and remained on the coast after their services had expired. They are known along the coast as "planters," and gain a fairly comfortable living from the cod and salmon fishery in the summer, and by fur hunting during the winter.

FISHERIES

In the appendices at the end of the present report will be found lists and short notes on the mammals, birds and fishes of the interior of the Labrador Peninsula, and it remains only to remark here on the value of the inland fisheries. The numerous large lakes of the several watersheds, and most of the rivers, especially those flowing north and east, are stocked with an inexhaustible supply of food fishes of large size and superior quality, including among other species the lake and brook trout, land-locked and sea-run salmon, whitefish, pike, pickerel, suckers and ling or freshwater cod. Along the southern, eastern and northern coasts, the cod is taken in large quantities as far as Ungava Bay, which is the present limit where trial has been made for taking this fish. Salmon are found plentifully along the coasts as far as the west side of Ungava Bay, which appears to be the western limit of the Atlantic salmon. Very little is known officially or otherwise concerning the fisheries of that great inland sea, Hudson Bay, and a great amount of wealth may be lying dormant in its waters from lack of knowledge concerning its fisheries. As regards the inland fisheries, owing to the distance from available routes to a market, they will probably never be used to their full extent, and even

the best situated lakes will not be fished for many years to come, or until railways are built through the interior. Three large lakes of the interior are known to contain considerable numbers of harbour seals (*Phoca vitulina*), which are completely land-locked, and never visit the ocean.

DETAILED DESCRIPTIONS OF ROUTES EXPLORED

EAST MAIN RIVER

The Hudson's Bay post at the mouth of the East Main River, on the east shore of James Bay, has been determined by W. Ogilvie, D.L.S., in 1890, to be in latitude 52° 14' 45" N. and longitude 78° 29' 15" W.

The river, at its mouth, is a mile and a half wide, but is obstructed by a number of sand and shingle shoals, bare at low water, with shallow channels between them. The river-banks are low and sandy. As the river is ascended, the sand gives place to clay, cut in places by the river into steep faces. The Hudson's Bay Company's post is situated on the south side, three miles from the mouth, where the banks are about fifteen feet high. The river opposite the post is a little under a mile wide. Three large islands of clay occupy the southern side of the river for two miles and a half above the post, with a narrow, shallow channel between them and the mainland on that side. Opposite the head of the upper island a small river, called Fishing River, falls into the main stream from the north-east. Tide-water extends seventeen miles up the river, and for this distance the course is about due east. The banks are low, formed of stiff blue clay, and much of the land on either side is low and swampy. The river gradually narrows from a width of three-quarters of a mile, above the islands, to about a quarter of a mile at the head of tide, where a small stream called Coldwater River, comes in from the south. The current, from the mouth to the head of tide, varies from two to four miles per hour. Along the river bottom there is an abundant growth of medium-sized white and black spruce, balsam spruce, balsam fir, aspen and balsam poplar.

Immediately above the head of tide, the character of the river changes to a succession of rapids, and for the next six miles the banks become increasingly higher, with steep cut faces, showing clay overlain by sand, or sometimes coarse boulder-clay, with an occasional exposure of rock coming up from beneath. The banks here rise from fifty to one hundred feet.

Twenty-five miles from its mouth, the river divides into two branches, which appear to be nearly equal in size, one coming from the north-east, the other from the east, the latter being the one surveyed. From the Indians at East Main post, it was learned that the north-east branch is called the Opinaca or Straight River, and that its volume is about two-thirds that of the other branch. It is much the easier river to ascend, being free from long rapids and portages, and takes its rise in a number of large lakes between the head-waters of the East Branch and those of the Big River.

Above the forks the course of the east branch is due east for seven miles, while its width varies from 600 to 800 yards; the current is sluggish and the banks low, but they rise gradually as the stream is ascended, so that in the last mile and a half

of this course, they are from fifty to seventy-five feet above it, and present cut faces of stratified sands and clays, or of boulder-clay. The river here narrows to a width of 300 yards and becomes rapid.

At the end of this course there is a sharp bend to the south, and a quarter of a mile above the bend is a chute of twenty feet called Talking Falls, with strong rapids below and above it. From this chute, the river, with several minor bends, has a general south-east course for the next six miles, being almost a continuous rapid with about 120 feet fall, including a chute of sixty feet, called the Island Falls, at the upper end. At this chute the river is divided into a number of narrow channels by several small rocky islands. The banks along this portion of the river are not high, and the country appears to rise with the river. There is a portage of 400 yards on the south side past the chute, and two miles above it a small river, called the Miskimatao, comes in from the south.

Above the chute, the river again expands to an average width of 600 yards, and flows from N. 60° E., almost on a level with the surrounding country, for ten miles between low banks of clay capped with sand. The timber continues the same as before, but is somewhat smaller. The river now narrows to 250 yards, and continues with small rapids northward for a mile, between rocky hills, then turning east, it widens slightly and is less rapid for another mile, to the foot of a narrow rocky channel called Clouston Gorge. This gorge for a mile and a half from its mouth is perfectly straight, and is never more than 100 feet wide, narrowing in one place to thirty feet, with rocky sides that rise almost perpendicularly 100 or 200 feet above the river, which rushes through it in one great rapid, falling in the interval 105 feet.

Above this the course changes to S. 70° W., and the river becoming slightly wider, mounts in the next three-quarters of a mile twenty feet to the foot of a rocky island 1200 yards long with a narrow channel on either side. Through these channels the river falls over 100 feet in a succession of chutes. For three-quarters of a mile above the head of the island, there are a number of small islands with rapids between them.

To pass these obstructions it is necessary to portage canoes and outfit three-quarters of a mile through a deep swamp, with only one spot sufficiently dry to allow the loads to be laid down. The portage begins immediately below the gorge on the south side, and ends in a small bay near the head of the islands.

The river is now found flowing nearly at the level of the surrounding country, with a sluggish current between low banks that become more and more sandy. The general course of the next stretch is N. 60° E., and the distance twenty-two miles, the breadth of the river varying from a quarter to three-quarters of a mile, with an average of about half a mile. The limit of balsam poplar is reached near the upper end of this course, a fact due probably to the absence of low clay banks along the river above. The other trees are smaller, and white spruce beyond this becomes scarce. White birch is now a common tree, and Banksian pine is found wherever second-growth timber occurs on sandy soil.

Continuing on the same course for three miles and a half, the river again becomes rapid, and flows in a valley which at first is about 200 yards wide, with scarped sandy banks which rise about 150 feet above it. Soon the channel narrows to less than 100 yards, and the sandy banks give place to rock as it enters Conglomerate Gorge. In the upper half of the distance the fall is very steep, the

river passing with a succession of chutes, in small channels between a number of small, narrow, rocky islands. The total fall here is over 100 feet, including three chutes of twenty, ten and thirty feet respectively.

From the head of this rapid, the river bends to the south for a mile, then S. 30° W. one mile, and again south another mile to a chute of ten feet. At this last fall, the character of the river and surrounding country changes. From its mouth to this point the river has flowed in a shallow valley, nearly on the surface of a number of broad terraces of stratified sand and clay, arranged one above the other. Where it descends from one level to the next, the river has cut a valley back into the sands and clays of the upper terrace until the underlying rock has been reached, over which it falls in a succession of rapids and chutes, often hemmed in by steep rocky walls.

The terraces are composed of marine deposits laid down during the depression of the land at the close of the glacial period, when the level of the western side of the Labrador Peninsula was over 600 feet lower than at present. Farther up the river, marine deposits are wanting, and the surface material is formed of unstratified, coarse boulder clay. Owing to the absence of terraces, there are no marked drops from level to level, but rather a more or less gradual slope of the whole country, while the river, without even a shallow valley as in its lower part, flows almost at the level of the country and follows the general slope, except where diverted by rocky ridges that cross its course obliquely in several places. In the lower part the river is obstructed only by islands at the various falls, and there are few rock-exposures elsewhere; while in the upper part rocky islands are everywhere numerous, and long stretches of the shores are also formed of rock.

The surrounding country, in the lower part, is generally flat and often swampy, but there is a marked absence of small lakes, though about the upper part of the river some are found in every valley between the low, rounded, rocky hills that characterize this region. The soil in the hilly country is scant and poor, being composed wholly of boulder-clay, often with very little finer material. The climate also appears to be more rigorous than it is nearer the sea-coast, and the timber is much smaller, consisting of the following species arranged in order of abundance:—Black spruce, Banksian pine, larch, balsam fir, white birch and a few stunted aspens. The larch grows to the largest size, a few trees being upwards of twelve inches in diameter near the base; the other species seldom or never have a diameter exceeding nine inches, and in the upper part of the river are only found growing thickly on the lower ground, about streams or lakes, with the hills only partly covered by small trees of black spruce and Banksian pine. The white spruce does not grow beyond the limits of the deposits of marine sands along the East Main River.

Above the last-mentioned chute, the next course is about due east, including two short sharp bends to the south, in a distance of eight miles. Along this course, the river flows in a shallow, rocky channel, about a quarter of a mile wide, through an almost flat region, broken only by a few low, rounded hills. The descent is sharp, there being five rapids and two chutes of six and eight feet, separated by short intervals of swift current. At the upper rapid and chute, the river bends to the south-east for another eight miles. In this interval it is broken into several channels by a number of large islands, strung out along the entire distance. The current in these channels is moderate, with only one small rapid near the up-

per end. The Kausabiskau River is a small stream that falls in on the south side near the foot of this rapid.

Further up, the river for twenty-five miles forms a long gentle curve, bending first slightly north and then south of east, so that a line joining the ends of the curve would run east and west. Here, stretches of quiet water connect five short heavy rapids. Rocky islands are numerous and the shores are low and in places rocky, but more commonly swampy. To the south there are hills running in ridges roughly parallel to the course of the river. These culminate four miles up this course, in Flattopped Mountain, that rises nearly 500 feet above the water-level. The rest of the range rarely exceeds 300 feet, and 250 feet may be taken as its mean height above the general level. Similar ridges of rounded hills are seen to the northward, but they do not appear to be as high as those on the other side and they are more distant, leaving a wide margin of low swampy land between their bases and the river. The trees on these hills have almost all been burnt recently, leaving only a few patches of green wood. Where the rapids occur in the river, the hills close in on either side.

Medium sized rivers fall into the main stream at the second, sixth and tenth mile of this course. The first and third are called respectively Wabistan and Akuatago, both coming from the southward; the second is called the Wabamisk and comes from the northward. It is much larger than the others, being about 200 feet wide at its mouth, with a slow current.

The main river above bends to the south-east for eight miles, and then to the east again for eight miles. The country and river have much the same character as the part last described, the current being somewhat stronger, with three small rapids. At the upper end of the last course there is a small stream called the Clearwater River, that comes in on the north side and flows in a wide straight valley from E.-N.E., a continuation of the valley in which the main river flows below. The Indians who hunt in this region say that it is only a half day's journey from the mouth of this stream to a large lake on a branch of the Straight River.

Turning now sharply to the south-west, the main river, which has had an average breadth of over a quarter of a mile, enters the Great Bend, and contracts to about 100 yards, and for the next fifteen miles is nothing but a succession of heavy rapids and chutes. Its banks are high and rocky in most places as it breaks the range of hills before mentioned on the south side. The surrounding country is much rougher than any before seen, with rounded hills, from 200 to 300 feet high, arranged in close parallel ridges. The lower six miles of the river are particularly rough, and as the perpendicular cliffs on both sides render portaging impossible in many places, it is with difficulty that this part of the river is passed with canoes. At one place about three miles from the foot of the rapids, there is a sharp bend to the northward and the water rushing down is deflected by a sharp point running out from the east side at the bend, which causes the greater volume of the water to enter a small bay, where a great whirlpool is formed. It is stated that many years ago two large canoes belonging to the Hudson's Bay Company were drawn into this whirlpool and all on board drowned.

At the upper end of this south-west course, a small stream, called Misiatawagamisistic River, comes in from the south-west, and it is believed that there is a portage route by it, past the rapids below.

Turning now to S. 40° E. for three miles, the river gradually widens, and

passing two small rapids, again becomes easily navigable. It flows, with a sluggish current, in a channel 500 yards wide, and only slightly below the level of the surrounding low, flat, swampy country. This continues for fifteen miles, the general course being N. 60° E. Two small rivers come in along this course from the north. At the upper end there is a fall of ten feet, above which the river, continuing along the same course for fourteen miles, has a similar sluggish current, with the exception of one small rapid at the head of two large islands. The surrounding country remains low and swampy, except in the vicinity of the rapid, where a low range of hills passes close to the river on the south side.

Above the two islands the river again turns to the east and flows with a remarkably straight course for nineteen miles. The hills on either side here close in and narrow the valley, through which the river runs at a uniform rate of about four miles per hour, in a shallow channel averaging 400 yards in width. The hills, as a rule, do not rise much above 200 feet from the water, and only an exceptional one reaches 300 feet. They are arranged in ridges nearly parallel to the course of the river.

Along the upper three miles of this course the channel narrows to about 150 yards, and the current increases where a descent is made through a narrow cut in the hills. There is now a sharp bend to the south and then to the south-west for a mile and a half, as the river cuts through a range of hills, with a fall of twenty-five feet, including a chute of fifteen feet. At the bend a small river comes in from the north-east.

The surface material covering the hills along the last two courses is generally thin, and is in places composed largely of boulders, often of large size, with the spaces between them only partly filled with finer material.

The forest, for the most part, is made up of small second-growth black spruce, Banksian pine, larch, balsam fir and white birch, with a few aspen poplar.

Above the bend, the river again enters another valley between parallel ridges. Its courses are: first, east five miles, then N. 60° E. four miles, and again east eight miles. The average width is again about 400 yards, with a swift uniform current and only one small rapid. As this portion is ascended, the country becomes rougher, and the hills rise with steep slopes, from 200 to 400 feet above the water. The greater part of this region has been recently burnt, only patches of blackened soil being left to partly cover the rocky hills, while innnumerable boulders are seen scattered everywhere over the surface. A river about three chains wide at its mouth comes in from the south at the end of the first course.

Another sharp bend of three and a half miles to the west of south now follows, and in the lower mile and a half the river passes through a narrow rocky channel with perpendicular sides, called Prosper Gorge and falls in a succession of chutes and rapids over one hundred feet. To avoid this obstruction, the river was left four miles and a half below the bend, by a portage of three-quarters of a mile, which passes over a ridge and ends about the middle of the west side of a lake three miles long and three-quarters of a mile wide. This lake discharges from its north-east end by a small stream, nearly a mile long, into a second lake one mile long by half a mile wide. Crossing this lake, the small crooked stream by which it discharges, is followed some two miles to where it falls into the main river, two miles above the bend, and thus above the chutes and rapids. There is

only a slight fall from the upper lake to the river, and as a consequence, when there is a freshet in the main stream, the water from it backs up into the lakes instead of discharging from them.

Above this portage the river becomes very crooked. It first flows from the east for a mile and a half, then from south-east one mile, N. 80° E. three miles, S. 30° E. three-quarters of a mile, S. 45° W. a mile and a half, and finally S. 45° E. six miles, where it leaves an expansion over one mile wide, and full of large islands, at the foot of the Ross Gorge, running south.

Through this gorge the river falls sixty feet in two miles. The portage past it starts from a small bay on the west side, and is divided into two parts by a small pond. The first part is 300 yards long and rises about 150 feet; the second is three-quarters of a mile in length, passing over a steep ridge of boulders and ending in a small stream which enters the river a short distance above the head of the chutes.

About half a mile below the upper end of the portage, a river falls in on the north side. It flows in a deep, rocky valley running east-north-east for several miles, and has a long heavy rapid above its mouth. Its size has been estimated at about one-half that of the main branch, and it has been called Ross River. Above the gorge the main river is split into a number of small channels by several low islands. These islands form a delta in the eastern end of Lake Nasaskuaso, which extends to the westward six miles, and is a mile and a half across in its widest part. The river passes only through the east end of the lake, which formerly must have extended to the head of the portage, the portion now occupied by the delta having been filled up with alluvium brought down by the river. Surrounding the lake are rocky hills that rise from 200 to 400 feet above its surface. The greater part of the adjacent country has been burnt over recently. From its west end, the canoe route of the Hudson's Bay Company leaves the East Main River to cross to the Rupert River on the way from Nichicun to Rupert House. This lake is considered by the employees of the company to be situated half way between these two places. The Indians who hunt in this region are in the habit of congregating here and on the lakes at the foot of the large island above, to meet the canoes going to and returning from Rupert House.

Above Lake Nasaskuaso the character of the river and country again changes, the latter becomes flatter and less rugged, the hills seldom rise over 150 feet above the river, and the ridges are farther apart, with swamps and small lakes filling the broad shallow valleys between them. The river flows almost on the surface, and is often divided into several channels by large islands. Small lakes and bays also branch off on either side, so that it is difficult to tell when a tributary river falls in.

In this manner the river continues for nine miles, when it becomes divided into two main channels by Grand Island, fourteen miles long and five broad. The north channel is more than twice the size of the south one, and it is further subdivided especially in its lower part, by large islands. The south branch, from the foot of the island, passes southward about five miles and widens out into two lake expansions with numerous bays, all having an east and west direction. Into the south-west bay of the upper lake, five miles from its outlet the Clearwater River enters. This is a small stream flowing out of a large lake of the same name on the portage route from Lake Mistassini.

The upper lake referred to has been called Tide Lake, on account of the deposits of mud that cover the shores and islands up to freshet mark of the river, giving the lake the appearance of a tidal bay at low water.

For seven and a half miles above the head of Grand Island, the river averages 500 yards in width, but is shallow and much obstructed by sandy shoals. Its direction is again east, and at the head of this course is the junction of the Tichegami River. This stream takes its rise, according to the Indians, to the south-east, near the head-waters of the rivers flowing into the north end of Lake Mistassini. In volume, it appears to be about two-thirds that of the main branch, and it has a heavy rapid at its mouth.

There are only a few families of Indians who hunt along the lower part of the East Main River, there being a long interval from Lake Nasaskuaso to below the Great Bend, that is totally uninhabited. Owing to the numerous rapids and chutes, this river above the mouth of the Straight River is not used as a highway to the interior, and only one family ascends it above that stream. Previous to 1889, there were three families who hunted in the neighbourhood of the Wabamisk River, but during that winter, with the exception of one woman and a small boy, these all perished by starvation or cannibalism. In 1892, the scene of this tragedy was found at the mouth of that river, but, nothing being known of such an occurrence, it was only remarked as unusual that Indians should leave their tents standing, and their household effects scattered about.

Above Lake Nasaskuaso, from the many old camps seen along the river, there must be a number of families who hunt in this vicinity, and who in the summer descend to Rupert House, by the portage route to the Rupert River. Owing to the absence of hunters along the greater part of the river, the fur-bearing animals are rapidly increasing, and beaver signs are quite common; bear tracks are also numerous in the burnt regions. Not a sign of caribou was observed from Lake St. John to James Bay, and these animals seem to have been totally exterminated in the region about Lake Mistassini and from there westward to James Bay, being now only met with to the north and north-east of the East Main River.

Fish are found in abundance in every lake and river throughout the region. The following kinds were taken in the net along the East Main River:—Whitefish, pike, pickerel and suckers. In the lower parts, where the banks and bottom are formed of clay, sturgeon are taken in abundance by the Indians; and from the mouth to the first fall, and in the tributary streams, small whitefish and sea-trout ascend from the sea in large numbers, from about September 1st until the river is closed by ice. Trout are also caught in the rapids of the upper part of the river.

UPPER EAST MAIN RIVER

Three miles above the Tichegami, a rocky ledge crosses the river diagonally, causing a low fall, where the survey of the lower part of the river in 1892 began. Above this fall the river bends sharply northward for a half mile, and then about south-east for three miles, to the head of a long, but not strong rapid, which occupies the upper half of that distance. The direction now changes to north-north-east for two miles and a half to the mouth of the Kowatstakau River, a large branch coming in from the northward and entering the river from a considerably higher level by a heavy rapid or low chute. According to Indian estimation this

stream carries about one-sixth of the water of the main river. Immediately above the forks, what appears to be another branch, also broken by rapids, is seen on the south side; but it is only a channel passing on the south side of a large island or islands, and separating from the main channel above the rapids and portage, five miles farther up. The north or main channel contracts from a width of nearly half a mile, below the island, to less than a quarter of a mile, and the current is quite strong, with two rapids, the lower of which two miles above the foot of the island, is a half mile long; but the upper one is short and steep, with a tremendous rush of water, the river falling eight feet in one hundred yards. The portage is on the north side, and is called the Sunday Portage.

Up to this portage the country surrounding the river is low and almost flat, with only a few isolated hills that seldom or never exceed one hundred feet in elevation above the general level, while the river flows only slightly below it, in a shallow valley from 300 to 1,000 yards wide, having in most cases low sandy banks never more than seventy feet high. The sand and gravel of the banks are made up of modified boulder-clay arranged by the action of the river. On either side of the river the soil appears to be light and sandy, and, as small fires only have traversed this region, the timber has not been destroyed, but thickly covers the country, the trees occurring in the following order of abundance:—Black spruce, Banksian pine, larch, balsam fir, white birch and aspen, the last being exceedingly rare and only found along the river in low straggling clumps.

Above Sunday Portage the river flows directly from east for the next four and a half miles. The average width is nearly 400 yards and the current is strong, with two rapids one and two miles above the portage, the upper one being so heavy that canoes must be lightened to ascend it. The portage past it is about 200 yards long, on the north side. At the foot of the lower rapid a small branch from the south joins the river.

The river now turns sharply to the northward, and flowing from that direction, in the next mile breaks through a low ridge in a shallow, narrow, rocky channel, and falls fifty-five feet from the level above, the descent taking the form of a heavy rapid. To pass this the Pond Portage is made on the east side. To reach it a small stream is ascended about 200 yards, and from there 200 yards portage up a low hill leads to a small pond; crossing this, a rough road over boulders and through swamps for half a mile ends at a small channel of the river, behind an island. From here the course is N. 45° E. for a mile, and then in a general direction N. 45° W. for five miles, with many minor bends and crooks. About one mile up this course, what appears to be a large branch comes in on the east side, but it is probably only a channel leaving the main stream several miles above, and so forming a large island. The river continues about a quarter of a mile wide, is shallow, and flows with a strong steady current, breaking into small rapids at points and narrows. Another small stream comes in from the northward at the upper end of the course. Now again bending eastward a mile above, the river widens out into a small lake, so crowded with low islands that its limits cannot be seen.

From Sunday Portage to this lake, the character of the river banks and surrounding country is similar to that before described, the banks being low and the country nearly flat, with isolated hills and rocky ridges generally under 100 feet, and never exceeding 250 feet in elevation.

Owing to an unfortunate accident on the Koksoak River, through the upsetting of one of the canoes, the barometer readings were lost, and only a few booked in the survey note-book remain. From the mean of these data the height of the river in this vicinity is roughly found to be 1,400 feet above sea-level, which agrees closely with the supposed difference of level between here and Lake Mistassini, that place being fixed from the mean of readings taken from two aneroid barometers and extending over several months.

From the lake-expansion, the river bends southward for a mile, and then directly east, flowing from that direction four miles, from the base of a high rocky hill on the north side, which forms a part of a range extending from beyond the north side of the lake to the eastward. These hills are very steep and rocky, being formed of the hornblende-granite that now takes the place of the softer schists and gneisses of the flat country below. They rise from 400 to 500 feet above the river.

Before reaching the foot of the hills, the river becomes somewhat wider and flows between low banks of sand and gravel with a moderate current in a shallow channel, much obstructed with low sandy shoals. Much of the surrounding country has been burnt over, and in part is covered with small second-growth trees, Banksian pine then predominating. Where unburnt, the forest is somewhat larger and thicker than that seen lower down; this is owing most likely to a better soil.

At the foot of the hill the river again abruptly bends to the south for a mile and then gradually turns and resumes its easterly course for five miles to Sharp-rock Portage. Up to here the character of the river is similar to that lower down, being flat and shoal with a moderate current broken by two short rapids, the lower on the bend and the upper two miles above it. The range of hills on the north side continues along the river and crosses it at the portage, but so much lower that at the crossing it is little over a hundred feet high. To the southward the country is almost flat and both sides have been almost totally burnt over, the fire on the north side being most recent.

Sharp-rock Portage is on the north side and is about 400 yards long, the lower half passing over sharp vertical bands of hornblende-schist. The river falls ten feet over the same ledges.

Above the portage, the course is N. 60° E. for three miles to another portage 200 yards long, where a chute of eight feet occurs. Between the portages the banks are low, with traces of a terrace twenty feet high on the south side.

Farther up, the river flows from the north for a mile, and then from the east four miles to where it passes out from between rocky hills, from 200 to 250 feet high. From the last portage to this point, the flat valley is somewhat wider, and the shallow channel of the river is obstructed by a number of islands and gravel shoals, the current here being very strong.

After the hills are entered, the course is south-east for two miles, and then north for two miles. Along the south-east course the river is less than 300 yards wide, but on the northern course the width is irregular, varying from 300 to 800 yards. The current everywhere is strong.

At the bend, a medium-sized stream comes in from the south, and perhaps another on the north side a mile below. Another bend to the eastward, and a mile

of river, leads to Mink Chute, thirteen feet high, passed by a short portage over the rock on the east side.

The country surrounding the river from Sharp-rock Portage to here, is rougher than that seen below. The ridges of rocky hills are closer together and slightly higher, and there are also ridges of till apparently arranged roughly parallel to the direction of glacial striae, or S. 70° W. On both sides of the river there have been extensive fires and little of the original forest remains. The trees continue similar in size and numbers to those described below, aspen being the only one now absent. Terraces of sand and gravel are seen on both sides up to thirty feet above the water, and occasional cut-banks of boulder-clay are noticed, where the river has eaten away parts of the low hills of drift mentioned above. The rocky hills are moderately strewn with boulders.

Mink Portage is followed closely by another short one on the south side, past a chute of nine feet; and then for five miles the river flows rapidly between low and rocky banks to Channel Portage. This portage is on the north side, and is about 800 yards long, terminating in a small channel above a fall and behind several rocky islands. Up to the head of the islands there is but one small rapid in the next mile, whereas the main or south channel is a succession of chutes and heavy rapids for nearly two miles.

From the head of the islands, the river widens to over half a mile and flows evenly from the north-east between low sandy banks, over which can be seen high hills in the distance to the north-east, east and south-east.

Four miles of quiet water is followed by a shallow, flat rapid, full of small rocky islands and large boulders. After a sharp bend the course is to the north for a mile, and then north-east for two miles to another small lake expansion. Along the two last stretches, the river, contracted to less than 300 yards, flows between rocky banks, and is greatly obstructed by rocky islands and ledges, which cause short heavy rapids with very swift water between them.

On the south side, at the head of the rapids, a conical hill rises 350 feet above the river. From its top a good, unobstructed view of the surrounding country may be obtained, as it is totally burnt over and bare. To the north-east, the river is seen flowing with but one bend, through a wide, straight valley, surrounded by low hills. Those on the north side are about 200 feet high and are arranged in close, compact ridges, everywhere well wooded. On the south side there is a wide valley filled with small lakes, that separates the conical hill from a higher range parallel to and forming the north wall of the river-valley. The highest of these hills reach and may exceed 500 feet. They are bare and rocky, and have a very barren, desolate appearance, due to the absence of green woods; fire rather than unfavourable climatic conditions being the cause, as some of the hills have small patches of unburnt trees upon their summits. The sides and tops of these bare hills are strewn with innumerable boulders of all sizes, from masses several tons in weight to small gravel, but there is not much of the finer material on the upper parts.

In the river-valley, larch is seen eighteen inches in diameter, and black spruce and balsam fir of twelve inches, are common. The only evidence of an approach to barren ground is afforded by the thinning out of *"Ledum"* and *"Kalmia"* and the substitution of white reindeer moss as undergrowth, while the trees begin to grow wider apart with frequent open glades.

Above here the character of the river changes somewhat, long islands of till are numerous, and there is a marked absence of terraces or stratified deposits, these being replaced by banks of irregular height and outline, formed by the river cutting through the low lenticular hills of moderately fine boulder-clay. The islands formed of similar materials appear to be hills of the same description and have only been separated from those on either shore by shallow channels cut between them. For three miles and a half the river is over half a mile wide, but is very shallow, and its bottom is thickly strewn with boulders and subangular blocks of gneiss and granite, very similar to the rock masses seen in place in the vicinity. The descent, both here and in the expansions further up stream, is constant and quite steep, causing the water to flow with a very swift smooth current, which is more difficult to ascend in canoes than broken water, where the eddies and quiet places behind boulders and obstructions are available to rest before the canoemen attempt other short ascents; whereas in the steady, strong, smooth current no such chances to rest occur, and every foot gained must be held.

Bending from east to north-east, the river contracts to about 300 yards for two miles, and again expands at the head of a large island, at the end of the course. Two small streams enter from the north, at the upper and lower ends of the stretch.

Turning eastward again, the banks become more rocky and irregular with numerous small bays, so that the breadth of the stream varies from 300 to 1,200 feet. There is a small rapid one mile and a half up, and at its head a large stream named the Misask River enters on the north side. From this place the general course is N. 50° E. for six miles, to the Cascade Portage.

Immediately above the Misask River, the main stream is divided into two equal channels by a large island. The north channel is followed east for two miles and then south for three-quarters of a mile to the head of the island. The whole distance is a continuous rapid, culminating on the south bend in a chute of fifteen feet, which is passed by a portage of 800 yards on the east side. There is a steep rise of one hundred feet at the lower end of this portage, from the river up a cut-bank of till, to the level of the ridge above. From the head of the island, half a mile of quiet water leads to another portage, on the west side, 1,000 yards long, past heavy rapids, followed by small rapids for half a mile, to the foot of another large island. Following the smaller and southern channel, another half mile of stiff current leads to the Meat Portage, 300 yards long, on the west side. Another short rapid is then passed, to the head of the island. The rise in the river has now brought it to a level with that of the surrounding country, which is broken only by low ridges of till and an occasional rocky hill, seldom exceeding one hundred feet, so that the surface presents the appearance of a very rolling prairie, especially to the southward, where most of the trees have been burnt. Everywhere the surface is covered with innumerable boulders and subangular blocks of granite and gneiss.

Having now reached the general level, the character of the river changes, and for the next nine miles, to Long Portage Creek, it is a succession of lake expansions, connected by short rapids. These expansions are broken by deep bays, running between the low ridges, and often pass by small narrows into other lakes, the country being now covered by a perfect network of small lakes and water-courses, lying between the low hills. The general course is slightly south of east.

The first lake is about one mile and a half wide, and it is two miles from the head of the island to the next narrows and rapid. The water is shallow and there are several large islands. The rapid above is half a mile long and is followed by a smaller lake, one mile long, to a very heavy rapid, passed by a portage of 900 yards on the south side. Above, there is quiet water for half a mile, and then rapids, half a mile long, are followed by swift current for two miles to the next lake expansion. This lake is also full of large islands, and a narrow channel on the north side leads into a chain of lakes extending over ten miles to the north-east and branching off into numerous other small lakes on either side of the main chain. A mile and a half of steady current leads to another small lake, into which the Long Portage Creek flows.

Here the main river takes an abrupt bend to the south-west, and after a short sharp rapid is ascended is found to widen out into a string of lakes with numerous deep bays, for about fifteen miles; it then breaks into a heavy rapid two miles long, above which it continues south-west for a considerable distance, when it again turns eastward, passing behind a high hill some fifteen miles south of the forks.

The country about the forks is very similar to that already described, consisting of a series of low ridges of boulder-clay, arranged in broken roughly parallel lines, coinciding with the direction of the glacial striae, or S. 70° W. The general height of the ridges is about fifty feet, while the highest rarely exceed one hundred feet. Between and parallel with them are innumerable small shallow lakes, irregular in shape and full of high islands formed of mounds of till. These lakes are joined together by small watercourses, following each valley, and the different chains often have lateral connections where an interval occurs between overlapping ridges. The only conspicuous landmark in this vicinity is the rocky hill situated about fifteen miles south of the forks; it rises about 500 feet above the general level, and is unconnected with any other high land. To the south, south-east, east and north-east, the horizon is bounded by chains of high hills, at a distance ranging from twenty to fifty miles from the forks.

The East Main River was explored only as far as the head of the two-mile rapid mentioned above. The route to Nichicun leaves the main stream at Long Portage Creek, where the river is still a large stream, being nearly 200 yards wide at the rapid there, with an average depth of three feet. According to information received from the people at Nichicun, the main stream, although large where the route leaves it, soon splits up into numerous branches, none of which are of any considerable volume or length. The river bends to the south-west for some twenty miles, and then turns eastward again along the northern foot of the mountains that here form the watershed between the Rupert, East Main and Big rivers, flowing into Hudson Bay, and the Peribonka and Outardes rivers, emptying into the St. Lawrence.

Misawau or Long Portage Creek, from its mouth to the portage, following the stream, is thirty-three miles long; but in a straight line the distance is twenty-four miles, and the general course is slightly north of east; the difference in length being due to its crooks and turns. From the East Main River, for the first six miles the course is north-east, the stream here consisting of a number of small irregular lakes, joined by short stretches of river. At the narrows the river is generally about one hundred feet wide, with a moderate current and deep water.

This course terminates with a rapid of six feet fall, passed by a portage of 400 yards on the north side.

For the next four miles the river flows from the east, with a uniform breadth of one hundred feet. The current here is strong, with three short rapids, the upper passed by a "demi-charge'. Next follow small lake expansions and swamps for four miles, in the same direction, with one short rapid near the upper end. Still further up, the river is crooked, and forms a reversed curve, ending at the forks, four miles beyond, where it splits into two equal branches, the route following the eastern one.

Above the forks, the average breadth continues to be about one hundred feet, and where small rapids or swift current occur the water is so shallow that wading is resorted to in order to pass loaded canoes. For nine miles from the forks, to the Rocky Portage, the character of the river is constant; it has in most places a sluggish current, with small shallow rapids at long intervals. The banks are low, and the immediate surrounding country swampy. The portage is 500 yards long and follows the side of a hill on the south shore. The river here passes through a narrow valley, between high rocky hills, and in so doing falls thirty feet. The valley widens above the portage, and the river again flows from the east, in a low valley, filled with numerous small lakes on both sides, connected with the river. As the Long Portage is approached, the river becomes more rapid and shallow, and it is only with great difficulty that loaded canoes can be taken up it. It is left at the Long Portage, where it turns to the northward, rising in the small lakes in that direction, at no great distance above this place.

The country surrounding the lower part of this stream is almost flat, and is traversed by ridges of till never more than fifty feet high. These gradually rise until the forks are reached, where they average 100 feet. From the forks to the Rocky Portage the hills recede, leaving a low swampy valley through which the river flows sluggishly in a channel but little below the general level. At this portage the first rock seen in place along the river occurs. The stream here falls over ledges of red granite as it passes down a narrow valley between two steep rocky hills that rise abruptly to 300 feet.

From here to the Long Portage the valley is again wide and strewn with numerous small lakes and swamps, connected by short channels with the main stream. The hills on either side now have an average elevation of 300 feet and often show rocky faces.

Over one-half of the country surrounding the river has been burnt, and is now covered only with low shrub and reindeer moss. Owing to the want of forest growth, the innumerable boulders and angular blocks of all sizes stand out in remarkable distinctness, giving to the hills the appearance of gigantic plum puddings. These blocks and boulders with the amount of drift are a feature of the country, the drift along the lower parts of the stream being so thick that it covers all the underlying rocks which can be determined only from the profusion of angular, untravelled blocks scattered about. On the very summit of the high granite hill on the north side of the river, at the Rocky Portage, there is a perched boulder over ten feet cube. Its corners are only partly rounded. Numerous other large boulders are scattered over the highest parts of this hill, and so thickly are they everywhere strewn that one might walk for miles over the country in almost any direction without touching the soil with the foot. The trees along the river are

small and somewhat scattered, with little underbrush, the ground being covered with white moss and arctic berries. Black spruce predominates, with larch in the swamps and Banksian pine on the higher lands. There are also a few small white birches and balsam firs. One very small clump of aspen was noted.

The Long Portage is two miles in length, and from the creek passes S. 30° E. over a ridge 200 feet high, terminating at a small lake 150 feet above its lower end. The lower half is burnt bare, but there is at its upper end a thick growth of small black spruce, wth a few Banksian pines and larches. This portage is over the watershed which divides the creek from the waters of the Pemiska Branch of the East Main River.

From the portage at its upper end, a small shallow lake is followed by a portage of one mile to a slightly larger shallow lake full of great blocks of granite, which in turn is followed by another portage of a half mile, ending in another small lake, triangular in shape. The route to here has been due east; it now turns south, and in a half mile leaves the lake by the stream flowing out, with a short portage past a small rapid at the outlet, and so into Opemiska Lake. The country surrounding the small lakes consists of low ridges of till from fifty to one hundred feet high, well covered with small black spruce and larch to the exclusion of all other trees.

Opemiska Lake is six miles long, with an average breadth of three-quarters of a mile. Its longest axis lies nearly east and west. The water is clear and shallow. There is one deep bay at the north-west end, full of small low islands. The shores are generally low and sandy, and the surrounding country is also low, with small ridges of till. Ten miles to the south-east of the lake, a high isolated hill rises about 500 feet above the general level, forming a conspicuous landmark; is regarded by the natives as the dwelling place of spirits, and on that account given a wide berth. The country about here is unburnt, and is well wooded with black spruce and larch, the former constituting over ninety per cent of the trees. The only other tree met with is balsam fir, found sparingly about the shores of the lake.

The Pemiska branch of the East Main River flows out on the south side about the middle of the lake, and leaves it with a heavy rapid. Its volume here does not exceed one-quarter of that of the river at the mouth of Long Portage Creek. The route follows the lake to its eastern end, where it ascends for two miles a small river about fifty feet wide and full of rapids, with a total fall of twenty-five feet. Three short portages are necessary to pass the strongest parts of the rapids. The country surrounding the river is low, rough and rocky, with a superabundance of loose blocks and boulders, many of great size. Two were seen resting on a rocky knoll at the head of the rapids; the larger is more than twenty feet cube, and the smaller more than fifteen feet cube.

The river ends in Wahemen Lake, another large body of water stretching to the eastward, divided by long, low ridges of till into a bewildering number of deep bays. The route closely follows the southern shore, and, passing a small narrows, ends at a portage four miles from the outlet. The portage is 1,400 yards long, and joins the river above a heavy rapid. From there to Patamisk Lake, at its head, the distance is eight miles, in a general east course. The river passes through five small lakes, each full of deep, narrow bays, and connected with the

next lake by short, rapid stretches. The numerous bays and the small size of the stream makes it very difficult to follow the route without a guide.

Lake Patamisk is reached by a portage of 1,000 yards past a rapid in the river, which is here not above twenty-five feet wide and very shallow. This lake is the largest passed through between the East Main River and Nichicun. The route traverses the lake to the end of the north-east bay, seven miles from the outlet. Large deep bays indent both sides, and the main body is filled with large islands, which obstruct the view and hide the real size of the lake. A deep bay extends westward from a point half a mile above the outlet on the south side. The limits of the shore on the north side could not be determined, nor those of a wide deep bay on the south-east side, but the lake evidently extends to the foot of some hills about ten miles from its entrance. The water is very clear and in places deep, but as a rule shallow.

A portage of 500 yards leads from Patamisk Lake to a small shallow lake one mile long, with a portage 200 yards from its east end into another smaller lake half a mile long. The portage from this lake crosses a low bouldery ridge and ends in Kawachamack or Crooked Lake, about twenty feet below the level of the last, draining into the Big River; so that the last portage is over the height of land between the Big and the East Main rivers.

The country surrounding the route from Lake Opemiska to the height of land is everywhere the same, consisting of ranges of hills of boulder-clay seldom more than 100 feet above the general level. These are separated by wide irregular valleys filled with small lakes, so that fully one-third of this area is covered with water. An occasional rocky hill may be seen rising from beneath the masses of till, sometimes attaining a height of 300 to 400 feet. Immense numbers of boulders and loose angular blocks continue to be scattered in wild profusion everywhere. As the height-of-land is approached, the forest growth becomes smaller and less thick, and is made up almost wholly of black spruce, the largest of which are about six inches in diameter; the only other tree is the birch, which forms less than ten per cent of the whole. Where fire has passed, a number of years elapse before the second growth of black spruce springs up, which it does then only in a thin straggling manner.

Crooked Lake, stretching N. 60° E., is nearly five miles long and averages one mile in width, with numerous small lateral bays, which give it an irregular outline. The western part is filled with islands. The north shore is almost wholly burnt and bare, while small black spruce and larch cover the hills on the south side. The country becomes higher and rougher, with more rock showing up from beneath the drift. A short portage at the east end leads directly into the south-west branch of the Big River. This river rises about sixty miles to the south and south-west, where it drains a number of lakes lying along the northern slope of the mountains, close to others emptying into the head-waters of the East Main River to the west and those of the Outardes River on the south side of the mountains. The watershed in consequence runs east and west here, on or near the fifty-second parallel of latitude.

The route enters the river at a bend, where its course changes from north to east. In size it is nearly as large as the East Main River at the mouth of Long Portage Creek, being in the rapids about 200 feet wide, with deep water flowing four or five miles an hour.

From the portage, the river flows N. 60° E. for eight miles, to the foot of a sharp rocky hill 280 feet high. It flows almost level with the general surface, and, like all the streams of the region, is made up of a series of small irregular lake expansions, connected by short narrow stretches of swift water. Even in the widest parts a moderate current is appreciable. At the foot of the hill the river enters a large lake that stretches several miles to the eastward, and has several deep narrow bays separated by low parallel ridges of till. This body of water is called Big Back Lake. The river flows only through its north-west part, leaving it half a mile below its entrance, and then bending sharply to the west, passes close to the foot of the hill and enters Back Lake. From the top of the hill, looking north-west, the country as far as could be seen in that direction appears as if covered by a great number of small lakes that lie parallel to, and are separated from each other by low ridges running east and west. These are not separate lakes, but deep bays of either Back or Nichicun lakes; these two bodies of waters being separated only by a small short rapid.

This rapid is five miles from the foot of the hill, through Back Lake, but the irregular shore line of the lake must be at least fifty miles long. From the hill the irregular outline of Nichicun Lake is seen stretching away toward the north for a great distance, bounded by bold rocky hills often rising from 400 to 500 feet above its level. Through breaks among these are seen the valleys of the outlets of the lake. Toward the east, the country beyond the Back Lake is seen rising in ranges of hills from 300 to 800 feet high, of sharper outline than the ordinary Laurentian hills. These bound the horizon to the south-east and south, and are said to form the north-east flanks of the central mountain range of Labrador which extends along the watershed in a north-east and south-west direction from the bend of the East Main River to about thirty miles east of Nichicun. Thence it gradually sinks and is lost in the general level of the country, which must there be over 2,000 feet above sea-level. To the south-west and west the country is lower, with isolated rocky hills rising above the level of the low ridges of till.

The only signs of an approach to the barren lands is the lack of trees on the tops of the highest hills, but the rest of the country is well wooded where unburnt. Fires have destroyed great areas of forest in this region. They are sometimes caused by lightning, and when once started, burn with surprising rapidity, travelling as quickly through the dry, white reindeer moss as over the grass of the western prairies. The Indians too are often accountable for these fires, most of which, it is likely, have been started by them, as they use smoke for signalling from great distances. Islands in small lakes are usually fired for this purpose, but brands are often carried by the wind to the mainland, and thousands of acres burnt over in a short time, the fire continuing until the first heavy rain and often breaking out afresh when dry weather again sets in. At times the Indians purposely burn large areas in order to prepare the ground for bear-hunting; for within a few years after a fire, in this region, the surface becomes thickly covered with blueberries and other small fruits, forming feeding grounds for bears during the autumn months.

The climate at Nichicun does not permit the growth of grain, and in the small patch of land under cultivation at the Hudson's Bay post, only potatoes are grown and these rarely if ever ripen properly, the tops being frozen early in September, or even in August. Summer frosts are also common and often severe.

The following information concerning the trees and shrubs about Nichicun was obtained from Mr. Jos. Iserhoff, who is in charge of the Hudson's Bay post there :—Black spruce is found on the shores and islands of the lake in abundance, and trees that will square six or seven inches for twelve feet, are not uncommon. White spruce is not plentiful, and is seen only in certain places along the sides of the lower hills. Balsam fir is common, and is found everywhere near the water, some of the trees growing as large as the black spruce. Banksian pine is very rarely seen, its eastern limit being defined by a line drawn nearly north and south through the Long Portage, beyond which line to the eastward only a few straggling trees are found, while on the west side it is very abundant. White birch is common about the sides of the small hills, especially where fires have passed long ago; but no trees of a size sufficient to afford bark for canoe building are found in the vicinity, and all the bark is supplied by way of Hudson Bay. Although common about Lake Nichicun, a short distance to the north and north-east, it is very rarely met with. Small straggling aspen and mountain ash, found in little clumps at wide intervals, complete the list of trees of this interior portion of Labrador. Small fruits are very abundant, but the prevalence of early summer frosts seldom allows the fruit to ripen.

Lake Nichicun is 1,760 feet above sea-level, and is a very irregularly shaped body of water, with numerous deep bays. It is so plentifully strewn with islands that it is difficult to form an idea of its size; many of the islands are large, and one, Big Island, is six or seven miles long and about two miles wide. The greatest length of the lake is from east to west, about thirty miles, and at the western end a narrows continues on into Little Nichicun Lake, which extends several miles farther. At its widest part the lake does not exceed ten miles across, and it is so obstructed with islands there, that it appears much less. The average width is about five miles. The numerous long points stretching out from both sides, together with the islands, make it almost impossible to pass through the lake without great loss of time unless with a guide. One of its deep bays, to the south-west, heads within a short distance of the river, near the portage from Crooked Lake, and advantage is taken of this to pass the rapids in the river when travelling from Nichicun to the East Main River. The shores are low and covered with rows of boulders shoved up by the ice. The country surrounding the lake is rough, and covered with numerous ridges of boulder-clay. To the north-west, north and east, there are high rocky hills rising from 300 to 600 feet above the lake. The islands are mostly portions of boulder ridges, but some of the larger are high and rocky, especially Big Island. The water is very clear and moderately cold. As a rule, the lake is not deep and in many places it is quite shallow, with large boulders rising above the surface. It discharges on its east side, the river flowing out by three channels. The two southern ones soon join, but the northern channel does not unite with the others for nearly fifty miles, or until the river changes its course from north-east to westward.

The Hudson's Bay post is situated on an island a short distance from the inlet of the lake. This post has been long established, probably before the beginning of the present century. No record of the date is known, but in 1840, a Mr. John Spencer was in charge, and made a sketch-map of the surrounding country. At that time an outpost was situated at Lake Kaniapiskau. The map is now in the office of the Geological Survey, and is very interesting, as it shows the water-

shed between the St. Lawrence, Hudson Bay and Ungava Bay. At present the post consists of five small log buildings : the master's house, two servants' houses, a small store, workshop and powder magazine.

The supplies for the post are brought in from Rupert House by three large canoes, each manned by six Indians. In order to reach Nichicun in time to prepare for winter, the canoes leave the lake at the first open water or about June 15th. The trip to Rupert House is made by the route to the East Main River, down it to a small lake called Nasaskauso, thirty miles below where the route to Mistassini turns off. From this lake a portage route through a long chain of lakes is followed, and the Rupert River reached a few miles above Lake Nemiskau, about 100 miles above Rupert House, the river being descended to that place. The total distance from Nichicun to Rupert House, by the route followed, is somewhat over 500 miles. It takes two weeks to go down with the canoes partly loaded with the furs taken during the previous winter, Rupert House being reached about July 1st. Three or four days are spent there, and then the return trip up stream is commenced, and by working throughout the long summer days, from daylight to dark, Nichicun is again reached between the 15th and 30th of August. On leaving the coast, the canoes are loaded down to the gunwales, but before their destination is reached over a quarter of their loads are consumed. This gives some idea of the difficulty experienced in supplying an inland post like Nichicun.

Sufficient provisions cannot be brought in to support the people at the post, who have thus to depend largely on the country for food. During the summer they subsist almost wholly on fish, caught in nets in the lake, and are often for months without small luxuries such as tea, sugar and tobacco. During the winter the living is better, for then, besides the small rations of flour and other provisions, they are able to obtain abundance of fresh meat. About a dozen caribou are killed by the people of the post during the year, besides beavers, musk-rats and bears. Usually rabbits and ptarmigan are abundant during the winter season, and are shot and snared as required. In some years, however, both rabbits and ptarmigan are not plentiful, and caribou are scarce. During such seasons the food supply is very limited and great care must be taken to prevent starvation, especially as the Indians are affected by the same circumstances and flock to the post for relief. A supply of salt fish is laid in, every autumn, in case of need. The fish are principally whitefish and lake trout, caught with nets late in the autumn on the spawning grounds in various parts of the lake. The articles of trade in the store embrace small quantities of cloth, clothing, tea, sugar, tobacco, powder and shot.

There are about thirteen families of Indians who trade at this post, but this does not represent all the people inhabiting this portion of the interior, as a number of families prefer to descend to Rupert House and trade there, bringing in their year's supply themselves. Others living to the southward, who formerly traded at Nichicun, now descend the rivers flowing into the Gulf of St. Lawrence, and do their trading at Bersimis, Seven Islands or elsewhere along the north shore.

These Indians belong to the western Nascaupee tribe. They speak a dialect closely resembling that of the Montagnais. The men are of medium height and fairly good physique. Some are tall and well developed, but the average height

does not exceed five feet seven inches. Like other Indians they are sinewy rather than muscular. As a rule, they are less cleanly than the Montagnais, taking little care of their clothes or persons; and they generally swarm with vermin. Owing to the small numbers of caribou killed in this region, the natives are forced to clothe themselves in garments bought from the Hudson's Bay Company. They live in wigwams covered with cotton, as they cannot get either the deer-skin used in the north or the birch bark covering of the south.

The hunting grounds of the Indians of Nichicun extend from the height-of-land on the southward to the head-waters of the Great Whale River on the north. To the eastward they hunt as far as Lake Kaniapiskau and down its discharge about fifty miles. There appears to be quite an extensive area between their eastern boundary and the western limit of the hunting grounds of the Hamilton River Indians, who trade at Northwest River post. There is also a large area without hunters on both sides of the Koksoak River, from where the Nichicun Indians leave off, to where those from Ungava begin, as no signs of Indians are visible along this water-course for a distance of nearly 200 miles. The greatest number hunt to the westward of Nichicun, or about the head-waters and tributaries of the Big and East Main rivers.

The presence of a trading post in the interior of Labrador, such as that at Nichicun, is at present absolutely necessary to the Indians inhabiting that region, and it is doubtful if the country would support half the present population without it. In seasons of plenty it is not necessary, the Indians transporting their furs to some point on the coast, and returning inland with their next season's supply, but in seasons of starvation, without the aid furnished by the post, a majority of the people would die. The greatest number of deaths from starvation occur about the Rupert and East Main rivers, in the country midway between Nichicun, Mistassini and Rupert House, where the distance is too great from any of these posts to obtain assistance during the winter. So great has been the mortality in this region, during the last few years, since the extermination of the caribou there, that the country is nearly depopulated, and a supply of provisions is kept by the Hudson's Bay Company at Lake Nemiskau on the Rupert River, to relieve the Indians in extreme cases of necessity. From the above, it will be seen, that although at present the population of the interior is small, it appears to be in excess of what unassisted nature would sustain with the present habits of the Indians.

The Indians of Nichicun all read and write the syllabic characters invented and taught by the missionaries of the Church Mission Society, and letters written on birch bark with charcoal are commonly seen on the portages along the various routes. The missionaries have also a number of books printed in these characters, including a selection of hymns and almost the whole of the Bible. These books are greatly prized by the natives. Although nominally Christians, their religion is greatly mixed with pagan ideas, and as their opportunities of acquiring a knowledge of Christianity is limited to the short stay every summer at Rupert House, it is no wonder that they retain many of their old beliefs. The visit to the coast is the occasion for the celebration of marriages and baptism.

ROUTE FROM NICHICUN TO LAKE KANIAPISKAU

We left Lake Nichicun by the middle discharge, on August 5th, 1893. The general direction of the stream is north-east. For two miles, to the first portage, its breadth varies from 50 to 300 yards, with swift water in the narrows. The shores are very irregular and are made up of low ridges composed almost wholly of large boulders, with little fine material. Along the river and in the small bays, are distinct traces of a terrace twenty feet above the present water-level. When the lake stood at that height, it must have covered an area nearly twice as great as it does at present, extending over a great deal of land now dry, more especially to the south and southwest.

The first portage is on the north side, following along the summit of a low ridge for 300 yards. The river here falls eight feet over a rocky ledge. Two other short portages in the next two miles pass similar small falls over ledges of rock. The third portage terminates in a bay of a small lake expansion, the river taking a short turn toward the north and falling into the lake about half a mile beyond the portage. The next portage is three miles below, the river in the interval varying from 50 to 800 yards in width, with numerous small deep bays running off on either side. Into one of these small bays the south discharge falls. The portage crosses a narrow point, around which the river, greatly enlarged, rushes in a heavy rapid, obstructed by many huge boulders. On both sides of the river here are sharp rocky hills rising from 400 to 500 feet above the water. Below the hills the valley widens out, and the surrounding ridges are low, with isolated rocky hills rising at intervals above them. For the next eight miles the course is north, and the river alternates from rapid narrows to small lake expansions covered with little islands and broken by narrow deep bays. In the narrows the river breaks into small rapids full of boulders, and has a strong current even in the widest expansions. A small lake is then entered with the river passing out to the north-west. The route crosses the lake and goes up a narrow bay for one mile and a half to its head. From here a portage of 400 yards leads to a small lake two miles long, surrounded by steep rocky hills 300 feet high. This lake is left at its east end by a half-mile portage, to another small shallow lake one mile long, surrounded with lower boulder-strewn hills, followed by another portage, a quarter of a mile long, that ends in Square Rock Lake, seven miles long, but very narrow, the average breadth being 400 yards, with small expansions at both ends and in the middle, where a small branch of the Big River flows out on the north side.

The lake is surrounded with hills from 200 to 400 feet high. These, like most of the country from Lake Nichicun, are burnt, and their exposed sides often appear from a distance to be solid rock, but on close examination they are found to be made up of angular masses and boulders, closely packed together. Where the forest remains, it consists almost wholly of small black spruce, with a few larches on the lower ground, and very small white birch on the hillsides. A few white spruce trees are seen growing on the low sandy terraces about the lake. The route leaves Square Rock Lake by a small stream flowing in on the south side nearly one mile from its east end. This stream comes from the eastward, in a wide valley, now filled with modified drift arranged in beds of sand and gravel, which appears to have once been the bed of a much larger stream than the pre-

sent. The stream is ascended for four miles, passing on the way two short portages, where the river falls in shallow rapids from one expansion to another. The last portage ends in a lake four miles long and about half a mile wide, strewn with small islands of till, or stratified sand. There is evidence of a terrace twenty feet above the present water-level, and there is a good deal of stratified sand and gravel seen along the shores. High rocky hills rise from either side of the broad valley partly filled by the lake. These hills have been more than three-quarters burnt over recently, and have a very desolate appearance. The trees are somewhat smaller than those seen about Nichicun, but they still grow up to the summits of the highest hills. A short portage leads to another lake, to the eastward, a half mile up which another portage is made past a shallow narrow; then the lake widens out and continues eastward for two miles. The hills on both sides are high and are burnt bare; the boulders, having been whitened by the action of the heat, stand out in marked contrast to the blackened vegetation. A portage of 400 yards leads to Eagle Lake, on another small branch that flows into the Big River, some distance below. This river is now divided into numerous channels by large rocky islands, which thus form a net-work of lake expansions over a wide area. Beyond this place the route is very difficult to follow, passing as it does through chains of lakes filled with islands, with deep bays branching off on both sides. The route in some places leaves the main lakes, passing by shallow narrows into large bays. The dividing up of the river into various channels, that often do not join for several miles, also leads to great confusion. Even with the aid of a map of the route, much time will be lost in following it here, owing to the sameness in appearance of the lakes and bays.

Crossing Eagle Lake, to its east side, one mile, the north channel of the branch is ascended one mile to Snipe Lake. Between the lakes the river is rapid and varies from ten to fifty yards in width. The latter lake is two miles and a half long by three-quarters of a mile wide, and runs northward, with a narrow bay stretching to the east for a mile from its north end. A south channel leaves the lake in a bay about one mile above the outer outlet. The river again divides, giving two inlets to Snipe Lake with a large hilly island between. The lake is covered with small islands. Many of the surrounding hills are rocky and precipitous, well wooded on the south side, with many blocks and boulders scattered over them. The route follows the narrow bay to the north-east. A portage of three-quarters of a mile leads from it to another lake expansion of this branch, eleven miles in length, which is called Long Lake, and lies about N. 60° E. It is very shallow and full of small islands, while great areas are obstructed with boulders and angular blocks of rock resting on the flat, shallow bottom. Many irregular bays indent the shore, especially on the north side, where the land is low. The river flows out at the south-west end, and must be broken by a considerable fall, as the sound of it is heard well up the lake. Several small streams feed the lake, the largest flowing in on the south side. The surrounding hills are rocky and burnt over, and are lower than those about the last lake. They gradually sink towards the east end, where the country is appreciably flatter and lower, with many lakes separated by low ridges.

Two short portages and a narrow lake one mile long, lead to a lake surrounded by low, rocky, boulder-strewn hills, and stretching towards the north-east. The route passes only two miles through the west end of this lake, and up a small

irregular bay to the northward. Here a portage of 500 yards ends in a small lake twenty feet above the level of the last. Half a mile beyond, another short portage is made to the last lake on the head-waters of the Big River. The route merely crosses this lake, which is large, and stretches away to the north-east, and then passes for 500 yards over a low ridge of boulders, forming the height-of-land between the rivers of Hudson Bay and Ungava Bay. The portage ends in a very large, irregular lake thirty feet below the last.

From the watershed, the route runs northward for six miles, in an irregular course, through Ice-bound Lake. This is another large body of water with wide, deep bays stretching off to the north-east and south-west. The water is very clear and shallow. The east side is bounded by rocky hills about 200 feet high, while to the westward the land is low, and is probably made up of points and islands in this, or in similar lakes in that direction.

A small stream flows eastward from the north side of the lake and the route follows it for six miles to Enchukamao or Male-otter Lake. The character of this stream is similar to that of others in the region, consisting of small, irregular lake expansions, connected by short rapids, with portages past three of them. The surrounding country is comparatively low; rocky hills are seen to the eastward 200 or 300 feet high; the rest are much lower, and are composed of till. Where unburnt, the country is covered with small, scattered, black spruce, with white moss coating the ground. Male-otter Lake stretches eastward eight miles, and varies from two to five miles in width. At its east end it is split into two deep bays by a broad rocky point, that rises about 500 feet above the lake. The summit of this hill is destitute of trees and is covered with white moss. Islands are numerous, and are generally well wooded with small black spruce. On the south side bare hills of granite rise often perpendicularly from 300 to 400 feet, while similar hills bound the north side, but appear to be somewhat lower. Both sides have been burnt bare, causing the scattered boulders and blocks that cover the hills to stand out prominently. Along the base of the hills, on the south side, there is a sandy terrace fifteen feet high, marking a former level of the lake. The water is remarkably clear; this is the case with all the water north of the East Main River, and is probably due to the lack of vegetable decomposition in the swamps and small shallow lakes, which to the southward gives the water a dark-brown colour. To the northward decomposition does not take place, at least it is not appreciable, on account of the short summer season during which the heat is sufficient to warm the cold waters fed by streams from the swamps that thaw out only on the surface, to a depth of twelve to eighteen inches.

Male-otter Lake discharges by a short stream from the head of its north-east bay into Lake Kaniapiskau. The route passes up the south-east bay, to its head, whence a portage of one hundred yards, over a low ridge, leads to the great lake. The difference of level is ten feet.

LAKE KANIAPISKAU

Lake Kaniapiskau is probably the largest in this part of Labrador. Its greatest length is from north to south, and is said to be considerably greater than that of Lake Nichicun, or above fifty miles. The lake is divided into two parts by a narrows, where the current is said to be strong. The southern part is much the

larger. As the route passed only through the northern portion, nothing is known of the lake above the narrows, except from information derived from the guide. A high rocky point stretches out from the east side of the northern part, and along with some islands in continuation of it, practically divides that portion of the lake into two great bays.

From the hill on this point, 300 feet high, a good view is obtained, but unfortunately the smoky state of the atmosphere obscured it when we were there. From the hill, the south bay is seen extending about ten miles to the base of a conical hill of granite over 500 feet higher than the level of the lake, which is estimated to be 1,850 feet above the sea. This hill cuts off the view of the southern portion of the lake. To the westward a deep wide bay stretches towards the southwest to the foot of high hills in that direction. Northward from that bay, a lesser one runs close to Male-otter Lake, where the portage is. The lake shore then sweeps eastward along the point, which extends about five miles in that direction. The bay on the north side of the point extends to the north-westward about five miles, where the river from Male-otter Lake comes in. Near here the Hudson's Bay Company formerly had an outpost from Nichicun, but it has been abandoned for over twenty-five years. Another deep bay extends to the northward, with a channel flowing out of it, between low rounded hills.

The east side of the lake is less irregular in outline, but a wide fringe of low islands extends from its north end to the narrows, with the river passing out by two channels, one opposite the point, and the other a few miles to the south. The country to the east of the lake is much lower than that on the other side, and consists of low rocky ridges, with wide valleys between, filled with lower ridges of till. The north end of the lake appears to be shallow, and is filled with islands, as is the case with the eastern half of the south bay. The western part of the latter is almost free from islands, and is said to be very deep. The islands about the southern discharges are arranged in parallel lines running north-east, and are chiefly composed of till, with many large boulders. Some are made up of stratified sand, which is also often seen resting on the till. The surrounding country is more than half burnt. The lower unburnt portions and islands are well wooded with small black spruce and a few larch trees. The summits of the high hills along the west side rise above the tree-line.

KOKSOAK RIVER

The largest stream falling into Lake Kaniapiskau flows in at its south end. Its main branch rises in Summit Lake, a body of water situated on the watershed about 100 miles south of the latter. A curious feature is that it has a discharge at each end, the northern one flowing into Ungava Bay, while the southern one is a tributary of the Manicouagan River that empties into the Gulf of St. Lawrence. This is not an uncommon case with lakes situated along the watershed in the northern region underlain by Laurentian rocks. The river flowing north from Summit Lake is joined by many other streams, draining the lake-covered region to the south and south-east of Lake Kaniapiskau, so that the river where it flows into that lake is of large size.

As before stated, Lake Kaniapiskau has three discharges, and the route follows the middle and least rapid one. Where it leaves the lake, the channel var-

ies from 50 to 200 yards in width; it flows swiftly, and is soon broken by a succession of heavy, shallow rapids, full of great boulders, the channel being cut in boulder-clay. These rapids are almost continuous for five miles, and no rock is seen in place. The south channel joins the middle one a mile and a half below the lake and, just above the junction, makes a very heavy rapid. Below the junction the river is 200 yards wide and carries about twice as much water as above.

Below the rapid the river, flowing north, widens out into a shallow lake four miles long and about one mile wide, with two deep bays on the west side, into one of which the north channel is supposed to empty. Northward of the lake there is a range of hills, partly wooded, while in other directions the hills are isolated and the country covered with low ridges of till. Boulders are still common, but not nearly as obtrusive as in the region west of Kaniapiskau. Leaving this lake the river narrows to a quarter of a mile, and is broken for a mile by a small shallow rapid; then, narrowing to 100 yards, it flows swiftly for another mile to a second lake expansion. Here, widening to three-quarters of a mile, the river continues northward for two miles in a shallow channel full of saendy shoals and small islands. These islands have a thick growth of stunted trees, not over ten feet high, of black spruce, larch, balsam fir and white birch. A straggling growth of spruce covers the low hills on both sides. Next, turning north-west, the river continues in the same manner two miles and then passes into a large lake, full of islands, that extends eastward. Where the river turns east, there are two distinct terraces of stratified sand twenty and thirty feet high, with sharp conical hills of boulder-clay protruding from the highest. Along the west shore of the lake three miles, a narrows 500 yards wide is passed, leading into another lake expansion three miles long and over a mile wide, with a deep bay toward the east. The country here is almost flat, with low hills along the eastern horizon. The river now turns northward again, and for the next three miles flows rapidly in a shallow channel about 400 yards wide, with swampy shores backed with bare hills, less than 200 feet high. Another lake expansion, one mile across, is followed by a stretch of three miles of river ending in a lake that extends away to the westward. Passing along its east shore, the river flows out one mile beyond its entrance. Now narrowing to 200 yards, it flows rapidly north-east for two miles, then widens to 500 yards for two miles, and, bending to the eastward, flows in that direction for three miles; at two short narrows it is broken into heavy rapids where it passes over low rocky ledges. With the exception of one small hummock, this is the first rock seen below Lake Kaniapiskau, but judging from the scattered boulders, the rocks underlying the thick deposits of drift are likely to be soft mica-schists and mica-gneisses, and this accounts for the change in the character of the country. These soft rocks having been unable to stand the abrading action of glacier ice, have been planed down, and only the harder parts rise in the low isolated ridges seen here. The granites of the region west of Kaniapiskau being much harder and tougher, resisted the glacial action, and now stand up in the rugged hills previously mentioned.

The river below is split into two main, and a number of smaller channels, with the stream in a shallow channel almost on a level with the surrounding flat country. Our route followed the east channel, which flows north-east four miles, and then north four miles, to the head of a heavy rapid. Two large channels join it at the fourth and eighth miles, and there is a heavy rapid between the second and

third miles, with a large rocky island dividing it. When again united, the river runs north-north-east for five miles, and flowing on the surface over low, flat ledges, is almost a continuous rapid for the whole distance. Throughout, the breadth is 400 yards. Three short portages are necessary to pass low chutes.

Turning due east along the southern flank of a low range of hills, the river next narrows to less than 300 yards, and flows swiftly between rising banks of till, with outcrops of rock along the shore. Now bending east-south-east for three miles and then south for two miles, the stream narrows to less than one hundred yards, and descends in a narrow valley, cut out of till, with a rocky bottom. On the north side, the hills increase in height as the river descends below the general level, and at the lower end rise abruptly 500 feet above the stream. Those on the south side are somewhat lower. In the five miles the river falls over 150 feet and is very difficult to pass with canoes. The Indians of Nichicun hunt only to the head of these rapids, and below there is an interval of over one hundred miles of the river untravelled, as it is utterly impossible to ascend the stream with loaded canoes. Along this portion no portages are cut out past the falls and rapids, and in consequence portage roads had to be made by us. At the rapid above, the sides of the valley are composed of almost perpendicular walls of till one hundred feet or more in height, resting upon jagged rocks covered with great rounded boulders for thirty feet above the water-line. These boulders are piled up by the ice passing through the gorge in the spring. The till banks at frequent intervals are deeply cut by small tributary brooks. On account of the broken character of the bank above, a portage had to be made along the water's edge over the loosely piled boulders and jagged rock. The river is here so rough, that the outfit had to be carried the entire five miles, and then the empty canoes were let down along the shore with frequent short portages past heavy pitches. A day and a half of hard work was necessary to accomplish this.

From Lake Kaniapiskau to the head of the gorge, the river wanders about almost on the surface of the country, spreading out into lakes, where the surface is flat, and contracting into narrow rapids where it passes between low ridges. It follows the main slope of the country, and falls with the general surface. Where it is obstructed with rapids, these are frequently over boulders without any rock in place, especially along the upper parts. The absence of a distinct valley and the presence of rapids over boulder-clay, show that the river is here flowing in a modern course, and does not follow its pre-glacial valley, which is still filled with glacial debris. At the gorge this changes and the river passes down from the general level into a deep distinct river-valley, probably of very ancient origin. This valley, during the glacial period was at least partly filled with till, which in scarped banks and terraces is seen along it, resting on its rocky sides. The river follows this old valley from the gorge to its mouth. The valley is, of course, not of constant depth, but descends in a series of steps, with the gradual slope of the surrounding country.

From the foot of the heavy rapid, the river, now in a distinct valley, takes an easy bend to the east and flows in that direction for eight miles. Here the current runs from four to seven miles an hour, with constant small rapids. The river averages 200 yards in width, and descends in a valley from a quarter to a half mile wide, walled in by steep rocky hills that rise 500 to 800 feet above it. These hills are almost wholly burnt, but where unburnt are covered with a straggling growth

of black spruce to within 200 feet of their highest summits. The tops are treeless, and are covered with white moss and low arctic shrubs. Boulders are now nearly absent from the sides and tops of the hills, in strong contrast to the hills about Nichicun and Kaniapiskau. Some boulders are seen, but they are so few as not to form a noticeable feature.

The lower parts of the valley are filled with drift, often extending high up the rocky hills in the cuts between them. In the drift the river has cut its narrow channel down to the solid rock below. The rock, where not covered with packed boulders, is seen along the water's edge. In many places the river banks are formed of tightly packed large round boulders that line the side to a height of fifty feet above its summer level. These have been transported and packed in their present position by the ice passing down during the spring freshets and their height gives an idea of the volume and power of the stream during flood time.

Turning south-east, the river continues in that direction under similar conditions for three miles; then it turns east-north-east, and the valley and river both broaden. The river, now a quarter of a mile wide, flows in a perfectly straight course for nine miles. Owing to its greater width, the water is very shallow, and the continuous rapid is full of bouldery shoals; the deepest channel being very crooked, requires constant crossing of the stream to follow it. No part of the rapid is rough enough to be dangerous, and the only source of danger is the frequent shoals, on to which the swift current quickly carries a canoe, if a sharp outlook is not kept. The packed boulders still rise from thirty to sixty feet above the water, with stratified sand and fine gravel, up to seventy feet, where a distinct terrace is seen, marking an older level of the river. Along the margin of the water there is an almost continuous exposure of solid rock. The hills are less precipitous, especially on the west side. The valley is filled with drift, of which sections are seen along the banks. The river now turns north-east for four miles and broadens slightly, the rapids giving place to a strong, steady current of nearly six miles an hour. A mass of ice, twenty-five feet long and six feet thick, was seen at the bend on the north side, piled up on a great quantity of packed boulders, sixty feet above the water, the remains of a great mass shoved there by the freshet in the spring, and left by the receding water. But a short time before, it had covered an area of over 100 yards square, but at the time (August 16th), it was melting quickly. Similar masses were seen along that shore for a mile below; they were all about thirty feet above the level of the water, and the largest was 200 feet long by thirty feet wide.

Both shores remain rocky, the rock coming out from beneath the packed boulders. On the west side, near the lower end of the course, there is a well marked terrace seventy-five feet above the water, that is seen extending downwards for two miles. In places it is flanked by a lower one forty feet high, with the boulders often packed to the top of it. The hills forming the sides of the valley are now about 500 feet high, and this nearly represents the height of the surrounding country, as all the little streams entering the river do so with falls from small cuts slightly lower than the summits of the hills. From the head of the rapids at the gorge, to this place, the river has fallen 420 feet without any direct drop exceeding four feet. The grade is nearly constant, and exceeds ten feet per mile.

The river next once more bends to the southward, and flows south-east for six

miles, with a strong current, in a slightly wider and lower valley. A large brook comes in from the eastward at the fourth mile.

For the last twenty miles the country on both sides is unburnt, and is covered with scattered black spruce and a few larches, never more than twenty feet high or exceeding nine inches in diameter. The tops of the hills rise from 100 to 200 feet above the tree-line. Turning again directly east, the river flows in that direction for six miles. The channel along here is wide and shallow, being filled up with sand and fine gravel, borne down by the strong current above and deposited over the flats of this part. Sandy shoals rise slightly above the water in places. The hills on both sides are slightly burnt and are lower, with gentler slopes towards the river than those further up stream. Rock exposures are less numerous, and the ice does not bank the boulders on the shores to more than fifteen or twenty feet high.

After a bend to the east-south-east, a small rapid is passed, and three miles below a little river falls in on the south side. This is the first tributary of any considerable size that joins the main stream below the commencement of the river-valley proper, and there must be only a narrow strip on either side draining into the river, the rest of the country probably being cut up into parallel valleys, with watercourses in each, which only join the main stream at long intervals. The small branch comes in with heavy falls, along the side of a rocky hill of 800 feet. Below, the river again flows eastward for three miles, with a strong current, and has a terrace of thirty feet on the south side. A bend of a mile and a half to the north-east is followed by another part of the north-east course. Then the channel broadens somewhat, and the current is considerably slacker for the next eight miles. The valley here slopes gently upward, on both sides, and is partly filled with drift. The hills are high, those on the south side rising from 600 to 800 feet, with well marked terraces at sixty and thirty feet, cut out of the drift along their flanks. The north side is unburnt,and the trees are small, stunted black spruce, that grow to within 200 feet of the summits.

The general course for the next ten miles is east-north-east, and, the valley narrowing, the river for the first six miles is a succession of heavy shallow rapids, full of boulders. Along the flanks of the hills on the south side, several distinct high-level terraces are seen at 30, 60, 75, 100 and 150 feet above the present river-level. The upper ones are broken, and only the lowest two are continuous. Below the rapids the river widens to more than half a mile, and is correspondingly shallow, with a sandy bottom. The hills on both sides now gradually lower, and those on the south side retreat, leaving a wide, low, drift-covered valley between their base and the river A bend of two miles to the south is followed by a stretch towards the east five miles long. At the foot of the first bend there is a rapid of three-quarters of a mile where the river is over half a mile wide, and flows with a strong current until it reaches the base of a low range on the north side, where it narrows to 400 yards and is broken into heavy rapids. The river now appears to break through this low range 200 to 400 feet high, and in doing so bends sharply to the south-east for two miles, then north-east two miles, again south-east two miles, and finally south for three miles, passing out into a broad valley, where it is joined by the Katakawamastuk or Sandy River, a large branch from the eastward. While passing through the hills, the river forms a continuous strong rapid, culminating in a twenty-foot chute a short distance above the forks.

Although the river descends rapidly, it does not fall as quickly as the general level of the country here, and, in consequence, below the forks it flows nearly on the general level, with only low rounded hills seldom more than 100 feet above its shallow valley.

In this manner it flows eastward for five miles, with only one small rapid, to the head of a rocky gorge. From the head of this gorge a very distinct drop is seen in the country to the eastward, with high hills that appear to be on the level with the land about the gorge bounding the horizon. At the head of the gorge the river is split up by little rocky islands into a great number of small channels, and it passes through them in a succession of small chutes or heavy rapids, gradually collecting into one channel; after half a mile, the stream, a mass of foam, rushes down a narrow gorge from thirty to one hundred feet wide, with perpendicular rocky walls from 50 to 100 feet high. In one mile the river falls 110 feet without any direct drop of more than five feet. The portage passes over the bare rock on the south side. Below the gorge the channel widens to half a mile, and continues eastward, with strong current and flat rapids for three miles. Here again narrowing to 100 feet, it falls thirty feet into a narrow rocky gorge, which was named Eaton Canyon, and turning directly south, rushes down between jagged perpendicular walls with a width varying from fifty to one hundred and fifty feet. As the stream descends, the banks rise and become 200 feet high a quarter of a mile below the first fall. Here the river turns sharply to the north-east and continues as a rushing torrent, through a deeper and still narrower gorge with overhanging walls of red granite on the east side. The overhang is so great that a stone dropped from the top on this side would almost reach the foot of the opposite cliff when it struck the water 350 feet below. After falling in this manner for a third of a mile, the river widens to a hundred yards, and changing its direction to east, descends less abruptly for a quarter of a mile, while the walls of the canyon are a hundred feet lower, and much less abrupt. Next, turning north, it makes a direct fall of a hundred feet into a circular basin about fifty yards in diameter. Nothing but seething water and foam is seen in this rocky basin, which resembles a gigantic boiling cauldron. A small brook on the north side also falls into the basin, descending the perpendicular wall in a cascade 200 feet in height. The river leaves the basin by a narrow rocky channel, rushing out with a fall of thirty feet in immense waves that gradually subside in a second and larger circular basin at its foot, where it widens to 150 yards. On each side of the central current there are strong eddies rushing up to join the downstream, where it passes out from the basin above; and, where the conflicting currents meet, great whirlpools are periodically formed. A small rocky island divides the river into two narrow channels where it leaves the larger basin, whence it flows north-east for two miles, and then gradually bending south in the next mile and a half, still a hundred yards wide, it rushes along in heavy deep rapids, between vertical walls of granite capped with drift that rise from 100 to 300 feet above its surface, until it suddenly bursts out into a wider valley running north-north-east, with a large branch called Goodwood River flowing down it from the southward.

The portage past the canyon was made along the east side, leaving the river above the first fall, coming out on the top of the bank at the sharp bend to the north-eastward, and thence striking due east for a mile over low rocky hummocks, with swamp between, and descending the steep rocky course of a small stream to

a narrow valley 200 feet below. It then follows this valley for half a mile to a small lake, after crossing which a portage of 150 yards leads out through a narrow gorge, with perpendicular walls 160 feet high. Large masses of rock have fallen from above and have filled the valley completely to a depth of seventy-five feet. The small river passes under this mass of broken rock, and in so doing falls twenty-five feet, to where it enters the main stream on the south side of the larger basin at the foot of the canyon. Over this mass of broken rock, canoes and outfit were carried, as there was no other place where the main valley could be entered, and the difficulty of the undertaking may be imagined when it is stated that over half a day's labour was required to pass these 150 yards of broken rock.

In the small valley the trees are much larger than any seen since leaving Lake Mistassini. Growing on a rich alluvial soil along the banks of the brook, is white spruce eighteen inches in diameter at the ground and sufficiently long to make two twelve-foot logs. The trees are, however, very knotty. Larch of similar size is also seen here, along with white birch eight inches in diameter. The first white spruce on the banks of the river was found on a low bank of sand and gravel at the mouth of the Sandy River. Below that point small trees of this species are commonly found growing on the lower terraces of stratified drift. The higher lands support only a small growth of black spruce and a few larches.

Below the junction of the Goodwood River the main stream runs north-north-east for six miles, with a rapid current, in a channel 300 yards wide. On the west side there are scarped banks of stratified drift one hundred feet high; and rocky shores on the east side are capped with drift and have two well defined terraces at 60 and 100 feet above the river, the lower terrace being cut in fine sand and grown over with fair-sized white and black spruce. Four or five miles beyond the lower end of this course there is on the east side a range of bare rocky hills over 1,000 feet high. Widening out to nearly half a mile, the river then turns north, and for fifteen miles flows with a moderate current in a shallow channel filled with sandy shoals. The eastern bank is very rocky, and from 200 to 300 feet high, with patches of sand along the gulleys where the brooks tumble in. These rocky banks form the foot-hills of the barren range before mentioned. The west side has also high and in many places rocky banks, but the country behind is much lower than on the other side, with a few isolated hills more than 500 feet high. On this side the surface is mostly unburnt, with fair-sized black and white spruce and larch growing on the stratified sands of the terraces, but with only a scant, straggling growth of black spruce on the rocky and drift-covered hills above.

Remains of terraces are seen along both sides at 10, 60 and 75 feet, that at 60 feet being the most constant. Contracting now to less than one hundred yards in width, the river falls eighty feet over a ledge of rock at the Granite Fall. Two small rocky islands divide the stream into three channels, the largest being on the north side. There is a first chute of twenty feet followed by a perpendicular fall of sixty feet in the smaller channels. In the main channel a large mass of rock broken away is apparently lodged at the foot of the fall, as the water dashes up from below in a great wave forty feet high. The river falls into a beautiful, circular basin, nearly half a mile in diameter, formed by a deep semi-circular bay on either side. These bays are surrounded by well wooded, perpendicular cliffs 200 feet high. A wide beach of small, well rounded boulders, rises sharply from the water and stretches for sixty feet to the foot of the perpendicular walls.

Below the falls the river again passes into a deep valley less than a mile wide, with rocky walls that often rise sheer from 800 to 1,000 feet. This valley during the glacial period has been partly filled with high scarped banks of from 100 to 300 feet, with terraces from 50 to 150 feet above the present level. The direction of the valley is nearly north-west, and the river, about 300 yards wide, rushes down it in a zigzag. At every bend the stream strikes against the rocky walls, while a low bar of large, round water-worn boulders extends out from the opposite shore, throwing the waters with force against the rocky banks, and forming deep wild rapids at these points. In this manner the river continues falling rapidly for ten miles; then the valley gradually widens and there is a considerable interval of drift-covered land between the river and the rocky hills on the east side, where terraces at 20, 50 and 100 feet are seen, cut in the drift. The west side is still bounded by rocky hills that rise about 400 feet. In the valleys of small streams cut into the drift, and on the terraces, white spruce trees forty feet high and eighteen inches in diameter are not uncommon.

This valley continues from three to five miles wide for twenty-five miles and is remarkably straight, the course being about north-west. The river skirts its west side, where it flows close to the base of the rocky walls that rise from 200 to 400 feet above it. For seven miles it does not average over 400 yards in width, is very shallow and greatly obstructed by sand and shingle bars, over which it breaks into rapids. At the end of this stretch, a small river comes in from the west, through a deep narrow cut in the mountains. Terraces are continuous along the east side at heights varying from 20 to 150 feet above the river. Balsam poplar trees forty feet high and ten inches in diameter were seen on the lower terraces, along with white spruce trees sixty feet high and over eighteen inches in diameter.

Below this branch the river soon widens out to more than a mile and is broken by sand bars into a number of wide shallow channels. The bottom is formed of shifting sands. The banks are lower and are composed of stratified sand cut into terraces. The current is slacker, and at the end of fourteen miles another and larger branch, called the Tipa or Death River, comes in from the west, joining the main stream by three channels, as it falls over a low ledge of gneiss. Below this tributary the river narrows somewhat, but still remains shallow, with lower banks, for four miles; then, narrowing to less than 400 yards, it bends to the northward into the head of Cambrian Lake, which is about two miles wide and surrounded by high rugged hills of Cambrian rock.

In fourteen miles the lake gradually sweeps round from north to north-west, and at the end of the curve another small branch from the west flows in from a wide valley between high barren hills that rise from 800 to 1,200 feet above the water.

The physical aspect of the country changes as soon as the Cambrian area is entered. Where the underlying rock is Laurentian gneiss or granite, the hills, though often high and with perpendicular sides towards the river-valley, always have rounded tops, with long gently curved outlines, while the hills formed from the stratified Cambrian rocks are much sharper and more rugged.

The general dip of the rocks is towards the north-east, and, in consequence, the mountains which they form show steep cliff faces towards the west, with long gentle slopes on the opposite side. These hills run in ridges roughly parallel to one another and to the general strike of the rocks, that is, from south-east to

north-west. They rise from 800 to 1,500 feet above the surface of the lake, which is about 400 feet above sea-level, and on the western side often have perpendicular cliffs over 500 feet high, with a great talus of broken rock at the bottom. The cliff-faces have generally a reddish colour, due to the oxide of iron present in all the rocks of this series. All except the lower slopes of these hills are barren, or covered only with arctic shrubs and mosses, with patches of snow in gullies near their summit; this adds greatly to the grand and desolate scenery, while the beauty of the pleasant, wooded valley of the river is enhanced by the contrast.

From the entrance of the small branch, the valley again turns northward and continues in that direction for eleven miles, to where the lake gradually changes into the river again, with high hills on the east side, in which the Cambrian rocks are seen resting on rounded masses of gneiss. The hills on the west side retreat, leaving a wide sandy plain, through which a large branch called the Piachikiastook or Ice-dam River flows, entering the main stream with a heavy rapid two miles above the end of the course. The main stream gradually narrows, and becomes shallow along the lower part of this stretch, where it runs between low banks of sand. Turning next to the north-east for seven miles in a wide sandy valley, it flows along with increased current in a shallow channel three-quarters of a mile wide, until it reaches a barrier of black shale and limestone, where it falls sixty feet in about 200 yards, at the Shale Falls. Below the falls there is a circular basin with steep sandy banks sixty feet high, and from it the river passes out to the north and flows in that direction for two miles between terraced banks sixty feet high covered with large spruce, with outcrops of iron ore showing beneath the sand along the water's edge.

Gradually bending around to the north-west, the river flows in that direction for twenty miles, until it is joined by a large branch from the eastward called the Swampy-bay River. By this stream the Indians formerly travelled to Fort Nascaupee, which was situated on Lake Petitsikapau on the upper waters of the west branch of the Hamilton River, and only a few miles from the watershed separating it from the Swampy-bay River. Along the first five miles of this course the river is about half a mile wide and flows between sharp rocky hills, which rise 600 to 800 feet above it. Here an almost continuous exposure of bedded iron ores is seen, consisting of red specular hematite, magnetite and siderite, interbedded with siliceous limestones and jasper. After five miles the hills retreat on both sides, leaving a wide valley of drift, through which the river runs with a steady current in a shallow channel half a mile wide. The drift is cut into terraces at 30, 50, 100 and 300 feet. A small branch from the east flows in here.

After four miles the hills again approach the river on the west side, where they are sharp and rugged and rise from 600 to 800 feet in precipices often terminated in sharp peaks. Two miles above the forks there is a strong rapid half a mile long, where the river narrows to less than 200 yards. The sands in the valley are greatly drifted by the winds, and in one place the drifts are covering up trees twenty feet high. The country is nearly all burnt from the falls to the mouth of the Swampy-bay River.

For eight miles below the Swampy-bay the main stream flows north-west in a narrow valley, between sharp rocky hills, from 400 to 600 feet high. The river channel is from 200 to 600 yards wide, and the current is strong. The lower parts of the rocky hills on the east side are covered with sandy drift and are terraced

at several levels up to 200 feet above the present height of the river. The hills on the west side rise directly from the water and have very little drift on their flanks.

The river next turns north-north-west for seven miles, and then north for seven miles more. Along the upper of these courses the valley widens to over two miles, and is filled with drift, terraced to the 200 feet level, behind which it slopes gently upwards with a few sharp rocky hills projecting above it. Along the second course the land on the east side is only about fifty feet high, for three or four miles to the base of the hills. The country on the west side is higher and the hills come out at intervals along the river, with a large brook flowing in from the west, about two miles from the upper end of the course. The river here widens out to nearly a mile and its current is not strong.

Along the last mile the river narrows to 400 yards and flows swiftly between hills of limestone from 200 to 600 feet high, very sharp and irregular in outline. The rock has the appearance of being greatly faulted. Turning now sharply to the north-east, the river continues to flow swiftly in a narrow, rock-bound channel for three miles, where it again turns northward, and continues in that direction ten miles to the Pyrites Chute, where it falls thirty feet in a half mile over black shales on edge. Along the upper half of this course the limestones are almost continuously exposed along the river banks, rising in sharp ridges on both sides from 100 to 800 feet high. Along the lower half the hills retreat and leave a wide sandy valley, covered with black and white spruce with a few larch and white birch. The largest trees rarely exceed twelve inches in diameter and are much shorter than those seen about the Cambrian Lake.

Below the chute the course is north-west for fifteen miles. For four miles the channel averages three-quarters of a mile in width, and the surrounding country is low and flat, with sharp hills of rusty rock and a few exposures of limestone on the east side. A number of low islands of limestone occur in the next mile, at the end of which the river, at the Limestone Falls, descends sixty feet over ledges of that rock, which cross the river-valley obliquely, and form a dam over which the water pours in three main channels. The middle channel follows the strike of the rock and forms a chute, while the other two fall vertically, directly across the strike. Below the falls, for four miles, the river about a half mile wide flows between scarped banks of sand and gravel seventy-five feet high; and then, narrowing to less than 200 yards, for five miles it rushes through a narrow valley called Manitou Gorge, cut out of limestone and shales, with walls from 50 to 300 feet high. Heavy rapids are met with throughout the gorge, and considerable danger was encountered running these with half loaded canoes, especially at the lower end, where outcrops of limestone cross the valley, hemming the water into narrow channels and causing small chutes. Below the gorge the river for six miles gradually bends towards the east until it is joined by the Natwakami, Larch or Stillwater River, a large branch from the west. Along this portion the current is strong and a number of large islands of sand and shingle divide the river into several channels. The banks are cut out of clay, overlain by sand, and often over one hundred feet high. As the forks are approached, the banks on the west side become lower and form a broad sandy plain between the two rivers. The Stillwater River has about half the volume of the main stream and flows in from the westward through a wide valley. There must be a considerable quantity of clay

along its banks, as its water is quite muddy, in marked contrast to the clear water of the main stream.

By this branch the Indians journey to Hudson Bay. They follow it to its head and cross from there to Clearwater Lake, and by the discharge of this lake reach Richmond Gulf. The Rev. Mr. Peck, a missionary of the Church Mission Society, crossed by this route in 1885, and the first expedition of the Hudson's Bay Company to Ungava, traversed the same route from Hudson Bay in 1824.

Immediately below the Stillwater the river turns to the north-east, and for five miles is less than a half mile wide, flowing with a swift current between low terraced banks in a valley two or three miles wide, bounded by sharp hills from 500 to 600 feet high. These hills, still composed of Cambrian rocks, run in sharp ridges from a quarter of a mile to two miles apart. The direction of the ridges is roughly at right angles to that of the river. They resemble one another very closely and sixteen of them were noted in as many miles. They have a cliff face towards the south-west, and a gentle slope towards the north-east, apparently coinciding with the dip of the rocks. All the cliffs show a thick capping of hard rock, probably trap, with rusty weathering shales beneath. On the steep side the hard capping rock often projects beyond the softer shales and so forms overhanging cliffs. The lower valley, where unburnt, is wooded with small black and white spruce and larch, growing in open glades upon the terrace. These trees also grow on the hillsides, up to about 200 feet above the river. Above this, only mosses and arctic shrubs are seen about the watercourses, the remainder being naked rock, which forms over one-half of the area under consideration. Ten miles below the Stillwater, a small river comes in from the westward. The valley, five miles below the forks, widens to five or six miles, and the river spreads out to over a mile, becomes very shallow, and is greatly obstructed by sand and shingle shoals, as it flows along with a strong current, in the same direction for twenty-one miles.

Toward the lower end of this reach, the sharp Cambrian hills give place to others of Laurentian rock, whose outline is less rugged and more rounded. The interval between the river and the rocky hills is occupied by a terraced sandy plain from twenty to fifty feet above the river and is partly covered with small trees.

Low ledges of gneiss now cross the stream and form a number of small rocky islands, causing a heavy rapid for nearly a mile, followed, two miles below, by another a quarter of a mile long. At both rapids the water is shallow and the channel is obstructed by reefs and large boulders. The foot of the second rapid marks the head of tide-water.

From here the course changes to east-north-east for eighteen miles. The hills on both sides retreat still farther and appear to be considerably lower. The river is now from two to five miles wide and is broken into numerous channels by long low islands of sand, and shoals bare at low water. The river banks are from ten to twenty feet high, with a wide drift plain extending to the foot of the bare, rocky hills, on which the remnants of terraces are seen up to 300 feet above the present water-level. This plain is only partly wooded with small black and white spruce, and but two clumps of small balsam poplar were seen on the north bank. Turning again to the north-east, the river becomes still wider, with a deep bay on the north side, around which the rocky hills sweep; these then cross the river seven miles down the course, where they form a number of high rocky islands that hem the water into deep channels, through which it rushes rapidly in and out ac-

cording to the state of the tide. At and below the islands the river varies from a mile to a mile and a half in width, and its valley is bounded by rounded rocky hills, rising from 100 to 300 feet directly from the water, with only in a few places a narrow border of drift between, which is sometimes terraced one hundred feet above the present sea-level. The course continues nearly north-east to the mouth of the river, some twenty miles below.

Fort Chimo, the Hudson's Bay Company's establishment, is situated facing a small cove on a low terrace on the south shore, about two miles below the islands. The terrace is about 200 yards wide and is backed by low rounded hills of gneiss. Small black spruce trees grow only in protected hollows about the post, and the general aspect is very uninviting, with barren, rocky hills bounding the horizon on every side. The post consists of about a dozen buildings, including a dwelling house for the officer in charge, four or five for the servants, a trading shop, office, two provision stores, oil shed, salt shed, carpenter, cooper and blacksmith shops and a dwelling house for the Indians. These buildings are all, or nearly all, made of imported lumber. There are a number of small boats attached to the post, along with a small sloop and a steam launch, used in connection with the salmon fishery. At present a vessel of about twenty tons is being built there, from wood obtained about Ungava Bay; most of it coming from some distance up the Whale River, which is the next large stream flowing into the bay to the eastward. Firewood for the post is cut during the winter in the vicinity of the first rapid, and is rafted down the river in summer.

The post is supplied by the company's steamer "Eric", which arrives at Fort Chimo about the first week in September and remains there, loading and unloading, for about two weeks. This is the only communication with the outside world and when the ship leaves, all touch with civilization is lost until the following year.

The fur trade is, of course, the most important, and is carried on both with the Indians and Eskimo. Foxes are the most numerous of the fur-bearing animals and are found throughout the barren and wooded country; they occur as to numbers in the following order: white, red, cross, black and blue. Martens come next, and are chiefly taken by the Indians along the edge of the wooded country, about the head-waters of the rivers. Their fur is very thick, dark and long, and the skins are generally larger than those caught farther south. Wolverines are common along the edge of the barrens and northward. White bears are killed frequently along the coast. Black bears are very rare, and specimens of the barren-ground brown bear are obtained only at infrequent intervals. Mink and otter are not common, and the beaver is not found north of the thickly wooded area. Formerly a great number of dressed caribou skins were traded at Ungava; but during the last two years very few were brought in owing to a change in the routes of migration of that animal.

The salmon fishery is carried on at a number of places along the river, below the post, during the month of August, and the annual catch averages one hundred tierces for export. Salmon are also taken in the mouths of the Whale and George rivers the average catch at the former place being fifty tierces, and at the latter one hundred and twenty tierces. Formerly the company employed a small refrigerator steamer in this trade at Ungava, and the frozen salmon were taken to London for sale. This has been abandoned for several years, and the salmon are now split and salted. The white porpoise is also taken at Ungava, on the Leaf River,

a stream a short distance north of the mouth of the Koksoak, and at George River. The total amount of oil so obtained is about eighty tierces of forty gallons each. Other articles purchased are feathers, ivory and eiderdown.

Seven years ago there were ninety families of Indians trading at Fort Chimo. But in the famine, due to the failure of the caribou hunt, during the winter of 1892-93, nineteen families starved to death in a body, and at another place six families were totally lost; besides these, all the other Indians were throughout the winter in a state of chronic starvation, and many died, so that out of a population of two hundred and fifty persons, less than one hundred and fifty survive.

HAMILTON INLET

Hamilton Inlet, Invuktoke, or Esquimaux Bay, is the largest and most important of the many long, narrow fiords or inlets that indent the Atlantic coast of Labrador and Newfoundland. Its greatest length, from Indian Harbour to the mouth of the Hamilton River at its head, is slightly over one hundred and fifty miles, while its average breadth is about fourteen miles. The longest axis lies north-east and south-west. At its mouth, from the mainland near Purple Island, on the north shore, to Grinder Point, on the south side, the distance is twenty-three miles. Thence the inlet gradually narrows for forty-three miles to the mouth of the Double Mer, where the width is less than two miles. Here the inlet is divided by a long rocky ridge, the northern portion, or the Double Mer, extending westward some forty miles. A narrow, less than one mile wide, extends from the point five miles into the main, or Groswater Bay. Again widening, the channel is divided by a large rocky island five miles long called Henrietta Island. At its head, on the south side, a long narrow bay, called Back Bay or Backway, runs off to the eastward for about twenty-five miles, with an average breadth of four miles. At the east end of this bay a ridge one hundred and fifty feet high separates it from a small lake, with a sluggish brook that empties into a bay on the coast. The total distance between the head of the bay and the sea coast is not over ten miles; the country between appears to be wholly formed of drift material and it is quite probable that in pre-glacial time there was an opening of the coast here.

The main bay above Henrietta Island quickly expands to four miles, and then more gradually to twelve miles, at the mouth of Valley Bight, eighteen miles above the narrows. Valley Bight is a small bay on the north side, about three miles wide at its mouth, and gradually narrowing for five miles to its head. From the mouth of this bay the main body has an average breadth of eight miles as far as Charley Point, some eight miles up. This portion is greatly obstructed by islands, of which Neveisik, St. John and Haines islands are of large size, and are also high and rocky. From Charley Point to Mulligan Point the distance is thirty miles, and the average breadth of this portion is fifteen miles, with two large bays, one on each side. That on the north side is called Nebavick or Mulligan Bay, and extends behind the long, low point of the same name. It is about four miles wide at its mouth, and of about the same depth, with a small river coming in at its head. The bay on the south side is called Etagaulett or Big Bay; it is ten miles wide and nearly five miles deep.

From Mulligan Point to the mouth of the Northwest River, some twenty-

three miles, the breadth gradually decreases to eight miles, and considerable intervals of low sandy land intervene between the water and highlands behind, while the waters on both sides are shallow, and are greatly obstructed by sandy shoals and low islands, especially on the north side, where a fringe of islands extends several miles out from Mulligan Point to within four miles of the mouth of the river. The Northwest River flows in at the foot of a small shallow bay, and at its mouth is about 100 yards wide, with an average depth of fifteen feet. The narrows are only half a mile long, and then the river expands into a shallow lake, one mile wide and three miles long, at the head of which is another contraction of about 400 yards, with a strong current where the river flows out of Grand Lake. This is a large body of fresh water extending westward some forty miles, and is from two to five miles wide, and very deep. As only a comparatively narrow strip of low sandy land separates this lake from the bay, and the sand has probably been deposited there by aqueous or glacial agencies, it is probable that at no very remote time the lake formed an extension of the present inlet.

On the south side, immediately opposite the mouth of the Northwest River, is Carter Basin. This is about three miles long and a mile and a half wide, and is connected with the main body by a channel little over one mile long. Into this basin two rivers empty, the larger or western one is called the Kenamou River. It is a large stream that rises on the highlands to the south-west, where its source interlock with those of the St. Augustine and Natashquan rivers, which empty southward into the Gulf of St. Lawrence. The Indians report that it flows through a deep valley in the Mealy Mountains and is unnavigable with canoes, owing to the almost continuous, steep, shallow rapids. No high falls are reported on this stream. The smaller stream is called the Kenemich River, and takes its rise on the top of the Mealy Mountains only a short distance inland, to the south and south-east of its mouth. It descends the steep sides of the hills close to its mouth in a succession of high and beautiful waterfalls.

From the mouth of the Northwest River, the shore trends southward nine miles to the end of Sandy Point, a low, broad expanse of sand stretching this distance out from the north side, evidently the remains of drift brought down by the Hamilton River. Opposite Sandy Point the bay is only three miles and a half wide, and shoal water, caused by an extension of the point, continues to the south side, with only eighteen feet of water at the deepest part, where the channel is less than a half-mile wide.

Beyond the point, the shore again trends northward, forming Goose Bay, which averages nine miles in width and is nearly twenty miles long, to the head of Terrington Basin, where Goose Bay River flows in. This is a shallow stream, draining a considerable area of country between the Grand and Northwest rivers. Goose Bay is in most places quite shallow, being filled up with sand brought down by the Grand or Hamilton River, which flows in on the south side, nine miles above Sandy Point. A low sandy point, about five miles wide, separates the river from the upper part of Goose Bay.

The country surrounding Hamilton Inlet is generally high and rocky. On the north side, commencing at the entrance to the bay, the hills range from 100 to 400 feet, and are only partly wooded with small black spruce, in the valleys and on the protected sides. As the narrows are approached, the land rises from 200 to 500 feet, and continues between these heights, until Valley Bight is passed,

Beyond, it is still higher, seldom under 500 and often over 800 feet, forming a high rocky ridge separating Double Mer from the main bay. Fifteen miles above Charley Point, the hills pass inland around the head of Mulligan Bay, leaving a wide interval of low land between their bases and the shore.

Still continuing inland, the hills cross from the head of Mulligan Bay to the shores of Grand Lake, and are more irregular in height and outline than below. One hill called Mokami, or Kokkak, rises in an imposing cone of over 1,000 feet, with bare rocky sides and top, forming a conspicuous landmark, said to be visible from any high hill, within a radius of seventy-five miles. The hills above Northwest River skirt the north side of Goose Bay, and gradually close in beyond it, to form, with those of the south shore, the wide valley of the Hamilton River.

The country along the south side of Hamilton Inlet at its entrance, is comparatively low and swampy. The hills first reach the shore about fifteen miles below the narrows, and then follow it closely to the mouth of Backway. Along the narrows they rise abruptly from 500 to 1,000 feet and in places are flanked with sandy terraces up to 150 feet above the sea. Along Backway they average 600 feet and culminate in a rounded conical peak called Monat, over 1,000 feet high.

On the other side of Backway there is generally an interval of low land, rising in terraces to the foot-hills of a high, barren range called the Mealy Mountains, that occupies a large area of country between the south side of Hamilton Inlet and the head of Sandwich Bay. These mountains rise precipitously from 800 to 1,200 feet along the side of the inlet, without any low land, from the mouth of Backway to within ten miles of the mouth of Carter Basin, where they pass inland, and ultimately form the south wall of the Hamilton River valley. Along the inlet the sides and tops of these hills are almost totally devoid of trees owing to the blasts of the prevailing cold north-west wind that sweep across the bay, especially during the winter season. Inland, it is reported that small trees grow abundantly in protected valleys. As the head of the inlet is approached, the trees are seen to cover the lower slopes and to rise higher and higher, until near the mouth of the Hamilton River, they are found extending to the very tops of the hills, here from 600 to 800 feet high. Below the narrows the inlet is obstructed by a number of large rocky islands; of these the most conspicuous is George Island, which lies about six miles off the south shore, at the entrance. It is nearly four miles long and in its highest point 750 feet above sea-level. A number of smaller islands are clustered along the shore, on the north side at the entrance, and Indian Harbour, an important cod fishing station, is situated among these. From the entrance the inlet is practically free of islands to within half way to the narrows, where it becomes obstructed by several large ones scattered up its middle. The islands above the narrows have been referred to previously as extending as far as Charley Point.

Below the narrows the greatest depth laid down on the chart is fifty fathoms, and the average depth is about thirty fathoms. The channel at the narrows and on the north side of Henrietta Island, ranges from ten to twenty fathoms in depth. Above, the water rapidly deepens, and soon shows ninety-two fathoms; it continues very deep to beyond Mulligan Bay, where it begins to shoal, especially along the shore, a fact probably due to the filling up of the bottom with material brought down by the large rivers emptying into the head of the bay. Twenty fathoms appear to be the average depth of the deeper parts to nearly opposite Northwest

River, then it rapidly shoals to fifteen and to five fathoms, until the bar at Sandy Point is crossed, after which slightly deeper water is found, which again shoals gradually to three fathoms at the mouth of the Hamilton River.

At Indian Harbour the tide rises seven feet at springs; at the lower end of the narrows the rise is four feet, while above the narrows the rise is only about two feet and continues the same to the head of the inlet, where the rise and fall of the tide is much modified by the direction and strength of the wind. Below the narrows there is a strong current formed by the ebb and flow of the tide; while through the narrows the rising and falling water rushes with a velocity varying from four to seven miles an hour, and in a number of places heavy rapids occur, which, with whirlpools and eddies, render the passage of small boats dangerous when the current is at its strongest. Above the narrows there is no perceptible current, except that caused by winds. The shores of the outer part of the inlet are partly wooded with small black spruce and larch, while the hills and islands support only a growth of low arctic shrubs and willows. As the narrows are approached, the trees become larger and on the protected north side cover the hills to their tops. White spruce, balsam fir and small white birch are seen. Continuing up the bay the trees become larger and better until on the low lands about its head, plenty of trees of the above species grow to sizes that fit them for commercial purposes, and aspen and balsam poplar are abundant. At Northwest River, and also at the mouths of the Kenamou and Hamilton rivers, good crops of potatoes and other garden vegetables are grown annually, and it is said that oats will readily ripen also. At and below the narrows, the cold arctic current, which passes down the coast, so lowers the general summer temperature, that potatoes cannot be profitably grown, and garden crops are confined to turnips, radishes and lettuce.

Hamilton Inlet is the present southern limit of the Eskimo on the Atlantic coast. There is now a little tribe of some half dozen families living in log houses on the shore of a cove called Carawalla at the head of Henrietta Island. A few more families are scattered along the shores of the lower half of the inlet. They are in a state of semi-civilization, having adopted European dress, and all talk more or less English. They are poor and dependent on the fishery and seal hunt for a livelihood. The Hudson's Bay Company have two establishments on Hamilton Inlet; the larger, called Rigolet, is situated on the north shore at the narrows, about three miles above the entrance to Double Mer. This is the headquarters of the Labrador Coast, or Esquimaux Bay district, the officer in charge having under his care the posts of Cartwright on Sandwich Bay, of Northwest River at the mouth of that stream, as well as those of Davis Inlet, and of Nachvak, both situated on the coast to the northward.

The post at Rigolet consists of about a dozen houses and stores, and trade for fur and fish is carried on with the Eskimo and "planters". The trade of the post at Northwest River is made with the "planters" living about the upper part of the inlet, and with the Indians, who hunt in the country drained by the Hamilton and Northwest rivers, as well as with those hunting to the southward in the Mealy Mountains. A Roman Catholic chapel was erected some years ago near this post, and a missionary priest from the St. Lawrence used annually to visit the Indians there during the summer. These visits, it is understood, are no longer to be made, the Indians being advised to go instead to Mingan, or other posts on the

St. Lawrence, to meet the missionaries. All the Indians of the region profess Christianity and are very careful to keep all the observances of the church, even when far inland, but their beliefs seem to be inextricably mixed up with their older pagan ideas and often their views on subjects of religion are very curious.

The Indians frequenting Northwest River post are probably the most miserable and ill-conditioned in Labrador. Being deer hunters and consequently depending largely on the caribou, both for food and clothing, they have little inclination to trap fur-bearing animals and thus improve their condition by trade. As their wants are mainly confined to tea, tobacco, powder and shot, and some few articles of clothing, a small amount of hunting only is necessary to provide their price, and beyond this, except for the labour of following the deer, or fishing, they do nothing, spending much of their time lounging about their tents. They will not work, even when offered very high pay, and when asked so to do, simply laugh and say they are not hungry. They are so improvident that they never lay in a stock of fish in the autumn, as the Indians to the westward do, and when during the winter, from some cause or other, they fail to find the caribou, they are soon reduced to starvation and many die.

These Indians belong in part to both the Montagnais and Nascaupee tribes. The former tribe hunts between Hamilton Inlet and the Gulf of St. Lawrence, the latter to the west and north-west of Hamilton Inlet. No great physical difference can be observed between these tribes; if there is any, the Nascaupees appear to be slightly taller and less robustly built than the Montagnais. They talk different dialects of the Cree language, but the difference is so slight that they converse freely together and understand one another quite readily. The name Nascaupee in the Montagnais dialect signifies "the ignorant ones" and is given on account of their lack of knowledge in regard to the works and ways of civilization, owing to their want of communication with the outside world.

HAMILTON RIVER

The Hamilton River is the most important stream of the eastern watershed of the Labrador Peninsula. Its drainage basin embraces a wide area of the country extending from the head of Hamilton Inlet westward to longitude 68°, or nearly half way across the peninsula. To the northward its tributaries interlock with those of the Northwest River which also flows into Hamilton Inlet, and with the headwaters of the George River and branches of the Koksoak River that empty into Ungava Bay. The southern limit of its large tributaries is very irregular and may be roughly taken to be near the fifty-second parallel of latitude, where the watershed separating them from streams flowing southward into the St. Lawrence, is extremely sinuous and almost impossible to trace or define.

Westward of the Hamilton basin the general slope of the country is northward, and the drainage is in that direction from about latitude 52°, the water reaching the ocean by the Koksoak River, which drains a considerable area of the central interior between the head of the Hamilton River and the Big River flowing into Hudson Bay.

Owing to the great difference in physical character between its upper and lower portions, the Hamilton River is naturally divided into two parts at the Grand Falls some 250 miles above its mouth. The lower part occupies a distinct

valley, cut out of Archaean rocks, with the present river-level from 500 to 800 feet below the general level of the surrounding country. The valley varies in width from 100 yards to more than two miles, and the river flows down it, between banks of drift, with a strong current broken by rapids in several places, especially along the upper stretches, but only in one place does it fall over an obstruction of rock.

This valley is well wooded where unburnt, and the timber is all of fair size and of commercial value, in marked contrast to the small stunted trees found partly covering the rolling country of the table-land, on either side of the valley. The river flows into the head of Hamilton Inlet, on the south side, and a long point of drift material, principally sand, projects out into the bay, separating the river from the head of Goose Bay, which extends several miles west of the mouth of the river on its north side. This point is evidently formed from material transported from the valley above and deposited in the quiet waters at the head of the inlet.

From the mouth of the river to the first fall, the distance is twenty-seven miles, and the direction is S. 80° W. At its mouth the river is three-quarters of a mile wide and shortly above widens out to nearly a mile and a half, for ten miles; then a number of flat, sandy shoals bare at low stages of the water, divide it into numerous channels. Man-of-war Island lies on the north side five miles up stream; it is low and about a mile long, and has a few trees growing on it.

On the south side, a mile and a half above the mouth, a channel enters from Mud Lake, a shallow body of water two miles long, extending to the foot of the mountains and separated from the river by two low, wooded islands. About two miles above Man-of-war Island, on the south side, a small stream, called Traverspine River, flows in; it rises in the mountains to the southward. Where this stream discharges into the river, there is a small Indian trading establishment and the proprietor, Jos. Michelin, has made a little clearing about the place, where he grows an abundant crop of potatoes.

Three miles and a half above Traverspine, another small stream, called Caroline Brook, comes in from the south. Opposite its entrance the river narrows to a mile and its channel continues with this width twelve miles to Muskrat Island, which is low and well wooded and a mile and a half long. On the south shore, opposite this island, there is a little clearing with the winter habitation of Thomas Hope, the last permanent residence on the river. For three miles above Muskrat Island the river narrows to less than a third of a mile, with a narrow island obstructing the channel in the upper mile. Above this narrow the channel widens out into a nearly circular basin about two miles across, into the west side of which the river pours with a chute of twenty feet called Muskrat Fall. Above this chute is a heavy rapid 400 yards long, with a chute of twenty-five feet at its head, the total fall being seventy feet. At the chutes, where it rushes over ledges of gneiss, the river is only about 100 yards wide. Immediately on the north side of the falls there is a rounded, rocky hill rising 250 feet above the level of the valley. On the north side of this hill is a wide plain of fine till. Where the edge of the plain has been cut away to form the basin below the chute, a wide section of over 100 feet of fine till is of recent origin, and it is probable that previous to the glacial period, the river channel was filled up with drift material, so that when the river again resumed its course, it was diverted from its old channel by the obstruction and passed to the south of the hill where the drift deposit was less thick. Having

once cut to the rock surface, well below the upper level of the drift on the opposite side, it has continued in its present channel ever since.

At its mouth, the banks of the river are low and sandy and have scarped faces from ten to thirty feet high, increasing slowly in height as the river is ascended. Terraces are seen to the south, flanking the mountains up to 300 feet above sea-level. Above Traverspine the banks rise from sixty to one hundred feet and are cut out of coarse, yellowish, stratified sands.

The western extension of the Mealy Mountains forms the southern wall of the valley, and, above the head of the low point separating the river from Goose Bay, rocky hills are seen also on the north side. The valley, as far as the first fall, varies in width from two to five miles and the river passes close to the foot of the rocky hills on the south side fifteen miles above its outlet. As the valley has been partly filled with drift, out of which the present channel is cut, it is only when the river accidentally passes close to the rocky walls of the valley, that any rock exposures are seen. The hills on both sides rise from 400 to 600 feet above the river-level, and partly represent the general height of the surrounding plateau, which rises somewhat higher back from the valley on both sides. These hills are wooded to their summits, but as the upper level is approached, the trees become small and stunted, and only a very few species grow on the table-land above. Black spruce forms over ninety per cent of the wood, the remainder being made up of larch, white birch and balsam fir.

In the valley, on the contrary, the growth is very good, considering the position. White spruce trees two feet in diameter and more than seventy feet high are not uncommon, and a large number of ship spars have been taken out about Traverspine. The black spruce does not grow quite as large as the white, but is still large enough to afford good commercial timber, and the same may be said of the larch growing in the valley. Balsam fir, white birch and both aspen and balsam poplar are here met with and grow to fifteen inches in diameter.

Above the chutes the river soon widens out and for thirty-five miles flows from the south-west. Its average width for this distance is slightly less than a mile. Fourteen miles above the chutes it narrows to less than a quarter of a mile and is broken by rapids for two miles above. Below these rapids there is a great sandy shoal, which extends across the course of the river and has forced it to cut a deep bay on the south side out of white sand, that rises in almost perpendicular banks over one hundred feet above the water. This place is called Sandy Banks, and the Hudson's Bay Company formerly maintained a small trading post on the north side, where the site of their clearing is marked by a new growth of birch.

Above Sandy Banks the stream is again over a mile wide, with a large island dividing it into two channels, and a deep bay runs off to the north-west from the main channel. Above this island the average breadth is half a mile for five miles, when it again widens to a mile for three miles, to the foot of the Porcupine Rapids. These rapids are nearly three miles long, with a deep channel, the river being about 300 yards wide. There is good tracking along the banks and no portage is necessary to pass this obstruction.

Above the Porcupine Rapids the river expands again into Gull-island Lake, which is six miles long and not over a mile wide. The name is a misnomer, as there is a very perceptible current throughout. Gull Island is a small rocky islet on the south side, about two miles from the head of the lake. From the Muskrat

Falls to Gull Island the character of the river and valley is very similar to the portion below. The river-channel is wide and shallow, at ordinary stages of the water, and the current is strong, so that tracking is resorted to in ascending with boats. The hills, as far as Gull Island, remain about four miles apart, and there begin to approach, so that the valley is less than half a mile wide at the head of Gull Island Lake. The height of the hills varies from 500 to 800 feet above the level of the river, and much of their surface is burnt over, with less than half of the north side of the valley wooded, with trees similar to those described along the lower stretch.

There are considerable accumulations of drift in the valley, into which the river has cut its present channel. Terraces are common and well marked, especially about the mouths of small streams flowing down from the table-land, on both sides. As many as seven were seen on the south side, below the Porcupine Rapids, the highest being 200 feet up the flank of the mountains. The river banks are sandy and steep, and vary from twenty to seventy feet, with a margin of nearly level shore at the water's edge, which affords good ground for tracking. Only two exposures of rock were seen along this course. Several small streams fall into the main river on both sides, but none of them is of any size or importance.

From the head of Gull Island Lake the course of the valley changes more to the northward and the river flows from S. 70° E. for eight miles; the next course is from S. 60° W. for two miles, and is followed by a stretch of nine miles directly from the south. Along all these three courses the valley is from a quarter to half a mile wide, with almost perpendicular rocky walls that rise abruptly from the water more than 800 feet, with narrow intervals of drift only in a few places. The river varies from 100 to 400 yards in width, and throughout the distance is an almost continuous rapid. Up the stream the Gull Rapid is the first, and extends from the lake upwards for five miles. The water is shallow, and the channel is full of rocky reefs and large boulders, over which it tumbles in foaming masses. Owing to the shallow water, this portion of the river blocks in winter with ice, which is piled up in all directions in great disorder and is quite impassable with loaded sleighs, until after sufficient snow has fallen to cover up and smooth out the smaller inequalities. The second rapid is at the bend and is called the Horse-shoe Rapid; it is also shallow and full of huge boulders. Along the upper stretch the river only in one place exceeds 100 yards in width, where it passes a small island. The channel is rocky and the water is deep, so that, although the current is very strong, the water is not broken, except by a dead swell, until within a mile of the head of the stretch where a heavy rapid makes it necessary to portage.

At the head of this rapid a large branch called Minipi River enters the main stream from the south, through a deep, narrow valley, down which it rushes with heavy rapids. This stream discharges a large volume of water from its gathering ground on the table-land to the south and south-west of its mouth. It is said to rise in chains of lakes close to the headwaters of the Natashquan and St. Augustine rivers which flow into the Gulf of St. Lawrence.

Between Gull Island Lake and the Minipi River, three-fourths of the timber in the valleys and on the hills of both sides has been burned, much of it by a great fire that raged throughout the summer of 1893. In the green woods remaining, many large spruce trees were seen, from twenty to twenty-four inches in diameter, and sufficiently long to furnish three logs each. A few narrow terraces were seen

on the hillsides, but owing to the scanty drift deposits there is not much chance for the development of terraces.

Above the Minipi, the main stream bends sharply, and for twenty-five miles flows from N. 80° W. The valley gradually widens out and to the upper end of the course varies from one to two miles across. Its walls continue to rise from 700 to 900 feet above the water, and are nearly everywhere burnt bare. Terraces again become well marked and numerous, and range from 20 to 250 feet in height. The river channel is cut out of the drift and the banks rise from ten to one hundred feet above the stream. The river, for five miles above the forks, is never more than 300 yards wide and then widens to about a quarter of a mile, and is broken by a small shallow rapid where it passes four well wooded islands, three miles up. Beyond the islands it narrows again for four miles and from there to the end of the course it passes what is known as the "slack water", where the width varies from 400 to 600 yards in a deep channel with gentle current. There are three large islands along the upper three miles, with another called Cockatoo Island four miles below. Two large brooks come in from the north near the middle of the course; the lower one issues from a deep cut in the hills. On the south side a small river flows in at the upper end above the islands. Both sides of the valley are almost wholly burnt to within a few miles of the upper end, where the north side is well wooded with somewhat smaller trees than those previously met with.

The valley now bends to the north-west for five miles, and then northward for ten miles to where a small river flows in from the north-east. Along these courses it does not anywhere exceed one mile from side to side, and the hills are particularly high and rugged on the west side, where they rise from 800 to 1,000 feet almost perpendicularly from the water. They are well wooded on both sides to within a short distance of the small river, where the eastern limit of an immense area of burnt country crosses the valley. This area, which extends on both sides of the valley almost to Grand Falls, has been traversed by numerous fires during different years, so that, with the exception of isolated patches here and there, all the original forest has been destroyed, and the sides of the valley and adjoining table-land are either destitute of trees, or partly covered with small second-growth timber of no commercial value.

Along the first or north-west course, the channel is only about 300 yards wide and is obstructed by a number of small islands of drift. The current is strong and there is a small river that drops into the valley with a beautiful fall on the west side near the head of the course. Above, the channel widens to a quarter of a mile, and the river is shallow, with small rapids to the upper end of the north course. The stream that here flows in from the north-east, called Cache River, is the largest yet seen on this side, and it has a distinct valley cut down between the rocky hills to a level with that of the main stream. Terraces are not prominently marked along the portion of the river just described.

For the next twelve miles the valley is narrow and very crooked, with sharp bends and a general course north-westward. The rocky walls rise sharply on both sides almost directly from the water, leaving in most places only a narrow margin of steep shore. The hills are nearly all bare and rocky. Terraces are not common, and are best developed at the junction of a small branch from the west about eight miles up, where the terraces are seen rising one above another for 250 feet.

The river varies from 100 to 300 yards across, and is deep and so rapid that in winter ice is formed only along the shores. The Mouni Rapids are two miles long and have three heavy pitches at the upper end.

The valley above straightens, and the river flows S. 80° E. from Lake Winokapau six miles above. The stream continues narrow and rapid to the outlet of the lake, and is joined by a small stream five miles below it. Towards the lake the sides of the valley continue to increase in height, until at its outlet bare rocky precipices tower above it 1,000 feet or more, with great masses of broken rock piled up at their base. Only a few small trees grow in cracks on the sides and tops, and the general aspect is wild and grand.

Beyond the valley on both sides, the country is covered with broken chains of rounded hills of gneiss that rise from 200 to 500 feet above the general level of the table-land, which is itself over 700 feet above the surface of the lake. The lower lands are either swampy or covered by small irregular lakes that discharge by streams into the valley, where they often fall perpendicularly 500 feet down the rocky walls. During the winter these streams freeze up, and their positions are marked by masses of ice often attached in fantastic forms to the bare surface of the rocks. In other places where the slope is less, the water wells out from below the already formed ice and congeals on its surface, in this manner forming large ice cones.

The table-land is almost denuded by fire, only small patches of trees being left about the lakes and swamps. These consist of a thick growth of stunted black spruce and larch of no commercial value.

Lake Winokapau fills an expansion of the river-valley, and is thirty-four miles long, its general course being N. 80° W., with two slight bends near its middle. For fifteen miles from its outlet it does not exceed a mile in width. Beyond, to its head, the breadth varies from one and a half to two miles.

From its outlet, the north shore, for six miles, has a narrow margin of drift between the water and the rocky hills. Beyond this, and all along the south side, the rocky walls of the valley rise abruptly from the lake, and there is a marked absence of drift both on the hillsides and in the valley.

The water is remarkably deep; an isolated sounding taken fifteen miles up the lake and about midway across, gave 427 feet, while another taken by Mr. Bryant* gave 407 feet. A third sounding was made fifty feet from shore on the south side, opposite the first mentioned, and gave a depth of 80 feet. No other soundings were made owing to the difficulty experienced in cutting through the ice, which at the time we passed was four feet nine inches thick, and two hours were required to make a hole through it with the implements at hand. Information obtained from Indians shows that the lower three-quarters of the lake are exceedingly deep; the upper quarter has been filled in with drift brought down by the river.

The present bottom of the lake probably nearly represents the level of the river previous to the glacial period, the valley below having been in places filled with drift during that time to levels indicated by the terraces seen along the sides of the valley, rising in places from 200 to 250 feet above the present river-bed. The absence of any rocky ledges in the river-bottom, except at the first falls, where

* A Journey to the Grand Falls of Labrador p. 26.

the ancient channel is on the north side of the rocky hill, points to this conclusion. Why the valley should be filled with drift below and above Lake Winokapau, and the portion occupied by the lake should be almost free of it, is a problem in glacial geology to be worked out in the future, but for which there are at present no data.

A small island of drift, covered with willows and a few large white spruce trees, six miles from the head of the lake, marks the beginning of the shallow portion. Above the island there are numerous wide, sandy shoals, bare at low stages of the water, and separated from one another by narrow channels. The main channel passes close to the south bank, and two large, low, wooded islands of drift separate it from a smaller shallow channel on the north side. At the head of the lake a small branch called the Elizabeth River flows in from the west, down a narrow valley, while the main valley bends to the north-west.

On the south side, at the mouth of the Elizabeth River, there is a wide, sandy plain about twenty-five feet above the river, and on it the Hudson's Bay Company formerly had a post, which was abandoned in 1873, and subsequently destroyed by fire. A small river flows into the lake from the south opposite the lowest island, and the drift on the hillsides is terraced up to 200 feet about its mouth. On the north side there are three large brooks with deeply cut valleys, and one on the south side; besides these there are many small streams that fall directly over the precipices, from the table-land above, breaking the monotony of the rocky walls and adding greatly to the beauty of the scenery.

The hills that bound the valley on its south side are remarkably regular in outline and have been rounded and scratched by glacier ice. Those on the north side often rise in perpendicular cliffs from the lake; their faces and tops are angular and rugged,and do not appear to have been glaciated. The walls on both sides are from 700 to 1,000 feet high, gradually lowering towards the head of the lake, the general level of the table-land on the south side is 950 feet above it. The country on top is nearly level, and covered with small lakes. Ten or fifteen miles to the south, a conical hill rises about 500 feet above the table-land. On the north side after an abrupt rise of 400 to 500 feet, the land slopes gradually, and does not attain the elevation of the south side for several miles back from the valley. Only a few small scattered clumps of trees remain of the original forest in the lake-valley; these show that at one time the shores and sloping hillsides were thickly covered with large trees of white and black spruce, up to thirty inches in diameter. At present most of the hills are bare, or covered only with small second-growth spruce and birch. The table-land to the southward is quite bare of trees, only the blackened stumps of the former forest remaining. On the north side, bare patches alternate with scattered second-growth black spruce of small size.

Lake Winokapau is well stocked with fish, the employees of the Hudson's Bay Company when stationed there depended to a large extent on fish for food. In the old journals* of the post, the catches of the nets are recorded and show that fish were taken abundantly, especially in the spring. The catch included carp, whitefish, lake and river trout in the order named. Potatoes and turnips were grown at the post, but not very successfully, as after planting in the spring,

* Winokapau journals seen at Rigolet.

everybody left the place, and did not return until September, leaving the crops to grow without cultivation.

From the mouth of the Elizabeth River, the main valley turns N. 40° W., and continues in that direction five miles to the mouth of the Metchin River, a small stream having a deep valley, and used as a canoe route to the north-west interior by the Indians. Along this course the valley is about a mile wide, with the hills more rounded and sloping than below, owing to the great quantities of drift deposited here, through which only the rocky summits protrude. The river is less than half a mile wide and flows close to the north side to within half a mile of the Metchin, where the deposits brought down by that stream have formed a low plain, and have forced the main stream into a narrow channel close to the south wall. Terraces are common and rise to more than 200 feet above the river.

The course of the valley now changes to N. 70° W., and with a few minor bends, continues in that direction for forty-five miles to the foot of the Bodwoin Canyon below the Grand Falls.

The narrow channel continues for a half mile above the mouth of the Metchin River, where it widens out to an average width of 500 yards, with high rocky walls on the south side, and drift-covered slopes on the north side. Six miles further up there is a sharp bend to the northward for one mile, when the river again resumes its previous course. At this bend the walls on both sides exceed 800 feet and those on the west side rise in perpendicular cliffs directly from the river, which is here 400 yards wide. Above the bend the character of the valley is unchanged for twelve miles, the valley being from half a mile to a mile wide, with high rugged hills, mostly burnt, on both sides. The channel is cut out of the drift and is more irregular in width than below, being frequently narrowed by projecting points. The current is swift and the water appears to be deep. Seven miles up a small branch flows in from the northward in a gorge cut down to the level of the main valley.

After two well wooded sandy islands are passed, another sharp bend of a mile to the northward opens out into a wider valley entirely filled by the river, where there is little drift on the hillsides or along shore. The river is very shallow and the current swift. This stretch is seven miles long and at its head the channel narrows to less than 200 yards, owing to the amount of material brought down by the Portage River, which cuts through a cliff and descends into the valley by a fall of nearly 200 feet that is almost hidden by the huge blocks of rock heaped up at its bottom. Shortly above the Portage River the main stream again widens out, filling the valley from wall to wall, and varying from half a mile to one mile in width for eight miles. The portage route of the Grand Falls leaves the valley on the north side four miles above the mouth of the Portage River.

Opposite this place and above it, the river is silted up with sand brought down by rapids and deposited in the wider, quieter waters. This sand forms wide flats, covered at high stages of the river, and cut by numerous, deep, winding channels. Four miles above the portage, two large, low, densely wooded islands mark the foot of the rapids that extend almost continuously beyond for twelve miles, to the mouth of the canyon. The channel above the islands soon narrows, and the drift deposits thin out, finally almost wholly disappearing from the sides of the valley, which contracts to less than 300 yards in width and becomes crooked. Three miles above the upper island the first rocky ledge since leaving the Muskrat Fall

is seen in the river bottom. Here there is a heavy rapid which continues half a mile to a short bend to the westward. At the foot of the rapid, Messrs. Cole and Cary, of the Bodwoin College Expedition, had the misfortune to burn their boat and supplies, and on this account it has been called Disaster Rapid. The charred remains of the boat were found close to the shore in a small patch of burnt woods.

Two miles above this rapid, at the angle of a small sharp bend, a large branch flows in from the west in a well defined valley. Inquiries made among the Indians who had hunted about here, failed to yield any information concerning this stream, and they were surprised to hear of its existence, as they all were without knowledge of any large stream between the main river and the Elizabeth River, which enters Lake Winokapau. The only explanation given about this unknown stream was that it must be a deep channel of the Valley River, and must leave that stream some distance above the main forks; but the origin and existence of two deep, well defined valleys such as these, forming an island, is anomalous and could only be accounted for by the river splitting into two branches before it leaves the table-land.

Above the junction of this stream, two sharp bends of the narrow main valley lead, after three miles, to a long straight stretch, where the valley widens somewhat, and patches of terraced drift are seen high up its rocky walls. At the upper end of the last bend a small stream comes in from the north, descending in a succession of beautiful cascades from the table-land 700 feet above. This stream drains a number of lakes, and when the river is swollen by the spring freshets, a small portion of it passes up a narrow bay above the Grand Falls, and from there by a rocky channel into the small lakes, of which the discharge is thus much increased during the early spring.

For five miles above the junction of this stream, the valley continues straight and narrow, with sandy terraces, flanking the rocky walls at intervals along both sides. The river varies from fifty to one hundred yards in width, and rushes along in a continuous heavy rapid, from where the main body of water enters the valley by Bodwoin Canyon.

Above the mouth of this canyon the main valley continues in the same direction upwards of ten miles, and then bends slightly northward, its further extension being concealed by the high walls on the north side. As far as seen from the canyon, the valley appears to be from a quarter to half mile wide, and is partly filled with terraced drift, with a branch flowing with a moderate current down it. This branch has less than a quarter of the volume of the other river and rises in Lake Ossokmanuan on the table-land, thirty miles to the westward. This lake also discharges by another outlet into the main Hamilton River, described later. Eight miles in a straight line north-north-west of the mouth of the canyon, the main branch of the Hamilton River issues from a small lake expansion, almost on a level with the surrounding surface of the table-land, and begins one of the greatest and wildest descents of any river in eastern America. A large number of barometric readings taken in the vicinity, in conjunction with regular readings at the Hudson's Bay Company's post, at Northwest River, give the height of the river as it issues from the lake as 1,660 feet above sea-level. The height of the valley at the mouth of the gorge, determined in the same manner, is very close to 900 feet above sea-level. Consequently, in twelve miles, the total fall is 760 feet. Such a fall would be nothing extraordinary for a small stream, in a mountainous

country, but is phenomenal in a great river like the Hamilton, which had been estimated to discharge at this point about 50,000 cubic feet per second, or nearly the mean volume of the Ottawa River, at Ottawa, that stream having a mean volume of 85,000 cubic feet per second at Grenville,* where it includes the waters of the Rideau, Gatineau and Lièvre rivers. The descent includes a sheer fall of 302 feet, the rest being in the form of heavy rapids.

The outlet of the lake is dotted over with small rocky islands, capped with dense thickets of small evergreens. These islands extend downward for a mile and divide the river into a number of narrow channels with a swift current. The stream, flowing southward, then narrows to less than 400 yards, and in the next mile passes over a number of rocky ledges between low wooded banks, falling fifty feet in a continuous heavy rapid. Again it widens out to nearly a mile, and for two miles is obstructed by many small islands, flowing swiftly between them, with short broken rapids. Next, turning south-east, it contracts to less than half its previous width, and rushes along with heavy rapids, in a shallow channel full of huge boulders, with low rocky shores, capped with thin deposit of coarse gravel and sand, and wooded above with small spruce and larch. In this manner the river continues for three miles, gradually narrowing as it descends, with a fall of forty-five feet along the last two courses. The banks and bottom of the river are wholly formed of rock, and as the stream in the next mile has cut a narrow and gradually deepening trough out of the solid rock, at the lower end of the course it flows in a narrow gorge, with sloping rocky walls 110 feet below the level of its upper end. As it descends its width decreases from 150 to 50 yards, and it hurries along with tremendous rapids.

The last 300 yards are down a very steep grade, where the confined waters rush in a swirling mass, thrown into enormous, long surging waves, at least twenty feet from crest to hollow, the deafening noise of which completely drowns the heavy boom of the great falls immediately below. After a final great wave, the pent up mass of water is shot down a very steep incline of rock for 100 feet, where it breaks into a mass of foam, and plunges into a circular basin below, the momentum acquired during the first part of the fall being sufficient to carry it well out from the perpendicular wall of rock at the bottom, leaving almost a free passage between the foot of the cliff and the falling water. The total fall from the crest of the incline to the basin below is 302 feet. The Indians believe that the space between the falling water and the wall is occupied by the spirits of two maidens who were accidentally carried over the falls, and who now pass their time in dressing and preparing deer skins. On this account, or more probably because of the feelings of awe inspired by the grandeur of the surroundings and the enormous power displayed in this rush of waters, those who hunt in the vicinity cannot be induced to visit the falls or the canyon below.

The shape and character of this fall resembles closely, though on a gigantic scale that of a small stream flowing down a V-shaped trough, inclined at a high angle, and issuing freely from its lower end. The basin into which the river precipitates itself is nearly circular and about 200 yards in diameter. It is surrounded on all sides by nearly perpendicular rocky walls 500 feet high, except at the narrow cut at the head of the falls, and where the river issues from the basin. The

* General Report Public Works, 1867-1882, p. 840.

surface of the basin is violently agitated by the rush of water from above, and its huge lumpy waves break high up the rocky walls. The falls are best seen from the top of the south wall, directly opposite, but the dense columns of vapour that rise out of the basin often interfere with the view and give a blurred, fogged appearance to photographs taken from that side. The noise of the fall has a stunning effect, and, although deadened because of its enclosed situation, can be heard for more than ten miles away, as a deep, booming sound. The cloud of mist is also visible from any eminence within a radius of twenty miles.

The river leaves the basin by a narrow canyon at right angles to the falls. It flows eastward about a third of a mile and then bends sharply to the south-west for a half mile, next to the east for a like distance, followed by another south-west bend of similar length. In this manner it zigzags until it finally ends in the main valley of the river.

From the falls to the mouth of the canyon the distance in a straight line is not above four miles, but by the river it is over twice as far. This canyon is cut down into solid gneiss, granite and gabbro. Its zigzag course conforms with the direction of two sets of fracture, or cleavage planes in the rocks, which appear to have caused lines of weakness and aided the eroding action of the water. Except on the inner sides of the bend, where there is a sloping wall of boulders, the walls are nearly perpendicular. At the top the width rarely exceeds one hundred yards; while at the bottom the river is seldom over one hundred feet wide and often measures less than half that width. The fall of the river from the basin to the mouth of the canyon is 260 feet, and, as this is accomplished without any heavy drops, the magnitude and grandeur of the rush of water at the bottom of the gorge may be imagined.

The canyon is cut sharply into the surface of the table-land without any appreciable dip of the ground towards it and there is so little indication of its presence from above, that the gorge is seen only within a few yards of its edge; and its walls are so steep, and the bushes along the top so thick, that in most places it is necessary to hold on to an overhanging tree and lean far out in order to see the narrow white line of broken foaming water that rushes along 500 feet below. As the country slopes gently towards the main valley, the canyon does not deepen with the descent of the river in it, and the walls are everywhere from 500 to 600 feet high, varying with the undulating surface of the table-land.

There is little doubt that the canyon is a valley of erosion in an unfinished state of formation, and probably previous to the glacial period was the valley of a much smaller stream than the one at present flowing through it. At that time the main stream in all likelihood followed the main valley. There is no evidence that the valley has been cut back, or otherwise eroded since the close of the glacial period, beyond the removal of the drift, which then filled it nearly to the top, as patches of drift still remain on the inner sides of the sharp bends. From the above facts some idea can be had of the great length of time required for the erosion of the main valley of the river, from the falls to the mouth of Hamilton Inlet, which is really a submerged portion of this river-valley.

John McLean, of the Hudson's Bay Company, as before stated, was the first white man to see the fall. In 1839, while on a journey overland from Ungava Bay to Hamilton Inlet, he descended the Hamilton River, visiting the fall in passing,

and he has given a short description of it in his book.* The falls are known to the Indians and inhabitants of the Labrador coast as the Grand Falls but as a recognition of the discoverer, as well as the indefinite character of the above name, it is now proposed to call them the Grand or McLean Falls.

The canyon below the falls was first discovered and partly traced by Messrs. Cary and Cole in the summer of 1891, and was named by them Bodwoin Canyon. Messrs. Bryant and Kenason also visited the fall in 1891, arriving there a few days later than the first party. Among others of the Hudson's Bay Company officers who have seen the falls, may be mentioned a Mr. McPherson, who visited them shortly after their discovery by McLean. Père Babel, O.M.I., a missionary who spent two or three seasons living with the Indians about the headwaters of the Hamilton River about 1870, has also given the writer a most graphic account of his visit to the falls at that time.

The portage route past the fall and rapids leaves the main valley on the north side at the foot of the rapids fifteen miles below the mouth of the canyon. The road rises 700 feet in a quarter of a mile as it ascends the steep wall of the valley by a narrow cut beside a small stream. It then passes over undulating wooded country, rising slowly for two miles, to a small lake that lies north-west of the lower end of the portage. Crossing the eastern end of the lake, the route turns northward and passes over four portages of 1,000, 200, 200, 300 yards long respectively, that connect as many small lakes or ponds. The last portage ends near the middle of Island Lake, which is about three miles long and a mile wide, with its longest axis running almost east and west. This lake discharges from its east end into another large lake that empties into the Portage River. Crossing to the north side of Island Lake, two short portages, with a small swampy lake between, lead into another lake about two miles and a half long, which also discharges into the Portage River. The route now changes to west-north-west, and continues in that direction until it reaches the lake expansion of the river above the falls. From the western end of the last lake a mile portage through a swamp leads to a narrow lake one mile long, with another mile portage from its west end into a similar narrow lake. The next portage is slightly shorter, and crosses a small watershed, passing close to the foot of a high hill on the south side called Lookout Mountain; it ends in a long narrow bay at the east end of Lookout Lake, the largest body of water along the route. This lake is followed seven miles to its western end, where a small river enters. The greatest breadth near the east end is less than two miles. The lake is shallow and dotted with small rocky islands. It discharges by the little river that falls into the main valley five miles below the canyon, and which, as already mentioned, forms a discharge of the main river during periods of high water.

The inlet is followed through a number of lake expansions for five miles, with three short portages past rapids and a final one of a half mile that leads to the head of a deep bay of the main river.

Lookout Mountain is a long round hill of gabbro, that rises 460 feet above Lookout Lake. Its summit and sides have been burnt over, and from its top a good view of the surrounding country may be obtained. The surface of the tableland is broken by long rocky hills, connected by low ridges of drift, that run west-

* Twenty-five years in the Hudso n's Bay Territory. Vol. II p. 75.

north-west, or parallel to the direction of the glacial striae. Between the ridges there are wide valleys filled by long irregular lakes or swamps. Southward from the top of Lookout Mountain, the country is seen sloping towards the river-valley and it is much more broken and rugged than in other directions. One sharp rugged hill rises well above the rest, and is probably the Mount Hyde of the Bodwoin Expedition.

The position of the river-valley here is well marked, the country sloping towards it on both sides. Beyond the valley, the country appears to be somewhat higher than on the north side. Ranges of burnt hills are seen stretching away to the south-west, and bounding the horizon in that direction. Westward, the position of the Grand Falls is marked by the column of mist that rises high over it. No other feature marks the presence of the canyon, and gently undulating hills extend as far as can be seen. To the north-west, the country is very similar, and in the distance lake expansions of the river appear. North and north-eastward, the ridges of hills are seen running in regular lines with a higher range bounding the sky-line about twenty miles away. Where any depression occurs in the ridges, a shining patch of water marks the position of a lake, in the valleys beyond. Looking south-east, or parallel to the ridges, a perfect net-work of small island-dotted lakes are seen, filling each valley, and separated from one another only by low ridges of drift. In the distance are a number of high rounded hills near the discharge of the Portage River.

Over half of the surrounding country has been stripped bare by frequent fires. In the swamps and around the shores of the lakes, where the trees are unburnt, black spruce and larch of small size grow thickly together. On the sides of the hills these trees are more stunted, and are separated by open glades. Where the hillsides have been burnt years ago, they are covered with a tangled mass of willows and alders, while the tops are coated with white moss and semi-arctic shrubs and berries. Only on the banks of the river about the falls were trees large enough for commercial purposes seen. Surrounding the basin, white spruce seventy feet high and two feet in diameter at the base, are common, along with large-sized black spruce, balsam fir and white birch. The moisture from the constant column of spray, as well as the warmth from the open water, may account for the better growth of the trees in the neighbourhood. Along the river banks and on the islands above the falls, the trees are larger, and more varied than about the lakes of the portage route, fair-sized white and black spruce, balsam fir, larch and white birch growing freely.

UPPER HAMILTON RIVER

Above the Grand Falls, the character of the river changes completely; it no longer flows in a distinct valley cut deep into the surrounding country, but nearly on a level with the surface of the table-land, spreading out so as to fill the valleys between the long, low ridges of hills that are arranged in echelon all over the country. The river in passing around the ridges is often broken into several channels by large islands formed by separate ridges, and in other places, where there are wide valleys between the hills, it fills long, shallow lakes, with deep bays, and often studded with islands. The river is now so divided into channels and so diversified with island-covered lakes, that without a guide it is almost im-

possible to follow its main channel, and much time is lost tracing its course through the lakes, which often have several channels discharging into, as well as out of them. The current instead of flowing regularly, now alternates between short rapids and long lake stretches.

The banks are often low and covered with a dense growth of small willows and alders, that forms a wide fringe between the water and the conifers of the higher ground behind. In other places, generally at rapids, the stream has cut a channel into the sandy drift that forms the low ridges on one or both sides. The shores of the lakes are very often low, with an interval of flat land between the water and the hills behind. These low shores and those of the islands are generally thickly strewn with boulders, piled up in ridges by the expansion and drift of the ice in the spring. The general direction of the river from the Grand Falls to Lake Petitsikapau, more than 100 miles above, is nearly west-north-west, or parallel to the direction of the glacial striae, and that of the ridges of drift. All these features give to the upper portion of the river an aspect of newness, and indicate that its present course and conditions have been determined by the post-glacial configuration of the table-land, in marked contrast to the ancient appearance of the deep, rock-walled valley of erosion below the canyon in which the river must have flowed for ages, slowly abrading the hard gneisses and granites and carrying away the results of atmospheric decay brought down from its sides by the rains and small tributary streams.

The first expansion of the river above the portage is called Jacopie Lake. It is seven miles long and about two wide, with two deep bays on the east side, and is surrounded by low, rounded, rocky hills, totally burnt over on the east side, and partly so on the west. A chain of low islands of drift extends along the east side and almost closes off the bays from the main body of the lake. In a few places, bosses of rock are seen rising from beneath the drift of the islands. At the head of the lake, the current is quite strong in the main channel, with a heavy rapid at the inlet, in order to avoid which, when the water is high, a small channel behind a long narrow island is followed by canoes. There are two short portages here past small chutes.

Above the lake is a stretch of eight miles where the river flows swiftly and is broken by two heavy shallow rapids filled with large boulders. The banks are generally low and are cut out of drift, the channel averaging half a mile across. Numerous islands divide the stream into different channels, especially towards the upper end, where the river broadens out into the next lake expansion. This is called Flour Lake, and it is ten miles long and apparently about two miles wide, with deep bays running off on both sides. Its surface is so broken by islands, many of them small and rocky, that it is impossible to determine the shore line of the lake by passing up its middle. There is distinct evidence of current everywhere, and this grows stronger as the head of the expansion is approached. At the upper end the river splits into two nearly equal channels that do not again join until Sandgirt Lake is reached, fifteen miles above. The north channel is very rapid, and soon leads into Lobstick Lake, a large and long body of water on the route to Lake Michikamau, described in the part of the report referring to that lake. From Lobstick Lake a stretch of five miles of river leads into Sandgirt Lake, where the streams again unite.

The south channel, leading out of Flour Lake, is the ordinary canoe route.

The distance by this channel between Flour and Sandgirt lakes is fifteen miles. The stream varies from 100 yards to over a mile in width, and is obstructed by numerous islands. The surrounding country is low and rolling, with long ridges of drift and little rock. The trees are small and are principally black spruce and larch, with white spruce and balsam fir along shore, and white birch on the hillsides. The current is always strong, and it is broken by seven short heavy rapids, where the stream narrows and is obstructed by islands. The river-bed at these rapids is composed of large, rounded boulders.

Five miles above Flour Lake, the south channel again divides, and the canoe route continues to follow the southern branch, which flows out of a deep bay in the south-east corner of Sandgirt Lake, the other channel flowing out of the next bay a few miles to the northward.

Lake Kanikauwinikau or Sandgirt Lake, is an irregular-shaped, shallow body of water, with many islands of drift and with sandy or boulder-strewn shores. It is twelve miles long from the southern outlet to the mouth of the Ashuanipi Branch, on its northwest side, where two deep bays continue on several miles farther to the westward, one on each side of the river, and divided from it by wide low points of drift. From the mouth of the Attikonak Branch, on the south-west side, to the northern outlet, the distance is eight miles. Besides the two bays on the west side already mentioned, there are two others, one to the south and the other to the north; these are only a few miles deep, with small streams flowing in at their heads from wide-spreading series of lakes. The country surrounding the lake is somewhat higher than that along the river below, especially on its south side, where a ridge of rocky hills extends from the east to the shores of the Attikonak Branch. Some twenty miles westward, a wide range of hills is seen rising with barren sides over 800 feet above the general level, and it continues in a north-western direction. The outlines of these hills are sharp and rugged, quite unlike those of the hills of the Archaean area already passed through. Only their lower slopes are wooded, and in the month of August large masses of ice and snow remained in protected gullies on their northern slopes. The name of Ice Mountains was given to these hills. To the north-west, rounded hills from 200 to 500 feet high are seen, separated by wide valleys containing the bays on that side of the lake. To the north and north-east, the country is undulating and lower, with higher, rounded ridges bounding the horizon. To the east, only low ridges of drift break the general level.

Sandgirt Lake is an important gathering place for the Indians of the interior, on account of the number of routes that centre here. The Hamilton River divides into two branches, the larger or Ashuanipi Branch flowing in from the north-west and the Attikonak Branch from the south. The main route from the Hamilton River to Lake Michikamau also ends here. The Indians who trade on the lower St. Lawrence and hunt anywhere in this vicinity, always congregate here in the spring, and descend to the coast in company, either by the Romaine or Moisie River.

Returning in the autumn, they travel together to this lake, where they separate into small parties for their winter hunts. The standing poles of their wigwams, scattered everywhere along the shores and on the islands of the lake, show that several families camp here.

On account of its favourable situation, a cache was made on an island in the

lake, to store the surplus provisions and outfit, and from here, with lightened canoes, the Ashuanipi Branch was first explored, after which a trip was made to and around Lake Michikamau, before Sandgirt Lake was finally left by the Attikonak Branch.

ASHUANIPI BRANCH

The Ashuanipi Branch, as before stated, flows into the lake on its west side. Its course for thirty miles above, to Birch Lake, is nearly north-west. For five miles above Sandgirt Lake, the river flows through a flat, well wooded country, and then passes close along the southern base of a sharp, rocky hill 300 feet high. This has been burnt over, giving an unobstructed view from its summit. The bay of the lake to the northward comes close to the base of the hill and extends some miles westward of it, where the continuation of the valley is filled with a large treeless swamp. South-west of the river a network of large lakes occupies over half of the area between the river and the Ice Mountains, some ten miles distant. From this hill to a small lake expansion four miles above, the river varies from 100 to 500 yards in width, with sandy banks from ten to sixty feet high, cut out of the roughly parallel ridges of indistinctly stratified drift, between which it flows with a swift current. The lake expansion is about two miles wide and over three miles long; it is quite shallow, with low, willow-clad banks.

A stretch of five miles of swift water, terminating above in a short rapid, separates the last from the next lake expansion. A number of high islands of drift obstruct the channel, and the banks are again high and irregular. Occasional white spruce trees are met with along the river bottom, up to fifteen inches in diameter, along with small black spruce, larch, balsam fir, white birch, and a few clumps of small balsam poplar.

The next lake expansion is eight miles long; its lower half is crowded with low islands, covered with willows; the shores are also low, with a wide fringe of willows and alders between the water and the trees behind. There is a long ridge on the north side, culminating in a rocky hill 300 feet high at its west end.

The increase in the size of the trees about this lake is very marked, and is probably due to the change in quality of the soil, caused by the disintegration of the Cambrian rocks, which here underlie the surface deposits and form a very large percentage of the drift.

White spruce thirty inches in diameter at the base and forty feet high is not uncommon along the shores, black spruce is often twenty-four inches in diameter at the base, but rapidly lessens above, so that few exceed eighteen inches six feet from the ground. Balsam fir is abundant, but not very large. White birch is also common and grows up to ten or twelve inches in diameter, but is generally crooked and does not afford good bark for canoe-building. Small clumps of balsam poplar are met with frequently with trees six inches in diameter, but crooked and straggling like the birch.

At the head of the lake expansion, an island seven miles long divides the river into two channels, with the greater part of river flowing in the northern one. The island is formed by a high ridge of drift into which the river has cut deeply in many places, giving sections of from twenty to sixty feet, and showing that the material is almost wholly sand, with evidence of bedding. In places the banks

are cut into small terraces up to a height of sixty feet, in one place to the number of eight.

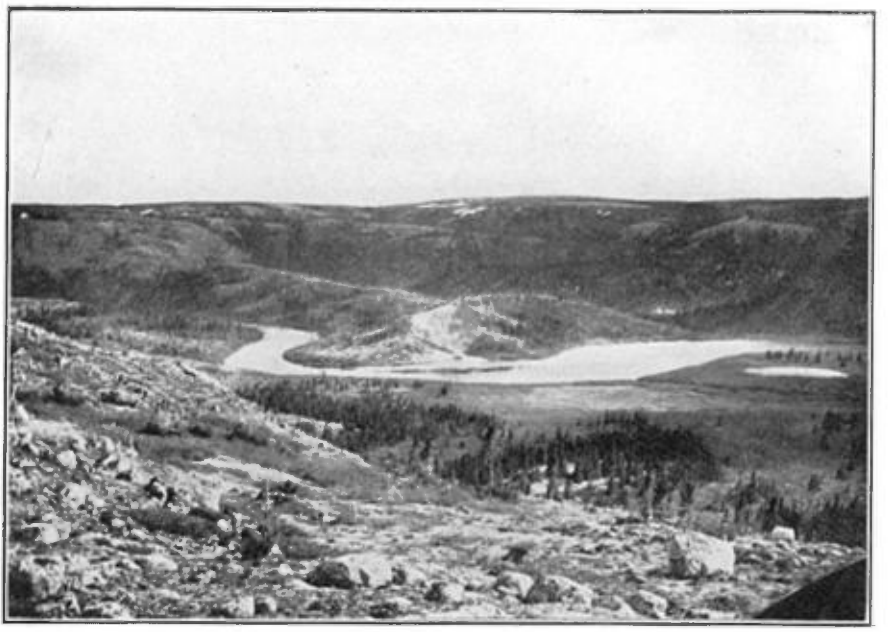
The north channel varies from 200 to 300 yards in width, is dotted with small islands of drift, and has a swift current with strong eddies behind sharp boulder-strewn points. All these eddies swarm with large brook trout from three to six pounds in weight. Five miles up, the channel widens out and is split by a number of large low islands as Birch Lake is entered.

The shape and size of this lake are well seen from the summit of a sharp rocky ridge that extends for two miles along its south side near its western end. This ridge is very similar to others that now run south-east and north-west, parallel to one another, with wide valleys between them. The hill consists of stratified Cambrian rocks, highly tilted, and has cliff-faces on both sides with intervals covered with drift resting on the steep slopes. The summit of the ridge is irregular and narrow, so that almost anywhere the foot of the hill can be seen on both sides from the top. The sides, where unburnt, are covered with large white spruce in open glades to within a hundred feet of the top, where they give place to a thick tangle of willows and alders. On the top the willows are smaller, less matted, and do not interfere greatly with travel. The higher points are only covered with small shrubs, including the cranberry (*Vaccinium Vitis-Idœa*) that grows in great profusion. The highest point of the ridge is about 350 feet above the water.

Birch Lake is ten miles long from the northern outlet to the mouth of its southern inlet, and is less than five miles across in its widest part. Long ridges of drift form deep bays at both ends. The large island already referred to divides the eastern end into two bays, while a long string of islands separates off another portion of the lake on the north. The western end is also deeply indented by three narrow bays that develop into channels of the river at their heads, and thus form two large islands that extend to the next lake to the north-west.

The north side of Birch Lake is bounded by a sharp ridge extending the whole length of that side. Its height varies from 300 to 400 feet; its top and the greater part of its south side are treeless, the lower parts having been burnt over many years ago, and the conifers have since given place to willows and alders. Fires have devastated much of the country surrounding the lake, and, as the trees once destroyed appear to grow again very slowly, large areas have a barren, desolate appearance; they are covered with small bushes and shrubs, and in many places only with white reindeer moss. This moss, or rather lichen, covers the ground everywhere, even in the thickest woods, and, except in wet weather, is much more agreeable under foot than the tangled masses of Kalmia and Labrador tea met with throughout the country to the southward. On the islands and shores where the forest is unburnt the trees are very similar in size to those last described. To the south of the ridge there is a wide valley stretching far away to the south and south-west, broken only by low ridges of drift and streaked everywhere with water—parts of large irregular lakes—the view from the ridge giving an impression that over one-half of the surface in those directions is covered with water.

The southern inlet of Birch Lake appears to be the largest; it varies from 100 yards to nearly a mile in width, and is greatly obstructed by low, sandy islands, with shale beneath. The channels are shallow, and the current strong,



VALLEY OF THE WIACHOUAN RIVER—Near its outlet Richmond Gulf.

ESKER RIDGE, ALONG ASHUANIPI BRANCH—Hamilton River.

PORT BURWELL—At Eastern Entrance to Hudson Strait.

with several small rapids, especially along the upper part, the last a heavy one 200 yards long, where the river flows out of Dyke Lake. There are twelve miles of river between the lakes, and several small streams enter by deep bays on both sides. At the foot of the upper rapid two channels separated by two long islands join as the river issues from Dyke Lake.

The shores along the river are low and well wooded, and the general flatness of the surrounding country is broken by a few short rocky ridges of irregular outline on both sides.

Entering Dyke Lake by the right-hand channel, a bay about one mile wide and four miles long is ascended to the end of the large island that extends from Birch Lake. The bay is walled in between steep rocky ridges that rise from 300 to 500 feet above the surface. The ridge on the north side terminates abruptly in a sharp pointed hill 490 feet high and cut transversely to the ridge by a great fault, and on this account called Fault Hill. The southern ridge is wooded, the northern one is mostly burnt. The lower flanks of Fault Hill are covered with groves of white and black spruce for 300 feet up; above this, only willows and alders grow to near the summit, where moss alone partly covers the surface. The trees, as the river is ascended, again become small, and, although large white spruce trees are met with on the lower flanks of the hills, they are stunted in height, and thick branches grow close to the ground, forming great knots in the trunk and rendering the wood practically valueless. Poplar is not seen above Birch Lake.

The only way in which an idea of the extent and shape of these irregular lakes along the river can be obtained, is by climbing the hills. For this reason Fault Hill was ascended, and from its summit Dyke Lake was seen stretching away far to the north-west. The southern channel extends into a deep bay behind two large islands on the south side. These islands are separated by a narrow channel a short distance above Fault Hill, and from there the upper island continues five miles with a channel nearly half a mile wide, dividing it from a point of the mainland. Looking backwards, the two northern channels, as well as the one ascended, can be traced to Birch Lake. They are all dotted with islands, and the darker water in several places indicates short stretches of rapids.

The bay on the north side of Fault Hill is much deeper and wider than that on the south side, and extends seven miles eastward. Its surface is covered with numerous islands, very irregular in shape, and apparently representing ridges of drift, the lower portions of which are submerged. Abreast of Fault Hill, the lake is nearly twelve miles wide, but no idea of its size can be obtained on its surface owing to the number of islands. Westward, the lake gradually narrows, and two large islands almost separate the northern side from the main body. Eight miles further up, the large islands terminate, and the lake narrows to about two miles.

The country about this lake is much rougher than any previously passed through and the north side of the lake is bounded by a continuous ridge that rises from 300 to 500 feet. The larger islands are high and rocky, and consist of broken ridges. Along the south shore there is an interval of low land extending to within a short distance west of Fault Hill, where a wide ridge commences and extends westward several miles. This is probably one of the highest points in this region; the main hill rises far above the surrounding ridges and the upper half appears quite barren.

The lower land to the south is covered with large lakes, and the horizon is

bounded by a long, unbroken ridge. From the narrows the lake continues north-west for nine miles to the head of the north bay, where a short, deep, rocky narrow about two hundred yards wide divides it from Lake Petitsikapau. A high rocky ridge bounds the north side of the lake along this part, with an interval of swamp between it and the water, terminating in a low muddy shore. The high land on the south side ends about three miles up, and is replaced by a flat swamp, thickly covered with black spruce and larch. The trees, on the slopes of the northern ridge are larger, and many stout, knotted white spruce are seen on the lower flanks more than two feet in diameter at three feet from the ground. The main river enters with a short rapid on the south side near the head of the lake. At the time this place was reached, the water in Lake Petitsikapau was very high, and a large volume was passing through the deep outlet, which was mistaken for the main river. In consequence, a week was spent carefully examining the western and northern shores of that lake, in search of a large river flowing into it.

Lake Petitsikapau (or Willow-fringed Lake) is the largest body of water in this part of the country. It fills a wide, shallow valley between sharp ridges of rocky hills similar to those already described. Minor ridges cut its ends into a number of deep bays and give to it a very irregular outline. Almost everywhere the shores are low and swampy and bordered with willows. The greatest length is twenty-five miles from south-east to north-west, and its widest part measures eight miles across. The north-west end is divided into four narrow bays, of which the northern one is the longest. To the southward there are only two bays, the most southern of which is from two to three miles wide, and extends south-east over ten miles, with only a narrow neck of land between it and Dyke Lake. The northern end of the lake is covered with numerous low islands of limestone and shale; these islands are generally long and narrow, running parallel to the strike of the rocks. The water between the islands is very shallow, and, in many places difficulty is experienced in finding a passage for light canoes. The southern portion is comparatively free of islands, and those found there consist of drift and are somewhat higher than those of limestone and shale. The whole lake is very shallow, and in its widest part, where islands are absent, it was found not to exceed ten feet in depth. Small streams flow into the heads of all the northern bays, and from the ridges these are seen to drain chains of small lakes in a wide valley that extends many miles beyond the head of the lake, where the waters of Hamilton River interlock with those of a branch of the Koksoak River flowing into Ungava Bay. The largest stream entering the lake flows through a chain of lakes to the eastward and empties into the north-east bay. A rocky ridge from 200 to 300 feet high and less than a half mile wide, extends along the north shore westward of this stream, and divides Petitsikapau from a deep narrow bay of Lake Attikamagen or Deer-spear Lake, at the head of the George River, which also empties into Ungava Bay. This bay runs north-west some eight miles, and joins the main body of the lake, which, from the crest of the ridge, is seen stretching away several miles in that direction; it then bends eastward, where it disappears behind a high ridge. A deep cut in the horizon line to the east shows where the outlet of the lake passes between the hills.

Lake Petitsikapau is on the edge of the barren grounds. The trees still grow in the valleys and on the lower hillsides, but the upper parts of the hills are barren. Northward a succession of high, barren ridges are seen, with an occasional

glimpse of a lake, or of a valley wooded with small spruce and larch trees. Total barrens do not occur in Labrador until Ungava Bay is reached, as trees always grow in the river-valleys to the south of it, although the uplands beyond Petitsikapau are covered only with willows and arctic shrubbery.

For many years the Hudson's Bay Company had a post called Fort Nascaupee on the second northern bay of Petitsikapau. This post was established about the time of McLean's journeys from Ungava to Hamilton Inlet, in or about the year 1841, and it is mentioned by W. H. A. Davies in an article published in 1843, as having then been lately established.* This post was erected for trade with the Nascaupee Indians of the interior, and was quite successful until after the second establishment of Fort Chimo in 1866, when the Indians began to desert it; those from the north going to Fort Chimo, while the southern Indians traded at Mingan or Seven Islands, on the Gulf of St. Lawrence, or at Northwest River—all of them preferring to undertake the long arduous journey to and from the coast, where they could obtain better prices for their furs, and purchase provisions and other necessities at a much cheaper rate than at the interior post, where the cost of transport and maintenance added several hundred per cent to the original cost of the goods. The post was accordingly abandoned about 1873, and now the only trading posts of the interior are those situated at Nichicun and Mistassini.

The ruins of Fort Nascaupee stand in a small clearing, close to the shore of the lake, and only a short distance above high water mark. The houses were built of small, squared logs, with board roofs. When visited, the dwelling-house was in a fair state of repair, with the window sashes and some of the glass still in place. The doors and movables inside had been broken up and used for firewood by Indians; the roof was nearly unbroken, and leaked only in a few places. This building is about twelve by eighteen feet, and has a low room under the attic roof above. Adjoining the main building on each side are two smaller buildings, evidently used for a kitchen and store; the roofs of both have fallen in. Traces about twenty yards to the east of these ruins, probably represent the remains of some outbuilding. About fifty yards behind, the powder house covered with earth was seen, with broken roof and partly filled up with earth. Adjoining this is a small burying place with a large wooden cross in its centre, but without any marks on the graves, which are probably those of Indians. In the attic a fragment of "The Albion", of March 7th, 1846, was found. Close to the house were several patches of rhubarb eighteen inches high, while a number of introduced plants still flourish in the old door-yard.

As previously stated, the main river flows into Dyke Lake, from the south, close to its north-west end. At its entrance the river is obstructed by a number of small rocky islands and large boulders, between which the stream descends in a heavy, shallow rapid about 300 yards long. The lake above the rapids has the general north-west and south-east trend, and is six miles long and two miles wide at its south end, gradually decreasing to a mile at the other end. Both sides are high and rocky. The river flows into the lake from the south almost opposite the outlet. At the entrance a large dyke crosses the stream, forming a number of islands with heavy rapids between them; above the rapid is a short stretch of swift current, and a large island of drift divides it into equal channels each about 300

* Trans. Lit. and Hist. Soc. Quebec, vol. IV., part 1., p. 74.

yards wide, where the river falls with shallow rapids for a quarter of a mile from Astray Lake, immediately above.

Astray Lake, so called from our wanderings in search of the river, follows the general direction of all the lakes of the vicinity, determined by the course of the rocky ridges. From the head of its longest northern bay to where the river leaves it, the distance is twenty-five miles, and the south-eastern bay extends some distance beyond. In its widest part it is about four miles across. Two rocky ridges, forming long narrow points, divide the northern half into three deep narrow bays; the southern end, five miles below the outlet, narrows to less than two miles and passes close to the foot of Red Mountain, the high hill seen from the top of Fault Hill. Two low ridges of limestone extend down the centre of the wide part of the lake, and form chains of rocky islands. The ridges on the south side of the lake are low and broken, and the shore line on that side shows frequent low cliffs of yellowish-white limestone. Quartz Hill is a sharp hill of white quartzite that rises 300 feet above the lake, on the south side, opposite the outlet. This hill is wooded almost to its summit with white and black spruce trees, but on the summit they do not grow more than six inches high. The trees surrounding the lake are very similar to those seen about Dyke Lake, except that they are somewhat smaller.

A small branch of the river flows into Astray Lake, twenty-four miles from its north end, coming in with a short, shallow rapid from the next lake called Marble Lake, which is separated from the last only by a narrow ridge of limestone. The other channel of the river flows out of a south bay and joins Astray Lake, a few miles to the east of the first.

Marble Lake stretches north-westward from the outlet, and for four miles is more than three miles wide; it then contracts to about a mile, and becoming shallow, soon shows current, and thus changes into the river. There is a small rapid two miles above, where a ridge of drift-covered islands extends diagonally out from a long point on the north side, causing the stream to flow in a narrow channel on the south side. The shores of the lake are low, and often composed of ledges of white limestone. The surrounding country is also low, apparently swampy, and well wooded with a thick growth of small spruce and larch.

The river above the narrows continues to flow with a strong current from the north-west for six miles, in a shallow channel over half a mile wide, with low swampy shores. Many sandy shoals obstruct the channel, and huge boulders are scattered everywhere.

The course of the stream now changes to south-west, and in the next six miles is broken by heavy rapids, full of large boulders, as it descends from the next lake above. Flowing in this direction, it crosses the strike of the rock at a right angle, and the rapids are formed by the river passing over nearly flat beds of limestone. Two miles above the bend there is a fall of six feet, where the river drops down over the edge of a thick bed of limestone. The channel along this stretch is very irregular in width, and is often split by large islands. The rapids end in a long narrow lake trending north-north-west from its outlet for several miles to where it appears to end against a high range of hills. The west side of this lake is bounded by a continuous range of sharp, barren hills that extends far southward.

The river now nearly doubles on its former course, and passes directly from

the south through three long narrow lakes, called the Menihek Lakes, connected by short river stretches.

ROUTE TO LAKE MICHIKAMAU

Having returned from the upper part of the Ashuanipi River to Sandgirt Lake, an exploration was made from there to and around Lake Michikamau. A description of this portion of the country is introduced here, because the other route leads up the Attikonak Branch to its head, and from there down the Romaine River to the Gulf of St. Lawrence, and it is thought advisable to complete the description of the interior before entering upon that of the southern region.

The route to Michikamau leaves Sandgirt Lake by its northern discharge, which is four miles long, over half a mile wide, and is obstructed with large islands. The channels are shallow with low shores, and the current is strong, terminating in a quarter of a mile of heavy rapids, where the river empties into Lobstick Lake. This is another large body of water, divided into deep bays by long low points and large islands. The surrounding country is nearly flat, and broken only by small rounded hummocks of rock, that seldom rise over 100 feet above the general level. There is also a marked absence of the long parallel ridges of drift, and bare rock shows in almost every elevation, forming the many small islands scattered over the surface of the lakes. There are two deep bays that extend away from the inlet of the lake. One runs directly south-east, with its outlet close to Flour Lake, into which it discharges by the north channel of the river, as has been already mentioned. The other bay runs due east about eighteen miles and is divided into two portions by two large islands that extend from the westward of the inlet to within four miles of the head of this bay. There is also a great bay stretching in a north-west direction from the discharge and ending at the foot of a range of rounded hills some twenty-five miles distant, where a small river flows in, which is used by the Indians as a canoe route to the caribou grounds on the George River, beyond the north end of Lake Michikamau.

The route to Michikamau follows the east bay, passing along the south shore of the large islands. Four miles from the inlet a narrow is passed, where the water between the low, rocky islands and shore is so shallow that only with difficulty a channel can be found for light canoes between the boulders, which thickly cover the bottom. At the narrow, a slight current is apparent flowing toward the west. Beyond the narrow the route continues up the bay, passing between many rocky islands for ten miles, to another narrow about fifty yards wide, between the second large island and a long rocky point. Here the current is strong for 200 yards, when the lake again opens out, but is covered with such a multitude of small rocky islands that no idea of its extent can be obtained by passing through it. For ten miles the route now follows the south shore, passing through narrow channels between the islets. A number of long, rocky points form deep, narrow bays along shore, and complicate the navigation, so that even an Indian guide is often at fault as to the right direction to follow. Two short heavy rapids on a small stream lead upwards into another island-covered lake, with even more crooked and narrower channels through which the route passes to a small bay near the eastern end of the lake, five miles from its outlet.

A range of rounded hills from 200 to 400 feet high extends along the north

and east sides of the lake. At the head of the small bay there is a gap in the hills about half a mile wide, where at ordinary stages of the water a small stream trickles down from the next lake, a mile beyond, through a series of little rocky pools filled with boulders. When the water is high in Lake Michikamau, which connects with this small lake, a large stream discharges from it through this valley, thus connecting the headwaters of the Hamilton River with those of the Northwest River, which flows out of Lake Michikamau on its north side. A portage of a mile and a half is here ordinarily made. It crosses a rocky hill on the east side of the valley, and then passes over a high drift plain to near its upper end, where it terminates on the wide bouldery shore of the upper lake. This lake is very shallow and full of small rocky islands and points, with its shores and bottom deeply covered with boulders. It lies in a continuation of the valley, between low rocky hills. Two miles eastward, a rocky narrow occurs, where the water runs in and out, the direction of the flow being determined by that of the wind. Beyond the narrow, the lake widens to over two miles and extends a few degrees south of east, for eleven miles. A long low point separates this bay from a similar one on the north side. The south side is bounded by low, rounded, rocky hills, and the surface of the lake is strewn with small rocky islands, with shallow water between them, where large solitary boulders often rise above the surface. The bay on the north side of the long point, heads nearly opposite the portage, where a small stream enters it from the west. Near the mouth of this stream, the Hudson's Bay Company kept a small outpost called Michikamau during the time that Fort Nascaupee was occupied. Nothing can be learned about this outpost from the Hudson's Bay Company journals at Rigolet or Northwest River, beyond the bare facts that a post was maintained there for a number of years and was finally abandoned from the same reasons which caused Fort Nascaupee to be given up. This post was not visited, but, from the accounts of the Indians, some of the buildings have been accidentally burnt, and those remaining are in about the same state of decay as Fort Nascaupee.

From the head of the lake the route turns south-east for nearly six miles, following down a small river that flows close along the west side of a rocky ridge flanked with sandy drift. The channel varies from 100 to 200 feet in width, and is bounded on the west side by a long point of sand, broken into narrow islands towards the south. This point and the islands are merely a ridge thrown up by the river between it and a large lake to the westward.

The next change in direction is to due east, where the river flows first with a strong current between a number of low rocky islands, and then widening gradually passes, for four miles, between high banks of drift into Lake Michikamau. The hills on the west side of the river are rounded and irregular, varying from 50 to 200 feet, and covered thickly with boulders. The east side is from 50 to 100 feet high and flat on the top, with traces of terraces from thirty to fifty feet above the present level of the lake.

LAKE MICHIKAMAU

Michikamau, or the Great Lake of the Indians, is the largest in eastern Labrador, being second only in size to Lake Mistassini. Its greatest length from south-east to north-west is about eighty miles, and it is twenty-five miles across

in its widest part opposite the discharge. The main body of the lake is sixty miles long, with a long, narrow, unexplored bay extending south-east more than twenty miles, from the south-east corner. The widest part of the lake is in the southern third; in the northern part of the middle third, a long point, and a line of large, high islands of eruptive rock, extend far out from the north-east side and narrow the lake to six miles. Between this point and the north-west end, the average breadth is eight miles. Islands are numerous along the shore and in the southern part of the lake, but elsewhere it is unobstructed. In comparison with Lake Mistassini, this is a much finer body of water, and its size appears much greater, owing to the absence of long points, and chains of islands. Lake Michikamau is surrounded by rugged hills which add to the grandeur of the scenery, in marked contrast to the low monotonous shores of Mistassini. The water of the lake is remarkably clear and cold, and according to the Indians, who set lines through the ice in winter, the depth is very great.

On account of the heavy sea running during the whole time we were engaged in exploring the lake, it was impossible to make soundings from the small canoes, except behind islands and close to the shore. The lake being free from islands, any moderate wind raises such a sea that canoe travel is frequently impossible, and the Indians are often weeks in passing from the discharge to the north end, on their way to the caribou grounds.

The lake occupies a deep basin surrounded by chains of rounded Archaean hills that rise from 200 to 500 feet above its surface. This basin is very ancient, and like that of Lake Mistassini, must have existed previous to the deposition of the Cambrian rocks which are now found lying undisturbed in many places around the lake.

The hills surrounding the lake are wooded for only about 200 feet above the water, their tops being covered with white lichens and small arctic shrubs. The outer islands and exposed points are also treeless, and the trees growing on the more protected islands and shores are small black spruce and larch, with only an occasional clump of straggling white birch on the lower slopes of the hills. From a high barren hill north of the discharge, the view looking northward beyond the lake is exceedingly desolate, and shows a succession of low rocky ridges extending to the horizon. Trees grow only in small patches in the lake-strewn valleys between, and innumerable huge boulders are scattered indiscriminately everywhere. Northward along the west shore, for seven miles from the inlet, the shores are low and boulder-strewn, with many small low islands of drift strung along in a close fringe. The shore line is irregular and small ridges of drift form points behind which long, narrow bays run off westward. Some of the islands are flattened at the top, evidently by the action of water, and there are small terraces on the scarped sides up to thirty-five feet above the present level of the lake. Beyond this the shores become higher, with rounded hills or dark brown rock rising in small hummocks above the drift, and also forming high rocky islands along shore. The country behind is quite rough, rising in irregular hills, from 50 to 250 feet high, and culminating in a sharp cone called Petitscapiskau, more than 350 feet high, which is visible for many miles along the other shore, and forms an admirable triangulation point. From Petitscapiskau to the north end of the lake, some six miles, the shores are low and sandy, with boulder-covered points. The land

slopes gently up from the water to an even ridge of drift-covered granite about 300 feet high that extends north-west far beyond the north end of the lake.

The north shore is low and sandy, with shoal water extending far out from it. Many boulders of red granite are scattered about, both in and out of the water, and are sometimes arranged in rows along the shore, by the expansion of the ice in the spring before the waters rise.

A little river enters the north end of the lake, with a small rapid full of large boulders, where the channel is about fifty yards wide and too shallow for canoes. This is the discharge of Michikamats or Little Michikamau Lake, which occupies the northern extension of the valley and is separated from the main body of the lake only by a long, narrow interval of drift. This lake is over twenty-five miles long and extends north-west to and beyond the north side of a high range of hills which is seen in the distance to divide the main valley. From the north end of Michikamats, three portages connecting narrow lakes lead to a branch of the George River, where the Indians of the region assemble in September to spear the caribou, which then cross the river in immense herds in the course of their annual migration from the high barren grounds behind Nain to the wooded region of the interior, where they pass the winter.

The east shore of Michikamau for twenty miles from the north end, is low, with bouldery points and reefs, and without the fringe of islands. A sharp rocky ridge 300 feet high runs parallel to the shore, and about six miles back from it. The interval between the water and the hills is occupied by small lakes and swamps that lie between low ridges of drift.

Twenty miles up, the highlands come out on the shore of the lake; and from there to the outlet, or for the next thirty miles, the shores are high and rocky, with deep water close in, and only a few small rocky islands along shore. The country behind is exceedingly broken and rough, with bare hills of dark-brown rock, rising in irregular, sharp bosses from 50 to 300 feet above the surface of the lake. Along the lake southward, the gabbro rocks, which form these broken hills, are replaced by granite near the discharge, and then the country becomes more regular, although still very hilly.

From the summit of a barren granite hill 400 feet high, close by, the discharge or Northwest River is seen to leave the lake between a number of large, flat-topped islands of drift about thirty feet high, that extend outwards from the shore some four miles, and along it for six miles. A long, low point of drift, passing into a ridge, separates the river from the southern part of the lake, and the river is seen extending eastward through a succession of lake expansions, until it passes behind and is hidden by rocky ridges in that direction. Another chain of lakes extends northward from the river and passes close to the base of a high range on the horizon. By these lakes a second route leads to the caribou grounds, which is used by the Indians when they want to proceed there direct, without the delay usually caused by adverse winds on Michikamau and Michikamats. The river flowing into the Atlantic near Davis Inlet, heads in the high range to the north, and a winter route from the George River to the coast follows its course closely. Owing to many rapids and falls, entailing several long portages, this stream is never used as a canoe route by the Indians.

From the discharge to the south-east end of the main body of the lake, some ten miles, the shores are low and sandy, with boulder-covered point and much

swampy land behind. There is a deep narrow bay that extends south-east from this corner, where it passes away between rounded, rocky ridges, running parallel to its course. Its entrance is nearly closed by small, low islands; its upper end was not explored, but it is said to be more than twenty-five miles long, with a small river falling in at its head.

The south end of the lake is shallow and is dotted with many small islands of granite. The shore is very irregular and often rocky, and the country behind is broken by several ridges from 200 to 300 feet high. There is another deep bay on the south side, where a couple of small streams discharge.

The country along the west side is broken by low ridges, with a wide interval of swampy land along the shore. The coast line is indented by deep bays, between wide swampy points, fringed with boulders. From the south end to within five miles of the inlet, there is a wide fringe of large islands of sandy drift, that rise only a few feet above the water.

PORTAGE ROUTE BETWEEN LAKE ATTIKOPIS AND NICHICUN

The portage route to Nichicun leaves Lake Attikopis by its western tributary, which is ascended for about one mile; then a portage of over a mile leads to a little lake that empties into the small river. From this little lake two portages of a mile and a half mile respectively, with a small pond between them, end in a narrow lake, one mile long, connected by a short portage with a larger irregular lake, nearly three miles long. The general direction of this portion of the route is almost due west, and is through a wide valley surrounded by barren, rocky hills, from 300 to 600 feet high. The only trees seen skirt the lakes or grow in the swamps, the remainder having been destroyed by fire, leaving exposed low hummocks of drift thickly strewn with boulders. A portage of a quarter of a mile crosses the watershed and ends in a small lake drained by a tributary of the Big River. The direction of the route now changes to nearly south-west, for nine miles, as it passes first through a lake two miles long, connected with the next by a river stretch of one mile, with three portages past rapids, followed by a lake for five miles and another river stretch of a mile, with several rapids. A change of direction next occurs to west-north-west for the next twenty-four miles, along which course the stream passes through seven small lakes, and is greatly augmented by the junction of small branches from the lakes that partly fill the surrounding valleys. Between each lake there are heavy rapids, so that the large lake, called Naokokan, into which the river empties, is some 200 feet below the level of the lake at the watershed, or nearly 1,800 feet above the sea. The country surrounding the river is rough, but the rocky hills near the valley die away to the south and west as Naokokan is approached. Recent fires have destroyed the greater part of the small stunted, black spruce and larch, which partly covered the lower lands. Naokokan is a large, irregular lake, nearly covered with islands and deeply indented with bays. Its greatest length, of thirty miles, is from east to west, while its width appears to be nearly twenty miles. From an elevation of 300 feet, near the mouth of the river, the lake had the appearance of a wide plain covered with numerous small lakes, and it was found only on passing into the lake that these numerous small lakes were really connected by straits and passages. Three days were spent in examining the southern shore of the lake in

search of its outlet, and in that time only one of the deep western bays was explored. Owing to unfavourable weather—heavy southwest gales, accompanied by rain and fog,—and failing supplies, the exploration was ended here, without the outlet being found and descended to Nichicun. It has since been learned that the outlet is somewhere near the north-east angle of the lake, and that along it the distance to Nichicun is not more than twenty-five miles.

A large branch was discovered, falling with heavy rapids into the south side of the lake. This is the main stream of the Nichicun River, and takes its rise in a number of small lakes to the south, along the northern slopes of the mountains forming the watershed between it and the Manicouagan, Outardes and Peribonka rivers. South and west of Lake Naokokan, there is a wide, flat plain, broken only by small isolated hills, and covered with innumerable lakes; to the north and north-east, the high mountains of the vicinity of Nichicun are seen with their rugged barren tops.

GEOLOGY

The following notes on the various geological formations of the Labrador Peninsula are the result of observations made along widely separated lines of exploration in that great territory, and the time given to the work was very limited. It will thus be understood that they afford only the means of making a rough estimation of the distribution and extent of the areas of the different rocks, with some general remarks on their relations, modes of occurrence and age, together with a more or less detailed statement of the various exposures of rock actually examined along the routes followed.

The descriptions of the different rocks are from observations made in the field, together with a microscopic examination of the hand specimens brought back. It is to be regretted that circumstances prevented more than a small number of microscopic sections being made. These have been examined by Mr. W. F. Ferrier and described in Appendix V.

GEOLOGICAL FORMATIONS

The term Laurentian is employed to designate the complex mass of highly crystalline Archaean rocks of which the greater part of the Labrador Peninsula is composed. These do not differ in any essential particulars from those similarly designated in other parts of Canada. They consist chiefly of gneisses and schists, some of which are believed to be highly metamorphosed materials of clastic origin, while others are regarded as foliated eruptives. As it is not possible, except in limited areas, to separate these rocks on the map, they are necessarily treated together.

The rocks of clastic origin are in nearly all cases the most ancient. The age of the areas of irruptive rocks is not known definitely, but many of them are very ancient, as fragments from them are included in the conglomerates of the Huronian. Others closely resemble the basic irruptives found cutting the Cambrian strata, and possibly are newer than that bedded series. These basic irruptives are in turn cut by later intrusions of granite, so that if the former are post-Cambrian, some of the latter may be high up in Palaeozoic time. Where the age of these

rocks can be determined by their intrusion into the bedded series of the Huronian or Cambrian, they have been separated from the rest of the complex, and the remainder grouped under the name Laurentian until more evidence is obtained as to their exact age. It may be taken for granted, however, that by far the greater portion of the irruptive rocks included in the Laurentian are extremely ancient, and that the areas of those supposed to be post-Cambrian are unimportant compared with the areas of rocks long antedating that formation.

Under the name Huronian are included several widely separated areas of clastic and volcanic rocks, together with many basic eruptives; these are represented by various schists, conglomerates, breccias, diorites and other rocks more or less interfolded with the Laurentian.

The Cambrian rocks rest unconformably upon the Laurentian and Huronian, and are made up of bedded sandstones, argillites, shales and limestones, along with bedded traps and other basic intrusive or volcanic rocks. More detailed descriptions of the Huronian and Cambrian rocks are given under their respective headings.

The Laurentian and Huronian gneisses and schists are intensely folded. This folding took place long previous to the deposition of the sedimentary beds of Cambrian age; and a sufficiently long time had elapsed between the period of folding and the Cambrian submergence, to allow for great removal of material by denudation and for the main sculpturing of the peninsula. The Cambrian rocks are found flat-bedded in the valley of Hamilton Inlet, and extend fifty miles up the Hamilton River; they are also found resting almost undisturbed in the great basins of Mistassini and Michikamau lakes. These examples show that the chief physical features of the Labrador Peninsula due to erosion, existed previous to the deposition of the Cambrian, and the enormous lapse of time requisite for the formation of the Hamilton inlet and river-valley can hardly be conceived, if the denudation was not much greater than that under present conditions.

LAURENTIAN

The Laurentian rocks occupy more than nine-tenths of the area of the peninsula, the remainder being underlain by scattered areas of Huronian and Cambrian.

By far the greatest area of the peninsula is underlain by medium to coarse-textured hornblende-granite-gneiss, corresponding to the Fundamental Gneiss of Logan. This gneiss varies in colour from red to light gray, a pink variety being most abundant. It is made up chiefly of orthoclase, abundant quartz, together with hornblende, and commonly mica. It nearly always has a gneissic foliation, and at times an augen structure, due to the orthoclase collecting in bead-like masses, between laminæ of hornblende and mica. Sometimes over large areas the foliation is obscure, and the rock then approaches a true hornblende-granite.

Pegmatite dykes or veins are very numerous everywhere in the Archaean rocks of the peninsula. They are found cutting the Huronian schists and basic eruptives, the anorthosite areas, the mica-gneisses, as well as the hornblende-granites, to which they appear to be genetically related. The most abundant mineral of these veins is orthoclase in coarsely crystalline masses, quartz in irregular crystalline lumps is next in abundance and hornblende is nearly always present, together with mica (biotite or muscovite) often in large plates, but usually

much bent and twisted. Black tourmaline and red garnet are often found, the latter being most abundant. The colour of the orthoclase varies from red to white, and depends on the colour of the granite or granitite area, from which the pegmatite is derived. The width and direction of these veins are not nearly so constant as those of the basic dykes found throughout the region. They are often lenticular, and appear to have been injected into fractures and fissures, filling even very small cracks. Some of the veins are of great size, like those met with above the Great Bend of the East Main River, where the pegmatite is often more abundant than the mica-gneiss and schists constituting the original country rock. The larger veins often hold angular fragments of the well foliated gneiss and schists, and some of these fragments are of great size. Although differing in appearance from the basic dykes, it is believed that these veins of pegmatite, from their character above described, and from the fact of their cutting all varieties of rocks of the Archaean must be of irruptive origin, as has been clearly shown to be the case with similar veins met with in Sweden, and ably described by Prof. W. C. Brogger,* who believes that the pegmatite veins were formed during the later stages of irruption of the granite, when the main mass was in part solidified, and that the veins cutting the surrounding rocks were injected in a molten state; also that the materials of the veins were not deposited from highly heated aqueous solutions.

The rocks next in importance as regards area, are the mica-gneisses and mica-schists, that occur in wide persistent bands throughout the Labrador peninsula, and are taken to be the representatives of the Grenville Series of Logan, lately so well described by Dr. F. Adams.†

Mica-gneiss greatly predominates over all the other members of this group, and it varies from coarse-grained, well crystallized gneiss, through all gradations of texture and composition to mica-schist. Pink or white orthoclase, quartz and mica (generally biotite) are always present, and hornblende is often found in small quantities. Garnetiferous bands are frequently met with, especially in the great areas along the Manicouagan River. The gneisses are usually very quartzose, and in many places shade into an impure, garnetiferous quartzite. All are well foliated or stratified, and in many places the dip of the foliation approaches the horizontal, giving the rocks the appearance of flat-bedded, altered clastic rocks. In many places these gneisses and schists are associatd with bands of crystalline limestone.

LAKE MISTASSINI TO EAST MAIN RIVER

The rocks underlying the country from the north-west shore of Lake Mistassini almost to the East Main River, are all referable to the Laurentian. From the numerous exposures examined, it would appear that hornblende-mica-gneisses and hornblende-gneisses, alone, characterize this area, with only one large dyke of diabase cutting them. These gneisses are often only obscurely foliated and approach closely to the structure of hornblende-granites. To all appearance this great area is like those between Lake Nichicun and Lake Kaniapiscau, along the Koksoak

* Can. Rec. Science, vol. VI, No. 2. "On the formation of Pegmatite Veins."

† American Journal of Sci., Vol. L., July 1895.

River and also on the Big and Great Whale rivers, referable in type to the fundamental gneiss of Logan's Trembling Mountain section.

Leaving Lake Mistassini, coarse to medium-grained, pink and red, hornblende-mica-gneiss is met with in several places along the low banks and small islands of the northern channel of the Rupert River, before the first portage is reached. In these gneisses hornblende appears to be always more plentiful than mica. Scattered throughout the mass of the gneiss, are lenticular patches of dark hornblende-schists and often finer bands of hornblende-schists and hornblende-mica-schists. General strike N. 50° W.. The same kinds of rock are constantly met with to the portage past the fall, where the river enters Pinched-neck Lake. Below the portage, great angular masses of dark green amphibolite are seen in which the hornblende is arranged in large sheaf-like masses of long, narrow, secondary crystals, some of the masses being six inches in diameter. On the islands of Pinched-neck Lake, the exposures are small and few, and show pink granite-gneiss, with inclusions and broken bands of dark hornblende-schist, much contorted. Strike N. 10° E. to N. 40° E.

At the narrows leading from Lake No. 7 to Lake No. 8 of the portage route between the Rupert and East Main rivers, there is exposed a portion of a large diabase dyke. The rock is of a dark greenish-gray colour with more or less rounded, yellowish-green masses of plagioclase. The size and direction of the dyke is unknown, as its contacts with the surrounding gneisses are concealed. This rock has been microscopically examined by Mr. A. E. Barlow, and his description of it is to be found in Appendix V. The few exposures along the portage route to the East Main River show that the underlying rock is all hornblende-mica-gneiss, with its associated bands of hornblende-schist, as far as the outlet of Clearwater Lake. Only two or three small rock-outcrops are seen along the discharge of this lake, and they are all fine to medium-grained mica-gneiss like that found along the East Main River in the immediate vicinity of the mouth of that stream. General strike N. 10° E.

LOWER EAST MAIN RIVER

The land surrounding the mouth of the East Main River is low, and the river-banks consist of stratified clay. On Governor Island, at the entrance of the river, there is a large exposure of light-gray, medium-grained granite-gneiss, cut by masses and dykes of a dark-red hornblende-granite. The gray gneiss is much contorted and has a general strike of N. 90° E.

The next exposure seen along the river is on a small island close to the south shore, two miles above the Hudson's Bay post, where coarse, gray mica-gneiss appears, holding patches and veins of fine-grained, pink hornblende-granite. Strike N. 75° E. No Laurentian rocks are again met with along the river for 125 miles, or to within twenty miles of the lower end of the Great Bend. The river, in this part of its length follows closely the strike of a band or bands of Huronian rocks, described under their proper heading.

The gneiss below the Great Bend, varies from fine to medium texture, and is either pink or light-gray in colour. It is very felspathic, and as a rule holds little quartz. Hornblende and mica are present, the former being always most abundant. In places, the foliation is indistinct, and the gneiss then approaches a hornblende-granite. The general strike varies from N. 70° E. to N. 85° E. The

foliation of this mass apparently took place previous to the deposition of the Huronian schists, as blocks of the gneiss are inclosed in these, with the gneissic structure sometimes transverse to the structure of the schists. At the lower end of the Great Bend, these hornblende-gneisses are associated with small areas of light-gray rock, composed chiefly of white orthoclase, with crystalline grains of opalescent quartz, and scattered porphyritic crystals of orthoclase. This appears to be an intrusion of quartz-porphyry into the granites. Along the next two miles the granite-gneisses are mixed up with diorites and hornblende and chlorite-schists that are taken to represent intrusive masses of Huronian age, as they clearly cut the gneisses. These gradually thin out, and only a few narrow bands of dark-green hornblende-schist are seen penetrating the gneiss for a mile above, to the chutes.

The river above the chutes flows in a shallow channel between rocky banks overlain with drift. For twenty-one miles, only Laurentian gneisses are met with until they are again cut off by an area of basic irruptives. The gneisses are light-gray and pink in colour. For the lower half of the distance, a coarse-grained hornblende-granite predominates. It often has an augen structure, but in other places is almost unfoliated, and then holds large porphyritic crystals of orthoclase. Segregations of hornblende are common, often large, and always lenticular in shape. The rock has the appearance of an irruptive mass. Associated with it are bands of finer-grained mica-gneiss, with a more marked foliation. Along the upper half of the distance, the hornblende-gneiss is much finer and very felspathic, while the accompanying mica-gneiss is more abundant. The strike throughout is very regular and is almost directly E. and W.

The basic intrusives first appear about two miles below the Broken-paddle River. From here to the mouth of that stream, the main river passes close to the contact between the Laurentian gneisses and the Huronian rocks. Contacts were seen in several places, and at all of them the Huronian dykes were undoubtedly intruded into the older Laurentian gneisses.

Gneisses are not again seen along the river for seventeen miles; they re-appear five miles above the last exposure of Huronian, the rocks in the interval being concealed beneath the drift.

For the succeeding twenty-five miles, to beyond the next sharp northern bend of the river, the rock is chiefly a mica-gneiss. It varies from a mica-schist to a medium-grained gneiss, and its general colour changes with that of the constituent minerals, from dark-gray to light-gray or pink. The rocks have a general dip to the northward $< 15^{\circ}$-70°. They are cut by numerous dykes or veins of coarse pegmatite, either white or light-pink in colour. These dykes are very irregular in size, and along their direction pinch out and come in again, so that they have a lenticular appearance in most places. They clearly cut the gneisses, and often enclose angular masses of the gneiss, which when so situated is generally schistose. Farther up the river the pegmatite becomes more abundant, and at the upper end of this course greatly exceeds the gneiss and forms high rocky walls showing large enclosed fragments of the schist. The pegmatite is composed chiefly of coarsely crystalline orthoclase, with large masses of quartz and little mica or hornblende. Large dark-red garnets are not uncommonly scattered through the mass, and in some places large crystals of black tourmaline are seen.

For the next ten miles, to the lake portages, the same rocks are seen, along

with a medium-grained red hornblende-mica-gneiss. Here the pegmatic dykes are not so large and are less abundant. The red hornblende-mica-gneiss is interbanded with the gray mica-gneisses, but their relations to one another could not be studied. The general dip is N. 10° E. < 15°-80°.

At the upper end of Prosper Gorge, the rock is chiefly a medium to coarse-grained, pink hornblende-mica-gneiss, in which the hornblende predominates over the mica. It holds a few fine-grained dark-gray schistose bands. Dip N. 35 E. < 15°. This rock has the appearance of an irruptive and is associated with a gray and more micaceous gneiss, holding grains of magnetite.

A mile above the portage, there is a large exposure of coarse, red, highly felspathic gneiss, containing small quantities of light-green decomposed hornblende. Dip N. 50° E. < 30°.

Medium- to fine-grained hornblende-mica-gneiss, along with thin bands of gray mica-gneiss, outcrop at intervals for the next six miles, to a small chute. Above the chute, and from there to the foot of Ross Gorge, the gneisses become darker and more schistose, and are cut by dykes of red pegmatite that carry much hornblende. The schists are mica-hornblendic and micaceous. The strike of these rocks along here shows that there has been a great bend in the foliation, which assumes a direction N. 60° W. Three miles above the chute, there is a large dyke of coarse diabase, holding much pyrites, and running N. 30° W., or diagonally across the strike of the foliated rocks. The composition of this dyke is similar to the newer dykes previously described as of post-Huronian age.

The few exposures met with on the portage past Ross Gorge, show pink mica-hornblende-gneiss, full of small red garnets, and cut by coarse pink pegmatite.

Between the head of Ross Gorge and Lake Nesaskauso, there is only one small exposure of pink mica-gneiss. About this lake, the rock is to all appearance an altered, intrusive hornblende-granite. It is generally red in colour and coarse-grained, with frequent bands of dark mica-hornblende-schists. These bands are long lenticular masses lying parallel to the foliation, and when followed along the strike are soon found to pinch out.

From the lake to the foot of Grand Island, the rocks along the river are mostly light-coloured mica-gneiss, with a few bands of mica-hornblende-schist, both of which are cut by large masses of white and pink pegmatite. Garnets are common both in the pegmatites and gneisses. The strike of the foliation here is again nearly parallel to that below Prosper Gorge, or N. 80° E.

The exposures along the northern channel past the Grand Island, are few, and everywhere show coarse, light-pink or white pegmatite, in great dykes, cutting mica-schists and enclosing broken bands of mica schists and mica-hornblende-schists. The pegmatites are much more plentiful than the foliated rocks. In the pegmatites garnet is common, in large dark-red or black crystals, and dark-green hornblende and greenish muscovite are frequently met with, along with much quartz. Two miles above the foot of the island, there is a large mass of dark-green amphibolite, which is probably the decomposition product of a diorite dyke; its contact with the gneisses is concealed. The rock is made up of dark-green hornblende arranged in stellar masses of needle-like secondary crystals. These masses vary from half an inch to one inch in diameter, and give to the rock a beautiful spotted appearance on its smooth glaciated surfaces. Large blocks of the same rock are found at the rapid on the south channel, about a mile and a half

above the foot of the island, and probably represent an extension of the dyke in this direction.

About Tide Lake, along the south channel, the pegmatite dykes are fewer and smaller, and, in consequence, more of the foliated gneisses are seen. These are mostly mica-gneisses, that vary in texture from medium to fine, and in colour from light-gray to light-red. Along with these are a few bands of red hornblende-mica-gneiss. Above Tide Lake no rock is seen along the south channel until within two miles of the head of Grand Island, where a low exposure of light-green serpentine appears on the north side. The mass seen is about thirty feet wide, and is bounded on the east side by green chlorite schists, containing small blotches of white plagioclase. The serpentine contains pearly hydromica in radiating flakes, and whitish hornblende in secondary radiating crystals. It is probably a highly decomposed dyke cutting the pegmatite and mica gneisses that are seen a short distance above.

From the head of Grand Island to the end of the survey of 1892, a distance of about ten miles, the rocks are all mica-gneisses cut by pegmatite dykes. The gneiss varies from a fine dark-gray mica-schist to a medium-grained light-gray gneiss. The pegmatite is always white, and as the river is ascended the dykes gradually die out.

UPPER EAST MAIN RIVER

At the starting point of the survey of 1893, the rocks are medium to fine-grained, dark greenish-gray mica-schist,and dark-gray mica-gneiss, cut by large, irregular masses of white or light-pink pegmatite. Both pegmatite and gneisses are cut by small dykes of fine-grained, compact, dark-green diabase. In the next three miles, small exposures of fine-grained, light-gray, highly felspathic granite-gneiss, cut by pegmatite, are seen on both banks of the river. Strike N. 80° E. with northerly dip.

At the lower end of the large island immediately above the mouth of the Kawatstakau River, the rock is finely banded gray and pink granite-gneiss, cut by pegmatite. Strike N. 65° W. Fine-grained, dark-gray, highly micaceous gneiss, associated with coarse white pegmatite, is seen at the small rapid one mile and a half above the last. From here to Sunday Portage very few exposures are seen, and all consist of gray and pink mica-gneiss along with pegmatite. Some of the gneissic bands are garnetiferous. Strike N. 80° W.

At the foot of the next rapid, two miles above, there are exposures of dark-gray granite-gneiss, cut by gray pegmatite. Half a mile above this rapid, low cliffs occupy both shores for a short distance, the rock being chiefly coarse, white pegmatite, with broken bands of fine-grained, dark-gray hornblende-granite-gneiss, often weathering greenish from the presence of decomposed hornblende. Some of the bands are highly hornblendic. Strike N. 80° W. Two other exposures occur on the south side, before the Pond Portage, both showing the same dark greenish-gray hornblende-granite gneiss, cut by pegmatite, and at the upper exposure the rock is nearly horizontal. Mica is the principal constituent, the hornblende forming but a small percentage of the mass. At the foot of Pond Portage, similar schistose gneisses, cut by pink pegmatite, are seen, dipping N. 5° W. $< 15°$; while at the small lake on the portage, these are found interbanded with coarser highly felspathic, light-gray granite-gneiss, both cut by pegmatite.

Strike S. 85° E. At the short rapid on the north-west bend, three miles above the Pond Portage, the rock is mostly a dark greenish-gray mica-schist, with coarser, more felspathic bands, and pegmatite. Dip N. 80° W. < 25°. A mile and a half above, on the west side, is an exposure of medium-grained, light-gray granite-gneiss, cut by pegmatite; while half a mile farther on the same side, there is a sharp rocky point where dark, greenish gray mica-schist is interbanded with lighter-gray granite-gneiss, and is cut by a yellow-weathering, red pegmatite. Strike N. 10° W.

At the islands, a mile and a half above the north-west bend, the rock is a dark-red, highly quartzose granite-gneiss, holding little hornblende. One mile above, and on the south side, light-gray, medium-grained granite-gneiss is seen, with a few bands of dark mica-schist. Strike N. 80° W. No exposures now occur along the river for over three miles, until the foot of the high hill is reached on the north side. There the rock is a coarse pink pegmatite, at times a coarse syenite, and holds a few broken bands of mica-schist. The mountain mass appears to be formed of coarse pink and red hornblende-granite. On the opposite shore are seen dark greenish-gray mica-hornblende schists.

A quarter of a mile above, where the river bends abruptly south, away from the mountain, the rock is a coarse, red hornblende-granite, and is followed a mile and a half beyond by medium-coarse flesh-red hornblende-granite, with a light-green serpentine, or chloritic mineral, filling small cracks and veins in it. The hornblende is dark-green in colour. The quartz, at times, is stained dark-red, and small red garnets are also present. The granite often shows signs of foliation, and so becomes a hornblende-granite-gneiss.

At Sharp Rock Portage a continuous section of schists is exposed for a quarter of a mile. At the lower end of the portage, dark-gray mica-schists are interbedded with more felspathic, fine-grained, light-gray gneisses, and are conformably followed by a considerable thickness of dark hornblendic and altered hornblende-schists, on edge, their strike being S. 85° W., and very regular, except where they fold around lenticular masses of dark-green hornblende. The schists are arranged in narrow, dark-green, light-green, white and brown bands. The white bands are highly felspathic, while the colour of the brown ones is due to the decomposition of pyrites, which mineral, along with quartz, is also found in small irregular veins, cutting the schists. A few small bands of white pegmatite also cut the schists. These schists closely resemble the hornblende-schists associated with irruptive rocks, found in several large areas along the lower parts of the river, and are supposed to be of the same or Huronian age. The pegmatites and the masses of hornblende-granite from which they are derived, must be post-Huronian, as they distinctly cut these rocks.

One mile above the portage, on the south side of the river, bands of greenish-gray mica-schists and mica-hornblende-schists are seen, interfoliated with thin felspathic bands of a light-gray colour, and the whole is cut by pegmatite. Strike S. 85° W.

A mile above the last, on the same side, is a large exposure of coarse white pegmatite. At the chute, a short distance farther up along the north side, the dark-gray schists are much contorted and broken by masses of pegmatite.

At and below the islands at the narrows, two miles above the chute, the dark greenish-gray mica-schists and mica-hornblende-schists are partly interfoliated

with a medium-grained, pink, highly quartzose hornblende-gneiss, which appears to have broken up between the bedding planes of the schists, and in places forms great masses wholly displacing them. The granite has in many places a porphyritic appearance, due to large perfect crystals of orthoclase, generally parallel to the plane of foliation. At the upper end of the island the schists are found only in broken bands and fragments imbedded in the granite. On the south shore, opposite the head of the island, the schists are, however, well developed, and only a little granite is seen.

Three-quarters of a mile beyond, and for nearly half a mile along the north shore, red hornblende-granite and gneiss are found holding a few broken bands of mica-schists and hornblende-mica-schists. The same rocks are again seen coming out at the head of a small island half a mile above; dip N. 5° W. $\angle$ 30°. At the foot of the hills, three-quarters of a mile farther up, on both sides, are hornblende-granites cutting mica-schist, interbanded with medium-grained, highly felspathic hornblende-granite-gneiss; dip N. 5° E. $\angle$ 40°. For the next four miles there are three small exposures, all of medium-grained, pink hornblende-granite and gneiss.

At and below Mink Portage and at the chute immediately above, there are a few bands of mica-schist along with a great thickness of medium to coarse-grained, light-gray hornblende-granite, at times showing signs of foliation parallel to that of the schists. Dip N. 30° W. $\angle$ 45°. Both schist and granite are cut by white pegmatite. From here to above the islands of Channel Portage, a distance of over four miles, on both sides of the river there are many exposures of medium-grained, light to dark-gray hornblende-granite-gneiss, associated with, and apparently cut by pink to red granite, also medium-coarse in texture. The granites are most abundant and both rocks show frequently signs of foliation. Strike N. 50° E.

For the next four miles upward, the river flows between low sandy banks, the rocks again appearing on the small islands in the rapid at the end of that distance, where part of a great diabase dyke is seen cutting a flesh-red, medium-grained hornblende-granite. The same dyke is probably seen on the north side, a quarter of a mile above the islands, where it cuts a medium-grained, pink hornblende-gneiss. Strike N. 60° E.. The dyke is here thirty-five feet wide, and runs N. 20° W. In structure it is fine-grained, and it splits into sharp, angular fragments, along two principal cleavage-planes, arranged at an acute angle to one another. The colour is dark-green and only a few blotches of dull, white felspar are coarser than the general texture.

Exposures of pink and red, medium to coarse hornblende-gneiss, are frequent along both banks of the river for the next two miles, and are followed by a great exposure of dark-greenish hornblende-schist, which forms the mass of a high hill on the south side. The hornblende-schist, towards the upper end of the exposure, takes up mica and gradually passes into a dark-green mica-hornblende-schist, closely resembling the rock met with along the river below the granites. It is also cut by white pegmatite.

Above this, for two miles, the shores are composed of till, and then again become rocky, forming an almost continuous exposure for the next two miles, with frequent exposures in the following ten miles. Red and pink hornblende-gneiss forms the mass of the rock, and often holds broken bands and lenticular patches

of dark-green hornblende-schist. General strike N. 60° E. In places the bedding, or plane of fracture, is nearly horizontal. Some bands are composed largely of felspar, and are then light pinkish-gray in colour and fine-grained in texture. Four miles above the Cascade Portage, a large diabase dyke is seen at intervals for nearly half a mile along the north shore. As its contact with the surrounding granite could not be seen, its width and direction could not be determined, but its course is roughly parallel to the river, or about N. 45° E. This dyke is medium-grained in texture, dark-green in colour, and holds numerous small, porphyritic crystals of greenish-white plagioclase.

Exposures of hornblende-granite are very frequent to the mouth of the Misask River. Two miles and a half below that place, the rock is a medium fine-grained, light-gray, highly felspathic hornblende-gneiss. Dip S. 60° E. < 20°.

On the islands in the rapid immediately below that river, the same light, pink and gray hornblende-gneiss occurs, and here holds a few broken bands of dark-green hornblende-schist; while small fractures and cracks in the pink hornblende gneiss are filled with light-green serpentine. At the first portage above, an abundance of the same rock is seen, and here dips S. 60° E. < 5-40°.

Beyond this point only angular blocks are seen, until the last portage before Long Portage Creek is reached, where similar fine-grained, light-gray and pink, highly felspathic, hornblende-gneiss occurs, holding broken bands of hornblende-schist. Strike N. 65° E.

No further exposures are seen along the route until the rocky portage on Long Portage Creek is reached, where there is a mountain formed of medium to coarse, red hornblende-granite, at times showing signs of foliation. Although no exposures of rock in place are seen in this long interval, yet, from the number of large angular blocks scattered about the river-bed and apparently not far-travelled, the rock underlying this section of country must be wholly hornblende-granite and gneiss. Above this to the second small lake beyond the Long Portage, loose blocks of granite are common, but no rocks are seen in place until they come out on the north side of that lake, where they are dark-pink, medium-grained hornblende-granite. The next exposure is seen at the small rapid at the entrance of Opemiska Lake, where the same granitic gneiss is seen lying nearly flat. Strike N. 80° E.

On a small rocky island on the north side, half a mile from the eastern end of this lake, coarse, pink pegmatite-gneiss holding broken bands of hornblende-mica-schist is again met with. Strike N. 80° E. At the lowest rapid on the river between Opemiska and Wahemen lakes, there are large exposures of medium-grained, pink, highly quartzose, hornblende-gneiss. Strike N. 80° E. It is associated with coarse pegmatite, the contact of which with the gneiss is covered, and above, in the rapid, there is a large development of dark-gray mica-hornblende-schist.

Half a mile farther up, at the short portage over a small island, there is a considerable thickness of dark-gray mica-hornblende-schist. Dip N. 30° W. < 50°. These beds are sharply cut by large dykes of pegmatite that hold considerable quantities of hornblende. Between this and the last exposures, on both sides of the river, the hills are formed of coarse, red hornblende-granite, from which the pegmatite runs out as dykes. Granite is seen on the shores and islands along the river to Lake Wahemen. These granites are often foliated, but com-

monly show no signs of structure. No exposures were seen along the shores of Lake Wahemen or of the small lakes between it and Patamisk Lake; but from the large angular block of granite it may be taken that this kind of rock underlies the drift of this region. Dark-gray mica-schists cut by pegmatite are seen on some of the islands in Patamisk Lake. Strike N. 80° E.

At the west end of the first small lake beyond Patamisk Lake, there are immense angular blocks of dark-gray mica and hornblende-mica-schist. On the south side of the same lake, half a mile from the portage, there is a large exposure of fine-banded, highly contorted hornblende and altered hornblende-schists. The bands are of various colours, being yellowish, white, light-green, dark-green and reddish-brown. Dip N. 70° E. $\angle$ 50°. On the other side of the lake, and half a mile beyond, similar banded schists are seen. Dip N. $\angle$ 60°. Some of the bands contain finely divided pyrites and weather brown. They closely resemble the rocks seen at Sharp Rock Portage on the East Main River. From here no rocks are seen in place until the Big River is reached, but the angular blocks on the next two portages are nearly all mica-schist, or a fine light gray mica gneiss.

UPPER BIG RIVER

A great area of hornblende-granite is now entered, that extends from the Big River north-eastward to Lake Kaniapiskau, a distance of over one hundred miles. Throughout this distance, the rocks met with consist almost wholly of pink of red hornblende-granite, at times associated with hornblende-mica-granite and rarely including fragments of the bedded series of mica-gneisses. These granites are generally massive, and do not show signs of foliation, except in the segregated masses of hornblende that frequently occur with them. The segregations have commonly a schistose structure induced by pressure. Where the segregations are large and numerous, the remainder of the rock contains a very small proportion of hornblende, it apparently having been nearly all collected into dark-coloured masses. Some of the segregations contain a small amount of mica. Along the Big River above Nichicun Lake, the coarse, red granites are seen in two places; the lower being at the Sharp Hill, where the river enters Back Lake. Both exposures show no signs of foliation, are coarse in structure, and contain a very small percentage of mica.

The islands of Lake Nichicun are often rocky, and wherever examined the rock was found to be coarse-grained, pink and red hornblende-granite and mica-hornblende-granite, the former predominating. On the first portage below Nichicun Lake, a considerable exposure of medium-grained highly felspathic mica-hornblende-gneiss was seen, along with thin bands of dark-gray micaceous schist. Strike N. 80° E. For several miles below, rock exposures are frequent along the river, and where examined show coarse-grained, pink and red hornblende-granite. At the lake expansion below the third portage, the bedded series of micaceous gneiss is again seen. From here to beyond Lake Kiaswachigastook, the rocks are all granite. On Eagle Lake the granite in places shows signs of foliation. Strike N. 75° E. On both sides of the long bay of Snipe Lake there are numerous broken bands of mica-schists and mica-hornblende-schists inclosed in the granite, and this development of the bedded schists continues across the portage to Long

Lake, where the granites again come in, holding many segregations of hornblende-schist inclosed in a magma of almost pure orthoclase.

KOKSOAK RIVER

No rock in place was seen from here until the height-of-land was passed, but from the immense number of blocks and boulders scattered about, the underlying rock is taken to be hornblende-granite. From the height-of-land to Lake Kaniapiskau, a number of exposures were examined, and all were found to be hornblende-granite, sometimes including hornblende segregations, and rarely showing signs of foliation.

On an island, off the discharge of Lake Kaniapiskau, the bedded series of gneisses is again seen as fine-grained rusty-weathering dark-gray mica-hornblende-schist. The first exposure on the river is three miles below the lake, where an outcrop of dark-gray, schistose mica-gneiss occurs at a heavy rapid. Strike S. 85° E. No other exposures are seen for several miles, but from the many large blocks scattered about in the drift, the underlying rock is supposed to belong to the bedded series of gneisses.

The next exposure on the river is eight miles below the last, where the rock is a dark-gray mica-schist, with numerous thin bands of light-gray felspathic gneiss. Below this, there is an interval of twenty-two miles to the next rock-outcrop, which occurs at a rapid below the lake expansions. Here the rock is very coarse, pink pegmatite, some of the orthoclase faces being eight by ten inches. The rock contains a considerable amount of quartz in large rounded masses, and is singularly free of mica or hornblende. It resembles a great dyke over 300 yards wide, and appears to run N. 70° E. The same kind of rock is met with at the next rapid, one mile below the last. Similar rocks occur frequently for two miles below, when very coarse, pink and gray granite-gneiss appears. Dip N. 15° E. $<$ 50°. Some of it has an augen structure, and there are also finer-grained bands. These rocks do not resemble the bedded mica-gneisses, and may represent irruptive granites, with the pegmatite dykes derived from the granite mass.

From here, along the east channel past the large islands, the river flows over many rocky ledges to the head of the first gorge thirteen miles below. These exposures show a great development of coarse to medium-grained gray granite, often with porphyritic crystals of white orthoclase, and charged with a considerable quantity of mica. Along with these are broken bands of finer, and often darker, mica-schist and granite-gneiss, that perhaps represent the bedded series. All these rocks are cut by dykes of coarse pink pegmatite. Along the gorge these rocks are continuously exposed for eight miles. The coarse red pegmatite here develops into a hornblende-granite, from the presence of dark-green hornblende, and it carries in cracks small veins of light green chlorite. These rocks cut the coarse-grained light-gray basic syenites or granites,* which in places contain well formed crystals of brown orthorhombic pyroxene. Associated with and cut by both the granites, are large masses of mica-schist and fine-grained mica-gneiss, in the form of broken bands. These schists and gneisses are often highly charged

* See No. 6, Appendix V.

with dark-red garnets, some of the crystals being nearly two inches in diameter. The general strike of the foliation is S. 75° E.

For several miles below the valley continues narrow, with high rocky walls that afford an almost continuous exposure on both sides of the stream. Owing to the heavy rapids in the river, the rock could only be examined at favourable landing places. Where examined the light-gray basic granites were found to predominate; they are at times garnetiferous and sometimes change to a mica-hornblende-granite from the presence of small quantities of dark hornblende. They then hold segregations of hornblende with a schistose structure. The rocks are often foliated, but still the general appearance and the well developed crystallization point to their irruptive origin. They continue to hold large fragments of the finer-grained, less metamorphosed, bedded series. The hornblende-granites and pegmatite dykes cut both of these rocks.

Eight miles below the gorge, and along the stretch of three miles where the river runs east, the mica-hornblende-granites are very abundant and hold many segregations of hornblende. The direction of the foliation is S. 75° E. They are penetrated by many large red pegmatite dykes, and cut by small veins of serpentine and steatite. Three miles below, where the river bends to the north-west, there is much fine-grained schistose hornblende-granite of a dark-green colour. Strike S. 55° E.

For the next five miles the river banks are sandy, but farther down stream the same varieties of rock are seen, the granite changing to a mica-hornblende-granite from a free admixture of hornblende with the mica. Strike S. 75° E.

At the foot of the next long rapid, twelve miles below the last exposure, the rock is a medium-grained, greenish-gray, basic mica-hornblende-gneiss. It is composed chiefly of a yellow-weathering plagioclase, and holds a good deal of dark-green hornblende along with mica. It changes into the light-gray gneiss, and the rusty colour is probably due to decomposition. Strike S. 80° E.

Seven miles farther down, at a heavy rapid, a large diabase dyke was seen, but could not be examined, as it was impossible to land near it.

The next exposure examined was three miles above the mouth of Sandy River, where medium-grained, light gray mica-hornblende-gneiss was seen. Strike S. 60° E. Similar exposures were seen at the low chute a mile below, where the rock was found to be contorted on the strike, and holds a number of shattered bands of hornblende-schist. General dip N. < 25°.

At the second gorge, four miles below Sandy River, medium-grained, light-gray and pink mica gneisses and mica-hornblende-gneisses were seen in nearly flat layers. There are large masses of dark-green hornblende-schist in places, and these appear to be the remains of old dykes, foliated by pressure. The same rock is seen at the small chute one mile below, and there the dip is N. 15° E. < 20°-50°.

At the head of Eaton Canyon, the same flat-bedded gneisses are seen, cut by large dykes of dark-red pegmatite, holding large decomposed crystals of green hornblende. The canyon proper is cut out of a medium-grained, dark-red hornblende-granite, from the mass of which the pegmatite dykes appear to be given off. The granite is extremely brittle and is much fractured along two sets of cleavage-planes; it is so minutely broken that it is next to impossible to obtain an ordinary hand specimen. There is a large dyke of fine-grained, compact diabase

125 feet wide, running N. 55° E. along the south side of the river. This dyke appears to have been the cause of the shattered condition of the granite, as the latter is more broken and friable near the contact than elsewhere. At the foot of the canyon, the granite is again displaced by the medium-grained, light-gray mica-hornblende-gneiss, that forms the steep rocky walls of the river-valley to the mouth of the Goodwood River.

Below the Goodwood, the walls continue high and rocky for many miles. Five miles down, the rocks, where examined, consist of coarse to fine-grained, gray and pink mica-hornblende-gneiss. Strike S. 75° E. Six miles farther down the same gray and pink granite-gneisses are seen, cut by red hornblende-granite. Strike E. Two miles above the Granite Fall, only coarse-grained, hornblende-gneiss with light-green hornblende is seen. Strike S. 45° E. At the fall the rock is also coarse, pink and red hornblende-gneiss, including lenticular masses of dark hornblende-schist, often much broken. The gneiss is considerably contorted, but the general dip is N. 45° E. < 40°.

For seven miles below the falls, the river has banks cut out of drift, which conceals the underlying rock; then the rocks are seen at the bends of the river, where the heavy rapids occur, and where a landing cannot be made. In consequence, no exposure was examined for twelve miles below the falls, where a highly contorted, coarse-grained, gray and red hornblende-gneiss was seen.

The valley now widens out, and there is a considerable interval of drift between the river and the rocky hills. In a few places low hummocks of red hornblende-gneiss are found along the shores. At times the gneisses are massive, but they generally show signs of foliation, and have a general dip of N. 45° E. < 20°-70°. These characters continue till the crystalline rocks are replaced by the overlying Cambrian strata. Sixteen miles below the Stillwater River, the Laurentian rocks are again found rising from below those of Cambrian age, although the latter still form the summits of the hills on both sides of the valley.. The first exposure on the south side of the river shows finely banded, pearly-gray schists, somewhat calcareous, with plates of silvery hydro-mica, and in some of the bands green hornblende and chlorite. The hornblendic bands are full of dark-red garnet, some of the crystals being nearly two inches across. These bands are vertical, and the strike is S. 45° E. A curious coincidence is that, on the Hamilton River, near the eastern contact of the Laurentian and Cambrian rock, similar beds of hydromica-schists are met with. Three miles below, on the same bank, the Laurentian rocks are again seen, and are here fine-grained, gray mica-gneiss, cut by large masses of red pegmatite. Dip N. 55° W. < 40°.

On the summit and side of the hill in rear of the last exposure, the rock is a fine-grained, dark mica-schist, interbanded with coarse-grained pink mica-gneiss. Dip N. 75° W. < 10°-40°. On the north bank at the Head-of-tide Rapid, medium-grained pink mica-gneiss is met with. Dip S. 35° E. < 40°. Below this there appears to be only patches of the Cambrian rocks on the tops of the hills on the north side of the valley, and these soon disappear.

From five miles below the rapid, there is an almost continuous exposure along the south shore for nearly four miles. Along the upper part the rock is largely fine-grained, light-gray mica-gneiss. Dip S. 75° E. < 40°. A mile below, a section of 400 feet of banded, light and dark-coloured mica-schists is seen, along with

thin bands of dark-green, hornblende-schist. Dip S. 65° E. < 10°-30°. Some of the dark micaceous bands are full of small, dark-red garnets.

Similar schistose rocks, cut by large veins of pegmatite, appear on the high rocky islands, above the Hudson's Bay post. Immediately behind the post is fine-grained, gray and light-pink mica-gneiss, cut by large dykes of pegmatite. Strike N. 45° E. Similar rocks now bound the river on both sides to its mouth, and they all appear to belong to the bedded series of dark gneisses, except the pegmatites, which may represent dykes from some irruptive masses in the vicinity, not seen along the river.

About George River, the country is high and rocky, and near the Hudson's Bay post the rocks are contorted, gray mica-gneiss, cut by fine to coarse-grained red hornblende-granites. The high country eastward of the Hudson's Bay post is mostly bare rock, and shows gray and pink granite-gneiss, cut by large masses of red hornblende-granite.

Near Port Burwell, the rock is a highly contorted, fine to medium-grained, red hornblende-gneiss cut by large dykes of dark-green diabase.

LOWER HAMILTON RIVER

The first rock seen in place along the Lower Hamilton River, is at the Musk-rat Falls, where the river passes over a number of ledges of dark grayish-green, diorite-gneiss,* along with medium-grained, light-gray and pink mica, and mica-hornblende gneiss. These rocks are greatly contorted along their strike, which appears to be about N. 80° E. About five miles above the falls, a rocky spur projects from the south wall of the valley, giving an exposure a quarter of a mile long on the bank of the river, where contorted, medium-grained, pink and gray mica-gneisses and mica-hornblende-gneisses are seen.

On the north shore at Sandy-banks Rapid, there is a low cliff of coarse, light-red sandstone along with bands of fine conglomerate of irregular thickness and of Cambrian age. No other exposures are met with until the second bend of the Horse-shoe Rapid is reached, where there is a high cliff of fine-grained, dark-gray mica-gneiss with coarse, light-gray and pink augen-mica-gneiss. Dip S. 65° E. <70°.

Along the south shore of the river, from here to the mouth of the Minipi River, there is an almost continuous exposure of gneiss and granite, which could not be examined, owing to the river being open along this part, and to the impossibility of travel on the ice along that shore. Immediately above the Minipi River, there is a large exposure of dark-red hornblende-granite, with gray and pink mica-hornblende-gneisses and mica-gneisses. Dip S. 75° E. < 50°.

Five miles above the Minipi River, a large dyke of very coarse-grained pyroxenite† crosses the valley and narrows the river-channel to less than one hundred yards, with an island on the south side. On this island the rock is well exposed. It has a brownish colour, and is much rotted on the surface, where it is broken into great rounded masses. It is formed of a jumble of large crystals of rhombic pyroxene and holds a good deal of black mica in small scales. The direction of the dyke is S. 5° E., and it exceeds seventy feet in width.

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* No. 11, Appendix V. † No. 13, Appendix V.

No rock is seen in place in the river-valley for thirty-five miles above this dyke, and until the valley again becomes quite narrow about three miles above Squirrel River. But an examination of scattered angular blocks shows that the underlying rocks are largely mica-gneisses. Above this, up to Lake Winokapau, exposures are frequently met with on both sides of the river. The first is on the north side and shows a band of coarsely crystalline limestone, enclosed in coarse, highly felspathic augen-gneiss, associated with finer gray mica-gneiss. The limestone band is very irregular and varies from one to four feet in thickness only. In colour it ranges from pure white to a beautiful cobalt-blue and contains no associated minerals. Strike N. 75° E. The next exposure examined was on the south shore, three miles higher up, where the rock was found to be medium to fine, dark and light-gray mica-gneiss, along with apparently broken dykes of dark-green schistose hornblende. Strike N. 35° E.

A mile above the last, medium-grained, gray and pink augen-mica-gneiss was seen, together with fine-grained mica-gneiss, in broken bands. Strike N. 35° E. The orthoclase of the augen-gneiss has often a beautiful pearly lustre.

From here to Lake Winokapau, all the rocks met with were coarse, highly felspathic augen-mica-gneiss, varying in colour with the felspar, from white through yellow and pink to red. At the entrance of the lake the rocky walls rise 1,000 feet sheer, and huge angular blocks, fallen from above, are piled up at the base of the cliffs. On the surface of one of these large blocks is a beautiful example of the secondary crystallization of hornblende, which is nearly always present in small quantities in these rocks. The needle-like crystals vary from one-tenth to one-fortieth of an inch in diameter, and from a half to two inches in length; they are arranged so as to radiate from centres, thus forming dark-green stars.

The next exposures of rock, on the north shore of Lake Winokapau, twelve miles above its outlet, are schistose to medium-coarse, pink mica-gneiss. Strike N. 80° E. Exposures of mica-gneiss and mica-hornblende-gneiss continue for three miles along this shore, and these are cut by a dyke of dark-brown, coarse-grained pyroxenite similar to that already described. This dyke is more than one hundred feet wide. On the south side, sixteen miles above the outlet, and for four miles beyond its first appearance, the shore is high and rocky. The rock is mostly gray, fine to medium-grained mica-gneiss, cut by small veins of white pegmatite. Dip N. 10° W. $< 45°$.

The north shore, for three miles below the lower island, at the head of the lake, rises in perpendicular cliffs of contorted, micaceous gneisses mostly pink in colour. There appear to be two series of rocks represented, the most abundant being a coarse augen-gneiss or granite, which in places holds large, almost perfectly developed crystals of orthoclase. The other is made up of fine to medium-grained mica-gneiss, sometimes schistose, and probably an altered clastic rock; whereas the first series has every appearance of an igneous origin, and encloses broken bands of the schistose rock. At the small point on the north side, opposite the lower island, there is a large dyke of very coarse, red pegmatite, formed of large crystals of red orthoclase (9 x 12 inches), and holding much brown mica in crystals, up to four inches in diameter. Masses of translucent quartz in the pegmatite hold large crystals of black hornblende. At the bend one mile below the mouth of the Metchin River, there is a low cliff of fine-grained mica-gneiss, the

dip being N. 60° E. 20°-50°. Opposite the mouth of this river, dark-gray mica-gneiss is seen holding large quantities of dark-red garnets; these are mostly small, but some crystals are half an inch in diameter. Dip S. 80° W. < 40°.

No rock is now seen for six miles, to the next sharp bend of the valley to the northward. Here, on the east side, are two or three small exposures of fine-grained gray and pink mica-gneiss. Dip S. 20° W. At the upper end of the bend and on the opposite side of the valley, a prominent hill rises vertically from the water. The rock here is a dark-green, medium-grained quartz-diorite, made up chiefly of dark-green hornblende, with irregular spots of plagioclase and a small amount of quartz. The relation of this rock to the mica-gneisses, which again outcrop on the east side above the bend, is unknown.

The valley from here is free from rock for sixteen miles, to where a point projecting from the north shore, shows highly contorted, mica-gneisses, associated with red hornblende-mica-gneiss. Strike E. to S. Large, angular blocks fallen from the cliff, opposite the mouth of Portage River, are all composed of mica-gneiss.

The next exposure is one mile above the Big Hill Portage, where dark-red hornblende-gneiss is seen. Rock in place is again seen in the river bed at Disaster Rapid, six miles above the portage, and from here to the mouth of Bowdoin Canyon, exposures are of frequent occurrence. Only the north bank of the river was examined owing to the stream being open.

At Disaster Rapid, the rock is a medium-grained, light and dark gray and pink mica-gneiss. Strike N. 80° E. One mile above, the same rocks were seen with highly felspathic, pink bands. This is followed, half a mile above, by an exposure, a quarter mile long, of red mica-gneiss and mica- hornblende-gneiss, in which the hornblende is much decomposed. These rocks are distinct from the banded mica-gneisses, and are associated with coarse augen-gneiss. A quarter of a mile above, the augen-gneiss is found along with broken bands of fine-grained mica-gneiss. Dip S. 60° W. < 40°.

These are followed, two miles beyond, by light-gray mica-gneisses, cut by broken bands of dark hornblende-schist, that are apparently formed from ancient diorite dykes. Along with these gneisses, and seemingly interbanded with them, are gray hornblende-gneisses and a very felspathic, pink hornblende-gneiss. Strike S. 5° W. The next exposure is half a mile above, and consists of medium-grained, dark and light gray mica-hornblende-augen-gneiss, with a few bands of pink hornblende-gneiss A short distance above the last, coarse hornblende-mica-gneiss and hornblende-augen-gneiss are again seen, not well foliated. Strike S. 65° E. This rock is more basic than any yet passed, and has the characters of an intrusive mass cutting or displacing the banded mica-gneiss.

No exposure is now met with for three miles, or to within a half mile of the mouth of the canyon, where a medium-grained schistose hornblende-gneiss is found, associated with a dark-red, compact hornblende-gneiss, holding very little quartz, as well as similar bands with both hornblende and mica. These rocks are highly felspathic and are very brittle, splitting along several jointage-planes. They have been greatly scattered and have been re-cemented by veins of chlorite and serpentine. Dip S. 60° E. < 40°-80°. The Bodwoin Canyon, for the greater part of its length, is cut out of this kind of rock, and its shattered condition and friable nature must have greatly aided the erosive action of the water.

At the Grand Falls the rock forming the walls of the basin and the canyon to below the first bend, is a coarse-grained augen-mica-gneiss. Strike S. 50° W. The foliation planes dip at a high angle, but the rock splits up into great blocks along several planes, one of which is nearly horizontal, and there appear to be two other principal planes, one running nearly east and the other south-west. The direction of these principal lines of jointage corresponds to and probably determined those of the reaches of the canyon immediately below the falls. Similar rocks, above the falls, are cut by bands of coarse hornblende-mica-augen-gneiss, and both are cut by large dykes of dark-green, medium-grained diorite.

UPPER HAMILTON RIVER

One mile above the falls, these rocks are exposed along the shore for a quarter of a mile, and here they appear to change gradually into mica-schists and mica-hornblende-schists by the reduction in amount of felspar.* Several bands of dark-green hornblende-schist are seen interbanded with the gray schists, but are found on close examination to cut the latter, and are in all probability squeezed diorite dykes. On the east bank, one mile farther up stream, is a very felspathic, red gneiss, with thin partings of mica, and at times chlorite; this rock is interbanded with ordinary, gray mica-schists. Dip S. 10° W. $<70°$. On the islands, at the outlet of Jacopie Lake, two miles and a half above the last exposure, are large masses of unstratified uralitic gabbro† enclosing broken bands of mica-gneiss.

On another island, half a mile eastward of the outlet, bluish-gray augen-mica-hornblende-gneiss is seen; strike E. The same rock was also seen, on the low hills, along the south-east shore of the lake.

The rocks underlying the portage route past the Grand Falls appear to be coarse augen-mica-gneisses and mica-hornblende-gneisses, cut by large masses of uralitic gabbro, which, owing to its superior hardness and weathering qualities, now rise as rounded hills from 100 to 500 feet above the general level of the surrounding country. Four of these hills were ascended, and each was found to be composed of medium-grained gabbro, in some places very felspathic. There are also several exposures of gabbro seen on the islands of Jacopie Lake. The rock varies from fine to coarse-grained, and often holds considerable mica. At the entrance to the narrow east channel at the head of the lake, thin bands of coarse-grained, red hornblende-granite are met with, cutting the gabbro.

A small exposure of medium-grained, gray and pink hornblende-granite-gneiss outcrops on the east bank nearly two miles above the head of the channel. This rock carries much bluish-white translucent quartz, and is somewhat contorted, with a general strike S. 60° W.

No rock was seen in place for several miles until the small hill on the west side near the outlet of Flour Lake was examined, where the rock was found to be dark-gray mica-gneiss.

The islands of Flour Lake appear to be all formed of hummocks of fine to very coarse-grained, dark-brownish and greenish gabbro, made up largely of coarsely crystalline plagioclase, with irregular masses of augite or hornblende, hypersthene and mica, and also holding small grains of ilmenite. The coarser masses are bad-

* No. 19, Appendix V. † No. 12, Appendix V.

ly weathered and decayed on the surface, the rock resembling a typical anorthosite, while the finer-grained rocks are similar to the gabbros of Jacopie Lake and Lookout Mountain, and all may have come from the same or nearly contemporaneous outbursts of igneous matter.

At the head of Flour Lake coarse-grained, red, very felspathic hornblende-gneiss crosses the river, with its strike N. 50° W. Similar rock, only finer grained, is met with three miles up the river, where it is much contorted and encloses masses of hornblende-schist. Beyond, no rocks are seen in place along the south channel of the river for ten miles to Sandgirt Lake. There are great numbers of angular blocks of hornblende-granite scattered everywhere along this interval, and this rock probably underlies the drift here. At the outlet of Sandgirt Lake there is a small island of coarse, red hornblende-granite, cut by small veins of finer-grained, similar rock.

There are very few rock exposures about the shores or on the islands of Sandgirt Lake, but on two small islands near the middle of the lake are huge angular blocks of light-gray and pink mica-gneiss, much contorted and holding inclusions and broken bands of hornblende-schist. On an island at the northern outlet of the lake is a ledge of fine-grained red hornblende-mica-gneiss; dip N. $< 45°$.

ASHUANIPI BRANCH

The first exposures along the shores of the Ashuanipi Branch occur at the foot of the hill on the north side, four miles above Sandgirt Lake. The rock on the top of the hill is an unfoliated gabbro like that of Lookout Mountain, which changes to a gabbro-gneiss on the eastern flank. The same rock comes out on the river at the southwest end of the hill, and here, as also on an island immediately above, shows obscure foliation striking S. 40° E. There is much broken fine-grained red hornblende-gneiss along the southern flank of the hill, which appears to have been baked by the intrusion of the gabbro and is very brittle.

After this no rock in place is seen along the river for ten miles, when a long exposure occurs on the north bank, consisting of evenly banded light-gray and greenish sericite and talc-schists, with a few narrow bands of a fine-grained slaty, altered hornblende-rock holding pyrites; dip N. 65° E. $< 25°$-$60°$.

These rocks closely resemble those met with on the Koksoak River immediately after leaving the Cambrian area, and those here noted are again immediately followed by rocks of the Cambrian series to the westward. This is probably only a coincidence, and does not show that the Cambrian has an altered series attached to its base, as the Cambrian strata found a few miles farther up-stream are of detrital sand-rock and bear no resemblance to the schists, which resemble the Huronian lithologically.

At a point a short distance above the exposure of schist, a portion of a large dyke is seen, made up of very fine-grained dark-green altered hornblende and plagioclase, with a considerable amount of pyrites disseminated through it.

In the small lake expansion, six miles above, the bedded sandstones of the Cambrian appear on several small low islands, and from here to the upper end of Menihek Lake the country passed through is underlain by rocks of this age. A description of these rocks is given farther on.

Along the river, above Menihek Lake, to the end of the exploration on the

Ashuanipi Branch, there is only one exposure of rock in place, and that is near the end of the survey, where dark pearly-gray hydromica-schists are found with thin layers of white orthoclase and quartz, associated with dark-greenish chloritic schists; dip S. 10° W. < 35°. Below this place, in the river-valley, to the Menihek lakes, large angular blocks of dark schist are met with frequently, and these rocks probably underlie the drift of this area. They resemble rocks of volcanic origin and are possibly plutonics of the same period as the Huronian rocks of the East Main River; they may be better correlated with these than with the Laurentian gneisses.

The small rounded hill at the end of the survey is formed from a mass of medium-grained dark-green diabase.

ROUTE TO LAKE MICHIKAMAU

At the northern outlet of Sandgirt Lake, medium-grained, red hornblende-mica-gneiss occurs on several small islands. Dip N. 60° E. < 45°. This rock is composed chiefly of red orthoclase and hornblende, and breaks up into angular fragments, along different jointage-planes, like similar rock at the outlet of Bodwoin Canyon. At the rapid, where the channel discharges into Lob-stick Lake, there is a coarse-grained, greenish-gray hornblende-mica-gneiss, holding small broken dykes now converted into hornblende-schist. At the foot of the rapid the rock is a well-banded, light-gray and pink mica-gneiss. Strike N. 10° W.

The geology of Lob-stick Lake and the country beyond, to the head of the eastern bay of Lake Michikamau, is very complicated, and would require much more study and examination to work it out than it was possible to give it on a hurried trip through the lakes. This area is remarkably free from drift, and in consequence the rocks are everywhere exposed along the shores, and on the myriads of small islands of the lakes. From the hasty examination made, it would appear that the route passes close to the contact of a great area of coarse-grained, red hornblende-granite, like that about Lake Nichicun, with an older series of foliated mica-gneisses and mica-hornblende-gneisses. The contact of these rocks was examined in a number of places, and everywhere the hornblende-granites cut the gneisses. The latter, near the contact are much contorted, and at the contact become darker and change from mica-gneiss to mica-hornblende-gneiss, from an admixture of hornblende, perhaps absorbed from the hornblende-granite. Both series are full of broken masses, or bands of hornblende-schist, the probable remains of old diorite dykes that cut the rocks previous to the final squeezing and folding, when they were broken up and changed to their present condition. All these rocks are cut by several large diabase dykes, which are undoubtedly of much later age.

MICHIKAMAU LAKE

At the head of the east bay of Lake Michikamau, the hornblende-granites give place to light-gray, talcose and hydromica-schists, holding small garnets, with partings of white orthoclase and quartz, closely resembling the rocks of the Ashuanipi Branch, at the contact between the Laurentian and Cambrian. Strike N. 25° W.

No exposures are seen along the shores of the east bay, or on the west side of

Lake Michikamau for eight miles northward, up to where low rounded bosses of anorthosite come out along shore and on the small islands fringing it. These rocks continue along this side of the lake for thirty miles, or up to within four miles of the north end. The rock is everywhere very constant in its physical characters. It is almost wholly formed of coarsely crystalline masses of dark-purple anorthosite, or labradorite, holding masses of dark brown hypersthene and ilmenite, and at times mica. The rock is badly weathered to a depth of several inches below the surface, and disintegrates, leaving rounded cores. The labradorite, where weathered, has a dark, greenish-brown colour. It is so coarse that cleavage faces six inches across are not uncommon.

The mass of dark-purple anorthosite includes large patches, or rather bands, of a lighter coloured and finer grained variety, due to the segregation of the almost white plagioclase from the darker.

The hypersthene is present in crystalline masses from one to eight inches in diameter. The ilmenite has no definite crystallization, but occurs as irregular masses, generally small, although sometimes measuring more than a foot through.

About four miles from the north end of the lake, the anorthosites give place to a coarse, red hornblende-granite, which occupies the shore for a couple of miles and then passes under the drift, at the head of the lake. The contact of the anorthosite and granite is concealed and their relations are consequently unknown.

The north end of the lake is low, and the shores are formed of sand and boulders; the eastern side is also low for twenty-two miles from the north end, to where a ridge of anorthosite hills projects into the lake, forming a prominent point and large high islands. From here, anorthosite is found on every point along the shore for nearly twenty miles. In physical characters this rock closely resembles that of the opposite side of the lake, except that the felspar has the peculiar opalescent character of labradorite, with a play of colours showing dark-blue, light-blue, green and bronze-yellow. Some of the crystals are six inches by eight inches, and at times the outline of the crystal and lines of growth are beautifully marked by the different colouring. The precious variety of the rock is not confined to veins or dykes, but includes the whole mass. Owing to the badly weathered condition of the rock, good specimens could not be obtained above water without blasting. The beauty of the rock was best seen along the shore below the water-level, where the surface protected by the water was fresher and had been smoothed and polished by glacier-ice. Here, looking down through the clear water, the play of colour from the numerous large crystal faces is most beautiful.

About eight miles north of the outlet of the lake, hornblende-granite replaces the anorthosite and again the contact is concealed. Exposures of granite are frequently met with up to the high hill just north of the discharge. This hill is granite with patches of bluish-gray Cambrian limestone. At the base of the hill is a large exposure of pink and gray hornblende-granite, with an obscure foliation in the direction N. 30° W. From here, for fourteen miles, to the south end of the lake, the eastern shore is low and formed of sandy drift, strewn with large angular blocks of Cambrian sandstone. The south end of the lake is shallow and filled with small rocky islands of coarse, red hornblende-granite, that are often thickly strewn with huge, angular blocks of Cambrian limestones and sandstones. The

west shore of the lake is also low and drift-covered from the south end to the entrance of the eastern bay.

HURONIAN

GENERAL REMARKS

The rocks included under this system belong both to the sedimentary and to the eruptive classes. The sedimentary rocks are represented by beds of arkose, conglomerate, limestone, shale and slate, sandstone, chert, quartzite and mica-schist. The eruptive rocks, which were in part, at least, contemporaneous in formation with the sedimentary series, are chiefly basic in composition, and at present are chiefly represented by schists, characterized by chlorite, epidote, altered hornblende, hornblende, sericite and hydromica. There are also massive diabases and diorites; all the rocks are more or less decomposed. The acidic rocks, associated with the above, are mica-granites, mica-hornblende-granites, and hornblende-granites, and perhaps quartz-porphyry. The rocks of the various areas found in Labrador bear a more or less close resemblance to the rocks or other Huronian areas in Canada described by Logan, Bell, Lawson and Barlow in former reports of the Geological Survey.

Two large areas of Huronian rocks, besides a number of smaller ones, have so far been met with in the Labrador Peninsula. The large areas appear to be confined to the western half of the peninsula, with only a few minor ones in the other half. The largest area is found along the East Main River, where it extends from a few miles above the mouth of the river inland for more than one hundred and sixty miles. In this distance the river generally flows closely parallel to the strike of the rocks. In three places granite-gneiss areas are met with along the stream, where they replace the Huronian rocks. It is impossible to state whether the areas separated by these granite-gneisses are all connected, or form separate wide bands. If, as is probable, they are connected, they constitute a very wide belt, known to be more than twenty miles across the strike where the river cuts it diagonally.

The clastic rocks are represented by a mica-schist, which always contains grains of white felspar and at times of quartz. In a number of places these schists change to a conglomerate from the inclusion of rounded pebbles of granite and syenite. The conglomerates are local, and are found in long lenticular masses thinning out at the ends along the strike. At Conglomerate Gorge, several of the lenticular masses of conglomerate are found overlapping each other and separated by bands of the mica-schist. The total thickness of the conglomerate here, including the separating bands of schist, exceeds 400 feet. In other places the conglomerates are not so well developed, and are rarely 100 feet through in the thickest beds. The mica-schists have not been microscopically examined, but macroscopically they are seen to be generally quite distinct from the more highly crystalline Laurentian mica-gneisses, although at times they seem to shade into them. The conglomerates are usually fine, but sometimes hold fragments several tons in weight. All the fragments are well rounded, and in many places they appear to have been flattened and drawn out in the direction of the foliation. By far the

greater number of the boulders are composed of fine-textured granite and syenite, with dark basic eruptives less abundantly represented.

In conjunction with a great mass of basic eruptives, a small area of agglomerate was found on the upper part of the river, with the contained fragments composed chiefly of quartzite, jasper, and diorite, altogether different from the conglomerates described above. The matrix is a dark greenish-gray chloritic schist, and is probably derived from altered volcanic ash.

The eruptives of this area appear to be confined to certain places, where they cut the mica-schists or are interbanded with them. The chlorite-schists, hydromica-schists and some of the hornblende-schists are often interbanded with the mica-schist, and seem to have been formed as ash beds along with them. As has been already stated, bands of these supposed altered ash-rocks were found in association with the garnet mica-gneisses and close to the crystalline limestones of the Laurentian along the Mouchalagan River, and other hornblende-schists are clearly altered dykes, that cut the beds of mica-schist, and probably proceeded from the masses of diabase and diorite that represent the cores of the volcanic eruptions.

The granites are evidently of later age, for they cut all members of the Huronian. The nature of the contact and other details are described further on in the report.

The other important area of Huronian rocks occupies the basins of the large lakes south-west of Lake Mistassini. To the north-east it runs under the Cambrian limestones, while its south-western limit is unknown, but probably extends for a considerable distance, possibly connecting with the great area of similar rocks known to run eastward beyond the head-waters of the Ottawa River.

In this area the clastic rocks are much better represented than along the East Main River. There is a great thickness of arkose material and agglomerates, with a matrix of chlorite-schist, that is likely an altered volcanic material. The agglomerates are associated with bands of red felsitic schists, formed from the finer detritus of the coarse-textured granitic material that affords the boulders of the agglomerate. The other bedded rock are quartzite and limestone, the latter being only in thin cherty bands.

The eruptives are massive diabases and diorites, generally highly altered and chlorite, and in one place changed to serpentine. The volcanic rocks, besides the agglomerates, form thick beds of chloritic and epidotic schists.

A mass of later granite is intruded into the western part of this area, and occupies the greater part of the basin of Lake Obatagoman and the south-western part of Lake Chibougamau. This area was first examined by Mr. Jas. Richardson in 1870, and only a few changes have been made in his delineation of it.*

Smaller areas of Huronian schist occur on the upper East Main River, in the vicinity of the Sharp Rock Portage and along the small lakes leading from that stream to the head-waters of the Big River.

Hydromica- and hornblende-schists occur along the Koksoak River, for some distance below the last outcrop of Cambrian rock, where they are associated with pegmatites. These rocks may be Huronian. On the upper waters of the Ashuanipi Branch of the Hamilton River, there is a large area, in part or wholly underlain by Huronian schists, but as the outcrops are very few, little is known of the

* Report of Progress, Geol. Surv. Can., 1870-71, pp. 292-294.

extent and kind of rocks occurring here. A small area of similar rock is met with on the Attikonak Branch at Gabbro Lake, and the strike is such as to lead to the belief that this is an extension of the area just mentioned. Below Birch Lake and at the head of the southeast bay of Michikamau Lake, there is a narrow band of talc-schists, hydromica-schists and chlorite-schists, which may be Huronian.

Along the east coast of Hudson Bay, areas of Huronian rocks have been described by Dr. R. Bell,** as occurring at Cape Hope and Paint Hills, between the East Main and Big rivers. The rocks are hornblendic, chloritic and epidotic schists, together with mica-schist conglomerates like those found on the East Main River. Farther northward, at Richmond Gulf, there are some thin-bedded quartzites, that underlie unconformably the Cambrian rocks of that region, and are supposed by Dr. Bell to be possibly of Huronian age. On the Great Whale River, a small area of Huronian schists was met with by the writer.†

The large quantity of drift, of undoubted Huronian origin, found about Lake Mistassini, leads to the belief that an area of these rocks will be found to the northeast of that lake. Dark-green schists are reported as occurring in the mountains about the heads of the Outardes and Manicouagan rivers.

Along the Atlantic coast, Dr. Bell‡ reports Huronian rocks about the mouth of Nachvak Bay, and about the Moravian Mission station Ramah, in the next bay south of Nachvak.

No other areas of these rocks are known in the Labrador Peninsula, but there is yet every probability that other bands will be found when the country is more fully explored. The occurrence of gold, copper, nickel and pyrites in rocks of this age in other parts of Canada, render the tracing of these areas of great importance.

LOWER EAST MAIN RIVER

Twelve miles above the mouth of the East Main River, the Laurentian gneisses and hornblende-granites found on the islands about the mouth of the river, give place to a dark-gray, fine-grained mica-gneiss, often schistose. The mica is arranged in thin layers of small plates, separated from one another by very fine grains of white orthoclase and quartz. This rock closely resembles the rock met with farther up-stream, where they form a conglomerate holding large boulders of granite and other Laurentian rocks. The mica-schists and fine mica-gneisses often have a porphyritic appearance on weathered surfaces, from the inclusion of large grains of felspar and quartz that are evidently only the coarser particles of the detrital material from which the beds were originally formed. Subsequent folding and pressure have probably changed these sedimentary rocks into their present condition. From their field relations to the Laurentian rocks and also to the irruptive members of the Huronian, there is little doubt that these rocks are the representatives of the sedimentary series of the Huronian, and in places they closely resemble the rocks described by Lawson in the region about Rainy Lake, referred by him there to the Couchiching series, which he supposed

** Report of Progress, Geol. Surv. Can. 1877-78, pp. 10 c., 11 c., 15 c.
† Annual Report, Geol. Surv. Can., vol. III (N.S.) p. 54 J.
‡ Report of Progress, Geol. Surv. Can., 1882-84, p. 15 DD.

to be unconformably below his Keewatin series.* In our hurried examination along the East Main River, no such unconformity was observed. These mica-schists and gneisses, in places contain hornblende along with the mica, and thus grade into a hornblende-schist which is quite distinct from the hornblende-schists produced from eruptive rocks, in that the hornblende is in thin laminæ, separated by the fine-grained white felspar and quartz similar to that in the mica-schists. At the first place where they are seen, they form low outcrops along the north shore of the river for a mile. Some of the bands are somewhat hornblendic. Strike N. 75° E.

At the head-of-tide, similar mica-schists are seen, cut by large irregular dykes of white pegmatite. Strike E.

Along Basil Gorge, six miles above tide-water, these rocks are again found, associated with large masses of hornblende and chlorite-schists. At the foot of the gorge, the bedded schists are cut by an irregular vein of light-pink, finely crystalline limestone, holding much green hornblende and some sericite. The vein varies in width from eight inches to eight feet and cuts diagonally across the bedding, with an obscure gneissic structure developed in it parallel to the bedding of the surrounding schists, which dip S. 75° E. $< 80°$. As the gorge is ascended, the mica-schists are found to be cut by large masses of fine-grained, dark-green, altered hornblende-schists and chlorite-schists. Owing to the perpendicular walls of the gorge no detailed examination could be made of the relations of these rocks, but they appear to be similar to those found farther up the stream, and described later on.

From the head of Basil Gorge to near the Talking Falls, nine miles above, there is only one small outcrop of mica-schist, on the point between the forks of the river, two miles above the gorge. Everywhere else the river has high steep banks of clay that overlie and conceal the rock beneath. At and below the Talking Falls, a medium-grained gray mica-hornblende-granite is seen, with obscure foliation but with every appearance of being an irruptive rock. The mica is much more abundant than the hornblende, and the whole is likely a post-Huronian intrusion, from which great dykes of white pegmatite run off and cut the mica-schists, as seen farther up-stream. At the sharp bend a mile above the falls, and for a mile from there to the foot of a long rapid, very coarse-grained, light-gray mica-hornblende-granite is met with on the islands and shores. From the foot of the rapid to its head, for nearly two miles, the northern shore is formed of rock. Along the lower portion of this stretch the dark mica-schists are seen to be cut by great dykes of white pegmatite. This pegmatite is exceedingly coarse, and, embedded in the white orthoclase, are large masses of that mineral having a light-bluish colour. There are also large plates of light-green muscovite scattered through the mass, but they are generally too much crushed and broken to be of value. Quartz in large masses is also present, along with large crystals of black tourmaline. Near the dykes the mica-schists are in many places much disturbed and twisted. As the stream is ascended, the dykes, which run generally parallel to the bedding, become smaller and fewer.

About half-way up the rapid, a large pegmatite dyke cuts off great angular masses of the mica-schist, which here dips N. 65° W. $< 60°$. Near the contact

* Annual Report Geol. Surv. Can., Vol. III, (N. S.), pp. 1—196 F.

the schist appears to be more siliceous and approaches an impure quartzite. Half a mile from the head of the rapid, the schist is found to include several beds of fine conglomerate from nine to fifteen inches thick. The pebbles are all derived from medium to fine-grained red and gray granite. At the head of the rapid the rock is a rusty mica-schist, charged with partly decomposed pyrites and cut by thin dykes of fine-grained hornblende-schist that run almost parallel to the bedding of the mica-schists.

At the Island Fall, two miles farther up the stream, the mica-schists again outcrop, striking N. 85° E. For six miles above, the banks of the river are cut out of stratified clays and sands, and no rock is seen in place up to the foot of the rapids that extend for three miles below Clouston Gorge. Along both shores, up to the foot of the gorge, mica-schists are seen at frequent intervals rising from beneath the stratified drift. There is a continuous exposure of rock from the head of this gorge to the rapids below it. The mica-schists are now associated with irruptives in the form of large masses of medium to fine-textured diorite of a dark-green colour. In some of the coarser grained rock there is a beautiful secondary arrangement of hornblende in small radiating masses of crystals. These diorites seem to be intimately connected with bands of dark-green altered hornblende-schists and chlorite-schists, which appear to have originally formed dykes cutting the bedded rocks now represented by the mica-schists, their present schistose structure being due to subsequent pressure. This would also account for the breaking and apparent inclusion of fragments of these chloritic-schists in the mica-gneisses. The large masses of diorite cut the mica-schists and gneisses. The latter rocks, near the contacts with the diorites, are apparently more highly altered than elsewhere, as they then occur either as true mica-schists or as crystalline, fine-grained mica-gneiss. The strike is also disturbed, and all the phenomena of the contact point to an intrusion of the diorites and their associated dykes into the bedded series, previous to the final folding of the latter.

Above Clouston Gorge the banks of the river again become low and are formed of stratified drift up to within a short distance of the next rocky defile, called Conglomerate Gorge, twenty-two miles farther up-stream. The only rock seen between these places is a low boss on the south shore, eight miles above the lower gorge. This low hill is formed of medium-grained, dark-green diabase, and is probably part of a great dyke similar to others of a like nature that are found everywhere throughout Labrador, where they cut the rocks of all the formations, including the Cambrian. This mass is over one hundred yards wide, but as its borders are not seen, its total width is unknown. About a mile below the mouth of Conglomerate Gorge, there is a small exposure of medium-grained mica-hornblende-gneiss, that has the aspect of a Laurentian rock, but the exposure is so small that it is hardly possible to say what the age of this rock may be.

Conglomerate Gorge is three miles long, and the channel and shores are rocky throughout, but as the strike is almost parallel to the direction of the gorge, no great thickness of strata is exposed. At the lower end of the gorge, mica-schist is seen interbanded with green chlorite-schists, which appear to be either old dykes or altered pyroclastic beds. Both series are cut by a dyke of medium-grained, dark-green diabase, holding a considerable amount of pyrites in small grains. The dyke is about one hundred feet wide and its direction is N. 10° W. The schists on the east side of the dyke strike N. 50° E., while those on the west

side strike N. 30° E., showing a disturbance due to the intrusion. The wall-rock is also considerably altered near the dyke. For half a mile between the dyke and the lower fall, the mica-schists are highly charged with pyrites, and are separated from the green chlorite-schists by fifty feet of light yellow slate.

Between the chutes the rock is all mica-schist holding small lenticular masses of a coarse conglomerate. A small dyke of fine-textured, dark-green diabase, nine inches wide, was observed here, being probably a branch from the main dyke already noted.

From the upper chute to the head of the gorge, a distance of more than a mile and a half, only mica-schist and conglomerate are seen. The conglomerate occurs, as before, in heavy lenticular beds, and the total thickness of these must be at least 400 feet. The fragments in the conglomerate range from large pebbles to boulders two feet in diameter. Fully nine-tenths of them consist of a medium-grained, pink granite that closely resembles the rock of a granite area passed through farther up the river. The remainder of the pebbles are made up of a fine-grained, rusty-weathering diorite, light-bluish quartzite, and medium-grained gray mica-hornblende-gneiss, the last being very rare. Above Conglomerate Gorge, the river makes a sharp reversed curve in the next three miles, and the several small rock exposures along it are of mica-schist, with an occasional bed of conglomerate. At the upper end of the bend there is a small chute where the last conglomerate bands are seen. The matrix is mica-schist and is at times charged with pyrites, and some bands of the schist hold small, dark-red garnets.

Mica-schist outcrops frequently along both shores of the river for the next twenty-five miles, up to the mouth of the Wabamisk River, but, as the strike of the rocks is roughly parallel to the direction of the river, only a comparatively small cross-section is displayed. Five miles above the last conglomerate mentioned, a dyke of dark-green diabase of medium texture and holding masses of light-green huronite and a large amount of pyrites, crosses the bedding of the schists. This dyke is seventy-five feet wide, and its direction is N. 75° W., or nearly parallel to the other large dyke seen at Conglomerate Gorge. Several small dykes of the same kind occur a short distance farther down stream, and differ from the larger only in that their texture is finer.

At the mouth of the Wabamisk River, the bedded series of mica-schists is replaced by hornblende-schists, chlorite-schists and altered diorites. On the north bank half a mile above this branch, the chlorite-schists are highly charged with pyrites, which for 100 feet along the strike is found in an almost pure bed ten feet thick. The surface of this ore is much oxidized and changed to brown limonite. On analysis only traces of gold were found in the pyrites.

Frequent exposures of green chorite- and sericite-schists are met with on the small islands and shores for the next two miles up the stream, where there is a contact between the altered hornblende-schists and a fine-grained, schistose mica-gneiss. The hornblende-schist cuts it sharply, and is itself somewhat altered for several inches from the contact. The hornblende-schist encloses fragments of the gneiss that at times have their foliation transverse to that of the schists. Here also is seen a soft, green steatite rock, holding fragments of boulders of dark green, altered hornblende-gneiss also cut by the green hornblende-schists.

At the mouth of the Aquatako River, green chlorite-schists are again seen, charged with pyrites and cut by a vein of calcite nine inches wide. For the next

ten miles up-stream, frequent exposures of dark-green altered hornblendic and chloritic schists occur on the shores and islands, the squeezed products of altered diabase, diorite and quartz-porphyry.* Along the upper three miles of this stretch, the exposures of schist are mixed with others of fine- to medium-grained, white mica-hornblende-gneiss. Where the contact between these rocks is seen, the green schists cut the gneisses, and often inclose masses of them, showing that the schists have been eruptive rocks in the gneisses. These gneisses† bear a close resemblance to the majority of the boulders found in the conglomerates already described, and may represent the source from which they have been derived. They now occur along the river banks for twenty miles, with a total absence of the hornblende-schists, until the lower end of the Great Bend is passed, when the schists and associated diorite rock are again met with. The total width of the band here, including the inclosed bands and masses of gneiss, is slightly less than one mile across the strike, which runs N. 70° E.

Below the whirlpool, the bands of fine-grained hornblende-schist are thin, and the hornblende-granite predominates. At the whirlpool there is a thick band of dark-green, fine-grained, uralitic gabbro,‡ which abuts against a light-pink mica-hornblende gneiss of medium-texture and this latter is interbanded with green hornblende-schists. A close examination proves that the latter are altered dykes, probably connected with the gabbro masses in the vicinity. These dykes, as a rule, run parallel to the foliation of the gneiss, but are found in places to cross it, and also to branch, and again unite, thus inclosing large masses of the gneiss. The foliation of the dykes is constant in direction with that of the gneiss, and when the dyke is not parallel with the gneiss, the foliation is found to be transverse to that of the dyke.

Near the contact the mica-hornblende-gneiss has a hardened appearance, its texture is finer, and numerous small cracks are filled with light green chlorite. The geology here is further complicated by the presence of a number of small dykes of dark-green, fine-textured diabase, which cut all the other rocks. These small dykes show the faulted condition of the rocks they pass through, as at every few feet along their course they are broken, with a throw of six to twelve inches at each fault.

Above the whirlpool, for a mile along the south shore, the rocks seen are all thin-banded, fine-grained, light-grey mica-schists and dark-green hornblende-schists. Strike N. 85° E.

The Laurentian gneisses again come in above, and the Huronian rocks are not met with along the river for twenty-one miles, up to a point two miles below the mouth of the Broken Paddle River, where the Huronian irruptives are again found cutting the Laurentian gneisses.

This area of Huronian extends along the river for twelve miles, but as the strike is nearly parallel to the course of the stream, the breadth of the band (if the strike can be taken to represent anything but foliation induced by pressure) is not greater than three miles. The rocks here are all, or nearly all, of volcanic and igneous origin, and they are so intricately associated that little information could be obtained in regard to their relative positions in the necessarily hurried examin-

* See Nos. 5, 25, 30, Appendix V.
† See No. 21, Appendix V.
‡ See No. 2, Appendix V

ations made. The irruptive rocks have to a great extent been rendered schistose by pressure and have been much altered, so that diorites and diabase look alike and are hardly distinguishable under the microscope. From the field relations there appears to have been an older intrusion of diorite, together with volcanic outbursts, resulting in the formation of tuffaceous agglomerates and shales. These in turn appear to have been cut by masses of gabbro and their accompanying diabase dykes. The gabbro masses and dykes have a much older appearance and are more decomposed than the heavy dykes of diabase met with farther down the river, probably belonging to an older period than these.

The first contact with the gneisses is on the north shore, two miles below the mouth of the Broken Paddle River, where the rock is probably the remains of a great diorite dyke, now altered to a dark-green amphibolite, holding angular fragments of a fine-grained mica-gneiss, which is seen to be sharply cut on the west side. On a small island, just below the mouth of the river, five dykes of dark-green altered diabase or diorite cut the gneisses almost in the direction of the strike, which is here east. On the shore opposite the island, light-gray and pink mica-gneiss is seen, a good deal contorted. Strike S. 75* E. The next exposure is opposite the mouth of the small river, where the pink and gray mica-gneiss is in contact with a dark-green, coarsely crystalline diabase, holding crystals of light-green plagioclase. The diabase is fine-grained near the contact and abruptly cuts the gneiss, also entering cracks and irregularities in it.

No rocks are seen above for a mile and a half, to an island on the south side, where a light-gray, compact, altered diorite of fine texture, containing much disseminated pyrites in small grains, is associated with a compact dark-green, altered trap, and dark-green hornblende-schist. Above this island on the opposite shore, the altered diorite is seen sharply cutting the mica-gneiss, while a few small schistose bands of hornblende penetrate the gneisses along the strike and a larger dyke from the diorite cuts them transversely. Similar contacts are seen on both sides of the river in the next mile, after which the Laurentian gneisses do not appear.

These altered diorites and hornblende-schists continue for more than a mile, when, on the south shore, a band of agglomerate is encountered, which appears to be nearly 300 feet thick, including an intrusion of diorite fifty feet wide. This agglomerate in its western extension appears to pass into a schistose, basic, arkose material full of large rounded grains of quartz. The matrix of the agglomerate is a dark-green and grayish schist,* and the boulders and pebbles are all, or nearly all, well rounded, and flattened or pulled out parallel to the bedding or foliation. The largest boulders are fifteen inches long and twelve inches thick. The greater number are composed of gray quartzite, having at times a pinkish or green tinge. Along with these are a few boulders of dark-red jasper, and a light-green diabase. To the eastward the conglomerate also passes into grauwacke holding large grains of quartz.

For the next mile, up to a low chute, the rocks are massive altered diorite and chlorite-schists. Above the chute, there is a considerable thickness of mica-schist similar to the bedded rock associated with the irruptives, at the places already noted on the lower parts of the river. These mica-schists are associated with a

* See No. 28, Appendix V.

fine-grained, highly siliceous, dark-gray schist, that holds small pebbles of quartzite and fine-textured granite, and is probably a squeezed conglomerate. They are cut by bands of hornblende-schist, and there is a large band of altered diabase† on an island. A mile above the chute, dark green chlorite-schists and altered hornblende-schists are seen, containing narrow quartz-veins that hold small quantities of copper-pyrites.

For six miles above the last-mentioned exposure, there is a constant jumble of chlorite-, sericite- and altered hornblende-schists, along with massive altered eruptives,‡ and small areas of a dark-gray quartzite holding scales of mica, and perhaps representing the bedded series. The eastern contact between the Huronian and Laurentian rocks is not seen on the river, there being an interval of five miles between the upper exposure of the former and the next outcrop of gneiss.

The next area of hornblende-schists, hornblende mica and mica-schists is found between the Prosper and Ross gorges, over fifty miles farther up the stream. These rocks here form a belt less than a mile wide, and are cut by large masses of pink pegmatite. The schists are more gneissic and less decomposed than those previously noted, and there is an absence of the altered diorite and diabase masses commonly found with them. They probably represent only altered schistose dykes, due to the Huronian period, with perhaps some of the micaceous bands of that formation. Taken altogether, they have an older, more metamorphic appearance than any of the Huronian areas previously described, and until further evidence is forthcoming cannot well be separated from the general Laurentian mass.

CAMBRIAN*

The series of rocks classified as Cambrian, comprises beds of arkose rock, sandstone, chert, limestone, dolomite, felsitic shale, argillite, and argillaceous shale, together with gabbro, diabase, fine-grained decomposed traps and volcanic agglomerates. No acid eruptives, such as quartz-porphyry, were found.

The sedimentary deposits have a minimum thickness of about 2,500 feet, and may have a much greater thickness, which can be determined only by close study of the areas along the Koksoak and Hamilton rivers, where a series of step or overthrust faults cause frequent repetitions of the different members, rendering it exceedingly difficult to determine the total thickness of the measures by means of observations made along a couple of lines of hurried exploration.

The following section is a rough estimate of the succession and probable thickness of the sedimentary rocks along the Koksoak River in descending order:

	Feet
1. Rusty-weathering, black, micaceous shales	600
2. Dark-gray, ferruginous cherts	200
3. Dark-gray, ferruginous cherts, together with beds of jasper and magnetite	500

† See No. 31, Appendix V.

‡ See Nos. 10, 16, 17, Appendix V.

* On Map accompanying this report these rocks have been classified as Pre-Cambrian (Keweenawan-Animikie) in the light of further petrographic examination.

	Feet
4. Fine-grained, dark-gray, ferruginous chert, somewhat calcareous and blotched with siderite	150
5. Light-pink, very compact, brecciated limestone, often very siliceous	20
6. Light-green siliceous shales	30
7. Black, carbonaceous, graphitic shales	100
8. Massive, cherty, dark-blue dolomite	10
9. Pearly-green shales, with cherty dolomite beds, showing ripple marks	40
10. Coarse, gray sandstone	3
11. Greenish-gray, calcareous shale, with occasional bands (6 in. to 15 in.) of fine-grained, dark-blue dolomite, weathering yellow.....	30
12. Fragmental, violet-pink, calcareous chert	200
13. Red calcareous sandrock	200
14. Medium-grained red-sandstone, and thin beds of red felsitic shales	10
15. Bands of red and gray sandstone, separated by beds of red felsitic shales	425
	2,518

This section is constructed from several broken sections taken along the river. No. 15 rests unconformably upon Laurentian granite. No. 14 represents the lowest beds of another cliff-face, and perhaps may be the upper part of No. 15.

There is a break in the section between No. 11 and No. 12, with probably a few beds missing. From No. 4 to No. 11 the section is continuous, while the upper measures are added by estimation, from the various exposures seen along the river, and are only an approximation of the thickness of the iron-bearing cherts, shales and limestones.

On account of the great distances dividing the respective developments, it is impossible to correlate these rocks directly with those of Lake Superior or Newfoundland, which are supposed to represent the same geological period. The only rocks with which they closely agree are found along the east coast of Hudson Bay, which have been called by Dr. R. Bell,* the Manitounuck and Nastapoka groups. These he correlates with the Nipigon series, the equivalents of the Keweenawan of Lake Superior. From an examination of the various sections given by Dr. Bell, and a comparison of the hand specimens, there appears to be a closer agreement between the rocks of Hudson Bay and the Animikie formation of Lake Superior, which underlies the Keweenawan rocks.

The correlation of the rocks of Central Labrador with those of Newfoundland is difficult owing to the lack of specimens from the latter place. There appears to be considerable resemblance between the section above, and that given by Sir Wm. Logan,† of the rocks along the Labrador shore of the Strait of Belle Isle and the northern part of Newfoundland. The fossils found in these rocks are of lower Cambrian age. Unfortunately no fossils have been found in the supposed

* Report of Progress, Geol. Surv. Can., 1877-78, pp. 11c—20c.
† Geology of Canada, 1863, pp. 865-67.

Cambrian rocks of the interior of Labrador or those of Hudson Bay, and until such are found their precise age and equivalency can only be conjectured on lithological grounds.

Whatever their precise age may be, there must have been a great lapse of time between the deposition of the Huronian rocks and the main period of deformation and folding to which these, in common with the aggregation of rocks classed as Laurentian, were subjected, and the deposit of these later strata, which rest unconformably upon both of the older formations. This period of time was sufficient to permit not only the levelling down and removal of great masses of the contorted older formations, but also to allow the sculpturing of the main existing features of the peninsula upon the surface thus formed, including, in part at least, the erosion of the great valley of the Hamilton River and Inlet. In this excavation beds of sandstone identical with the lower beds of the Koksoak and upper Hamilton rivers, and of Lake Michikamau, are found resting horizontally in the valley of the inlet and river, at or near the present water-level. The great basins of Mistassini and Michikamau lakes were also formed previous to the deposition of these sandstones and limestones; and along the shores of these lakes and in other places, where the contact between the older and newer rocks is seen, the gneisses and schists present the same rounded hummocks so characteristic of the uncovered and subsequently glaciated Laurentian and Huronian hills of many parts of northern Canada. In many places the overlying rocks rest undisturbed upon the rounded surfaces, but in other localities they show signs of having been shoved over them.

When the amount of denudation and erosion implied is considered, and also the length of time required to cut deep valleys out of Archaean granites and gneisses, where the excavation since the glacial period is practically nothing, it must be admitted that the interval between the deposition of the Laurentian and Huronian strata and that of the rocks classed as Cambrian, marks one of the greatest breaks known in geological time.

The greatest development of this series is found along the Koksoak and upper Hamilton rivers. From the direction of the strike of the areas, it is highly probable that they are portions of a single great belt that extends from the neighbourhood of latitude 54° N. to beyond the Koksoak River, and continues in a north-north-west direction to Hopes Advance, on the east side of Ungava Bay, from where specimens of similar rocks were brought to Fort Chimo by the Eskimo. The total length would in this case be more than 400 miles. The breadth of this band where examined is about fifty miles. Both on the Koksoak and Hamilton rivers the strata are inclined towards the north-east or north-north-east, at angles varying from ten to eighty degrees. A number of parallel step-faults, with heavy throws, cause a series of repetitions of the various members of the formation. On the Koksoak River, below the junction of the Stillwater River, the hills on the north side of the stream show sixteen of these faults in a distance of twenty miles. Above the Stillwater, the repetitions of measures from this cause are numerous, but their extent and number were not determined. On the upper Hamilton River, where the whole series is well developed, the same step-faults were noticed and are there marked by the sharp ridges so characteristic of the country underlain by these rocks. The ridges are cut off abruptly on their western faces, while their eastern slopes agree with the dip of the underlying rocks.

At Lake Mistassini, where only the cherty limestones are found, similar faults have been noticed, the direction of the thrust there being from east-south-east towards west-north-west. On the east coast of Hudson Bay, at least one line of fault, and perhaps two or more may be observed, so that the rocks now dip seaward at moderately high angles. The coast is fringed with a chain of islands of the newer rocks, and these islands have abrupt faces towards the land, and slopes towards the bay at the same angle as the inclination of the beds. The sections observed in the rocks of the islands are in part similar to those on the mainland, and are evidently a repetition caused by an overthrust similar to those met with on the Koksoak River. The thick strata of sandstone, chert and limestone appear to have resisted flexure, under a pressure exerted from the direction of the sea, on both sides of the Labrador Peninsula, and instead of folding they have faulted and have been thrown into a series of steps. The shales, where well developed, have been folded as well as faulted.

These rocks along the east coast of Hudson Bay, as before stated, form only a narrow fringe on the mainland, and include the islands a short distance off the coast. They extend from Cape Jones northward for three hundred miles to Cape Dufferin.

The basin of Lake Michikamau is occupied by an outlier of Cambrian rocks, which may connect with the main area of the Koksoak River. Only the lower sandstones and limestones are found here, generally horizontal, but resting at a high angle against the granite hills near the discharge of the lake.

In the neighbourhood of Lake Mistassini, the cherty limestones only are found, covering an area of one hundred miles long and about twenty-five broad. Small patches of arkose sandstone and conglomerate were met with on the Hamilton River about forty miles above its mouth, and similar rocks were found, flat-bedded, along the low shores of Hamilton Inlet, about Milligan Bay.

Dr. A. S. Packard* mentions as occurring along the Labrador coast from Domino Harbour to Cape Webuc, for a distance of 125 miles, a "development" of "domino gneiss", occupying depressions in the Laurentian gneiss, on which it rests unconformably, generally dipping at low angles. From his description of these rocks, they appear to be arkose conglomerate and sandstone beds, similar to those seen on Hamilton Inlet, and may represent the basal beds of the Cambrian, although Dr. Packard believes them to be of Pre-Cambrian age.

The igneous rocks of this series, as far as seen, all appear to be basic in composition, and include gabbro and diabase in the form of great masses or large dykes, as the deep-seated irruptives, with finer-grained greenstones, which occur as bedded traps and are generally so much decomposed that they show only chlorite in the microscopic sections. These trap-flows, in the interior regions, are always found interbedded with the clastic rocks. Many of the large diabase dykes or sills also conform with the bedding planes, and only by following the outcrops can they be found jogging from one plane to another. On the east coast of Hudson Bay some of the traps have formed overflows on the surface, and are now represented by dark-green, fine-grained melaphyres, having large amygdaloidal cavities filled with quartz and agate. Similar overflows of trap also occur on the Atlantic coast at Chateau Bay, near the eastern entrance of the Strait of Belle Isle,

* The Labrador Coast. Hodges, New York, 1891, pp. 286-290.

where the trap rests directly on Laurentian gneisses without any of the bedded clastic rocks.

The mode of occurrence of thick beds of magnetite iron ore overlain by cherty, non-fragmental carbonates in this series, closely resembles that of the iron ores of the Lake Superior region described by Irving, Van Hise† and others. This, with other characters of resemblance, renders it almost certain that the two developments represent the same period, or, in other words, that the Animikie rocks of Lake Superior, assumed to be Lower Cambrian, are equivalent to the rocks here described as Cambrian in Labrador. There must have been at this time a widespread subsidence of the Archaean of north-eastern America.‡

KOKSOAK RIVER AREA

At Cambrian Lake, about 150 miles above the mouth of the Koksoak River, the west side of the probable northern extension of the Hamilton River area is first seen. The first exposure occurs on the west shore of the lake, five miles below the mouth of the Death River where the measures form a low cliff and dip N. 10° W. < 100, or at a small angle to the direction of the shore. The section displayed, in descending or natural order, is as follows :—

	Feet
1. Brecciated, purplish, calcareous sand-rock	100
2. Banded, red and gray sand-rock, consisting of grains of quartz with a calcareous matrix.....	200
3. Ferruginous red argillite	10
4. Medium-grained, red sand-rock and red argillite	—

The lowest measures are concealed and broken, but from appearances there must be at least 300 feet of red calcareous sand-rock, with partings of red argillite, and some beds of green siliceous argillite holding a good deal of pyrites in cubes. A bay with low shores separates this section from the next exposure, a mile and a half away, but as the second exposure is nearly on the strike of the first there can only be a small break in the series. This second exposure is half a mile long, and gives the following section in descending order :—

	Feet
1. Fine-grained red ferruginous chert; containing small blotches of carbonate of iron	150
2. Light-pink, very compact brecciated limestone, containing a considerable quantity of silica.....	20
3. Light-green, siliceous argillite	30
4. Blackish graphitic shales	100
5. Blue dolomite, somewhat cherty	10
6. Pearly, green shales, showing ripple marks and parted by thin beds of dolomite	40

† U. S. Geol. Surv., Monograph XIX.
‡ Compare Annual Report, Geol. Surv. Can., vol. II (N.S.), p. 8 R.

	Feet
7. Coarse gray sandstone	3
8. Greenish-gray, calcareous shale and dark-green argillaceous limestone, with occasional beds of fine-grained, dark-blue, yellow weathering dolomite (6 inches to 15 inches thick)	30
Total	383

The shore is now drift-covered for one mile, and then forms a low cliff for two miles, but as the strike of the rocks nearly coincides with the shore-line, no great thickness of beds is seen. The section probably repeats the last, with the addition of some 200 feet of argillaceous limestone and black shales on top.

The next outcrop occurs at a high point on the same side of the lake and five miles northward of the last. Here the Cambrian strata rest unconformably on a boss of hornblende-granite, dipping E. <70.

The following is a descending section of the beds which probably are the lowest of the series :—

	Feet
1. Red sandstone	4
2. Red argillite	3
3. Red sandstone	5
4. Red argillite	4
5. Red sandstone	10
6. Red argillite	6
7. Red sandstone	3
8. Red argillite	5
9. Red sandstone	2
10. Red argillite	25
11. Red sandstone	2
12. Red argillite	8
13. Red sandstone	2
14. Red argillite	4
15. Gray sandstone	3
16. Red argillite	5
17. Red and gray sandstone	15
18. Red argillite	40
19. Gray sandstone	2
20. Red argillite	3
21. Red sandstone	8
22. Red argillite	6
23. Red sandstone	8
24. Red argillite	9
25. Red sandstone	30
26. Red argillite	4
27. Red sandstone	2
28. Red argillite	9
29. Red sandstone	4
30. Red argillite	2
31. Red sandstone	3
32. Red argillite	40

	Feet
33. Red sandstone	5
34. Red argillite	20
35. Gray and red sandstone	60
36. Red argillite	2
37. Coarse, grayish-pink, arkose sandrock	10
38. Concealed, to granite	50
Total	423

The Cambrian rocks are not again seen on the shores of the lake, but cap the high hills on both sides. On the north-west side they are coarse, pinkish-gray sandstone, while on the south-east side red sandstones, rusty-weathering shales and limestones predominate.

The Laurentian hornblende-granite forms two low hills close to the water, the first being on the east side at the point where the lake changes direction from north to north-east, the second is on the north side three miles lower down where the lake again gradually narrows and shallows into the river. For ten miles below the second outcrop of granite, the river banks are low and sandy, until a small exposure is reached on the south bank, of fine-grained, dark green graywacke* composed chiefly of minute fragments of felspar and closely resembling a fine-grained trap, especially on weathered surfaces. This rock is very compact, and exceedingly tough. On a hill near by, the same rock was found capping a high cliff, with argillaceous limestone and black shales beneath it. Dip S. 80° W. $<$ 30°.

At the Shale Chute there are 500 feet of dark, greenish-gray shale, on edge, along with a few thin bands of light greenish-gray argillaceous limestone. On the south bank immediately below this chute, and for some distance further down, the rocks outcrop in a narrow band between the water and the overlying drift, giving a small section of very cherty, ferruginous limestone, holding thin bands of buff-weathering, pinkish siderite. These rocks are overlain by twenty feet of dark-blue, cherty limestone, containing nests of siderite.

Two miles below Shale Chute, there is a large exposure of bedded iron ore (a mixture of magnetite and hematite) about twenty-five feet thick, underlain by ten feet of highly ferruginous cherty limestone, with spathic ore in small spots and masses scattered through it. The magnetic ores are interstratified with thin bands of red jasper varying in colour from crimson to vermilion; these bands are of unequal thickness, and sometimes they are broken into lenticular masses. The thickest is about three inches, but they are usually less than one inch through. The next exposure is on the west bank, three miles and a half farther down stream than the last, where a dark-gray, compact chert holds angular fragments of cherty limestone and siderite, both weathering yellow, and all cut by many small quartz-veins. On the same bank half a mile lower down stream, fifty feet of red siliceous shale and jasper are overlain by 200 feet of jaspery magnetite; the shale holds many small red garnets, while the jasper bands are always less than six inches thick. In the next half-mile 400 feet of red jasper and magnetite are overlain by fifty feet of dark-gray, cherty rock

* See No. 9, Appendix V.

containing masses of carbonate of iron. The jasper bands vary from half an inch to eight inches in thickness; the magnetites are mostly impure and shaly.

On the north shore, opposite the mouth of Swampy-bay River, 100 feet of dark-gray, argillaceous limestone are overlain by 400 feet of dark shales, both nearly on edge. Strike N. 15° W.

At a heavy rapid, two miles above the Swampy-bay River, there is a large exposure of jasper banded with brownish-gray spathic ore. The jasper is olive-green in colour, and often has angular fragments of red jasper scattered through it, from the fracturing of thin bands and the filling of the cracks with the green variety. This rock would take a high polish and make a beautiful ornamental stone.

A mile below Swampy-bay River, there is an entire hill of dark-blue, cherty, ferruginous limestone holding large patches of siderite throughout. Along with the limestone are a few bands of jasper. These rocks are continuously exposed for a mile along the river, then follow two miles of drift-formed banks with rusty-weathering, black shales and argillaceous limestones in a greatly disturbed condition.

The river-valley for the next thirteen miles is wider, and only occasional exposures of shale and limestone rise from beneath the drift. Along this distance, down-stream, the limestones gradually take the place of the shales, and at the lower end of the stretch only thin beds of greenish-gray shale are seen at the base of the overlying magnesian limestone. For the next following twelve miles, to the Pyrites Chute, almost constant exposures of limestone occur along the river-banks. This limestone is almost identical with that found at Lake Mistassini and along the east coast of Hudson Bay. It is generally light-blue in colour, very siliceous, breaking into sharp, angular fragments, exceedingly fine in texture where free from grains of quartz, which are found in some of the beds. The rock has been much disturbed, being thrown into sharp folds and faulted into a series of sharp, parallel ridges of hills. The faulting and shattering has broken many of the beds of limestone into angular fragments which have been cemented again with calcareous matter into a sort of breccia. The whole, after being re-cemented, must again have been fractured, when the last cracks were filled with quartz-veins, that now penetrate the mass of rock in all directions.

At the Pyrites Chute the black shales are again met with; at the head of the chute they include a few beds of fine-grained, black limestone. The bedding is greatly contorted into small domes, that dip steeply in all directions. About half way down the chute the beds are more regular, and dip away from domes of light-weathering limestone on which they rest. The transition from limestone to black shale is made in about fifteen feet, through a little-gray, argillaceous limestone, that gradually changes to light, pearly shale, and this again to the dark variety. The black shales and limestones are all highly charged with pyrites, usually occurring as separate cubes, but sometimes in large masses.

Below the chute on the east side of the river, the low hills have rusty cliffs, and are probably formed of shale .

The light-blue magnesian limestones are again seen on the islands above the Limestone Fall, where they are less disturbed. At the fall the river descends sixty feet over ledges of limestone. The rock is of a light-blue colour, somewhat

siliceous, and brecciated by numerous small veins of quartz that cut it in all directions. A few thin beds of pearly-gray, calcareous shale are interbedded with the limestone. Dip N. 75° E. < 40°.

No rock is seen in the valley from this fall to the head of the Manitou Gorge, four miles farther down-stream, where the river has cut a long, narrow channel out of the shales and limestones. At the head of the gorge, large exposures of black shales are found, with a very regular dip N. 75° E. < 50°. They continue down the east side of the gorge, and were examined for over a mile. Where their edges have been polished in the channel, their colour is green. Pyrites in cubes is scattered in considerable quantities through the shales. A number of thin beds of light-gray pearly shale are enclosed among the black beds. Numerous small veins of quartz penetrate the shales; they are usually barren, but sometimes carry pyrites, and in one place a small quantity of galena was observed.

At the lower end of the portage, on the east bank, the shales overlie limestone; as the junction is approached, the shales change from black to pearly-gray, becoming somewhat siliceous and having interbedded thin bands of limestones which gradually become more numerous and thicker until they finally altogether displace the shales. The bands enclosed in the shales are very siliceous, and some of them pass into quartzite. Some of these quartzite bands are white, others yellowish, and others again have a purple colour. The limestones extend half a mile below the foot of the gorge, the beds gradually becoming flatter.

Four miles below the gorge, or a mile above the mouth of Stillwater River, there is on the east bank a large exposure of light-blue, fine-grained, siliceous limestone. Dip N. 70° E. < 10°. Below this river the valley widens out, and the river-banks are low and sandy, only two rock exposures being seen in seventeen miles. These exposures are respectively three and a half and eight miles below the Stillwater. They consist of well-rounded bosses rising above the drift. The rock at both places is nearly identical, and is a medium-grained, light-green, much altered diorite* holding much whitish plagioclase, with specks of pyrite. The diorites are directly on the strike of the capping rock of the sharp hills that bound the valley on the north side. The hills run in sharp ridges parallel to the strike of the rocks, and have perpendicular faces towards the west, while the slope on the opposite side is quite gentle (10°-20°). The cliff-faces of the ridges are all very similar in appearance; a thick cap of compact rock, perhaps bedded diorite generally overhanging the rocks below, which are rusty- weathering, black shales from 300 feet to 400 feet thick, with limestone forming a steep slope at the bottom. The two upper members of the series are seen in every cliff, the lower one being sometimes concealed, either by being covered with debris, or owing to the lower part of the hill not rising above the east slope of the adjoining ridge. The ridges are from a quarter of a mile to two miles apart, and sixteen of them were counted in a distance of twenty miles down the stream. Each of the cliff-faces of the ridges practically repeats, in a more or less complete form, the section given in the others. This, in itself, appears to be sufficient reason to assume that the beds are again repeated by faults,

* See No. 23, Appendix V.

otherwise the total thickness of the rocks would be enormous, and the uniformity of repetition of members wholly improbable.

Twenty miles below the mouth of the Stillwater, the Laurentian gneisses again rise from beneath the Cambrian, and the latter rocks are confined to the summits of the hills, from which they gradually disappear as the river is further descended.

HAMILTON RIVER AREA.

The rocks of the great area of Cambrian on the Ashuanipi Branch of the Hamilton River, were first seen on a number of low islands in the small lake-expansion six miles below the outlet of Birch Lake. The beds here are impure sandstone or graywacke, made up of irregular grains of quartz and red orthoclase cemented together with silica. These beds have evidently been formed from the detritus of the gneisses on which they rest. They dip W. $< 40°$.

Along the river to the outlet of Birch Lake, the banks are formed of drift deposits, and no rock is seen in place. On the low islands extending westward from the outlet of the lake and dividing it into two deep bays on the north side of the outlet, there are large quantities of black shale, with thin bands of dark argillaceous limestone evidently broken up in place by the ice. On the south shore, at the entrance to the south bay, is a low bluff of dark-greenish very siliceous limestone, holding small quantities of pyrite and having little irregular veins from two to four inches wide of siderite and calcite. The veins run generally parallel to the bedding which dips S. $45°$ W. $< 80°$. The rock has also two sets of cleavage-planes—one vertical and at right-angles to the true dip, and the other dipping N. $60°$ W. $< 45°$. On the sharp ridge on the south side of the lake, near its southern inlet, a similar dark-siliceous and ferruginous limestone is seen forming the crest of the hill. For three miles up the southern inlet, the only rocks observed were small exposures of a similar limestone, very much fractured and dipping west at a high angle. From the angular blocks scattered about, it is evident that these rocks hold large quantities of carbonate of iron, present as segregations or concretions in the limestone.

The river here becomes obstructed by many small islands, that divide it into numerous channels for the next seven miles to where it flows out of Dyke Lake. These islands appear to be all formed of bedded black shale. Just above the heavy rapid at the outlet of Dyke Lake, there is a rocky ridge extending along the north side. The rocks here are very complicated, bedded siliceous limestones being interbanded with volcanic ash rocks and eruptives and also with a jasper conglomerate. The rocks dip S. $80°$ W. 70, and the section exposed is as follows :—

40 feet of jasper conglomerate. The jasper is present generally in the form of small water-worn pebbles, but is at times angular, with a few larger pebbles of ferruginous red quartzite. The matrix is a dark-green schistose chlorite. In places where the jasper pebbles are small and numerous, it would appear that all the interstices had not been filled in with the ashy material, and that the pebbles were subsequently cemented together by infiltrations of white quartz.

20 feet of dark greenish compact rock, occasionally holding small amygdu-

les, filled with calcite. This rock is quite ferruginous, distinctly bedded, and is probably a volcanic-ash rock.*

10 feet of brownish, porous rock, highly siliceous and distinctly clastic, probably another ash rock.

5 feet of compact, finely crystalline magnetite, coloured by a small admixture of red hematite.

10 feet of brownish trap rock.

5 feet of bedded magnetite.

20 feet of brownish trap rock.

The cherty volcanic-ash rocks come out along the lake shore for about three miles above the rapid, where they appear to be backed on the hill behind by a large mass of dark-green, fine-grained diabase,** that is much decomposed on the surface.

On the summit of Fault Hill, at the end of the long point between the northern and southern discharges of Dyke Lake, a medium-grained, dark diabase† is seen, while on the southern flanks of the hill a brownish, fine-grained, highly siliceous shale is met with in broken masses, containing much carbonate of iron. Fault Hill derives its name from the great fracture which traverses it from south-east to north west, in consequence of which the western portion rises abruptly over 100 feet above the adjoining eastern end.

On the south shore of the lake, opposite Fault Hill, and continuing from there northward some three miles, light greenish-gray shales are seen, along with thin beds of dark-blue cherty rock of a fine texture often holding small grains of quartz. At times this rock is highly pyritous, and it often holds small yellow patches of siderite. These rocks are all on edge, and strike S. 60° E.

On the large island on the north side of the main channel, four miles north of Fault Hill, low exposures of light-green argillite interbedded with light-gray sand-rock, occur for more than a mile along shore. The argillites show ripple-marks, and in places are somewhat slickensided. All the beds are penetrated by numerous small quartz-veins.

At the point of the next large island to the north, where it adjoins the eastern shore, are twenty feet of light-gray sand-rock, often coarse-grained, and interbedded with thin bands of cherty limestones. These rocks are greatly cut up by small reticulated quartz-veins. Strike S. 30° E.

On the mainland just above, there is a large mass of light-green diabase,‡ generally quite coarse in texture, except on the north side, where it becomes fine-grained near its contact with the sand-rock, and causes the reticulated structures in the latter. The diabase often contains large porphyritic crystals of huronite and also specks of pyrite and pyrrhotite. This rock is in the form of a great dyke that stretches northward along the west shore of the lake for eight miles, to the narrows leading to Lake Petitsikapau. The direction of the dyke is such that, if continued, it would pass through Fault-Hill, and the diabase found there points to such a southern extension. The dyke appears to form all the points along the west side of the lake. At one of these, a mile to the north-

* See No. 34, Appendix V.
** See No. 22, Appendix V.
† See No. 33, Appendix V.
‡ See No. 34, Appendix V.

ward of the last-described exposure, the dyke is 200 yards wide and its contacts with the bedded series are well seen. The direction of the dyke is nearly parallel to the bedding, but it jogs occasionally from one bed to another. The west wall is formed of light-gray sand-rock, apparently baked at the contact, and full of small quartz-veins, which usually extend only a few feet from the contact. On the east side, black shales form the wall-rock, and near the contact they are changed to a light-green argillite. The diabase continues to be seen on the points, as above described, while in the bays between are black shales with occasional beds of black argillaceous limestone. The shales at times weather rusty from the decomposition of the pyrites contained in them.

On the east side of the entrance to the narrows leading to Lake Petitsikapau, there is another contact between the diabase dyke and the black shales and limestone. As before, the dyke runs mainly parallel to the bedding, but is seen in one place to jog four feet, and in another eight inches. The shales and limestones are hardened near the contact, and are of a light, grayish-green colour, owing to the contained carbon having been burnt out. They are cut by small quartz-veins that extend from eight to ten feet from the dyke, and then die out. The shales are tilted up at high angles and strike N. 50° W.

On the western point, at the narrows, a bed of fine granular magnetite, twenty feet wide, is seen extending along the shore for 200 feet. Like all other beds of this kind, the iron ore is associated with red jasper in broken angular masses, scattered in bands through the ore. The appearance of the jasper leads to the belief that it originally formed beds, varying from a quarter of an inch to six inches in thickness, which have been subsequently broken by folding and pressure, so as to assume their present appearance. The beds are on edge and the strike is N. 30° W. On the west side these beds are followed by 200 feet of dark cherty rock, with a brownish fracture, and containing a considerable percentage of carbonate of iron. These rocks contain in some places a few small pebbles of quartzite, and in others irregular masses of apple-green chert.

At the upper end of the narrows, the rock seen is a dark, shaly, siliceous limestone, holding a considerable quantity of iron. Strike W. These shaly, ferruginous rocks are met with along the west sides of the first deep northern bay of Lake Petitsikapau where their strike coincides closely with the trend of the shores.

Along the shores of the other northern bays and on all the low islands in the lake, rock is seen everywhere. In the northern bays limestone predominates, and is accompanied by shale. On the islands the latter is most plentiful, and in places has a perpendicular cleavage. Where the limestone is in thick beds, it has a dark bluish-gray colour and a medium-grained crystalline texture. In many places it includes angular masses of a very fine-grained, black carbonaceous limestone. Some of the beds hold small grains of quartz, and closely resemble similar beds at Lake Mistassini. These rocks are all much fractured, and are tilted up at high angles with evidence of numerous faults. Where the shales predominate, the rocks of the limestone bands are finer-grained and more carbonaceous. The shales are nearly always black, sometimes bituminous; rarely, bands of a lighter green colour are met with, more especially where limestone is plentiful.

Scattered amongst the broken shale and limestone, on two islands near the

mouth of the north-east bay, a number of blocks of a black carbon mineral were observed. The largest blocks measured eight inches in thickness, and, from the white vein-quartz attached to their sides, it is obvious that the mineral occurs either in veins or pockets. It has a foliated appearance, with plates arranged at right-angles to the walls. In colour it is black with a high lustre, resembling graphite. A more detailed description of this material is given under the heading of economic minerals.

On the summit of a range of hills along the east side of the lake, were found bedded limestones and ferruginous cherts, tilted up at a high angle, with their strike parallel to the direction of the hill, or N. 20° W. A small dyke of fine-grained diabase* cuts these rocks. In places on the western side of the summit, the rocks appear not to have been glaciated, and are much decomposed on the surface. The limestone is here represented by a residual, impure, black oxide of iron, and the small quartz-veins that penetrate it stand out from six to eight inches above the general mass.

Leaving Lake Petitsikapau, and returning to Dyke Lake along the west shore, to the northward of the inlet of the river we find a long exposure of brown-weathering, shaly limestone, and ferruginous chert. Strike No. 60° W. At the inlet of the river, the stream is broken into heavy rapids, as it passes over ledges and between small islands formed by a great dyke, that here crosses the stream and continues N. 30° W., along the east shore of the next lake-expansion above, for more than five miles. This dyke is over 300 yards wide, and only is medium-grained, dark-green diabase, holding in places light-green crystals of plagioclase. Near the contact, the rock is much finer in texture and darker-coloured. Dark-blue, medium-grained limestone is found on the east side of the dyke, where the beds dip N. 40° $\swarrow$ 80°, or away from the dyke. For twelve feet from the contact, the limestone has a baked appearance, its colour being lighter, and the bedding marked by different shades; its texture also appears finer, and it is very hard, brittle and cherty. The dyke runs parallel to the strike, but jogs from bed to bed, in one place crossing about twenty feet.

On the west side of the lake there is only one small exposure of shaly limestone. At the south-west angle, where the river flows in, another great dyke of diabase is met with, and its contact with the cherty limestone is seen. At the contact the limestone is baked, intensely fractured and re-cemented. The diabase near the contact is of a strongly developed porphyritic character.† The dyke is seen passing southward for a mile along the river, when it is covered with drift

In Astray Lake two chains of low, rocky islands and reefs extend several miles down the centre of the lake. These are all composed of a compact, light-blue limestone, very fine in texture, cherty, and greatly fractured, the small cracks being filled with quartz, which gives a finely reticulated appearance to weathered surfaces. Large irregular masses of black chert are scattered through it. The rocks weather yellowish-white, with some brown bands. These limestones are identical in appearance with those of Lake Mistassini and those of the Koksoak River at and below the Limestone Fall.

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* See No. 20, Appendix V.
† See No. 3, Appendix V.

Near the head of the middle northern bay of Astray Lake, on its west shore, a low hill, 150 feet high, of bedded jaspery iron ore is seen; dip S. 50° E. < 20. The ore is a fine-grained magnetite, with patches of red hematite, and holds broken bands of red jasper. Some of the beds more than fifteen inches thick are of pure ore without any jasper. The ore-beds are overlain by the buff-weathering, blue limestones, holding black chert, and are greatly shattered and recemented by quartz. These limestones come out in great thickness on a high island about a mile to the south-east. On the west shore, a large dyke of fine-grained, dark-green diabase follows the shore, from behind the island, southward for upwards of a mile. This dyke forms a low escarpment, and its contact with the bedded rocks was not seen.

On the north-east bay ledges of buff-weathering limestone are seen along the west shore and on the large islands. On the east side, three miles from the head of this bay, is an escarpment of 120 feet, cut out of black shales and thin beds of limestone; dip, N. 40° E. < 50°-60°. Between this escarpment and fifty feet of jaspery iron ore, exposed on a small point, is an interval of 200 feet concealed by drift. The ore-beds contain much jasper and are not very rich in iron.

The west shore of Astray Lake is low and drift-covered as far south as Quartz Hill, which rises in a sharp cone close to the shore between the lake and the river leading to Menihek Lake. The top of the hill is bare, and the rock is a white-weathering, light-gray and green quartzite, holding angular fragments of blue-banded flint that are evidently the remains of broken beds of that material. The beds are on edge, and the strike is N. 30° W.

On the long narrow island in Astray Lake, a low rocky escarpment extends for more than three miles along its eastern side. The rocks forming the escarpment are very fine-grained, compact, light-gray and pink cherts, much fractured, and overlain by a very siliceous buff-weathering limestone that dips N. 50° E. < 35°. There are frequent outcrops of buff-weathering cherty limestone along the west shore of Astray Lake for five miles, to the small rapid leading to Marble Lake. The strike of the limestone is parallel to the shore, and only a small section is exposed. The dip is N. 50° E. The same buff limestones form low cliffs at intervals along the east shore of Marble Lake for three miles from its outlet, and also appear on the west shore at its north end. On the eastern side of the river there are many loose blocks of dark-green trap, holding angular masses of red-jasper.

At the first heavy rapid, where the river turns westwards towards Menihek Lake, the rock is nearly horizontal, and lies in low flat domes. The same flat-bedded traps are seen at the small fall some three miles below the lower Menihek Lake, where they are full of small specks of pyrites arranged in bands. At the outlet of the lake there are many large loose blocks of alternately bedded jasper and magnetite. These blocks evidently show the condition of the bedded ores when undisturbed, the jasper being in continuous layers from one-half to three inches thick, and not in angular fragments scattered through the ore, as seen where the beds have been tilted and crushed

The shores of Menihek Lake are generally low and formed of drift, so that very few rock-exposures are seen. No outcrops occur on the east side of the lake, and only three on the west side. The first noted is on a long point, four

miles south of the outlet. Here the rock is not seen in place, but in fragments heaped up by the ice in a mound of large angular blocks. These blocks show a dusty-weathering, coarsely crystalline, siliceous limestone, containing a large percentage of small rounded grains of quartz, and at times containing large pebbles of dark chert, as well as irregular chert masses. Small veins of calcite penetrate the rock and hold globular masses of a brilliant black carbon, probably of the same nature as the "anthraxolite" of Lake Petitsikapau and of Lake Mistassini.

Ten miles to the south, where a small stream enters the lake from the westward, there is an exposure a quarter of a mile long, of flat-bedded dark-gray chert, much broken, and weathering a dark brown. The rock is blotched with siderite, often altered to an earthy limonite. The ore-masses vary from half an inch to two or three feet in diameter, and also occur as thin beds of irregular thickness. The total thickness seen is about forty feet, and the rock is everywhere split up into angular blocks, that are scattered about, giving the exposure the appearance of a dump at a mine.

The last exposure of rock on the Menihek Lake, is at the mouth of the large western branch, twelve miles farther southward. On the south bank of this stream, there is an outcrop of fifteen feet of similar ferruginous chert. From here southward for twenty miles, to the head of the lakes, although no rocks are seen in place, the numerous angular blocks of chert scattered about everywhere, with the continuous similarity in character of the country, lead to the belief that the Cambrian rocks continue underlying the drift to the entrance of the river, where the surface changes in aspect and loose blocks of Huronian schists replace those of chert.

LAKE MICHIKAMAU

The basin occupied by Lake Michikamau seems to have been cut out of the lower beds of the Cambrian series, and the area of these rocks here may be connected with the main mass to the north of Lake Petitsikapau, as the wide valley partly occupied by Lake Michikamau extends far beyond the north end of the lake towards the main area.

Although there are only a few places about the lake where the Cambrian rocks are seen in place, there is no doubt but that these rocks are everywhere present in the bottom of the lake, and that the loose angular masses of sandstone which are very abundant in many places along the shores, have been shoved by the ice out of the water into their present condition. Only the lowest beds of the Cambrian series are met, consisting of red conglomerate and red sandstone, with a few beds of limestone above them. On the west side of the lake, from the south end northward to the beginning of the anorthosite area, the shores are low and all the points are thickly strewn with angular blocks of red sandstone. This sandstone varies in texture from fine to coarse, and some of it is mottled with light-pink and green blotches. Such blocks are much more numerous than the gneissic boulders found along with them. The north end of the lake is low and the shores are formed chiefly of sand; the scattered boulders are mostly large and consist of Archaean rocks, these being much more abundant than the Cambrian sandstones. Southward along the eastern side, the blocks of sand-

stone are not numerous on the sandy shores until the anorthosite rocks have been passed, when they again become plentiful.

Eight miles north of the outlet of the lake, the low granite hills along the shore, and the numerous small islands, are almost completely covered by large blocks of sandstone and light bluish cherty limestone. These blocks continue until the hill on the north side of the discharge is reached, where patches of bluish-gray limestone are seen resting on the sides of the granite hill, and along the base of the hill thin beds of red sandstone rest at a high angle against the granite.

To the south of the outlet of the lake the shores are again low and sandy. As the south end of the main body of the lake is approached, huge blocks or coarse sandstone and fine conglomerate are seen on the low shore and islands.

The conglomerate probably represents the lowest beds of the series. Its matrix is a coarse sandstone, or more properly grauwacke, as it contains many small angular fragments of orthoclase, intermixed with the quartz grains. The pebbles of the conglomerate are mostly small, but are occasionally as much as nine inches in diameter. They are composed almost wholly of various kinds of hornblende-granite, mostly fine-grained, along with a few white quartzite pebbles, no anorthosite pebbles being seen. The conglomerate passes into a coarse red sandstone, and the latter, becoming fine-grained, passes into a very siliceous limestone, of a light bluish-gray or pink colour. The limestone is often greatly contorted, and at times the weathering of the finely bedded and highly contorted rock presents the appearance of organic structure similar to that of "*Stromatopera.*"

The low rounded islands of granite that form a wide fringe along the south shore of the lake, are covered by these blocks of sandstone and limestone, the latter predominating towards the western side of the lake. Many of these blocks contain more than fifty cubic feet, and are apparently almost undisturbed.

ECONOMIC MINERALS

Gold.—This metal was not actually observed in any of the rocks along the routes followed; but it may occur in the numerous small quartz-veins that cut the Huronian rocks, carrying iron- and copper-pyrites when close to the eruptive masses penetrating this formation. The shales of the Cambrian formation are also cut by numerous quartz-veins, often highly charged with pyrites; and these may contain gold, although careful examination of a number of them failed to show traces of free gold. It is to be regretted that circumstances prevented the search from being carried on by panning the gravels of these areas. The most promising localities for future investigation are along the Koksoak River, especially in the vicinity of the Manitou Gorge, a few miles above the mouth of the Stillwater River, where the quartz-veins carry abundance of pyrites, and some of them small quantities of galena.

Silver.—This metal has only been found associated with lead in the limestones of the Cambrian area of the coasts of Hudson Bay, where, according to Dr. Bell,* it occurs in bunches of galena in a band of magnesian limestone

* Report of Progress, Geol. Surv. Can., 1877-78, p. 20c.

twenty-five feet thick, in quantities sufficient to be of economic value. This band was traced from Little Whale River to Richmond Gulf, a distance of about twelve miles. Assays by Dr. Harrington give 5.04 to 12.03 ounces of silver per ton. An opening was made by the Hudson's Bay Company at Little Whale River several years ago, but the working proved unprofitable and was soon abandoned. This galena-bearing band of limestone was not observed in the Cambrian areas of the interior, and that ore was only found in small quantities in a few little quartz-veins along with pyrites.

Copper.—Copper-pyrites is sparingly met with in the Huronian, but not in the Laurentian or Cambrian rocks along the routes traversed. In the neighbourhood of Paint Mountain on Lake Chibougamau, the chlorite schists are charged with a small percentage of copper-pyrites associated with iron-pyrites ; but where seen the ore was too sparsely disseminated to be of economic value, and the indications of copper here are only valuable as pointing to the possible occurrence of more concentrated bodies of ore in the neighbourhood. On the East Main River, a few miles above the mouth of the Broken-paddle River, copper-pyrites was met with in small quartz-veins, cutting the chloritic schists of Huronian age

Iron.—The immense deposits of magnetite, hematite and siderite in the Cambrian formation, and their wide-spread distribution, may at some future date be of economic importance, especially those containing a large percentage of manganese which fits them for use in the manufacture of steel by the Bessemer process. The mode of occurrence of these ores appears to be closely analogous to that of the iron ores of Michigan and Wisconsin.†

The ores are always associated with a cherty limestone, and this cherty carbonate of lime is very wide-spread, being met with on the east coast of Hudson Bay, at Lake Mistassini, and along the Koksoak and Hamilton rivers. The associated iron carbonates are more limited in their distribution, being confined to portions of the country adjacent to Koksoak and Hamilton rivers, and to the northern part of the Hudson Bay area.

C. R. Van Hise, holds that the similar ores of Michigan and Wisconsin were originally deposited as carbonates along with lime and silica, and that the richer ores of magnetite and hematite are concentrations of the iron so deposited, carried by leaching waters holding silica to the lowest beds, where they were redeposited in a concentrated form, in troughs formed by the tilted lower fragmental beds of the series on the one side, and trap dykes on the other.

From the limited study of the Labrador areas, it is impossible to say whether this is the general case there, but on the Hamilton River, several of the large deposits of magnetite were close to, and apparently influenced by large dykes of diabase. Only in one place were the richer ores found undisturbed, at the entrance of Menihek Lake, and here they rested upon a flat-bedded impervious trap-rock. Along the Koksoak River, large dykes are not seen, and the rich ores are found always beneath and associated with the cherty carbonate ores, but in some places they did not appear to lie beneath these, but were rather interbedded with them.

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† U.S. Geological Survey Monograph XIX. Penokee Iron-bearing Series of Michigan and Wisconsin.

The bedded iron ores are first met with in descending the Koksoak River, on the south bank, just below the Shale Chute, or a few miles below Cambrian Lake, where a thin section of jaspery magnetite is overlain by twenty feet of cherty limestone containing large blotches of carbonate of iron. The following analyses of the ores were made in the laboratory of the survey by Mr. F. G. Wait :—

The jaspery magnetite ore :—

		Per cent.
(1)	Metallic iron	31.28
	Insoluble matter	55.71
	Titanic acid	none

The carbonate ore of the upper beds is described as a mixture of ankerite and magnetite

		Per cent
(2)	Metallic iron	33.62
	Insoluble matter	4.99
	Titanic acid	none

For the next ten miles, to the mouth of the Swampy-bay River, exposures of iron-bearing rocks are almost continuous, and the amount of ore in sight must be reckoned by hundreds of millions of tons. The ore is not everywhere high-grade, and probably a large proportion of it would be unprofitable to work, but there is certainly an almost inexhaustible supply of high -grade ore. It may here be mentioned that specimens were not procured from the thickest and richest beds, owing to the impossibility of breaking up the rounded and glaciated surfaces with the small hammers. Two miles below the last-mentioned exposure, the rocks were found to consist of a twenty-five foot bed of jaspery ore, composed largely of magnetite with a small admixture of hematite, underlain by ten feet of siliceous, ferruginous limestone, holding spathic ore in bands and nodular masses up to several hundred pounds in weight. A great part of the magnetite is nearly pure and contains little jasper. The beds are exposed along the right bank of the river for more than a quarter of a mile.

The rocks were again examined three miles and a half farther down-stream, where only the cherty carbonates were found; but half a mile below, the river passes close to a high hill on the west side, where fifty feet of red garnetiferous, siliceous, ferruginous shale and jasper are overlain by 200 feet of jaspery ore, composed chiefly of magnetite and coloured by an admixture of hematite. An analysis of the ore in the garnetiferous rocks gave :—

		Per cent.
(3)	Metallic iron	19.14
	Insoluble matter	72.86
	Titanic acid	none

And another analysis of the ore from the beds above gave :—

		Per cent.
(4)	Metallic iron	48.29
	Insoluble matter	30.62
	Titanic acid	none

On the same side, half a mile below, the section exposed on the hillside shows 400 feet of jaspery magnetite and hematite, overlain by fifty feet of cherty carbonate ore. A specimen of the jaspery ore containing a large percentage of hematite gave :

		Per cent.
(5)	Metallic iron.....	54.35
	Insoluble matter.....	16.03
	Titanic acid.....	none

The bedded iron ores outcrop along the river for about three miles farther down-stream to near the mouth of the Swampy-bay River, and then the main stream turns eastward and passes between banks of shale and siliceous limestone, so that the iron-bearing members are not again seen along its banks.

On the Hamilton River, the cherty carbonate rocks are well developed along the shore and in the hills surrounding the lakes from Birch Lake to the Menihek Lakes on the Ashuanipi Branch. The faulting of the rocks has caused these measures to be repeated in four ridges in a distance of about twenty-five miles across the strike. The most westerly ridge runs along the west side of the Menihek Lakes; the next is along the east side of Astray Lake; the third forms the ridge between Dyke and Petitsikapau lakes, and the last forms the watershed between Petitsikapau and the head-waters of the George River.

The concentrated magnetite and hematite ore were first met with at the rapid at the Discharge of Dyke Lake, where two beds each about five feet wide were found associated with cherty carbonate and a siliceous trap ash-rock. At the narrows into Lake Petitsikapau, over twenty-five miles beyond the same ridge, the ores again come out on the shore for 200 feet, with a width of twenty feet. Analysis of the ores from this place gave :—

	Per cent.
Metallic iron.....	30.43
Insoluble matter.....	51.22
Titanic acid.....	none

At the head of the middle northern bay of Astray Lake, there is a low hill where 150 feet of jaspery magnetite and hematite are seen. Some of the ore-beds are two feet thick between the jasper partings. Fifty feet of similar ore are exposed on the shore of the north-east bay, about two miles from its head.

At the outlet of the Menihek Lakes, large blocks of jaspery ore are scattered about, and they appear to rest horizontally on beds of trap. Here the magnetite and jasper are arranged in distinct layers, and the jasper is not broken as in all the other exposures where the rocks have been disturbed. This ore on analysis gives :—

	Per cent.
Metallic iron.....	40.72
Insoluble matter.....	29.90
Titanic acid.....	none

These were all the outcrops met with on the waters of the Hamilton River, but they are sufficient to show that the deposits are wide-spread and that the ores will be found in practically inexhaustible quantity .

In the Hudson Bay area, the more concentrated ores are not abundant, but there are great thicknesses of the cherty carbonates. Specimens of the ores brought home by Dr. Bell and analysed by Dr. Harrington, gave :—

	Per cent.
Metallic iron.....	25.44
Carbonate of manganese....	24.00

an excellent ore for spiegeleisen, and for conversion with richer ores into Bessemer steel.

The percentage of manganese in the ores from the Koksoak River area is considerably lower than in the Hudson Bay ores, but sufficient is present to give promise of richer deposits. The following analyses of No. 2 and No. 5, show the percentage of manganese in these ores :—

		Per cent.
(No. 2)	Ferric oxide.....	23.43
	Ferrous oxide.....	21.32
	Manganous oxide.....	1.34
	Insoluble residue.....	6.72

		Per cent.
(No. 5)	Ferric oxide.....	80.17
	Ferrous oxide.....	0.35
	Manganous oxide.....	3.09
	Insoluble residue.....	13.78

On the portage-route past the upper part of the Mouchalagan River, thick bands of magnetite were met with on Little Matonipi Lake, and on the portage leading northward from the larger lake, the Indians report that there is a hill of similar ore several miles west of the last-mentioned place in the same direction as the strike of the rocks. Large masses of similar ore were also seen on the Mouchoulagan River, so that it appears that this deposit may be traced more than forty miles along the strike. The ore is associated with the mica-gneisses and limestones of the supposed bedded series of the Laurentian. In composition it varies from a pure magnetite ore to a ferruginous gneiss. The quantity of ore seen is very great, as the band is more than 100 feet wide.

Titanic Iron Ore.—Throughout the great anorthosite areas of the peninsula, ilmenite or titanic iron ore is always found in more or less abundance, varying from small grains to masses several tons in weight. The banks of the river passing through these areas usually have thick beds of black iron-sands scattered at intervals along them, these iron-sands being derived from the disintegration of the anorthosite rocks.

Pyrites.—This mineral is abundantly found both in the Huronian and Cambrian rocks. In the area of Huronian to the south-west of Lake Mistassini, the chloritic schists, close to the junction of the eruptive masses of basic and acidic rocks, are always highly charged with pyrites. At Paint Mountain, on the south-west shore of Lake Chibougamau, the schists are very pyritous, and a zone extending twenty feet from the contact with the granite mass holds at least twenty-

five per cent of pyrites. Along the narrows leading to the east end of the lake, highly pyritous chloritic schists are met with for upwards of a mile.

On the East Main River, the schists at Conglomerate Gorge, in the vicinity of the large diabase dyke, are highly pyritiferous. Three miles above the gorge there is another large area of schist charged with pyrites.

Half a mile above the mouth of the Wabamisk River, is a large deposit of pure pyrites in a green chloritic schist. Where it is exposed along the river, the deposit is ten feet thick and 100 feet long, being concealed under drift at both ends.

In the Cambrian formation, pyrites is found in nearly all the strata, and is always present in the black and green shales. The black shales, when exposed in cliff-faces, always weather brownish-red from the oxidation of the contained pyrites. This mineral is particularly abundant at the Shale Chute, where it is found strung out in lenticular masses between the partings. In many places these masses are so large and close together that, if they were more accessible, they might form a pyrites ore. At the Manitou Gorge, similar masses of pyrites are present in the black shales and also in the quartz-veins cutting them.

Along the Hamilton River, the black shales are usually charged with pyrites, but no locality was seen where the percentage was sufficiently great for profitable working.

Anthraxolite.—A bituminous mineral with the lustre and colour of anthracite, is found in the Cambrian black shales and limestones, where it occurs either as irregular veins or in small irregular globules in veins of quartz and calcite, cutting the limestones. This mineral is widely distributed, being found at Lake Mistassini, at Petitsikapau and Menihek lakes on the Hamilton River, and also on Long Islands in Hudson Bay.

At Lake Petitsikapau the largest amount was found in loose blocks scattered about with broken shale, and, from the pieces found, it probably occurs as a vein from six to eight inches wide, with quartz lining the vein. The mineral is arranged in small flattened plates set at right-angles to the walls and these plates inclose little rounded grains of quartz, and are themselves often coated with ferric hydrate. The following is an analysis of a specimen from this locality made by Dr. Hoffmann :—

	Per cent.
Water (at 110°-115° C.).....	3.56
Additional loss on ignition in closed vessel.	2.48
Fixed carbon.....	86.83
Ash (light reddish-brown)....	7.13
	100.00

"The ash, which consisted for the most part of silica, would appear to be almost solely derived from accidental impurities, a view strengthened by the fact that other fragments of this material—which, although most carefully picked, were not regarded as absolutely above suspicion—left on ignition but 0.31 per cent of ash."

The analysis of a fragment picked up on Long Island, and so examined by Dr Hoffmann, gave 94.91 per cent of fixed carbon and only 0.25 per cent of ash.

From the above analysis and the mode of occurrence of this mineral, it is seen that it is the result of the hardening of probably liquid bitumen, derived from the carbon of the adjoining rocks, and inclosed in quartz or calcite veins, where it has lost much of its volatile matter and has assumed its present form. It is obvious that the occurrence of this mineral affords no indication of the existence of coal, as ordinarily understood, that is in beds of economic value for mining and burning.

Mica.—This mineral often occurs in large crystals in the massive pegmatite dykes met with everywhere throughout the Archaean rocks, but in very few places was commercial mica found, owing to the bent and broken nature of the crystals. The best locality noted was on the East Main River, between the Talking and Island falls, where the mica was in large plates of a light greenish coloured muscovite. Near the head of Lake Winokapau, fine crystals were seen in a large dyke of red pegmatite, and other localities might be mentioned which would repay prospecting if they were more accessible.

Ornamental Stones.—The agates found in the melaphyres of the Hudson Bay coast are often large and beautifully coloured and banded, and would polish well. The jasper of the iron-bearing rocks varies in colour from bright vermilion to crimson, and sometimes green. The red varieties are often in large masses, and slabs several square feet in surface and more than six inches thick, are easily obtained in many places. On the Koksoak River there is a thick band of apple-green jasper, brecciated with small angular fragments of the red varieties, which might be used for pannels and other decorative purposes. On the Hamilton River, near the outlet of Dyke Lake, the jasper conglomerate is in places formed of small pebbles cemented with white quartz and it can take a high even polish.

Labradorite of the precious variety occurs in great abundance on the northeast side of Lake Michikamau, where large and beautiful crystals of this mineral are seen continuously along the shore for more than ten miles. The play of colour in these large crystalline masses when placed below the surface of the water is particularly splendid, the opalescent hues varying from deep cobalt-blue to green and bronze yellow. On some of the faces the lines of growth of the crystal are distinctly marked by the different colours arranged in concentric bands. Among other localities where the precious labradorite is found, may be mentioned the islands in Lake Ossokmanuan, and the shores of the Romaine River above the burnt lakes.

Building Stones.—Many of the limestones of the Cambrian areas would answer admirably for building purposes, as would also the hornblende-granites, but, as the rocks are so far away from any point of shipment, they are valueless.

Cement Rock.—The rusty-weathering bands of magnesian limestone might very probably yield a hydraulic cement on burning.

Grindstones.—The hard sand-rock at the base of the Cambrian, would answer for this purpose, while the fine-grained cherty beds in the limestones would make good hone-stones.

Excellent flag-stones could be obtained from the green felsite slates of the Cambrian, and other materials such as brick clays, etc., of economic value, when

near settlements, are abundant in the Labrador Peninsula, but are practically valueless, owing to the distance from any market.

GLACIAL GEOLOGY.

The observations of striae and other glacial phenomena taken along the different routes followed during these explorations, in conjunction with similar evidence previously obtained on the rivers flowing westward into Hudson Bay, all show that the Labrador Peninsula, with the exception of a narrow strip of highlands along the North Atlantic Coast, was completely covered with ice during a portion at least of the glacial period. The movement of the ice followed the general slope of the country outward in all direction from a central gathering-ground, or névé, and the thickness of the ice was such that in its flow it passed over ridges and valleys unchanged, or with only minor deflections.

Either the greatest thickness of ice was to the northward of the southern water-shed, or there have been slight changes in the relative levels of the central area since the glacial epoch, as the present watersheds do not altogether correspond to the former central névé grounds.

The central névé ground, characterized by but slight traces of glacial motion, is situated about midway between the east and the west coasts of the peninsula, and between latitudes 53° and 55°, consequently its southern boundary is from fifty to two hundred miles north of the present southern watershed.

The region occupied by this névé is marked by the presence of partly rounded boulders and angular blocks of rock scattered indiscriminately over hill and hollow. These blocks and boulders, in the great majority of cases, rest upon rocks of the same kind, and have evidently not been transported to any distance from their original positions. They are often of great size, and are heaped together loosely, so that it is a dangerous undertaking to scramble up the steep sides of the hills owing to the liability of displacing them. In many places large blocks are seen perched upon much smaller ones, even on the very summits of the highest rocky hills. Either these conditions of the loose rocks must be due to their having been sub-angular cores in the rotted gneisses and granites, from which the finer material has been carried by water or by slowly-moving ice; or their present position is due to the boulders having been dropped upon one another from the ice-sheet that inclosed them when the ice finally melted away. The former supposition seems the most likely. The loose piles along the sides of the hills may in a great measure be due to the simple falling of the harder cores from higher elevations after the removal of the finer material, and the disappearance of the ice.

In that part of the névé ground crossed between Nichicun and Kaniapiskau lakes, the country is very rough and broken into ridges of sharply rounded hills of granite, that rise from 300 to more than 800 feet above the neighbouring lakes. In this area the signs of glaciation on the rock surfaces are very indistinct and no well-marked striae were found showing the direction in which the ice moved. The outlines of the hills, although rounded, are much sharper and more angular than in the regions where the glaciation is well marked by striae and where the smaller angular projections have been reduced to a common gentle curve by the grinding power of the ice-transported drift.

TILL.

In the southern half of the Labrador Peninsula, a detailed study of the boulder-clay or till is almost impossible, owing to the dense forest growth which covers the greater part of the area. It is only where extensive fires have denuded the surface of its trees, and much of the thick coating of moss and vegetable matter, that some investigation becomes practicable. Such being the case, only general facts relating to the drift deposits of the interior plateau are given here.

Unstratified drift is found throughout the whole interior, in varying thicknesses. To a great extent it appears to have been formed from the disintegration due to atmospheric decay of the upper portions of the surrounding rock-masses. Everywhere more than seventy-five per cent of the included boulders are from the immediate neighbourhood.

The amount of erosion and the change wrought upon the general surfaces by glacial action have not been as great as is often supposed. The ice certainly removed a considerable quantity of disintegrated material, with included cores, from the various hills, and deposited it, for the most part, in the adjoining valleys, working with a kind of "cut and fill" action, to reduce the surface to a general uniform level. There is no evidence to show that the glacier ever hollowed or scooped out deep depressions as has been often stated to have occurred elsewhere.

The amount of rotten debris removed from the hills and perhaps also displaced in the valleys, although great, does not represent an extraordinary depth of decayed rock overlying the harder unaltered portion; and the amount of drift now seen throughout the region would not, if evenly distributed over the whole area, afford a thickness greater than 200 feet of loose material.

The Archaean rocks that underlie more than three-quarters of the total area of the peninsula, are for the most part not easily disintegrated by the atmosphere, and in many places the striae present on their surfaces are as fresh as if made yesterday. This is especially the case when the rock has been protected by even only a very thin coating of drift. From this it may be seen that general erosion is very slow, and that after a certain depth was reached it would practically stop, so that, although an enormous length of time is supposed to have elapsed between the previous submergence of the peninsula in Palaeozoic and the beginning of the glacial period, the amount and depth of surface decay was probably much less than might have been anticipated. A further proof of the slow decay of this Archaean mass, is deduced from the deep and ancient river-valleys that extend far inland from the coast on all sides, and of which the Saguenay, Hamilton, Koksoak and Great Whale rivers may be cited as examples. These valleys are the main arteries of drainage of the high interior table-land, and, along with the valleys of their principal tributaries, have been eroded by the water to depths varying from 200 to 1500 feet below the general level, without any corresponding general reduction of the surrounding country to a base-level of erosion, as might have occurred, had the underlying rocks been composed of the softer sedimentary deposits usually holding carbonate of lime.

These valleys are of great age, that of the Saguenay having been at least partly formed before the Cambro-Silurian period, while the Hamilton Valley an-

tedated the deposition of rocks of Lower Cambrian age.* The process of formation of these valleys has continued slowly to the present day, by the agency of falling water and of frost. At their heads the valleys can be seen cutting farther and deeper into the central area, as at the Bodwoin Canyon below the Grand Falls on the Hamilton River. These deep-cut valleys, not having yet become complete, the drainage of the central area is by streams flowing in shallow channels, and following the light general slope of the country. In this central region, the former drainage system appears to have been considerably modified by the movement and deposition of glacial drift, which forms low ridges traversing the country, damming back the rivers to form lakes, with rapid stretches between, where the streams either flow over low rocky ledges, or down rapids full of boulders.

Although by far the greater number of the boulders in the drift belong to the immediate neighbourhood, a considerable percentage of them is far-travelled. The presence of these "erratics" in the drift, proved to be of practical benefit when ascending the different rivers, as they indicate the character of the rocks which occur farther back along the course of the glaciation. Rounded boulders of the Cambrian rocks of the Upper Hamilton River, were thus met with in the river-valley, a short distance above Lake Winokapau, 150 miles from the nearest outcrop, giving the first intimation that an area of these rocks would be found in that part of the interior. These boulders became more numerous as the river was ascended, and were found on the top of Lookout Mountain (500 feet) near the Grand Falls. Above Sandgirt Lake they form over twenty-five per cent of the drift, and on a nearer approach to the Cambrian area constitute over ninety per cent. of its coarse material. From the presence of large numbers of boulders of hornblende-granite in the drift about the Menihek Lake, it is believed that the Cambrian area does not extend far beyond that neighbourhood. In a similar manner, the occurrence of an abundance of Huronian boulders about the Mistassini Lakes, points to the presence of an area of these rocks in the region immediately to the north-east.

* If the deductions from the evidence above be correct, it follows that the theories advanced by several writers to the effect that the gorge of the Saguenay and other similar valleys in this part of the continent were eroded mainly during the Pliocene uplift immediately preceding the glacial period are incorrect.

APPENDIX I.

LIST OF MAMMALIA OF THE LABRADOR PENINSULA, WITH SHORT NOTES ON THEIR DISTRIBUTION, ETC.,

By A. P. LOW.

The following notes on the habits and range of the mammalia of Labrador, as far as refers to the interior, are largely the results of observations and information obtained during the recent explorations :—

Lynx Canadensis, Desmarest (Canada Lynx, Mountain Cat).—The lynx is commonly found within the wooded area, from the Atlantic coast to Hudson Bay. During the winter of 1893, many skins were taken in the valley of the Hamilton River. The number is said by the Indians and traders to vary with that of the rabbits which form the natural food of the lynx. When the rabbits are dying off after seasons of plenty, the Indians all say that the lynx does not breed, and only when the rabbits are again becoming plentiful do they again produce young. These animals are generally caught in dead-falls placed at the mouth of hollow logs.

"*Canis lupus,*" Linn. (Wolf).—The wolf is seldom met with in the southern regions since the extermination of the caribou there. It is now found only in the barren and semi-barren lands, where the caribou are still plentiful. A wolf was seen at the post at Northwest River, and a single skin was seen in the possession of an Indian on the upper Hamilton River; the animal had been shot near Lake Michikamau. On the Hudson Bay Coast, wolves were formerly plentiful, but of late years are quite rare.

"*Canis lupus,*" var. "*albus*".—The White or Artic Wolf is occasionally taken in the barren grounds, but does not appear to enter the timbered regions of the interior.

"*Canis familiaris,*" Say.—The Eskimo Dog is common along the coast everywhere, but south of Sandwich Bay the breed is much mixed. This animal plays an important part along the coasts, being used in the place of horses, or other animals for hauling. The methods of attaching the dogs to the sleds is different from that employed in the west, each dog having an independent trace, so arranged in length, that when the dogs are in line each one falls in behind another. The number of dogs in a team varies from four to thirteen. They are extensively used by the Eskimo and resident whites in travelling about the coast, and also for hauling wood, water and other loads. On ordinary "roads" each dog will haul about 100 pounds, but when travelling on the crust, in the spring time, the load can easily be doubled or trebled.

"*Vulpes vulgaris,*" Fleming (Red, Cross, Silver and Black Fox).—These different animals are only colour varieties of the same species. On the Moose River, in 1887, the writer found a litter containing seven kits; of these two were red, three were cross and the remaining two blacks or silver—thus showing that

the colour of foxes no more constitutes varieties than does the difference of colour in a litter of kittens of the common cat. There appears to be a greater proportion of dark-coloured foxes in the northern region than in the southern. The fox is found throughout Labrador from the St. Lawrence to Hudson Strait, where it is taken in the barrens and along the coast by the Eskimo. Most of the skins are taken before Christmas, as the fur becomes poor early in the spring.

"*Vulpes lagopus,*" Linn. (Arctic Fox, White Fox) is found most abundantly in the barren grounds. It is taken rarely south of Lake Michikamau or Nichicun. Along the seaboard the white fox ranges farther south, descending to the southern part of James Bay, and on the Atlantic coast being plentiful about Hamilton Inlet, but more rare southward to near the Strait of Belle Isle. Most of the foxes along the southern Atlantic coasts are said to be migrants from the northern coasts, and they are rarely caught south of Hamilton Inlet before that body of water is frozen over. The blue fox (var. "*fuliginosus*" is much less abundant than the white, with which it is found. It is very rare along the southern half of the Atlantic coast.

"*Mustela Americana,*" Turton (Sable, Pine Marten).—The marten is one of the most abundant and valuable fur-bearing animals of Labrador. Its northern range is practically limited to the southern boundary of the semi-barrens, and it is found only in the wooded stretches of the river-valleys north in this line ; north of the Big and Hamilton rivers, it is rarely found. The largest and darkest skins are taken along the edge of its northern limits, and on this account the skins bought at Fort George, Nichicun, Fort Chimo and Northwest River are much more valuable than those procured at the southern posts. The marten hunt is made after the smaller lakes set fast until December, and again during the months of March and April, after which the skins become poor.

"*Mustela Pennantii,*" Erxleben (Fisher, Pekan).—This animal only rarely enters the south-west limits of Labrador, not being known to occur east of Mingan, or north of Mistassini.

"*Putorius vulgaris,*" Linn. (Weasel).—Common everywhere south of the tree limit.

"*Putorius ermineus,*" Linn. (Ermine).—Common everywhere throughout the wooded regions.

"*Putorius vison,*" Brisson (Mink).—The mink is limited to the southern part of Labrador, and is only rarely found north of the East Main and Hamilton rivers. Not a single specimen was seen on the upper Hamilton River during the summer of 1894, and the Indians of that locality report it as rare. It is common on the lower river and about Hamilton Inlet. Several specimens were taken on the upper East Main River, but it is rare about Nichicun.

"*Gulo luscus,*" (Linn.) Sabine (Wolverine, Carcajou).—Abundant throughout Labrador, especially in the northern portions, where it is taken by the Eskimo as far north as Hudson Strait. This animal is the personification of the devil among the Indians, owing to its cunning and destructive habits. Every Indian has wonderful stories to relate about the ferocity and intelligence of the wolverine. No cache of provisions or outfit is safe from the attacks of these animals, unless built up from the ground on high posts, in such a manner that the floors

project and prevent the animals from reaching the sides or top. When a wolverine breaks into a cache, it not only eats the provisions, but breaks up and destroys other articles not fit for food. A wolverine in the vicinity of an Indian's hunting grounds, proves a very disagreable neighbour, from its habits of following the hunter's tracks and either springing his traps and removing the bait, or else devouring the martens and other animals already caught. The wolverine is seldom caught itself, as its cunning is sufficient, after it has lost a few claws in the traps, not to put its feet in the set traps without first springing them by moving them about. When caught, they frequently gnaw off their foot above the trap and leave it, at other times, they depart, taking trap and chain with them. In the fall of 1893, a wolverine carried away a trap from the Northwest River, and was taken a few days later in another trap on the Hamilton River, some thirty miles away from the place where it had picked up the first trap. The reason it was taken in the second trap, was because it could not obtain food while dragging the trap and chain through the bush, so, being reduced to starvation and hampered by the trap attached to its front leg, it was not able to spring the second one without being caught.

"*Mephitis mephitica,*" Shaw (Skung).—Stearns says that it is rarely seen on the southern coast.

Lutra Canadensis. Turton (Otter).—The otter is common throughout the wooded region and ranges northward into the barren grounds. The skins taken in the northern regions have the darkest and most glossy fur. Very abundant on the upper Hamilton River, especially in the vicinity of the Grand Falls, where a number of Indians families congregate in the spring to hunt it.

"*Ursus arctos,*" Richardson (Barren-ground Bear).—There is no doubt that this species is found in the barrens of Labrador, as skins are brought in at intervals to Fort Chimo, and the Nascaupee Indians have numerous tales of its size and ferocity.

"*Ursus Americanus,*" Pallas (Black Bear).—The wooded country is the northern limit of this species, and it is most abundant in the southern regions in the burnt districts. Specimens were seen on the East Main River and about the Grand Falls on the Hamilton River. About Lake Winokapau and the lower Hamilton River bears are numerous. At Cambrian Lake, on the Koksoak River, the tracks of a large bear were seen along the shores, but it is not known whether these were those of a black bear or a barren-ground bear.

"*Thalassarctos maritimus,*" Linn (Polar Bear).—This species is as a rule confined to the coast and rarely travels inland, except to produce its young. At such time it is met with from twenty-five to fifty miles from the coast. On the Atlantic coast it is occasionally found as far south as the Strait of Belle Isle, whither it is carried from the north on ice floes. North of Hamilton Inlet, it is frequently met with along the coast and on the islands, being common about Cape Chidley and along Hudson Strait. During the winter of 1894 the tracks of three white bears were seen close to Northwest River, at the head of Hamilton Inlet, and a few specimens have been killed in that locality. In Hudson Bay, the white bear ranges southward to Charleton Island, near the south end of James Bay, in latitude 52°.

"*Odobaenus rosmarus,*" Malmgren. (Walrus).—This species, once common along the entire Labrador coast and the Gulf of St. Lawrence, is now found only on the Atlantic coast about and to the northward of Nachvak. It is common at all seasons in Hudson Strait, and along the northern Hudson Bay coast. Large numbers are killed by the Eskimo on the chains of outer islands which stretch southward to opposite the Little Whale River off that coast.

"*Phoca vitulina,*" Linn. (Harbour Seal, Fresh-water Seal).—Common to the coast and low parts of the rivers all round Labrador. There are two or three large lakes inland near the head of the Stillwater Branch of the Koksoak River, but probably drained by the Nastapoka River in the Hudson Bay, where seals are reported by the Indians as plentiful. Another large lake inhabited by seals, is situated at the head of the north branch of the Northwest River, which flows into Hamilton Inlet. Skins in possession of the Indians, taken from these lakes, show that the seals belong to this species. According to the Indians, these animals never leave the lakes, and consequently have acquired a fresh-water habit.

"*Phoca foetida,*" Fabricius (Ringed Seal).—Along the whole Labrador coast. Commonest species in the Hudson Strait, and the principal food of the Eskimo.—(Tyrrell.)

"*Phoca Groenlandica*". Fabricius (Harp Seal).—Very abundant along Labrador coast. Common on south shore of Hudson Strait. Common in Hudson Bay.

Erignathus barbatus," Fabricius (Bearded Seal, Square-flipper).—Rare on the St. Lawrence and southern Labrador coasts. Common about Nachvak, where the dog traces made from this skin are obtained for the southern Hudson's Bay Company's posts. A large specimen was seen at the head of tide, some sixty miles above the mouth of the Koksoak River. Common in Hudson Strait and Hudson Bay. Numbers seen about the Twin Islands in James Bay. Specimen obtained at the mouth of Moose River by Dr. R. Bell.

"*Halichaerus grypus,*" Fabricius (Gray Seal).—Rare along Atlantic coast, Hudson Strait and Hudson Bay.

"*Cystophora cristata.*" Erxleben (Hooded Seal.)—Not common along the coasts of Labrador.

"*Delphinopterus catodon,*" Linn. (White Porpoise, White Whale).—Found everywhere along the coasts of the Labrador Peninsula from the St. Lawrence to the southern extremity of Hudson Bay. Fisheries for these animals are established in the mouths of the Koksoak, Leaf and Whale rivers flowing into Ungava Bay, and were formerly carried on at Great and Little Whale rivers on Hudson Bay. The whales are driven, as they ascend the river at high tide, into ponds inclosed by strong nets, and when the tide goes out they are either speared or shot in the shallow water.

"*Monodon monoceros,*" Linn. (Narwhal).—The "horns" of these animals are frequently brought to the Hudson's Bay posts by Eskimo from Hudson Strait and the north part of Hudson Bay.

"*Alce Americanus,*" Jardine (Moose).—It is very doubtful if this species enters the south-west limits of Labrador from the head-waters of the Ottawa River, where it is found abundantly.

"*Rangifer caribou,*" Linn. (Woodland Caribou).—Within the past twenty-five years the woodland caribou was plentiful throughout the southern wooded region, but now is practically exterminated on the southern watershed, being met only in small numbers about the heads of the rivers flowing into the eastern part of the Gulf of St. Lawrence. In 1892, along the route from lake St. John to Mistassini, and from there to the mouth of the East Main River, not a single deer track was seen. In 1885, the last herd of seven caribou was killed in the vicinity of Lake Mistassini A few woodland caribou are annually killed about the head-waters of the East Main River and Nichicun post. On the upper Hamilton River this species is still met with in small bands, but, according to the Indians the numbers at present killed are only a small percentage of the numbers annually slaughtered a few years past. This extermination of the caribou is very detrimental to the interior Indians, who in former times depended largely upon them both for food and clothing. Notwithstanding the quantity of flour now brought inland, and the fish caught and preserved for winter use, cases of starvation are of annual occurrence from the lack of animal food in place of the deer meat. In 1892, a deserted camp where a dozen persons had died of starvation two years previously, was passed on the East Main River. The survivors —a woman and a boy—told the usual tale of failure to find deer and consequent starvation. There appears to be no remedy for this except the abandonment of the interior by a large proportion of the Indians, with the total suppression of caribou hunting for a number of years. This is probably not practicable, and the Indians of the interior will consequently, it is feared, continue to die off.

The astonishing rate at which the fur-bearing and other animals multiply when undisturbed, was noted along the East Main River, where, owing to the death of Indians above mentioned, no hunt had been made for two years—and in that short interval the beavers had overstocked the small streams, and were common all along the main river.

Rangifer Groenlandicus, Linn. (Barren-ground Caribou, "Reindeer").—This species ranges in immense herds over the barren and semi-barren grounds. On the Atlantic coast, caribou of this variety are found south to the Mealy Mountains, a high barren range between Hamilton Inlet and Sandwich Bay. To the northward they are more or less common and at certain seasons of the year very plentiful about Davis Inlet and Nain. On the Hudson Bay coast they were formerly very abundant as far south as Cape Jones or the mouth of James Bay, but of late years they are found only in small numbers north of Great Whale River.

From information obtained from the Nascaupee Indians and others, the reindeer is believed to spend the summer season on the barren highlands near the coast, where the strong breezes keep down the pest of flies. In the autumn they migrate inland southward into the semi-barrens, returning to the true barrens again in the months of April and May. In the northern part of the peninsula there appear to be three distinct herds, one on the Atlantic coast, that passes the summer on the highlands between Nachvak and Nain; a second, which crosses the lower part of the Koksoak River and summers on the west side of the Ungava Bay and Hudson Strait; and a third, which passes northward from the vicinity of Richmond Gulf and Clearwater Lake, and summers along the highlands

of the north-east coast of Hudson Bay. Of late years, this last herd has become very small, and many of the Indians who lived on it have migrated from Hudson Bay to Fort Chimo, while the second herd was undiminished. The first herd supports the Indians living on the George River, and almost all from the Hamilton River. The principal hunt is made during the fall migration, when the bucks are fat and have not yet mated with the females. The Indians congregate along the George River, about a hundred miles beyond Lake Michikamau. They spread out along the river and await the crossing of the bands of deer on their way from the coast to the wooded country. As soon as a large body begins to cross, signals of smoke are made, and the Indians soon congregate and kill great numbers from their canoes by spearing them while in the water. The season for crossing lasts from ten to fifteen days. Much of the flesh is smoked for winter use, while the skins are preserved and dressed, either for clothing and other purposes or for sale. In the spring the deer migrate in small bands and are not so easily taken, as the snow and ice are then beginning to melt and they have to be killed by shooting after a chase. The migration of the second band is similar to that already described, except that during the fall migration small herds are continually crossing backwards and forwards along the river. Wide paths, caused by a single passage of the deer, were met with along the Koksoak River as far south as Cambrian Lake, and smaller paths as far as Lake Kaniapiskau, where a small number of the reindeer appear to remain throughout the summer. A couple of large paths were found on the Ashuanipi branch of the Hamilton River, and in the spring a number of tracks, made by small herds, were encountered below the Grand Falls. Periodically, the reindeer omit to return to the wooded areas from the barrens, and when this happens the Indians depending on them are left in a most lamentable condition, being largely without food and clothing. Many die of starvation in consequence unless outside aid is given. The death of over 150 persons along the Koksoak River during the winter of 1893, is but one of several such calamities which have happened during the last fifty years. In the evidence given before the committee of the Hudson's Bay Company, 1851, a letter was read from Wm. Kennedy as follows: "Starvation has, I learn, committed great havoc among our old friends the Nascopies, numbers of whom met their death from want last winter; whole camps of them were found dead, without one survivor to tell the tale of their sufferings."

Ovibos moschatus, Zimmermann (Musk Ox).—There is no evidence to show that the musk ox was ever found in Labrador.

Vespertilio lucifugus, Leconte (Blunt-nosed Bat).—A small bat is common in the southern portion of the peninsula, having been seen on the Hamilton River and at Lake Mistassini, and it is supposed to be referable to this species.

Vespertilio subulatus, Say, is reported by Stearns from Natashquan.

Sorex personnatus, Geoffroy St. Hilaire (*S. Cooperi,* Baird.).—This small shrew was obtained at Sandwich Bay.

Sciuropterus volucella, Pallas, var. *"Hudsonius"*, Gmel. (Northern Flying Squirrel).—Common in the valley of the lower Hamilton River and about the head of Hamilton Inlet. Found at St. Augustine (Stearns).

Sciurus Hudsonius, Pallas (Red Squirrel).—Found throughout the southern

wooded region as far north as the East Main River, and to the westward; on the Hamilton River from its mouth to Sandgirt Lake, and southward on the Attikonak Branch, but not along the Ashuanipi Branch.

Arctomys monax, Linn. (Woodchuck, Ground-hog).—Common in the country between Lake St. John and the East Main River, and on the Romaine River. Not seen on the Hamilton River, but said to be found about the head of Hamilton Inlet. "Common at Mingan, growing scarce towards Bonne Espérance" (Stearns).

Castor fiber, Linn. (Beaver).—Common in the wooded region and extending into the semi-barrens where food is found. On the Hudson Bay coast, rare north of Big River. In 1887, a specimen was killed in Richmond Gulf, latitude 56°. Charleton Island, in James Bay, was well-stocked with beaver introduced by the Hudson's Bay Company, but they were totally exterminated by wandering Eskimo in 1890. As before stated, beaver are very plentiful on the Lower East Main River. About Nichicun they are now more plentiful than formerly. Common about the Lower Hamilton River and upwards to Sandgirt Lake, becoming very rare to the northward towards Lake Michikamau

Hesperomys leucopus, Rafinesque (White-footed or Deer Mouse).—Common at Northwest River, Hudson's Bay post.

Arvicola riparius, Ord.—Specimen taken on Upper Hamilton River near Lake Petitsikapau. The Indians report a smaller species as not rare in the interior wooded country.

Cuniculus torquatus, Pallas. (Hudson Bay Lemming).—Common throughout the barren ground and southward to about latitude 54°. Specimen obtained from the lake Michikamau.

Zapus Hudsonius, (Zimmermann) Coues, (Jumping Mouse).—Not rare in the wooded region. Specimens taken at the mouth of the Hamilton River, near the Grand Falls, and on the Romaine River portages. The Indians who saw these specimens say that there is a much smaller species found in the interior, which closely resembles the larger, except in size.

Fiber zibethicus, Linn. (Muskrat).—Common in the southern-wooded region, but rare along the Upper Hamilton River.

Erethizon dorsatus, Linn. (Canada Porcupine).—Ranges from St. Lawrence northward into the semi-barrens. Very plentiful along the Hamilton River, where it is largely used for food by the Indians. Common at Hamilton Inlet, and northward to Hopedale. Traces seen along the Great Whale River, and also on the Koksoak River, above Cambrian Lake.

Lepus timidus, Linn., var. *"arcticus",* Leach. (Polar Hare).—Confined to the barren and semi-barren lands of Labrador. On the Hudson Bay coast a few are taken about Great Whale River. On the Atlantic they occur southward as far as Hamilton Inlet. A few are killed about Lake Michikamau.

Lepus Americanus, Erxleben (Hare, "Rabbit").—Found throughout the wooded region. Like the western rabbit, it is visited periodically with an infectious throat-disease, which about once in five years practically exterminates the animal. The disease apparently travels from the west towards the east and takes about two years to cross Labrador. The rabbit is largely used for food by the Indians, but is not sustaining, and they all say that on a diet of rabbits alone they rapidly become weak and unfit to work.

APPENDIX II

LIST OF BIRDS OF THE INTERIOR OF THE LABRODOR PENINSULA.

Urinator imber, Gunn. (Loon).—Common throughout the interior; breeds.

Urinator lumme, Gunn. (Red-throated Loon).—Common on upper Hamilton River and Koksoak River; breeds.

Urinator arcticus, Linn.—Seen June 3rd at Lake Mistassini; not common.

Uria troile, Linn. (Murre).—Common in open water of Hamilton Inlet until January 20th, 1894.

Alle alle, Linn. (Dovekie).—Very common in Hamilton Inlet until January 20th, 1894. Numbers of this and the preceding found frozen in bushes along the edge of the open water.

Gavia alba, Gunn. (Ivory Gull).—Specimen obtained at Rigolet, where it was shot during the winter; seen at Northwest River late in December after the inlet was frozen; not common.

Larus glaucus, Brunn. (Glaucous Gull).—Common throughout the interior; seen May 19th; eggs June 14th.

Larus Delawarensis, Ord.—Nests at Mistassini Lake; seen June 11th.

Sterna Forsteri, Nutt. (Forster's Tern).—Common throughout interior ; seen June 13th, Hamilton River, June 1st, Mistassini.

Merganser serrator, Linn. (Red-breasted Sheldrake).—Abundant throughout the interior; seen May 28th; eggs June 25th.

Merganser Americanus, Linn. (Red-breasted Sheldrake).— Abundant throughout the interior; seen May 28th; eggs June 25th.

Anas obscura, Gmel. (Black Duck).—Not common throughout the interior; seen May 1st; eggs May 23rd.

Glaucionetta clangula Americana, Bp. (American Golden-eye).—A few flocks seen on upper Hamilton River during June; seen at Mistassini May 3rd.

Somateria spectabilis, Linn. (King Eider).—One specimen killed at Lake Mistassini.

Oidemia Americana, Sw. and Rich. (American Scoter).—Common on Hamilton River, May and June, in migration; seen May 26th.

Oidemia perspicillata, Linn (Surf Duck).—Common on Hamilton River during migration, May and June; seen May 26th.

Branta Canadensis, Linn. (Canada Goose).—Breeds in marshes throughout the northern interior, and is seen along the rivers with young broods about July 1st; seen at Mistassini May 2nd, at Grand Falls, Hamilton River, May 4th. From the journals of the Hudson's Bay Company, the average date of first arrival at Lake Winokapau and Northwest River, is May 10th; several large broods seen on Burnt Lakes, Romaine River; not common at Lake Mistassini, but abundant on East Main River—especially on lower part, where the river is cut out of clays, with good bottom-lands; breeds in large numbers on the islands of James Bay.

Branta bernicla, Linn. (Brant).—Very rare in the interior; one sick killed

at Mistassini July 2nd. If these birds cross Labrador in their northern migration, they fly high and only rarely rest, as the Indians, who know them well on the St. Lawrence coast, report them very rare in the interior.

Nycticorax nycticorax naevius, Allen (Black-crowned Night-Heron). —Single specimen at Lake Mistassini, August 6th.

Phalaropus lobatus, Linn. (Northern Phalarope).—Seen on upper Hamilton River, June 13th. Not common.

Gallinago delicata, Ord. (Wilson's Snipe).—Male heard and seen at Lake Petitsikapau, Hamilton River, June 28th.

Tringa minutilla, Vieill. (Least Sandpiper).—Common about Upper Hamilton River. Breeds.

Totanus melanoleucus, Gmel. (Greater Yellow Legs).—Met with occasionally throughout the interior. Breeds. Seen May 31st.

Totanus flavipes, Gmel. (Yellow Legs).—Seen only after August 1st, on Hamilton River and at Mistassini.

Totanus solitarius, Wils. (Solitary Sandpiper).—Common throughout the interior, especially south of latitude 54°. Breeds. Seen May 27th. Eggs June 19th.

Actitis macularia, Linn. (Spotted Sandpiper).—Common along the upper Hamilton River. Seen May 27th. Eggs June 20th.

Aegialitis semipalmata, Caban. (Semipalmated Plover).—Common on Upper Hamilton River. Seen June 16th. Breeds.

Dendragapus Canadensis, Linn. (Canada Grouse, Spruce Partridge).—Common throughout wooded and in the semi-barrens. Eggs June 1st.

Bonasa umbellus togata, Linn. (Ruffed Grouse, "Partridge". Birch Partridge).—Common at Mistassini. Not rare at mouth of Hamilton River. Not found on Upper Hamilton River.

Lagopus lagopus, Linn. (Willow Ptarmigan).—Common throughout the winter. Breeds on Upper Hamilton River. Eggs June 25th.

Lagopus rupestris, Gm. (Rock Ptarmigan).—Common in valley of Hamilton River during winter. Leaves for northward about April 15th.

Ectopistes migratorius, Linn. (Passenger Pigeon). — Very rare. Eggs obtained at Fort George, 1887.

Accipiter atricapillus, Wils. (American Goshawk).—Specimen killed near Cambrian Lake, Koksoak River; also on lower Hamilton River. Not common.

Aquila chrysaetos, Linn. (Golden Eagle).—Breeds at head of Lake Michikamau. Seen in several places along upper Hamilton River.

Halidetus leucocephalus, Linn.(Bald Eagle).—A pair seen on Hamilton River below Grand Falls, April 28th. White heads distinctly seen.

Falco rusticolus obsoletus, Gmel. (Labrador Gyrfalcon).—Specimen shot at Cape Chidley.

Falco peregrinus anatum, Bon. (Duck Hawk).—Not uncommon throughout the interior.

Pandion halidetus Carolinensis, Gm. (Osprey).—Common throughout southern interior, to lat. 54°. Seen May 27th. Eggs June 12th. Nest on top of large white spruce.

Asio accipitrinus, Pall. (Short-eared Owl).—Seen on Upper Hamilton and Romaine rivers.

Nyctale Acadica, Gmel. (Saw-whet Owl.).—Specimen shot near Lake Mistassini.

Bubo Virginianus saturatus, Ridgw. (Dusky Horned Owl).—Common about Northwest River during winter. Common in the interior.

Surnia ulula caparoch, Mull. (American Hawk Owl).—Seen several times on Upper Hamilton River.

Ceryle alcyon, Linn. (Belted Kingfisher).—Was not found north of the vicinity of the Grand Falls, Hamilton River. Common on Romaine and at Lake Mistassini. Seen May 30th.

Dryobates villosus leucomelas, Bodd. (Hairy Woodpecker).—Shot in valley of Hamilton River in March. Not rare.

Dryobates pubescens, Linn. (Downy Woodpecker).—Common on Hamilton River throughout the year.

Picoides arcticus, Swains. (Black-backed Three- toed Woodpecker).—Common along Lower Hamilton River .

Colaptes auratus, Linn. (Yellow-shafted Flicker).—Single specimen seen near Grand Falls, Hamilton River, 30th May.

Chordeiles Virginianus, Gmel. (Night-hawk).—Very rare on Upper Hamilton River. Single specimen seen near the Grand Falls, May 31st. Common at Mistassini and along Romaine River.

Empidonax flaviventris, Baird. (Yellow-bellied Fly Catcher).—Common at Lake Mistassini. Not seen at Hamilton River.

Otocoris alpestris, Linn. (Horned Lark).—Common on barrens of Upper Hamilton River and about Lake Michikamau. Eggs June 19th.

Perisoreus Canadensis, Linn. (Canada Jay).—Very common through out the interior. Nest with four eggs taken at Rigolet, March 24th, 1894; and other at Northwest River, with three eggs, about the same date. Young able to fly from nest on May 18th, at Grand Falls, Hamilton River.

Perisoreus Canadensis nigricapillus, Ridgw. (Labrador Jay.)—Abundant throughout northern interior.

Corvus corax principalis, Ridgw.—Common throughout the interior. Resident.

Molothrus ater, Gray. (Cowbird).—Common at Lake Mistassini.

Scolecophagus Carolinus, Mull. (Rusty Black Bird).—Common throughout the interior.

Pinicola enucleator, Linn. (Pine Grosbeak).—Common on the Upper Hamilton River. Male seen May 1st.

Loxia leucoptera, Gmel. (White-winged Cross-bill).—Common on Hamilton River in March and April.

Acanthis Linaria, Linn. (Common Redpoll).—Abundant about the Hamilton River.

Plectrophenax nivalis, Linn. (Snow Bunting).—Plentiful on Hamilton River in early spring.

Calcarius Lapponicus, Linn. (Lapland Longspur).—Common on Hamilton River in early spring.

Ammodramus Sandwichensis Savanna, Wils. (Savannah Sparrow).—Very common on upper Hamilton River. Eggs June 24th.

Zonotrichia Leucophrys, Forst. (White-Crowned Sparrow).—Very common on upper Hamilton River. Seen May 16th. Eggs June 25th.

Zonotrichia albicollis, Gmel. (White-throated Sparrow).—Common at Lake Mistassini. Heard at Grand Falls, Hamilton River. Common on the Romaine River.

Spizella monticola, Gmel. (Tree Sparrow).—Common everywhere in Labrador. Breeds in great numbers on upper Hamilton River. Seen May 31st ; eggs June 21st .

Junco hyemalis, Linn. (Black Snow-bird).—Common at Lake Mistassini and upper Hamilton River. Seen May 29th. Eggs June 27th.

Melospiza fasciata Scott (Song Sparrow).—Common at Lake Mistassini.

Tachycineta bicolor, Vieill. (White-bellied Swallow).—Common throughout the interior. Seen May 25th.

Ampelis cedrorum, Vieill. (Cedar Wax-wing).—Rare at Lake Mistassini.

Lanius borealis, Vieill. (Great Northern Shrike).—Common on Hamilton River; seen April 16th.

Helminthophaga peregina, Wils. (Tennessee Warbler).—Not rare at Lake Mistassini.

Dendroica aestiva, Gmel. (Yellow Warbler).—Common at Lake Mistassini; seen near Grand Falls, Hamilton River, May 31st.

Dendroica coronata, Linn . (Myrtle Warbler).—Specimen from Grand Falls, Hamilton River, May 31st.

Dendroica maculosa, Gmel. (Magnolia Warbler).—Not rare at Lake Mistassini.

Dendroica striata, Forst. (Black-poll Warbler).—Common on upper Hamilton River. Seen May 31st.

Seiurus Noveboracencis, Gmel. (Water Thrush).—Common about Grand Falls, Hamilton River. Seen May 31st.

Sylvania pusilla, Wils. (Black-capped Yellow Warbler).—Seen near Grand Falls, Hamilton River, May 31st. Not rare at Lake Mistassini.

Parus Hudsonicus, Forst. (Hudsonian Chickadee).—Abundant on Hamilton River from April 1st.

Regulus satrapa, Licht. (Golden-crowned Kinglet).—Common on Hamilton River between Grand Falls and Sandy Lake; rare to northward; seen May 19th.

Regulus calendula, Linn. (Ruby-crowned Kinglet).—Very common along Hamilton River between Grand Falls and Sandy Lake. Seen May 29th.

Turdus ustulatus Swainsonii, Caban. (Olive-backed Thrush).—Very common along the upper Hamilton River. Seen May 16th. Eggs June 30th.

Turdus Aonalaschkae Pallasii, Caban. (Hermit Thrush).—Not rare at Lake Mistassini.

Merula migratoria, Linn. (American Robin).—Abundant throughout the interior. Seen May 10th. Eggs June 13th.

APPENDIX III

LIST OF THE PRINCIPAL FOOD FISHES OF THE LABRADOR PENINSULA WITH SHORT NOTES ON THEIR DISTRIBUTION.

Petromyzon, (sp.).—A small Lamprey was taken on the Bersimis River a few miles below Lake Pipmaukin, 1884, adhering to a large brook trout.

Accipenser, (sp.).—A species of Sturgeon is very plentiful in the Rupert River, being taken in large quantities at Lake Nemiskau, where the Indians congregate and dry the fish during September. The fish here are usually under three feet in length. Also abundant in the river from Lake Nemiskau to its mouth. Common in the East Main River, from its mouth to Conglomerate Gorge. Also found in the lower part of the George River and in the Nottaway at Lake Obatogaman, near its head.

Catostomus longirostris, Le Sueur (Long-nosed Sucker, Northern Sucker). —Common in rivers and lakes throughout the interior. The principal food of the Indians in many parts of Labrador.

Catostomus Forsterianus, Richardson. (Red Sucking Carp, Red Sucker). This is usually regarded as a variety of the above, but Sir John Richardson gives it as a distinct species, and the fish found in Labrador is quite distinct in shape, size of scales and colour, from the first named sucker. It is at least two weeks later on the spawning beds. Common throughout the interior. Preferred by the Indians for food to the gray sucker. Average weight of both species about 5 pounds.

Osmerus mordax, (Mitchill), Gill. (American Smelt).—Common at the mouth of the Northwest River, Hamilton Inlet, where it is abundantly taken in November and the early part of December.

Coregonus clupeiformis, (Mitchill), Milner (Common Whitefish).—Found abundantly throughout the interior, in lakes and rivers. Largest fish taken in Lake Mistassini, 14 pounds weight. Average weight 3 or 4 pounds. A small species of whitefish closely resembling the common whitefish is caught in abundance in the shallow salt water along the east coast of James Bay. These fish ascend the rivers of James Bay during the autumn months along with sea trout.

Salmo salar, Linn. (Common Atlantic Salmon).—Abundant in the rivers of the St. Lawrence and the Atlantic coasts and also in the rivers flowing into Ungava Bay. Reported by Dr. R. Bell, as taken by Eskimo at Stupart Bay, at the western side of Ungava Bay or Hudson Strait. The salmon enter the rivers of the St. Lawrence coast early in June, are taken in Hamilton Inlet in July, but do not ascend the Koksoak and other rivers of Ungava Bay until about the middle of August. From this there would appear to be some connection between the time at which the fish strike into the rivers and the temperature of the water along the coast, that the northward rising more slowly than the southern waters; or else the fish follow northward along the coast and take at least two months to

pass from the Strait of Belle Isle to Ungava Bay. There is no evidence, however, to show that the fish thus follow the coast. The time at which the salmon enter Ungava Bay from the Atlantic and the absence of this species from Hudson Bay, would seem to show that the waters of the western part of Hudson Strait do not rise sufficiently in temperature to allow the salmon to enter Hudson Bay in time to ascend its rivers before the spawning season, and this is the probable cause why no Atlantic salmon are found in its rivers.

The land-locked variety of "*S. Salar,*" or ouinaniche, is found in Lake St. John and the tributaries of the Saguenay River, where it has free access to the sea, but as the same fish was found plentiful in both branches of the Hamilton River, above the Grand Falls with its sheer drop of 300 feet, it is certainly land-locked there. It is also common in the Koksoak River below Lake Kaniapiskau, above perpendicular falls of eighty feet and sixty feet. Common in Lake Michikamau on the head of the Northwest River. It is also reported by the Indians as numerous in the upper George River, the Romaine River, the Manicuagan and several other of the rivers flowing into the Gulf of St. Lawrence. It has not yet been reported from the rivers of the western watershed. Average weight of the fish caught, not above three pounds. The Indians report that the largest in the Hamilton River do not exceed ten pounds in weight.

Salmo Hearnii, Richardson (Hearne's Salmon).—A small salmon, with bright red spots on its sides, is found along the northern east coast of Hudson Bay, and probably belongs to this species. Its southern limit is a small river a few miles south of Cape Jones. It is taken in nets in the salt water near Long Island, just north of Cape Jones, and also in some small streams flowing into Richmond Gulf. The Eskimo also report it common in some of the rivers north of Richmond Gulf

Salvelinus namaycush, (Walbaum), Goode (Great Lake Trout).—Very plentiful in all the larger lakes of the interior northward to Hudson Strait. Very abundant in the lake-expansions of the Hamilton River and Lake Michikamau. Average weight about 8 pounds, but many taken more than 25 pounds in weight.

Salvelinus fontinalis, (Mitchill), Gill and Jordan (Brook Trout).—This fish is abundant in many of the rivers and lakes of the Labrador Peninsula. Sea-run fish of this species are plentiful along the shores and lower parts of the rivers from the St. Lawrence to the southern part of James Bay. On the Atlantic coast and Ungava Bay, they are particularly plentiful and of large size. Along these coasts the mouth of every river swarms with trout during the late summer and autumn. The largest fish reported was taken at Nachvak and weighed fourteen pounds. In the Koksoak and George rivers, the average weight of the sea-run trout is about seven pounds. In Hamilton Inlet, there is less change in the sea-run fish than along the coast. At Northwest River the fish are small and do not average over one pound in weight. Here they were freely taken with a fly, up to the middle of December, when the mouth of the river was frozen over. In the mouth of the Hamilton River, sea-run trout average about three pounds in weight.

In James Bay, the trout taken along the coast and in the lower parts of the rivers are generally small and do not exceed two pounds in average weight. Between the lowest falls and the upper waters of the western rivers, brook trout are

rarely taken, but in the northern, eastern and many of the southern rivers they are abundant along their entire length.

In the Koksoak River, for a few miles below Lake Kaniapiskau, large trout were abundant, but lower down they became smaller, until the sea-run fish were met with. On the Hamilton River, below the Grand Falls, the trout do not average over one pound in weight. Above the falls, the fish are much larger, and average more than three pounds in weight, while fish of five pounds and seven pounds are common. On the Romaine River, no trout were taken until the Burnt Lakes were passed, when they became plentiful, though small. Outside of the rivers and small streams, this species is found abundantly in most of the numberless lakes throughout the interior. Two varieties are met with everywhere; one has pink flesh, the other yellow, the former having the finest flavour.

Esox lucius, Linn. (Pike).—This fish is found abundantly throughout the interior in the lakes and quiet-flowing streams; common on the rivers of the southern, eastern and western watersheds; not so abundant in the Koksoak River. It varies in weight from two to fifteen pounds.

Anguilla, (Sp.).—The Indians report eels as common in the upper Romaine River.

Stizostedium vitreum, (Mitchill), Jordan and Copeland (Wall-eyed Pike, Doré, "Perch" of the Hudson Bay Co).—Common in the southern rivers flowing into Lake St. John and to the westward, also in the Rupert and East Main rivers of the western watershed. Rare in the Betsiamites River, and not found east of that stream, being unknown to the Indians of Mingan. Not found in the Big River, or streams to the north of it, nor in the rivers of the eastern or northern watersheds. Average weight, three pounds.

Lota maculosa, (Le Sueur), Cuvier and Valenciennes (Ling, LaLoche, Maria).—Common in all the deep lakes throughout the interior. An important source of food for the Indians, owing to its taking bait freely during the winter months, when other fish cannot be caught. Weight, two pounds to fifteen pounds.

Gadus callarias, Linn. (Common Cod-fish).—Plentiful along the St. Lawrence and Atlantic coasts to Cape Chidley, also along the east shore of Ungava Bay to the mouth of George River. The following abstract from the Census of Newfoundland (1891) will show the extent and value of the cod-fishing of the Atlantic coast :—

"10,478 men, 2081 women and 828 children were employed in the fishery in 861 vessels, of which the tonnage amounted to 33,689 tons. The total catch of codfish amounted to 488,788 quintals." Fishing beyond Cape Chidley, along the east coast of Ungava Bay, was not undertaken until 1893, when a Newfoundland steamer was so successful that in 1894 two steamers and three schooners made successful catches in the neighbourhood of Port Burwell. The Esquimo report cod as being plentiful about the mouth of George River in the month of August. It is at present unknown whether the fish enters Hudson Bay, and it is a question which should speedily be settled by a properly equipped vessel, as valuable fisheries in the northern part of that great body of water may be lying idle for want of proper information concerning them.

NOTE.—Appendix V, of microscopic descriptions of rocks, is not given here. The foot-notes referring to Appendix V indicate which rocks have been so examined, and are described in report Geological Survey, Vol. VIII, part L. 1895.

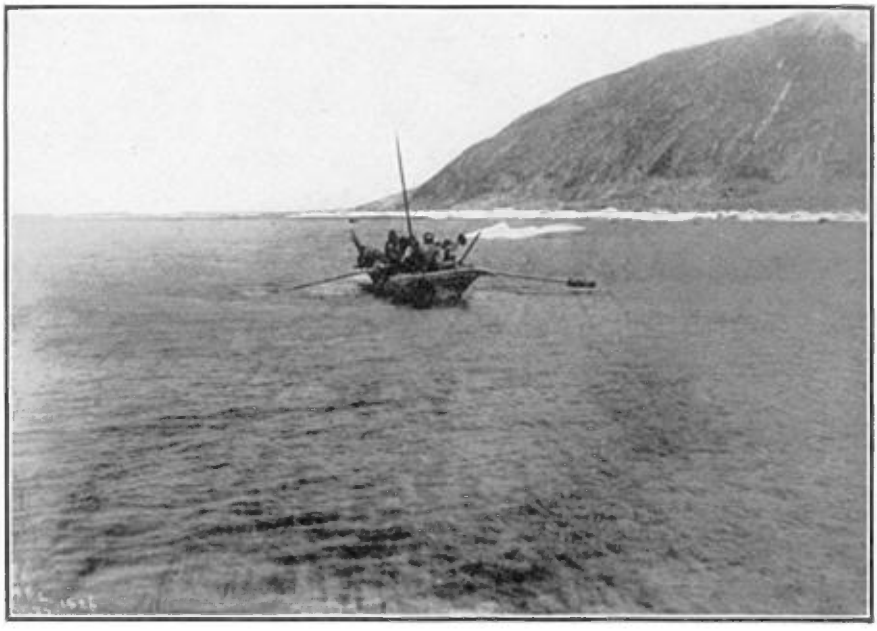
EXTRACTS FROM REPORT ON A TRAVERSE OF THE NORTHERN PORTION OF LABRADOR PENINSULA BETWEEN RICHMOND GULF AND UNGAVA BAY

GEOLOGICAL SURV. OF CAN., A. P. LOW, 1896.

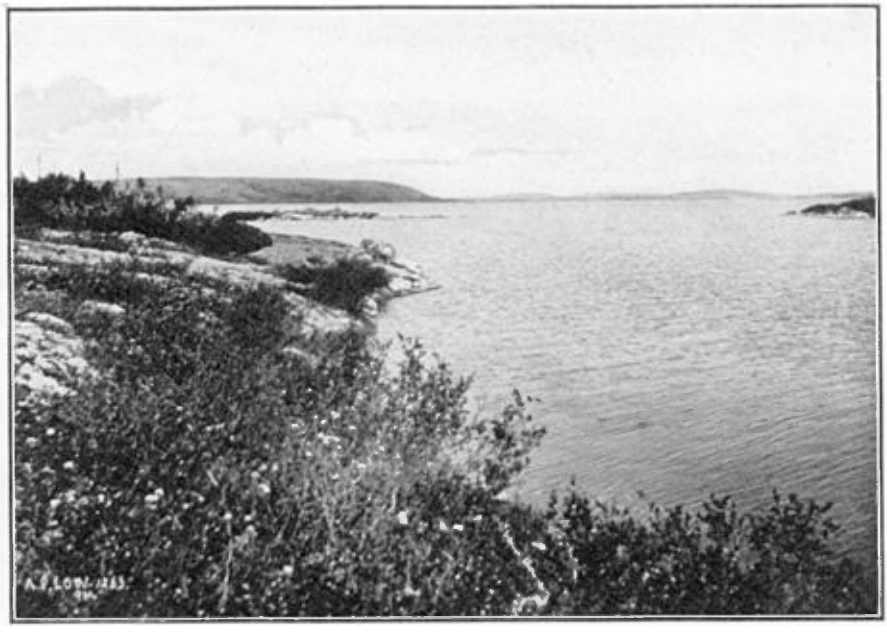
Journey to Commencement of Exploration.

To reach the point of departure of the exploration, far up the east coast of Hudson Bay, the party left Ottawa on May 27th, and proceeded by the Canadian Pacific Railway to Missinaibi station, situated near the head of the Michipicoten River, which flows into Lake Superior. Here the outfit and provisions were loaded into two large Peterborough canoes and a large bark canoe manned by four Indians, who were temporarily engaged to assist in the transport to Moose factory. From Missinaibi station the route led through Dog and Crooked lakes to the height-of-land separating the head-waters of Michipicoten from the Missinaibi branch of the Moose River. Having crossed the watershed Missinaibi Lake was followed northward to its outlet, and the river was descended to Moose Factory near its mouth in the south-western part of James Bay. This part of the route has been fully described by Dr. Bell,† and it need only be stated here that it is the easiest and shortest route from the railway to Hudson Bay, being in all about 350 miles. Rapids and falls necessitate some twenty-five portages, of which the longest is more than two miles, but most are comparatively short, ranging in length from 50 to 400 yards. The last portage is about 150 miles above the mouth of the river, and below it the stream passes, from the undulating country underlain by Laurentian and Huronian rocks, to a much flatter country where nearly horizontal beds of Silurian and Devonian limestone are masked beneath a considerable thickness of stratified clay and sand. These deposits of drift thin out towards James Bay, so that for upwards of fifty miles from the mouth of the river, the land does not reach an elevation of one hundred feet above the sea. This great plain was covered with large spruce trees and remnants of the forests are still found in patches along the banks or on the islands, but elsewhere it has been burnt and its place taken by a thick growth of small aspen and white birch. Much of the plain would undoubtedly make fine agricultural land and the climate is sufficiently temperate to allow the successful growth of hardy cereal and root crops, as these are now grown at Moose Factory, which is less favourably situated than the country further away from the influence

† Report of Progress, Geol. Surv. Can., 1877-78, Part C.



UMIACK OF WOMEN'S BOAT—Wakeham Bay.



VIEW OF SEAL LAKE—Five Miles East of Narrows, Looking East.

of the cold waters of James Bay. A drawback to settlement exists in the swampy nature of large areas having a clay subsoil, but this might easily be overcome in many places by drainage to the rivers, and a large tract of country made fit to support a considerable population when it is rendered accessible by railways.

A delay of a week at Moose Factory was occasioned by the repairs necessary to the large Collingwood fishing-boat belonging to the Survey which had been stored there in 1892. The boat was loaded with two tons of provisions and outfit, and carried the two large wooden canoes on deck, besides a crew of six men, and consequently was rather low in the water for safety or comfort. The trip up Hudson Bay lasted from the 14th to the 29th of June, and the course followed was across Hannah Bay to Point Comfort, thence north-east passing to the east of Charlton and Strutton islands to the east coast of Cape Hope, whence the coast was followed to Richmond Gulf.

COUNTRY BETWEEN HUDSON BAY AND CLEARWATER LAKE.

Richmond Gulf, or more properly "Gulf Lake", is a triangular body of salt water, widest at the southern end, where it measures nineteen miles from east to west, while its greatest length is twenty-three miles from north to south. It is separated on the east side from Hudson Bay by a high narrow ridge of Cambrian rocks, capped with trap, which rises in cliffs from 500 to 1200 feet above the water. A deep narrow break in the ridge near the south-west angle of the lake, (or gulf) affords a connection between the sea and the lake. The average rise and fall of the tide in this part of Hudson Bay is about six feet, and is sufficient to cause a tremendous rush of water in and out through the narrow channel which is about two miles long and less than 300 yards wide in its narrowest part. The difference between high and low water in the lake is about twenty inches. The south and east shore are rounded hills of Laurentian granite, from 500 to 1000 feet high, flanked by upturned beds of Cambrian rocks and trap. The expanse of the lake is broken by a number of large, high islands formed from the same upturned beds dipping west.

Along the outer coast in the vicinity, stunted black spruce and larch grow in clumps only in the low protected gullies, but around the margin of the lake the trees grow thickly everywhere, and on its eastern side, they rise nearly to the summits of the hills, showing that the climate is more moderate away from the cold waters of Hudson Bay.

The Clearwater River, a large stream discharging Clearwater Lake, flows through a deep, narrow gorge near the south-east angle, into Gulf Lake, and about two miles to the eastward another stream called the Wiachouan falls in. The mouth of this river was reached on July 1st, and after discharging the boat, which was then sent in charge of two Eskimos to Great Whale River, the outfit and provisions were rearranged for portaging inland. The Wiachouan has a fall of 315 feet just above where it reaches the salt water. This was passed by a portage two miles and a quarter long that rises 500 feet to the summit of a rocky ridge and then descends to the stream immediately above the fall. One mile above, a fall of 55 feet necessitated another portage of quarter of a mile, with a very steep rise at its lower end. The river above this, for twelve miles, to where the route leaves it, is about forty yards wide, and winds through a valley nearly

half a mile wide walled in with rounded Laurentian hills that rise from 300 to 500 feet above it. The valley is well wooded with small spruce and larch, the upper sides and tops of the hills being partly bare.

The route left the river on its north side, by a portage that rose in a mile and a quarter to a small stream nearly on a level with the surrounding country, or about 750 feet above sea-level. Five short portages were made along the stream, where it connects as many small lakes, and then a portage of 1000 yards was crossed to a lake drained by another tributary of the Wiachouan. The route followed this stream due east eleven miles, through three lakes of two, one and a half and seven miles long, respectively, connected by portages of 175 and 750 yards. The route then turned north and passed over four portages of 90, 220, 375 and 500 yards, connecting short lake-traverses to a large lake drained by a branch of the Clearwater.

This lake is five miles and a half long and has a number of deep bays at both ends. A portage of a third of a mile, led from its east end to the small stream discharging it, which was followed northward two miles, and there left on the north side by a portage up a steep hill and then one mile over a barren plain to the Clearwater River.

The river was ascended four miles and a half to an expansion called Stillwater Lake, passing on the way five short rapids where half-loads were tracked up. The lake is seven miles long and averages half a mile in width; at its head there is a heavy rapid passed by a portage of 300 yards. The current above is sluggish for two miles, to where the stream branches into three parts, all outlets of Clearwater Lake. The eastern and smallest stream was followed for a mile and a quarter, when a narrow neck was crossed into the middle branch at the head of a long rapid, about one mile below where it flows out of the lake. Clearwater Lake was not reached until July 11th owing to the large quantity of supplies to be carried over the numerous portages.

The country between Richmond Gulf and Clearwater Lake has a great sameness of character and consists of a plateau rising abruptly from the coast to a general elevation of 750 feet. Its surface is broken by rounded ridges of granitic hills that rise from 100 to 400 feet above the general level, while the valleys between the ridges are filled with lakes, generally long and narrow, those of each valley being connected by short rapids. The largest rivers, like the Clearwater, have deep valleys cut below the general level of the plateau, but these only extend a few miles inland, so that beyond fifty miles from the coast all the water-courses are but little below the level of the plateau. About one half of the plateau is barren, the trees being confined to the margins of lakes and the lower lands of the valleys. The forest is wholly composed of black spruce and larch, the former constituting about ninety per cent of the whole. The trees are small, slim and grow close together on the lower grounds, but on the higher they are separated by open glades. The largest trees never exceed twelve inches in diameter three feet from the ground, nor are they ever more than thirty feet high.

The small streams and lakes are well stocked with trout and white fish. In the Clearwater, large brook and lake trout are plentiful, especially in the rapids below the lakes. The barren-ground caribou is not abundant in this region, and in summer is not often met with, being at the season in the barrens farther north. Willow ptarmigan were found everywhere in great numbers, but other feathered

game is scarce. A few families of wandering Indians inhabit this area and the frequent standing poles of their wigwams showed they had camped along the route.

CLEARWATER LAKE

The exploration of the shore-line of Clearwater Lake occupied our time from the 12th to the 20th of July, much delay being caused by wind and rough water.

Clearwater Lake is a large and beautiful body of water, whose greatest length from south-east to north-west is forty-five miles. From its north-west end the main body of the lake is nearly twenty miles across, it then narrows to about half that width and continues so to the head of the south-east bay. The shore line is very irregular, being broken by rocky points into numerous bays of various forms, some of which are quite long; they are most numerous along the north-west and southern shores, and these portions of the lake are fringed with many rocky islands, some of them large. Islands are also found along the other shore, but are not nearly so numerous. Besides the fringe along shore, the middle of the lake is occupied by several large and high islands that extend into and nearly block the entrance of the south-east bay. The main outlet of the lake is near its south-west corner, where several large islands divide it into three channels, as already mentioned. Another outlet leaves the head of a narrow bay some four miles west, and this stream does not join the main discharge for more than twenty miles; still another outlet is said to flow from the head of a long narrow bay that stretches westward from the northwest corner of the main lake. The streams flowing into the lake are all small and unimportant; the largest is called Noonish River and enters at the north-east corner, while another large brook into the head of the south-east bay. The water is remarkably clear, deep and cool, and it abundantly stocked with large lake and brook trout, whitefish and suckers. The surrounding country is formed of rounded Laurentian hills that rise from 200 to 500 feet above the lake. Only two hills exceed 500 feet in altitude, and they are but little higher, one, called Burnt Hill, is situated near the mouth of the north-west bay, the other or Berry Hill is on the north side, about ten miles east of Burnt Hill. From the summit of the latter, the east end of Seal Lake may be seen some twenty miles to the northward. The hills are higher around the western and southern portions of the lake, the land becoming lower and flatter to the north and east, especially about the south-east bay, where large areas are flat and swampy. The forest is similar in size, growth and distribution to that already described, the trees about the south-east bay being somewhat larger and the woods continuous over the low areas.

COUNTRY BETWEEN CLEARWATER AND SEAL LAKES.

The canoe-route from Clearwater Lake to Seal Lake, ascended the Noonish River due east, for fifteen miles, through small lake-expansions connected by three rapids, to a small lake at its head. The rapids are too shallow for canoes and were passed by portages of 1000, 600 and 50 yards respectively. From the lake a portage of 500 yards led over a ridge to a narrow southern bay of Seal Lake.

The country surrounding the route is similar to that last described, with low partly barren hills rising from 100 to 300 feet on both sides of the valley. A new

feature is the quality of stratified sand arranged in ridges along the valley. These ridges are uniform in height, about fifty feet above the water, and look like terraces but on examination are seen to be sharp and narrow and are probably eskers formed by a glacial river flowing westward. A continuation of the ridges was seen on the southern bay of Seal Lake, about three miles from where it joins the main body, and there they form long narrow points stretching out from the west shore.

SEAL LAKE.

The time between July 24th and August 3rd, was spent on Seal Lake, but owing to a succession of strong gales for several days, the lake was too rough for canoes and consequently there was only sufficient time to carry a survey-line from the southern bay to the head of the north-east bay. From this survey, supplemented by information obtained from Indians, the lake was found to be more than fifty miles long, while it varied in breadth from half a mile to five miles. Its western end is about twenty miles directly north of Berry Mountain on Clearwater Lake, where it discharges by the Nastapoka River, a large stream flowing into Hudson Bay forty-five miles north of Richmond Gulf. The southern bay on the Clearwater route is six miles long and is broken by a number of smaller irregular bays on both sides.

Thirteen miles east of its mouth, the main lake narrows to less than 300 yards for a short distance and has a strong current that practically joins two lakes. To the eastward of the narrows the breadth varies from one to two miles, for six miles, the lake then dividing into long narrow bays, one running a little south of east, the other nearly north-east. The east bay was not explored but is said to have about the same length as the south-east one, or about sixteen miles. The north-east bay subdivides about two miles from its mouth, the main bay continues north-east, the other running nearly west for some ten miles. The surface of the lake is partly broken by islands, many of those in the western part being large and high. In the eastern part, the islands are generally small and rocky, but there is a chain of them along the north shore formed of sand, the remains of esker ridges. The water has a brownish tinge and is not nearly so clear as in the last great lake; in many places it is quite shallow.

The name is derived from the seals living in its waters, which are either the common harbour seal (*Phoca vitulina*) or a closely allied species. The harbour seal is known to travel over land for considerable distances, but its presence in this lake nearly a hundred miles from salt-water at an elevation of nearly 800 feet above the sea, can hardly be due to its migration up such a rough stream as the Nastapoka. Another way in which it might have reached the lake was during the subsidence of the land at the close of the glacial period, when the lake was nearer sea-level than at present by more than 600 feet, and when the deep bay extended inland up the present valley of the Nastapoka to or near the outlet of the lake, with such conditions it would be easy for seals to reach the lake, and having found it full of fish they probably lost the inclination to return to the sea. Three seals were seen in the lake, and the Indians kill annually more than thirty, showing that the animal breeds freely in the fresh water.

The same rolling semi-barren country was found about Seal Lake, with rounded rocky hills rising from 100 to 300 feet above its surface; the trees are si-

milar to, but smaller than, those about Clearwater Lake. Barren-ground caribou were seen plentifully on the island and about the shores of the lake.

Seal Lake was left on August 4th, by a small stream called Buzzard Brook, which flows into the head of the north-east bay at the top of a prominent, steep hill. The brook flows from the north east in a valley from 100 to 1000 yards wide. It is a succession of small lakes joined by rapids, which were passed by four short portages in the seven miles to the height of land separating the Nastapoka from the head-waters of the Stillwater branch of the Koksoak. The height of land portage is fifty yards long and passes through a low boulder strewn gully to Shem Lake.

The drift becomes much thicker as the watershed is approached and is thrown into irregular sharp hummocks from 50 to 150 feet high, covered with many boulders and angular masses of rock. The sandy esker-ridges continue from Seal Lake up the valley to and beyond the height-of-land.

UPPER STILLWATER RIVER.

Shem Lake is seven miles and a half long from the portage to its discharge at its northeast end; it varies from a quarter to one mile wide and occupies a continuation of the valley followed from Seal Lake. The country surrounding the lake rises from 100 to 200 feet, with gently sloping hills masked by a thick mantle of drift through which the rocks appear only on the summits. The drift is largely composed of angular blocks and boulders, and it is evidently little travelled. The lake discharges by a large brook which falls twenty-five feet in a quarter of a mile below the outlet; it is then joined by a northern stream of equal size, and the combined stream is called the Natuakami or Stillwater River.

From Shem Lake to Natuakami Lake, fifty-four miles lower down stream, the character of the river and surrounding country changes so little that the whole may be included in one description a bewildering detail of rapids and changes of course. The stream between the lakes flows in a general north-east direction. With numerous minor bends, it first flows nearly north-east for thirty-four miles, then turns gradually towards north for twelve miles and finally north-east for eight miles.

The main stream is joined by tributaries at frequent intervals, mostly from the northward, the largest flow in at the eighth, eighteenth, twenty-sixth, thirty-fifth and forty-seventh miles below Shem Lake ; the last is the only important stream, and has been named Russel River. It flows through a deep northern valley and joins the Stillwater by a fall of ten feet. It is somewhat smaller than the main stream which above the junction flows with a rapid current in a shallow channel about 150 yards wide. The level of Natuakami Lake is 370 feet below that of Shem Lake and the river between the lakes is almost a continuous rapid without any direct falls, the total number of rapids is sixty-four, or more than one per mile. They are very shallow, greatly obstructed with boulders and dangerous to descend with canoes.

The country does not slope with the river, and consequently the bottom of the valley for several miles above Natuakami Lake is about 700 feet below the general level of the surrounding region. The valley varies from a quarter of a mile to a mile in width, and small black spruce and larch grow on the low bottoms

and nearly to the summits of its rocky walls. The river is not well supplied with fish, only a few trout and suckers being taken with net and hook. Barren-ground caribou were plentiful on the sandy islands above Natuakami Lake, but were scarce along the upper part of the river where they probably confined themselves to the barren upper hills to escape the tormenting swarms of flies met with in the valley.

The country above the valley is formed of rounded ridges of bare granite hills without soil or trees, fire having destroyed every vestige of vegetable growth.

NATUAKAMI LAKE.

Natuakami Lake occupies a broadened portion of the valley and is only an expansion of the river without current. It is fifteen miles long and varies from a quarter of a mile to three miles in width. The water is generally shallow and at the head of the lake there is a delta of low sandy islands three miles long, formed from detritus brought down by the river. These barren, wind-swept islands are a favourite resort for caribou in fly time. The sides of the valley rise gently and do not obtain an elevation of 50 feet above the lake within from five to ten miles of the shores, leaving wide areas of swamp and bottom lands on both sides, where small black spruce and larch grow thickly except where removed by fire.

A number of Indians were found here engaged in killing caribou; they reported that the lake is well stocked with trout, whitefish and suckers, and that a few salmon are taken in the nets, but that the greater number of salmon ascend the Kenogamistuk branch to spawn. A number of small salmon were taken between Natuakami Lake and the junction of the Kenogamistuk on the way down stream.

LOWER STILLWATER RIVER.

The distance from the Natuakami Lake to the junction of the Kenogamistuk is thirty-seven miles, and the general course of the river is about east-north-east, the stream forming a light curve on the south side of that course. The river leaves the lake at its east end, where, for two miles, it is broken into shallow rapids, with a fall of twenty-five feet. Small islands and shingle bars divide the stream into several channels, all very shallow and greatly obstructed with boulders which form the bottom at the rapids, no rock being seen in place in the bottom at these or other rapids further down stream, showing that the present bed of the river is probably a new one, considerably above the level of its pre-glacial bed. The valley at the outlet of the lake narrows to about half a mile, and lower down varies from half a mile to one mile across. The steep rocky walls rise from 400 to 1000 feet above the river. The stream averages a quarter of a mile in width, and the interval between the shores and the sides of the valley is occupied by low swamps resting upon clay soil. Terraces up to 160 feet above the level of the river were observed almost continuously on both sides of the valley from the outlet of the lake, and probably mark the level of the sea during the period of post-glacial subsidence. The terraces were not seen above Natuakami Lake, but this was probably due to the lack of drift upon the rocky walls of the valley there, as the clays extend about eight miles above the lake, to the foot of the heavy rapids of the upper river.

STILLWATE RIVER, LOOKING WEST—Ten miles above Natuakami Lake.

View of South end of Lake Michikamau from hill (450 ft.) near outlet of lake.

The trees in the valley below Natuakami Lake are larger than any met with in crossing from Hudson Bay, and a few small balsam fir and balsam poplar were noted, along with the black spruce and larch.

Below the outlet rapid, there is an interval of five miles of quiet water, followed by two miles and a half of rapids, with a descent of thirty feet, where the channel is again broken by bouldery islands, while the low muddy shores of the stretch above, give place to high banks of rounded boulders. Then follows eleven miles of even current at a rate of about three miles an hour, the river flowing in a shallow channel from a quarter to half a mile wide, obstructed by many sand bars; the banks are low and muddy, with swamps or long narrow lakes between the river and the sides of the valley, which are from one to two miles apart. The slopes rise from 800 to 1000 feet and are flanked by terraces, the high-level terrace (200 feet) being very persistent, and in places having its upper part and top formed of packed boulders. The lower terraces are seen only in the gullies of small tributaries and never rise more than 50 feet above the river.

The quiet water is followed by fourteen miles of heavy rapids connected by stretches of swift water, extending to the junction of the Kenogamistuk, the total fall being 65 feet. The stream varies from 200 to 400 yards in width with banks from ten to thirty feet high, composed of tightly packed boulders which form points jutting a short distance into the stream. Eddies occur below the points and are of great assistance in ascending with canoes. The hills are somewhat higher and more rugged, often terminating in sharp points due rather to the weathering of the granite than to lack of glaciation.

A short distance above the Kenogamistuk, a large stream called the Lookout River flows in from the northward. It is broken into several channels at its mouth by low shingly shoals, over which it falls in steep shallow rapids. About a mile up the river passes out of a deep narrow gorge, at the mouth of which are two well-marked terraces 100 and 250 feet high. The poles of a number of Indian tents were standing on both terraces, where the natives live during the autumn while keeping watch for herds of caribou that cross the river in the vicinity.

KENOGAMISTUK RIVER

The Kenogamistuk is a much larger stream than the Stillwater, being at its mouth more than a mile wide, but as it is greatly obstructed with sand and gravel bars, the width of the combined channels would be about half a mile only. The channels are shallow, but the current is very strong and the volume of water great. The river was ascended five miles from its mouth, to where a large tributary flows in with tremendous rapids through a narrow gorge from the south-east. As the stream was ascended its channel was found to contract and the deeper water became more rapid, so that for half a mile below the branch, its width was about 200 yards and the rapids quite unnavigable. From a hill nearby, the valley of the main stream was seen stretching for several miles to the south-west and down it the river poured in a continuous heavy rapid for more than six miles. The valley varies from one to two miles in width, and the rocky walls rise from 600 to 1,000 feet above the stream. The banks of the river are usually steep and often show sections of contorted, bedded clay, gravel and shingle. The high-level terrace (250 feet) is well marked on both sides of the valley.

According to the Indians who hunt along the Kenogamistuk, the river is almost a continuous rapid from its mouth to the first forks some forty or fifty miles above, the forks being situated about thirty miles directly south of Natuakami Lake. The western branch is much the smaller and rises in a large lake near the head waters of Little Whale River; the larger branch flows from the southward for a considerable distance, from where it again branches, the western branch rising near the head of Great Whale River, the southern branch draining several large lakes not far to the northward of Nichicun and Lake Kaniapiskau.

LARCH RIVER

From the junction of the Stillwater and Kenogamistuk, the combined stream is called the Larch River for sixty-six miles, to where it is joined by the Kaniapiskau, the general course for this distance being nearly east-north-east. The course is north-east for twenty-five miles below the Kenogamistuk. As the valley here is from two to four miles wide and the river from 400 to 1,000 yards across, there is a considerable interval of flat swampy land between the shore and the sides of the valley. The hills continue rugged and slightly lower than those previously described. A good view of the country surrounding the river was obtained from the summit of a sharp peak of granite 890 feet above the water, on the north side of the valley about two miles below the forks. The country is more broken than the uplands about Natuakami Lake, being deeply cut by the ravines of small streams leading down to the river. The depressions are dotted with small lakes and ponds, and the whole upper surface is devoid of trees, the vegetation being confined to small willows and arctic shrubs. The clay banks of the river slope gently from the water to heights ranging from twenty to forty feet. The shores are generally sandy with frequent bouldery points; the channel is shallow and obstructed with long sand bars and shoals, over and between which the river flows with a uniform current of about four miles an hour. The valley closes in to less than a mile towards the end of the course, and the river also narrows and breaks into heavy rapids for the next eight miles, with a total fall of 60 feet, the general course of the stream being south. Along the first five miles, the rapids are very heavy, the river being hemmed in between low banks of huge boulders, so that its breadth varies from 100 to 200 yards only. The channel widens by degrees along the lower three miles, and the rapids gradually change into a swift unbroken current flowing in a shallow channel. Two large streams join the river from the northward, the upper, called Young River, comes in with a tremendous rush over huge boulders about the middle of the course; the other, or Junction River, falling in at the lower end, and taking its name from the fact that its valley appears to mark the junction of the Cambrian rocks with the granites. The surrounding country is somewhat lower, but more rocky and broken than that last described. Terraces at elevations of 30, 60, 100, 150 and 200 feet were observed in many places.

The course of the main stream below Junction River is south-east for ten miles, then east for nine miles, north-east for nine miles, and finally east for eight miles to its junction with the Kaniapiskau. The river varies from a quarter to a third of a mile wide along the three upper courses, and flows with a swift, even current broken only by shallow rapids at the sixth and fourteenth mile. The banks are high and scarped in places, when they show sections of stratified clay, but in

most places they have a gentle slope, and between the frequent bouldery points are covered with a thick tangle of willows that extends from the water to the edge of the trees some sixty feet above the river.

The aspect of the country changes with the change of the rock, the unequal granite hills giving place to regular ridges of stratified rock, which have a gradual slope towards the east coinciding with the dip of the strata while presenting steep cliffs toward the west. These ridges vary from 200 to 500 feet in height above the river, along the western part, but as the Kaniapiskau is approached, they become higher and about the junction with that stream some are 1,000 feet high. The valley immediately below Junction River widens out until the hills forming its sides are from five to ten miles apart, the space between being occupied by a flat plain elevated about sixty feet above the river. As this plain is underlain by clay, its surface is usually very swampy and is covered with deep *"Sphagnum"* moss, through which a passage from the river to the hills can be made only with great difficulty. All the tributaries have deep gullies cut into the clay. The trees are the same as those last described, being confined to black spruce, larch, balsam fir, white spruce and balsam poplar; they are all small and of no commercial value. The spruce, larch and fir grow thickly on the plain and lower parts of the hills, of which the summits are barren.

The river is very rapid along the last course of eight miles above the Kaniapiskau, having a fall of forty feet. It narrows to about 300 yards and rushes along in a much narrower valley than formerly, between high banks of clay faced with boulders, to the forks. The Kaniapiskau is the longest and largest branch of the Koksoak River, and takes its rise in Summit Lake in north latitude 53°, out of which the Manicouagan River also flows southward to the Gulf of St. Lawrence, thus forming a continuous waterway from Ungava Bay, southward across the centre of Labrador to the St. Lawrence. The Kaniapiskau was explored from Lake Kaniapiskau downwards in 1893, and a description of it is given in my report on the Labrador Peninsula.* Where it joins the Larch River it is about half a mile wide, with a strong current and shallow channel.

KOKSOAK RIVER

The united stream below the junction of the Larch and Kaniapiskau is called the Koksoak, an Eskimo word signifying "big river". The river averages about half a mile in width for six miles below the forks, and flows with a swift current in a shallow channel. The banks are low and either strewn with boulders, or sandy. The hills on the sides of the valley are from one to two miles apart, and are arranged in sharp ridges whose axes are nearly at right angles to the river. These ridges rise from 500 to 800 feet above the water and have steep cliffs on their south-west sides.

The course of the river is north-east for the next twenty-five miles, and its channel varies from half a mile to a mile and a half in width, being obstructed by large islands of sand and gravel covered with a thick growth of willows. The banks vary from ten to thirty feet in height and are formed of sand with a bouldery shore. The valley is from one to three miles wide and rises in low sandy ter-

* Annual Report, Geol. Surv. Can., Vol. VIII (N.S.), pp. 107-123 L.

races to the flanks of the rocky hills, which are formed of schist, gneiss and granite instead of the shale, limestone and trap of the former courses. The hills become lower as the river is descended, and although formed of different rocks they still preserve the characteristic westward facing cliffs and vary from 300 to 500 feet in height. The channel contracts to about half a mile at the lower end of the course with rocky shores, islands and reefs that break the stream into heavy rapids for a mile. The tide affects the river to the foot of this rapid.

The course is nearly east for eighteen miles from the rapid to Highfall Creek, a small river falling in from the southward. Along this course the banks are generally high and rocky and the south shore is an almost continuous rock exposure. The channel is about a mile wide and is broken by many low islands of sand and boulders. The hills on the south side rise in many places directly from the river, but are only from 50 to 200 feet high; on the north side there is usually wide sandy terraces between the river and the rocky hills behind.

From the mouth of High-fall Creek the course of the river changes to north-east for ten miles; the stream widens to nearly two miles and the low hills retreat, leaving a wide interval of swampy land on both sides. The shores are flat, and when the tide is low, extensive mud-flats are laid bare on both sides. Eight miles below High-fall Creek the shores again become high and rocky, and the river is obstructed by several large rocky islands that divide it into a number of channels through which the water rushes in or out according to the state of the tide.

The next and last course of the river is nearly north-north-east for thirty-two miles, to its mouth in the south-west part of Ungava Bay. Along this course the channel is deep, and with the exception of a few rocky islands along the shore and a large one, called McKay Island, twenty miles above the mouth, no obstructions to navigation occur. The current varies from four to seven miles an hour up or down with the rise and fall of the tide, which at the mouth of the river ordinarily rises more than thirty feet, while exceptional spring tides have been known to rise sixty feet above low-water mark. The shores of this lower part are high, irregular and rocky, and at low-water the numerous small bays are filled with mud. The banks usually rise directly from the water into bare rocky hills from 200 to 400 feet high, but in places terraces occur on their flanks up to 200 feet above the present water-level. The river averages about a mile and a half in width, but nine miles above its mouth it narrows to less than half a mile across, for nearly two miles.

The trees in the valley below the Kaniapiskau are all small, and consist nearly exclusively of black spruce and larch, with only a few clumps of balsam poplar on the low sandy islands of the upper reaches. The trees cover the bottom lands and grow about half way up the hillsides about the Forks, but as the stream is descended they become smaller and are only found on the lower parts, and finally die out about fifteen miles above the mouth of the river, the only remaining vegetation being small arctic willows, birches and shrubs.

The survey was completed to the end of the north point at the mouth of the river on the 5th of September, after which the river was ascended thirty miles to Fort Chimo, to await the departure of the Hudson's Bay Company's steamship *"Erik"*, in which the party was conveyed to Rigolet, on the Atlantic coast, and from there to Quebec in a schooner.

Fort Chimo is the most northerly post of the Hudson's Bay Company in Labrador, being situated in North Latitude 58° 08′ or just inside the tree limit. The

fort is located on a low terrace on the south bank, facing a small cove and opposite the highest safe anchorage for sea-going ships. The post consists of about a dozen small buildings, the greater number of which are made from imported lumber, as the trees of the region are too short and small to be of much use for building. The permanent inhabitants are the usual officers and servants of such a post, and these with their Eskimo wives and children number about twenty-five persons in all.

Trade is carried on with the northern Indians, who live about the tributaries of the Koksoak, and with the Eskimo along the coast of Ungava Bay and Hudson Strait as far west as Cape Wolstenholm. The total number of Indians trading at and dependent on Fort Chimo is about one hundred and fifty. They belong to the Nascaupee tribe, and speak a dialect of the Cree or Algonkin language. They are a poor, degraded people, without thrift or forethought, and as a rule, very lazy. Being caribou hunters they can hardly be induced to trap fur-bearing animals. They depend wholly on the herds of barren-ground caribou for their food and clothing, and sell a certain number of caribou skins not required for their own use, with a few furs, to the Hudson's Bay Company for powder, shot, tea, sugar and tobacco, which comprise all their necessaries of life. Foxes, both white and the varieties of the red species, form their principal fur hunt, but otters are also taken, and in early spring they made excursions southward into the wooded country for martens.

The Eskimos trading at Fort Chimo are about 140 families, or 700 persons in all; but less than half of these visit the post, as the more northern families send in their furs by a few able-bodied men who travel with dogs on the ice along the coast to and from the post in the spring. The Eskimo trade is chiefly in deer, seal, fox, white bear, wolf, and wolverine skins, walrus ivory, seal and porpoise oil.

The Hudson's Bay Company also engages in the salmon and porpoise fisheries along the lower Koksoak and in the Whale River to the south and Leaf River to the northward. In 1896 the salmon fishery was poor, the catch being far below the average, and only equal to half the catch of the previous year. The porpoise fishery is small and would be abandoned if it did not give employment to the Eskimo during the summer season.

CLIMATE

The climate of the region embraced in this report totally unfits it for agricultural purposes. At Fort Chimo, lettuce, radishes, and a few small turnips are grown with a great deal of care and attention.

The rivers break up in the interior about the first week in June, but the ice does not leave the larger lakes before the end of that month. The snow of the previous winter remains in all sheltered gullies fronting the north throughout July. During the day the temperature often rises to 70° F., but the nights are always cold, and severe frosts are common throughout July and August; ice a quarter of an inch thick having been noted during the night of August 8th. Snow falls about the middle of September, and by the end of the month the ground is permanently covered, and the small ponds are frozen over; the rivers being closed by the middle of October. The following are the mean temperatures from three readings

daily taken at 6 a.m. noon and 9 p.m. July, 50.7 F.; August, 54.1 F.; September (1 to 11), 42.8 F. Light rains and showers are frequent during the summer months, but the total rainfall is not great; during July and August, rain fell on forty days. The prevailing winds of summer are from west and northwest, and they are generally accompanied by clear weather, with passing showers.

GEOLOGY

LAURENTIAN

The rocks met with along the greater part of the route from Richmond Gulf to Ungava Bay have been classed as Laurentian. They are composed chiefly of more or less foliated granite, made up of felspar, quartz, mica and hornblende, with minerals of decomposition. The felspar is chiefly orthoclase, and varies in colour from red through pink to white; quartz is always present and often in considerable quantities, and the mica and hornblende are generally found together, but at times one or other is absent.

Intimately associated with the granites is a series of more or less quartzose, mica-gneisses and mica-schists, interbanded with hornblende-schists and hornblende-gneisses and at times with a quartz-magnetite-gneiss. These gneisses and schists are supposed to represent a bedded series of rocks somewhat similar to the Grenville series, but they are so highly altered that no trace of their supposed former clastic structure remains. They are cut by newer granites and their present highly crystalline condition is thought to have been caused by the deep-seated intrusion of great masses of granite. The age of these bedded schists is for the most part very great, as some of them were altered by the granites, and subsequently deformed along with the granite, after which they have been deeply sculptured and denuded before the deposition of the iron-bearing Cambrian rocks. While most of the schists are thus probably very ancient, others may be of the same age as the Cambrian and may represent those rocks where they are greatly altered by granite intrusions, as along the lower part of the Koksoak River, where it has not proved possible to separate some very similar gneisses and schists from the Cambrian.* The Cambrian rocks of the east coast of Hudson Bay have a breadth of twenty miles at Richmond Gulf, and the Laurentian gneisses, upon which they rest quite unconformably, are first seen at the second portage of the Wiachouan, some four miles from the shore of the gulf. Here the stream falls over a fine-grained pink mica-gneiss, while the bank of the stream opposite the foot of the fall is formed of upturned beds of coarse quartzite, red felsitic slate and fine-grained, dark-green trap, apparently thrust over the gneiss.

CAMBRIAN

The Cambrian rocks found on the Larch branch of the Koksoak, are a northern extension of the great area previously discovered on the upper Hamilton and Kaniapiskau rivers.† As before stated, the western limit crosses the Larch im-

* Similar gneisses and schists were found in 1897 along the south shore of Hudson Strait and were seen to be altered from the ordinary black shales and charts of the Cambrian by the intrusion of large masses of granite.

† Annual Report, Geol. Surv. Can., Vol. VIII, (N. S.), pp. 261-280 L.

mediately below the mouth of Junction River, or thirty-five miles above the mouth of the Kaniapiskau. The contact between the Laurentian granites and the cherty dolomites and shales is not seen, there being an interval of over a mile between the granites at the mouth of Junction River and the low cliffs of nearly flat-bedded Cambrian. These cliffs, 200 feet high, are composed largely of shale resting on thin beds of light-yellow, compact cherty dolomite, while higher up the cliff thin bands of brownish and greenish argillaceous limestone are interbedded with the shales. The shale is much disintegrated and has a dark, rusty colour on weathered surfaces, but is greenish and brownish on fresh surfaces. Dip N. 80° E. $< 5°$ to 10°.

On the same side of the river two miles below, there is a steep hill, three hundred feet high, formed of dark-blue, finely crystalline, cherty dolomite, greatly shattered and re-cemented with quartz, so that the rock resembles a breccia; it also has in places thin partings filled with a black bituminous mineral like anthraxolite. These rocks are much disturbed and appear to underlie the shales of the previous section. Dip E. $< 5°$ to 45°.

From the western limit of the Cambrian to the junction with the Kaniapiskau, there are only two outcrops of rocks on the banks of the Larch River, and in order to examine the rocks in the cliffs forming the sides of the valley, from a half mile to two miles of deep swamp had to be crossed, entailing from one to four hours for each observation. On this account only a few observations were made along this portion of the river, and in consequence many of the different rocks found along the Kaniapiskau and Hamilton rivers were not seen in place; but as they are all represented by large angular blocks on the banks, they must occur not far from where these blocks are found. The direction of the ice-movement being from the westward, if transported by glacial agencies, they could only come from that direction and not from the Kaniapiskau area which lies nearly south of the Larch River. Among the angular blocks the largest and often the most numerous are composed of jaspilite, or a mixture of jasper and iron ore; in many the jasper is not abundant and the blocks are almost pure magnetite, or a mixture of magnetite and hematite, forming a valuable ore, very similar in character and composition to that of the extensive areas found on the Kaniapiskau and Hamilton rivers.* The other rocks commonly found scattered in blocks along the river banks, are red argillites and red sandstones, like those forming the beds resting unconformably upon the granite at Cambrian Lake,† a dark-gray; siliceous ankerite with purple spots, cherts, dark-green, fine-grained trap, and greywacke and two varieties of conglomerate. One of these resembled the conglomerate at the base of the formation, being composed of quartz, felspar and granite pebbles cemented with sand and silica; the other was composed chiefly of small pebbles of quartz, felspar and jasper, with a matrix which varied from red to green in colour, and which may have been a volcanic ash like that of the agglomerate of Dyke Lake.‡

The next section examined was on the north side of the river, seven miles below the limestone hill. The following sequence was exposed on the sides and tops of the low hills forming the wall of the valley at that place:

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* Annual Report, Geol. Surv. Can., vol. VIII, (N.S.), pp. 270, 278-9, 283-6 L.
† Ibid p. 269 L.
‡ Ibid. 274 L.

	Feet
1. Broken black shale	60
2. Bands of shale and argillaceous dolomite. The shale thins out and becomes pearly towards the top of the measures, the dolomite at the same time changing to a light-blue cherty variety, shattered and re-cemented with small reticulated quartz veins	100
3. Light-blue, buff-weathering, cherty dolomite	400
4. Black shales (partly concealed)	125
5. Light-blue cherty dolomite	50
6. Black, rusty-weathering shale with thin beds of argillaceous dolomite	175
7. Rusty-weathering, green chert, much broken	50
8. Black shale	40
9. Rusty-weathering, disintegrated shale	800

The rocks of the section are greatly disturbed and there are probable repetitions in the beds, while the shales may be folded among themselves, thus giving an altogether too great thickness to the measures. Dip N. 35° E. to 40′ < 60°.

Three miles lower down the stream, at a short rapid, the rock outcrops on the north bank, showing about 100 feet of buff-weathering, silicious dolomite with broken bands and masses of black chert. The exposure has the appearance of having originally consisted of alternate beds of dolomite and chert, in which, by movement and crushing, the cherts have been broken and the spaces between the fragments filled with the ferruginous dolomite under great pressure

The hills on the north side were again visited eight miles below the rapids, where the rocks are fine-grained argillite of a dark-green colour, along with a fine-grained green chloritic rock closely resembling the fine agglomerate or volcanic greywacke at the foot of Cambrian Lake.** The buff-weathering dolomites were also seen in several places along the face of the hills below the rapid

Five miles above the junction with the Kaniapiskau, the north bank is occupied, for half a mile, by a white and cream-coloured, fine-grained silicious limestone, which varies from an impure limestone to a quartzite, with the proportion of contained silica, and is identical with the silicious limestone found at the foot of the Manitou gorge on the Kaniapiskau.

Immediately below the junctions of the Larch and Kaniapiskau there is a small hill on the south bank formed of fine-grained, black, argillaceous dolomite with bands and lenticular patches of brownish ankerite. Both are penetrated by small grains of quartz, but more particularly the dolomite. Dip N. 80° E. < 10°.

In my previous report it was stated that the ridges on each side of the river below the forks appeared to be formed of a thick cap of compact rock, perhaps bedded dolomite, generally overhanging the rocks below, which are rusty, black shales from 300 feet to 400 feet thick, with dolomite forming the steep slope at the bottom.† A section made over the ridges on the south side, commencing two miles below the forks, shows that this description is only partly correct, as the bands taken for dolomite are really diabase.

** Annual Report, Geol. Surv. Can. vol. VIII (N.S.), pp. 270 L, 343 L.

† Annual Rep. Geol. Surv. vol. VIII, p. 272 L.

The following is the section in descending order :—

	Feet
1. Shaly, argillaceous dolomite, light-gray in colour, and weathering greenish. Dip N. 50° E. < 45°	4
2. Light grayish-green, fine-grained, compact diabase, greatly decomposed and altering to steatite	8
3. Shaly dolomite	4
4. Light-green, decomposed diabase, somewhat micaceous	15
5. Shaly dolomite	9
6. Light-green, coarser, decomposed diabase	75
7. Dolomite, very shaly, weathering-white, other bands greenish	100
8. Fine to coarse decomposed diabase	75
9. Mostly fine-grained, decomposed diabase	550
10. Concealed, (small valley)	300
11. Light-green argillite, silicious shales and limestones of a pearly-green colour	120
12. Fine-grained, decomposed diabase	40
13. Shale and argillaceous limestone	8
14. Light-green decomposed diabase	200
15. Baked, silicious, argillaceous limestone	6
16. Decomposed diabase	4
17. Baked limestone	3
18. Diabase with two thin beds of shale, all cut by a dyke of diabase holding opalescent bluish quartz	400
19. Concealed (small valley)	900
20. White-weathering, pearly, argillaceous limestone, much indurated	25
21. Pearly, green shale, somewhat rusty	40
22. Decomposed diabase	10
23. Pearly, green shale	30
24. Decomposed diabase	20
25. Silicious, argillaceous limestone and shale	50
26. Decomposed diabase	15
27. Pearly shale	3
28. Decomposed diabase	50
29. Light-green talcose schist with segregations of black decomposed pyroxene (soft like steatite)	75
30. Concealed, (small valley)	400
31. Green and pearly-gray sericite and chlorite-schists, holding grains of pyrite, and cut by small quartz veins	150
32. Concealed	80
33. Black, micaceous, graphitic shales becoming an impure iron ore near the contact with diabase, and holding small crystals of pyrite away from contact	50
34. Decomposed diabase	800
35. Rusty-weathering, black, micaceous shale and green chloritic schists	200
36. Decomposed diabase	100

The diabase has been injected in the form of sills, generally parallel to the bed-

ding of the detrital rocks, but when the contacts are followed it may be seen to cross from one bed to another, showing that it was intruded subsequent to the formation of the stratified rocks, and is not of the nature of a contemporaneous flow. The intrusion was probably deep-seated and the cooling slow, as the diabase everywhere shows distinct signs of perfect crystallization, and in the larger masses the texture is often very coarse. The amount of alteration to the inclosed limestones and shales is surprisingly small, and except in the thinner bands, it is only found near the contact with the diabase in the south part of the section; but it appears to have been much greater in the northern part, where the shales have been converted into micaceous and chloritic schists. A curious feature is the extreme decomposition of the diabases, both the fine- and coarse-textured varieties being often changed to a very soft steatitic rock.

In the next eleven miles, only two exposures are seen on the banks of the river, and these are both formed of light-green, coarse-textured diabase, but little decomposed, the decomposed portion having probably been removed by ice, as the rocks are well striated.

Eleven miles below the last examined exposure of the unaltered Cambrian, the rocks again outcrop on the south shore of the river, and from there to its mouth are almost continually seen. The following descending section was made where they first outcrop on the south bank:—

	Feet
1. Light, greenish-yellow mica-schist, the mica being scales of silvery secondary biotite, the schist holding lenticular patches of quartz	2
2. Dark, grayish-green mica-schist holding many large dark-red garnets	4
3. Light-coloured mica-schist (like No. 1)	3
4. Dark, garnet-bearing mica-schist (like No. 2)	2
5. Light, pearly mica-schist	9
6. White quartzite	5
7. Light-coloured mica-schist (like No. 1)	120
8. Light cream-coloured shaly limestone	3
9. Dark-green, garnet-bearing hornblende-schist	9
10. Dark, garnet-bearing mica-schist	15
11. Light-gray, tremolite-limestone, fine-grained and very silicious	4
12. Dark-gray mica-schist	15
13. Light, pearly schist containing mica and steatite (squeezed dyke)	35
14. Dark-green mica and mica-hornblende-schists, all containing many large garnets, with bands of hornblende-schist, 3, 6 and 12 inches wide	15
15. Rusty-weathering mica-gneiss (sillimanite-gneiss) holding considerable pyrite in small grains	15
16. Rusty-weathering mica-gneiss (sillimanite-gneiss)	200
17. Dark mica and hornblende-schists full of garnets	30
18. Light-coloured mica-schist	50
19. Quartzite	8
20. Pink and gray mica-gneiss, fine-grained and very quartzose	300

CAMBRIAN HILL FORMING COASTAL RIDGE—South side of entrance to Richmond Gulf.

The presence of limestone and quartzites in the above section, together with the evident bedded structure of the schists, leads to the belief that most of the members were ordinary clastic rocks that have been altered to a crystalline state by the adjacent masses of granite which have burst through the beds in the immediate neighbourhood of the last member of the section and which forms part of a great mass of granite to the eastward. All the members are cut by large dykes of coarse white pegmatite and the pegmatization appears to have continued, on a smaller scale, in the deposition of felspar and quartz between the laminæ of the schists to the production of the gneisses. Opposite the section on the north side of the river, there is an immense mass of granite, and further down stream the granite is seen inclosing broken beds of the schists. Here, whenever large masses of the schists are found, they are penetrated by a net-work of pegmatite veins and dykes, many of which are very large. The hornblende and steatite-schists of the section are probably altered irruptives and the last closely resembles the alteration product of the diabase dykes described above.

Similar schists were found about the edge of the unaltered Cambrian areas on the Hamilton River* and south of Lake Michikamau† but their relations were not understood and no special attention was given to them. The remarkably formed hills of the Cambrian area continue into the region of the metamorphic schists and granites, and although somewhat modified by the granite masses, they all have sharp slopes inland or towards the south-west with an easy grade in the opposite direction. There is little doubt that the schists and associated rocks of this locality are but highly metamorphosed representatives of a portion of the Cambrian, and that the granites which have broken through and altered them, are considerably newer, as the bedded rocks appear to have been subject to the pressure which caused the over-thrust faulting by which the ridges of the hills in the region were formed, previous to the granite intrusion.‡

Half a mile below the place at which the measured section was made, the dark mica-schists form less than a fourth of the rock-mass, the greater part being a medium-grained, pink mica-hornblende-gneiss and pegmatite, both penetrating the schists.

At the next point, the schists are greatly contorted and are chiefly rusty-weathering mica-gneiss often holding garnets in bands. Between the Tide Rapid and High-fall Creek, the south shore is very rocky, and in this vicinity dark and light mica-schists predominate, being interbanded with dark-green, garnet-bearing hornblende-schist, and in several places with narrow bands of light, pearly, green, schistose steatite, which in one band held rounded masses of light-green plagioclase. This rock appears to have originally been a light-green diabase like the masses found associated with the Cambrian rocks below the Kaniapiskau. There are also bands of rusty-weathering mica-schist holding pyrites, and pink and gray fine-grained mica-gneisses all cut by a coarse-grained mica-hornblende-granite often holding large porphyritic crystals of orthoclase, and, in turn, along with the

* Annual Report, Geol. Surv. Can., vol. VIII (N.S.), p. 227 L.

† Ibid, p. 229 L.

‡ In 1897, along the south shore of Hudson Strait and about Ungava Bay, the writer found the Cambrian rocks passing from unaltered black shales, grits, and ferruginous, silicious dolomites with associated greenstones, into garnet-bearing mica-schists, hornblende-schists and gneisses, quartzites and crystalline limestones, in consequence of adjacent intrusive masses of granite and associated dykes of pegmatite.

other rocks, cut by great dykes of white pegmatite. The rusty-weathering mica-schists contain much pyrite, but it is seldom sufficiently pure to be of value. For three mile below High-fall Creek there are several exposures of dark-mica-schists and mica-hornblende-schists cut by the porphyritic granite and pegmatite.

There is then an interval of low shore to where the river narrows at the large islands above Fort Chimo, where the shores again become high and rocky. The mica-schists and hornblende-schists are met with along with the rusty-weathering gneiss and occasional garnet-bearing bands. The light-coloured, coarse-grained granites are more abundant as are the great dykes of pegmatite.

On the north shore, opposite Fort Chimo, there is a dyke or sheet of fine-grained, dark diabase, six feet thick, interbanded with mica-schist, all with a gentle dip towards the water and evidently an undisturbed portion of the series.

Between Fort Chimo and the mouth of the river the dark mica-schists and hornblende-schists are frequently seen to be cut by coarse granite and pegmatite, but they gradually thin out, and the rusty-weathering gneiss totally disappears before the mouth is reached. The granites and pegmatites compose over four-fifths of the rock near the coast, and they change in colour from gray to pink and red along the lower fifteen miles of the river.

SUPERFICIAL DEPOSITS AND GLACIATION

The observations of striae and other glacial phenomena along the route between Hudson Bay and Ungava Bay, show that the region was completely covered with ice during the glacial period, and that the ice moved outward and downward from a narrow névé near the present watershed.

The thickness of the ice-cap cannot be determined, but it had a sufficient depth to over ride all the inequalities of the surface, so that the tops of the highest hills were equally striated and rounded with the lower lands. On the Hudson Bay coast, the high range of Cambrian rocks which separated Richmond Gulf from the main bay, were striated to their summits, 1,200 feet above sea-level, or some 300 feet above the level of the interior watershed.

The region of névé cannot have been very wide, and lay on and slightly to the eastward of the present watershed. As elsewhere in the peninsula, it is characterized by poorly marked striae and by an accumulation of unstratified drift, full of large, partly rounded boulders and blocks of rock similar to that found in place in the immediate neighbourhood. The drift is arranged in steep, irregular hills from fifty to one hundred and fifty feet high, that run in no particular direction either parallel or transverse to the striae, and which appear to be accidental in both height and shape. Their surfaces are largely covered with boulders and blocks, and they seem to be composed of decayed rock-material only slightly displaced by the movement of the ice. This condition of the drift extends from the east end of Seal Lake to the east end of Shem Lake, the drift hills being most conspicuous near the present watershed.

EXTRACTS FROM REPORT

ON AN EXPLORATION OF THE EAST COAST OF HUDSON BAY

FROM

CAPE WOLSTENHOLME TO SOUTH END OF JAMES BAY

GEOLOGICAL SURVEY OF CANADA, A. P. LOW, 1900.

The east coast of Hudson Bay may, for descriptive purposes, be divided into three portions, namely, the northern part extending from Cape Wolstenholme to Portland promontory, the middle section lying between Portland promontory and Cape Jones, and the southern portion from Cape Jones to the south end of James Bay.

The northern and southern sections are very similar in character, the shores being formed of low rounded hills of gneiss or granite, rising very little above the wide drift-covered valleys; and inland, presenting a slightly rising plain broken by long, rocky ridges, hardly worthy of the designation of hills. The shores are rocky at points, while the bays are fringed by sand or boulder beaches. The water for a considerable distance from land is shallow, and the bottom very uneven, with rocky ledges and sharp ridges of boulders, which, when they rise above the surface, form the wide fringe of small islands characteristic of these portions of the coast. From the above description, it will be seen that the greater parts of both the northern and southern sections of the coast are dangerous to approach with ships drawing any considerable depth of water, especially in the present unsurveyed state of the waters. The central portion, however, differs from the coast to the north and south of it, being bold, with hills often rising directly from the water to altitudes of a thousand feet and upwards. Chains of islands, lying from half a mile to five miles from the coast with deep water between, extend along more than half this section, and afford excellent shelter for the largest ships, as well as a safely protected channel for small craft.

About Cape Wolstenholme the land rises abruptly with steep cliffs facing the sea to elevations of a thousand feet and upwards, being a continuation of the high land forming the south shore of Hudson strait. From Cape Wolstenholme the general trend of the coast is about south-west for thirty miles to Nuvuk. Along this stretch of coast the shores are generally rocky and indented by many small bays with numerous rocky islands lying between the mainland and the large, high Digges island. On leaving the cape the general elevation of the land sinks rapidly, so that at Nuvuk the highest hills have an elevation of not more than 500 feet, and the general level along the coast is much less. From Nuvuk to Kovik the coast runs nearly due south, and the distance is sixty miles. This portion is char-

acterized by flat shores, rising slowly into barren plains of drift, from which protrude low, rounded ridges of granite. The shore in many places is fringed by long, low islands of drift, with very shallow water between. This is a favourite summer feeding ground for the barren ground caribou, which roam over it in small bands. From Kovik the general trend of the coast is south for twenty-five miles, and then south-west for thirty-five miles to Cape Smith. The coast and country along the first of these courses is very similar to that last described, but along the second course a high range of snow-capped hills, which form the highlands of Cape Smith and the neighbouring islands, approaches the coast at an acute angle with a gradually narrowing, low drift plain between the sea and the hills. This range of hills comes out at Cape Smith, and from there runs far inland in a direction about east north-east, forming the north shore of Mosquito bay. The hills are formed of dark green diabase thrown up into a number of sharp, narrow, parallel ridges with a small river connecting chains of small lakes in each valley. The hills vary from 500 feet to upwards of 1,000 feet in altitude, and the higher summits are partly covered with snow. Rising as they do from the nearly flat country on both sides they form a prominent feature of the country.

Mosquito bay, as is usual with all unsurveyed inlets, has been shown altogether too large on previous maps. The distance from the point of the mainland at Smith island to its head is only twenty-eight miles, and being divided by a long, narrow point into two bays, varying from one to three miles wide, its total breadth is much less than is given on the charts. Some of the older charts show a water connection between this bay and Hopes Advance bay on the west coast of Ungava bay, but it is now known that several hundred miles of land lie between them. Southward from Mosquito bay the coast line is greatly broken by large, irregular bays, with generally rocky shores, never very high, and backed by a rocky country, formed of long, rounded hills seldom exceeding an elevation of three hundred feet. A wide fringe of islands extends along the coast; these are usually rocky, but many are formed of boulders and finer drift material. The water for a considerable distance from the mainland is shallow, and the murky nature of the bottom renders an approach dangerous for any craft. This character of coast extends from Mosquito bay to Portland promontory, or from latitude 58° 45′ to lat. 60° 45′.

Between Portland promontory and Cape Jones the coast forms a long flat segment of a circle with the convexity to the eastward. This portion is characterized by bold granite hills rising quickly from the coast, and in part flanked by trap-covered sedimentary rocks, which also form chains of islands running parallel to the coast. The first of these chains is the Hopewell group, which lie close to the mainland and extend south-east for fifty miles from Portland promontory. They are formed from tilted sedimentary rocks capped with a considerable thickness of trap. The rocks dip gently seaward and present abrupt cliffs along their inner sides. The channel between them and the mainland varies in breadth from a few yards to upwards of a mile. At Hopewell Narrows, about the middle of the chain, the channel is less than twenty yards wide,* and is only covered with about three feet of water at high tide, thus rendering a passage for large craft impossible; everywhere else there is a sufficient depth of water.

* Report of Progress, Geol. Surv. Can., 1877, p. 33, part C.

From Hopewell islands to the mouth of Langland river, the distance is fifty-eight miles and the general direction S.S.E. This portion of the coast is very bold, with high granite hills rising directly from the shore. A few small islands of granite and trap occur close to shore, and these, in conjunction with small bays, afford excellent shelter for small boats.

The mouth of Langland river practically marks the northern end of the sound which is formed by the Nastapoka chain of islands extending southward nearly one hundred miles to Little Whale River. These islands are similar to those of the Hopewell chain, but are without the capping of trap. The mainland is occupied by high granite hills, which to the southward of Nastapoka river, are flanked by tilted sedimentary rocks capped with trap. The sound varies from a quarter of a mile to three miles in breadth, with deep water in the channel everywhere.

From Little Whale river to the northern opening of Manitounuk sound, the coast runs south-west for twenty-eight miles. The trap rocks rise directly from the water, forming a ridge from 600 to 1,000 feet high, and there are no harbours for even small sailing boats. Manitounuk sound from its northern opening to Great Whale river is about thirty miles long and it varies in breadth from half a mile to three miles. The northern or boat opening is very narrow and only available for small sailing boats. The second opening is eight miles farther south and has a good channel with deep water. The Manitounuk islands resemble those of the Hopewell chain, being formed of stratified sandstones and limestones capped with trap, with steep cliffs facing the sound and gentle slopes to seaward. The mainland is less rugged than to the northward, rising a mile or so from the coast into rounded hills of granite that vary from 500 to 1,000 feet in elevation. The margin between the hills and the water is occupied by sandy plains from which rise at intervals ridges of tilted limestone. These limestone ridges also form chains of small islands along the mainland. Another portion of the ridge forms a peninsula about ten miles north of Great Whale river, with an excellent harbour on its north side.

The distance from the mouth of Great Whale river to Cape Jones is eighty-five miles and the general direction about south-west. The coast along this section is remarkably straight without any bays or prominent points. The granite hills only come out to the shore in a few places, usually being from half a mile to three miles inland with sandy, terraced drift occupying the interval between them and the shore. A broken ridge of tilted up limestone rests upon the shore for about ten miles, commencing about 15 miles south-west of Great Whale river. Behind this ridge are a number of excellent boat harbours. This portion of the coast is very free from islands until Long island is reached, and in consequence is easily approached by vessels of all sizes. Long island is twenty-four miles in length and varies from half a mile to three miles in breadth. Its north-east end is thirty-five miles from Cape Jones, and it lies parallel to and about four miles from the mainland. On its inner side it frequently presents low cliffs of limestone and sandstone, while a second low ridge running down the middle of the island is formed of carbonate of iron capped by trap. Between the south-west part of the island and Cape Jones, the sound is occupied by a large number of low islands formed of limestone. From Cape Jones all the way southward to the south of the East Main river, a distance of upwards of 175 miles, the character of the coast is very similar to that already described between Mosquito bay and Portland promontory. The

mainland is formed of low rounded hills and ridges of gneiss and granite rising slightly above swampy valleys of clay and sand. With few exceptions the hills never exceed 200 feet in elevation, and the general level of the country is under fifty feet. The coast line is very uneven, being broken into many large bays, while the entire shore is fringed with islands of rock or drift extending several miles out from the mainland. The water between the islands is generally shallow and the bottom uneven, so that it is dangerous to approach this uncharted coast with deep draught vessels.

Wastikun, a cone-shaped island, lies about five miles north of the mouth of Big river; and as it has an elevation of two hundred and fifty feet, it is a prominent land-mark and is used as such for vessels approaching that river. The Paint Hills island are also higher than any land in their neighbourhood, and having deep water about them, are safe to approach from seaward. Cape Hope island, which lies about fifteen miles north of the East Main river, is also high and is seen a long distance off.

The coast to the southward of the East Main river is even lower than that to the northward, and the rocks only come out on shore in a few places. Islands are less numerous, and towards the mouth of Rupert bay are largely formed of drift. Sherricks mount, which marks the eastern entrance to Rupert bay, is a peninsula with a cone-shaped hill about 700 feet high, and it forms the most striking land-mark of James bay. To the southward of the East Main river the whole bottom of James bay has been silted up with sand and mud brought down by the large rivers flowing into its southern part, and in consequence, wide flats extend far out from shore, increasing in width as Rupert bay is approached, so that in that bay the only navigable parts are in the channels cut out by the currents of the rivers flowing into it, and even these rarely have a depth exceeding ten feet.

FOREST AREAS

The southern portion of this region is partly wooded, the northern tree limit, leaving the coast of Hudson bay near the north end of Richmond gulf,* curves northward and crosses the route to Lake Minto about 20 miles inland, thence bending eastward and southward, recrosses the Leaf river about 100 miles inland and comes out on Ungava bay near the mouth of the Koksoak river. The trees near the northern limit are all short and straggling; they grow only in the protected valleys and their struggle for existence is manifest by the number of dead tops and branches found everywhere. Black spruce and larch, or tamarac, are the last survivors of the forests to the south and the latter tree grows to about twice the size of the spruce. The white spruce reaches nearly as far north as the black spruce, and the balsam poplar comes next in order, followed quickly by the balsam fir, all of which trees are found on the islands of Richmond gulf. The banksian pine grows as far north as the Great Whale river, which is also the limit of the white birch and aspen.

As before stated, the northern tree limit on the coast of Hudson bay is towards the north end of Richmond gulf. Thence southward trees grow in protected gullies on the mainland to Manitounuk sound, where the country is fairly well

* See Report of Progress, Geol. Surv. Can., 1877, p. 25 C.

wooded with small black and white spruce and birch; small trees of the same species also growing on the inner sides of the Manitounuk islands. Southward of Great Whale river the coast is wooded to beyond the northern end of Long island, where the limit passes inland, leaving the islands and Cape Jones barren. The trees again come out to the coast about twenty-five miles south of Cape Jones and continue from there southward. The islands off the coast between Cape Jones and Big river, with the exception of a few southern ones close inshore, are all barren. To the southward of Big river the trees gradually extend outwards on the islands, so that at Cape Hope all of them are wooded. Merchantable timber is found in the valleys of all the rivers northward to the East Main river and pulpwood to the Big river, beyond which, although much of the country is well wooded, the trees are small and the branches continue to the ground, causing the stems to be full of knots and consequently of little value.

CLIMATE

With a difference of 800 miles of latitude, it follows that the climate of the northern and southern portions of the east coast will show marked differences. The southern portion may be classed as cold temperate, while the northern part is truly arctic. The temperate climate may be taken to extend to Cape Jones or to be limited to the shores of James bay. While to the northward it is subarctic or arctic and unfit for agricultural purposes of any kind, at Rupert House in the southern part of James bay, excellent root crops are grown annually. Oats have also been successfully grown there and no doubt the hardier varieties of wheat would also ripen.* Rupert House is situated practically upon the sea-shore and consequently directly influenced by the cold ice-laden waters of James bay, which must considerably lower the temperature in early summer. Such being the case there can be little doubt that better crops could be raised a short distance farther inland, away from the direct influence of the sea. There is no doubt that the large area of country situated to the south and southeast of James bay and underlain by good clay soil capped with sandy loam, would with proper drainage make excellent farming land capable of raising any crop grown in the North-west territories. At the mouth of East Main river, roots are grown to perfection and abundant crops of wild hay are gathered yearly to feed the large herd of cattle kept there. At Fort George, at the mouth of Big river, good crops of potatoes and other roots are grown annually, and cattle are also kept. This is the present northern limit of agriculture, as nothing is grown at Great Whale river, where sandy soil aids the climate to prevent the successful cultivation of any crop. In an appendix is given the meteorological observations kept during the time of the exploration.

FISHERIES

The fisheries of Hudson bay will probably prove to be its greatest natural resource, as along the east coast the sea is found well stocked everywhere with good fishes. In James bay a net set at random along shore or about the islands always

* In 1896 and 1897 wheat ripened at Waswanipi, in lat. 49° 45', or 122 miles south of Rupert's House, from seed sent by Dr. Robert Bell to the officer in charge of that post.

caught fish. These are usually sea-run brook trout and whitefish identical with the Lake Superior whitefish† and being sea-run are, like the trout, much improved in flavour. These trout and whitefish vary in weight from one to six pounds and are the best of food fish. Similar fish are found abundantly along the entire coast to Cape Wolstenholme. The Arctic trout or Hearne salmon† is found along the northern coast as far south as Seal river, which is situated a few miles south of Cape Jones. This is a beautiful fish with well flavoured, dark pink flesh and it varies in weight from one to fifteen pounds, the average being about five pounds. These fish are salted at Fort Chimo on Ungava bay and fetch nearly the same price in London as salted salmon from the same locality. They are very plentiful about the mouths of the northern rivers and along the coast, while the Eskimos report them abundant at the Belcher and other islands lying off the east coast. There is no doubt that this fish equals or surpasses in colour and flavour the salmon of British Columbia. Cod are known to exist in Hudson bay,† being taken at Cape Smith and at Comb Hills in James bay by members of the expedition. The Eskimos also catch them in Nastapoka sound and at the Belcher islands; at a number of places in James bay they are also taken by the Indians.

The specimens of cod taken by us were not very large, but the men who caught them were Nova Scotia fishermen and said that they were true cod and identical with those taken on the Grand Banks. Food for these fish is abundant in Hudson bay and there is no reason why extensive fisheries in this Canadian inland sea should not exist. The undoubted presence of cod in Hudson bay deserves investigation, as a very valuable and exclusively Canadian fishery may be found there. The presence of cod points to that of halibut in the deeper waters of the bay.

The only other salt-water food fishes in Hudson bay are a couple of species of sculpin which are eaten extensively by the Eskimo. Sturgeon are caught in the lower parts of the southern rivers to the East Main river and lake trout occur in the mouths and lower reaches of the northern rivers. The Atlantic salmon does not appear to enter Hudson bay, as no record could be obtained of its doing so from the Eskimos. Its range in the arctic waters of Hudson strait seems to limit it to the rivers on the west side of Ungava bay. A curious coincidence in connection with this range of the salmon is that the ouananiche or land-locked salmon has never been found in the waters of rivers flowing westward into Hudson bay, although common in the rivers of the northern, southern and eastern watersheds of Labrador.

GEOLOGY

GENERAL REMARKS AND DESCRIPTION

The rocks of the entire east coast of Hudson Bay are very ancient, and with the exception of those which form the chains of islands along shore between Portland promontory and Cape Jones, and also a narrow margin on part of the coast in the same region, they have all been cut by granite which has not only intimately penetrated them, but by its heat and pressure has so changed them to crystalline schists and gneisses that only in a few places can any trace of an original sedimentary origin be found. The unaltered sedimentary rocks with their associated sheets

† See Report of Progress, Geol. Surv. Can., 1877, p. 28 C.

of trap and diabase bear not only a remarkably close resemblance to the so-called Cambrian rocks of other parts of the Labrador peninsula, but also to the iron-bearing rocks of the southern shores of Lake Superior and the Animikie and Nipigon rocks to the north of Lake Superior. So close is this resemblance that hand specimens of nearly all the various rocks of these different areas can be duplicated from the Hudson Bay region, and this close resemblance is also found in the thin sections of these rocks when microscopically examined. A collection of hand specimens brought home by Mr. J. M. Bell in 1900, from the region of Great Bear Lake, when placed beside the specimens from Hudson bay, were found to bear so close a resemblance as to be undistinguishable without reference to the labels. The close resemblance of this series of rocks occurring over an area extending from southward of Lake Superior to north of the Arctic Circle, and from the eastern part of Labrador to the neighbourhood of the McKenzie river, shows that the conditions under which they were deposited must have been nearly identical throughout this wide area. The finding of new areas of these rocks as the northern country is more fully explored, points to an almost continuous deposition of this formation over the whole Archaean area of Canada. No fossils have as yet been discovered in any of the beds of this formation, but the presence of certain concretionary forms in its limestones and the amount of carbon in many of the shales lead to the belief that at least low forms of life existed at the time these rocks were deposited. The lack of fossil evidence as to their age, which is taken to be very great, makes their classification in the Cambrian probably erroneous, as in all likelihood they are of pre-Cambrian age and in the opinion of the writer are the oldest known sedimentary rocks of Canada. Notwithstanding this opinion they will continue to be classed as Cambrian* in order to correspond with the areas of similar rocks of Labrador which have already been so classed.

This series consists of several thousand feet of sedimentary rocks, commencing at the bottom with a considerable thickness of coarse arkose, formed largely of more or less rounded grains and pebbles of quartz and feldspar, cemented by infiltrations of quartz, and evidently representing a great mass of decomposed granite, from which the finer mica and decomposed feldspar had been washed out in a shallow sea. This, towards its summit shades into a great thickness of banded arkose, sandstone, argillite and greywacke, all of which are feldspathic and the argillites and greywackes also contain quantities of finely divided bisilicates and probably represent the finer material of similar decomposed granite. The basement granite from which these rocks were derived has not been recognized in the region under discussion. The upper beds appear to pass into argillites, greywackes and cherts, all more or less impregnated with oxide of iron, which often is found in them as large masses of pure magnetite or a mixture of magnetite and hematite associated with red jasper. These beds are overlaid with cherty carbonates of lime, magnesia and iron, and are in turn capped by limestones, dolomites, carbonaceous shales and sandstones which form the upper beds of the series. These deposits, to the upper portion of the iron-bearing beds, appear to have been laid down in shallow water as ripple-marks are found on many of the beds. The upper beds of limestone and dolomite were deposited in deeper water. At the close of the period of deposition the beds emerged from the sea, and then took place an enor-

* On map accompanying this report these rocks have been classified as pre-Cambrian, Keweenawan-Animikie.

mous eruption of dark-green trap and diabase, which was injected as sheets or laccolites between the bedding of different measures of these rocks from the summit of the arkose upwards. Not only was the diabase injected, but it also flowed out over the surface, and there, cooling less slowly and without pressure, formed a fine-grained trap in many places full of small cavities formed by the expansion of contained gases, and subsequently filled by infiltration with chlorite, epidote, calcite or agate. These surface flows are well seen in the trap capping of the Hopewell and Manitounuk islands and the coast about Little Whale river. At these places several different flows can be seen resting upon one another. The diabase also formed large vertical dykes cutting the sedimentary rocks, and these were the probable outlets of the diabase from the interior. The outburst of these dark-green igneous rocks, which did not greatly affect the rocks that they penetrated, was followed by a far greater outburst of granite and other allied acidic rocks which had a very marked effect upon the sedimentary rocks through which they burst. The granite irruption was co-extensive with the area now known as the Archaean region which embraces the greater portion of eastern Canada and extends southward into the United States, thus occupying fully a third of the northern half of North America. The irruption of the granite was almost universal over this vast region, and it is now found in large areas where no remnants of the former sedimentary crust remains. More often it is associated with bands and masses of silicecus biotite gneisses, dark schists and crystalline limestone, which have been so altered by the heat and pressure of the granite intrusion that only in a few places are traces of their original sedimentary character preserved. Not only did the intrusion change these rocks into crystalline schists, but the accompanying hot solutions of silica have penetrated between their thinnest laminae and there deposited extra quartz, thus further disguising their original structure and composition. The investigations of Adams and Barlow on the relations of the Hastings group of Eastern Ontario, show that the undoubted sedimentary rocks of that region can be traced into crystalline gneisses and schists, and the siliceous unaltered dolomites pass into a crystalline tremolite limestone. In the Labrador peninsula, similar changes of the limestones have been noted and the accompanying iron ores pass into magnetites associated with quartz often in the form of a magnetite gneiss. Along the east shore of Hudson bay in the rocks intruded by the granites, the limestones and iron-bearing beds are absent and the altered beds appear to be confined to the arenaceous beds of the series and the accompanying diabase sheets.

In the southern part of the area fronting on James bay, many of the very quartzose gneisses and schists, under the microscope display rounded grains of quartz, apparently arranged in bedded planes and sometimes showing obscure lines of growth outside the originally rounded grains. All of these rocks show signs of subjection to enormous pressure which has destroyed their original structure and it is only in very favourable cases that a clue to their original clastic condition is found. The diabasic traps afford the best example of the metamorphism induced by the granite. These dark-green rocks were very extensively developed along the east coast of Hudson bay and large areas of them are met with from near the Kovik river in lat. 61° 30′ southward to beyond the East Main river in lat. 52°. These basic rocks have different associations with the granites in the different localities where they are found. In some places they are surrounded by large

masses of granite and then are usually much altered by the pressure induced by the intrusion, the extreme phase of the alteration being to dark and light-coloured hornblendic and chloritic schists. From this extreme the diabase is found passing up through lesser stages of alteration until it appears as masses only slightly altered near the contact with the granite upon which it rests.

The granite outbursts were not universal throughout this vast region, and the areas of so-called Cambrian sedimentary rocks represent areas where the earlier crust remained unbroken by any such intrusion; and it is along the edges of these areas that the evidence of the later age of the granites is found, as there the granites are seen in a few places to penetrate the sedimentary strata and their associated diabases.

The granite outburst appears to have been followed by a period of quiet, during which the great masses cooled and solidified, and in doing so, probably contracted in size. This contraction probably disturbed the equilibrium in the crust by lessening the pressure on the side of the granite mass, and so causing the pressure outside the area to act upon the unaltered areas of the older sedimentary rocks as a thrust from seaward or towards the large areas of cooled granite. The result of this force acting upon the rocks close to the surface was to cause a buckling of their strata and a forcing of large blocks of the series over one another, and also over the now solid granite, so as to form them into long ridges which slope more or less gently away from the granite masses and present steep broken cliffs towards it. This throwing of the strata into ridges also causes repetitions of more or less similar sections of the formation in each ridge, and the development of cross faults in the ridges greatly complicates the work of identification of the various beds of the formation as seen in the cliffs. This phenomenon of ridges with sharp cliffs facing inland or towards large masses of granite is a universal characteristic of all the areas of these old sedimentary rocks throughout Labrador, and seems to be equally characteristic of the Lake Superior and of those westward of Hudson bay.

This explanation, buckling and a nearly horizontal movement of the bedded rocks, afford a solution of many of the difficulties met with in a study of the stratigraphical relations of these rocks in themselves and in regard to the granites below them, and accounts for the unconformable contacts of totally different members of the series with the granites, in localities, but short distances apart, which cannot be done on the theory that often the lower beds are wanting in certain places owing to their not being deposited on uplifted portions of the sea bottom, as no signs of such inequality exist, and all the lower deposits point to the existence of a nearly flat sea bottom extending over the continent and covered with a shallow sea at the time when they were deposited. There are also frequent discrepancies in the sections of the bedded rocks themselves, which are sometimes proved to be caused by such nearly horizontal over-riding of one part of the series by another portion, and cannot be accounted for in any other manner at present.

The idea of this buckling and over-riding of immense blocks of these rocks was brought to the writer's attention by a study of the ice along the shore of Hudson bay when pressure is exerted upon it by storms from seaward during midwinter when the ice is very hard. The ice under these condition is forced up into the ridges over the rocks on shore, and also for some distance out from shore into ridges upon itself owing to a buckling and fracturing along lines parallel to the re-

sistance of the shore. These ridges are greatly modified by the breaking of the ice forming them into blocks by cross cracks, so that the ridges instead of resting uniformly upon the underlying ice or rock and having a uniform height, are thrown up into all shapes with a more or less regular dip seaward, and sharp faces toward the land, while the height of the ridges varies with the tilting of the separate blocks, and also with the degree to which the ice has been fractured into such blocks. These results of the action of pressure on shore ice appear to be identical on a small scale with what happened to the so-called Cambrian formation subsequent to the cooling and probable contraction of the granites.

Following this movement of the bedded rocks in geological time came a much later outburst of diabase, which occurs in the form of dykes cutting all the older rocks. These dyke vary in breadth from a few inches to upwards of one hundred yards. They generally run more or less parallel to the coast, and perhaps fill deep cracks in the surface or were developed along lines of weakness. No large centres of gabbro or diabase have been found from which these dykes flow, nor are there any flat-lying flows of trap in connection with them.

No record of any other geological change has been noted along the east coast of Hudson bay from the injection of these newer diabase dykes until the advent of the glaciers in Post-Pliocene time. And during this great interval of time, the rocks forming this coast appear to have been continuously above the level of the sea, thus preventing the deposition of any fossiliferous beds. During the Silurian and Devonian times, there may have been a slight depression along the coast allowing the deposition of narrow rims of limestones of these ages, but if so they have been totally eroded by the glacial and other action, so that the only evidence of such deposits are a few fragments of limestone scattered along shore, and these may have been transported by floating ice from the northern or western parts of Hudson bay.

During the glacial period the entire coast was covered with ice, and the records left by the glacial striae show that the centre of glaciation at first was in the southern interior of Labrador, close to the present watershed of the south-flowing rivers. The second set of striae show that the centre of dispersion moved north to about the middle of the peninsula, while the latest set of striae are from the north-east and prove the last centre of glaciation to have been in the northern half of the peninsula of Labrador. Since the close of the glacial period, the land has risen to a height of upwards of 700 feet above its level during the ice age. There are no indications* that this rise is still going on, and if it is doing so it is too slow to observe.

From an economic standpoint, the investigation of the rocks along the east coast of Hudson bay has shown† that extensive deposits of iron ore occur in the unaltered sedimentary rocks of the Cambrian. These ores occur as beds interstratified with certain siliceous rocks of the middle portion of the series, and appear to have been deposited from solution in a shallow sea. The upper beds of ore occur as ankerite, or a carbonate of lime, magnesia and iron, and as such are us-

* It may be mentioned that this opinion is not shared by Dr. Bell who has examined the east coast of Hudson bay from Moose Factory to Cape Dufferin, on Portland promontory, as well as the western side of the bay, and has published many reasons for an opposite conclusion. See "Rising of the Land around Hudson Bay," Bull. Geol. Soc'y. Am. 1895; "Evidences of Northeasterly Differential Rising of the Land along Bell River." Bull. Geol. Soc'y. Am. 1897. See also Smithsonian Report for 1897, pp. 259-367.

† Report of Progress, Geol. Surv. Can. for 1877, Part C, pp. 16 and 21.

ually associated with a large percentage of manganese, which renders these ores valuable in the manufacture of Bessemer steel. Beneath the carbonates are siliceous beds in which the ores are present as oxides, either magnetite or hematite, or a mixture of both, associated with red jasper. These beds may be due in part to infiltration of iron leached from the carbonates above, but much of the iron appears to have been originally deposited in the present beds.

The carbonate ores are found on all the islands of the Hopewell chain, on a number of the Nastapoka islands, and on Long island. The greatest thickness of ore noted was about twenty feet and it was broken by partings of black chert. The oxides are largely developed in the Nastapoka islands, where their thickness is often more than fifty feet, but all of these measures are siliceous and only part of them sufficiently rich for profitable mining. The oxide ores also occur on the islands and southern shores of Richmond gulf, but of all the exposures seen there, none were sufficiently rich to be worked.

The intrusion of granite into the large areas of basic rocks met with along the coast at intervals from Kovik river to the southward of East Main river and the foliation of these latter by pressure has caused a segregation of the sulphides, always found scattered through the diabases, into long lenticular masses parallel to the foliation. And large veins of quartzose granite and pegmatite from the granites penetrating these basic rocks have also taken up some of their sulphides which may prove valuable ores. The area northward from Portland promontory to the vicinity of Mosquito bay appears to be the most promising for the discovery of sulphide ores in the form of pyrite, pyrrhotite and chalcopyrite, as the diabases of that region have been greatly crushed and foliated and are also penetrated by a great many veins of quartz.

Little time could be given to the examination of that area and the hand specimens obtained from the mineral deposits there show that they contain a small quantity of nickel and copper without gold, but results obtained from hurriedly collected samples need not be taken as an indication of the absence of these metals in paying quantities in these rocks. The Paint Hills area of squeezed trap contains in places large segregation masses of pyrite which carry a small quantity of silver, but no gold. Pyrites are also plentiful in the limestone of Long island and the islands north of Cape Jones. There is a bed of siliceous dolomitic limestone full of cavities a short distance below the thick capping of diabase which extends along the coast from beyond the north end of Richmond gulf southward to the head of Manitounuk sound. In many places the cavities of this bed are filled with galena accompanied by pyrite and blende, all of which appear to have been leached out of the overlying diabase and to have been deposited in the cavities of the limestone. These deposits have not as yet proved to be sufficiently concentrated to allow of profitable mining.

A vein of anthraxolite resembling anthracite coal is said to have been discovered on Long island.* This vein is reported to be about nine inches wide and cuts dark shales and limestone on the island. Similar veins of this mineral have been discovered in the interior of the Labrador peninsula, but it is only interesting as a mineral and is not economically valuable, as the veins are too small to work with profit, even if the mineral were equal to anthracite, which it is not, as it always

* Report of Progress, Geol. Surv. Can. for 1875, p. 325 and 1877 p. 24 C.

contains a large percentage of quartz which renders it practically useless as a fuel.

In the upper portion of the Cambrian formation, as seen along the coast south of Great Whale river, on the Manitounuk islands, and along the coasts, below the traps, are beds of fine-grained limestone, some of which might apparently be suitable for lithographic purposes. In many places the granites would afford excellent and beautiful building stones; most noticeable among these is the area of augite-syenite found on Walrus island, of the Paint Hills group. This rock is a beautiful porphyry holding pearly crystals of feldspar varying in colour from pink to violet or flesh-red, set in a dark-green ground mass. Large slabs of this rock could easily be obtained which would be admirably adapted for interior and exterior decorations.

CAMBRIAN

GENERAL OBSERVATIONS

The islands lying along the coast from Portland promontory to Cape Jones are formed of a practically unaltered series of sedimentary rocks often associated with outflows of trap. These rocks are also found resting continuously upon the granites, and associated crystalline rocks of the mainland from a short distance south of the mouth of the Nastapoka river to Boat harbour in Manitounuk sound, and beyond there in broken patches as far as Humbug (Hamburg?) harbour, some thirty miles south of Great Whale river. These rocks of the islands and the mainland all dip westward or seaward at angles varying from 5° to 45°, and the breadth of the strip resting upon the mainland varies from a few yards to upwards of twenty miles at Richmond gulf, where they attain their maximum development. This series of rocks bears a close resemblance to those found along the Koksoak and Hamilton rivers, in the interior of Labrador, which were called Cambrian in former reports, and are classed under that name in the present report, although there is no fossil evidence for such a classification.* They are probably older than much of the granite of the Labrador peninsula, which has been called Laurentian, and they are probably the unaltered equivalents of many of the schists and gneisses inclosed in and cut by these granites.† Except in a very few places, the contacts between these sedimentary rocks and the underlying granites appear to be unconformable and due to faults, but in the few places where the rocks were seen to rest undisturbed upon the granite, the latter was found to cut and alter the bedded series, thus undoubtedly showing the granite to be the newer rock.

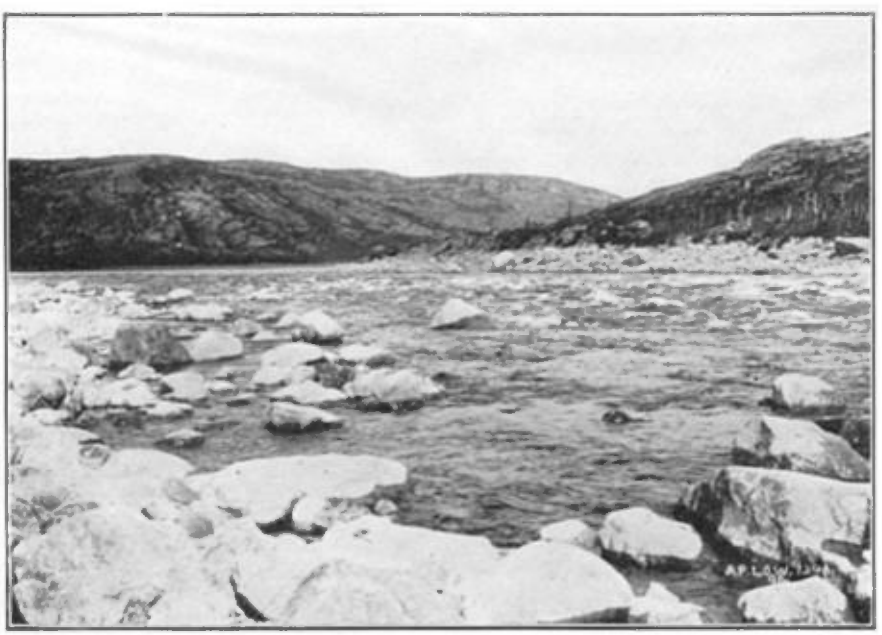
This series of sedimentary rocks is largely composed of arkose, feldspathic sandstones and quartzite, feldspathic argillite, greywacke, dolomites and limestones, all more or less ferruginous; and associated with them sills and dykes of trap and diabase, which also occur as surface flows.

The constituent matter of all the rocks (with the exception of the limestone and dolomite) is such as would allow them readily to pass into micaceous and hornblendic schists and gneisses by the intrusion of newer granites.† In some of

* On map accompanying this report these rocks have been classified as Pre-Cambrian.

† These speculations involve questions to which the answers are only individual opinion.—R.B.

HIGH ROCK, MANITOUNUK ISLANDS—Hudson Bay.



RAPID—Larch River Ungava.

the rocks of the lower portion of the series, consisting as it does of beds of ferruginous feldspathic arkose sandstones and argillites, this change would readily take place from the accession of heat and pressure due to such a granite intrusion; and to the northward of Great Whale river patches of such rocks were found in a partly altered state inclosed in granite; while to the northward of Richmond gulf portions of the trap overflow are found inclosed and altered by similar granite. As before stated the contacts of the bedded rocks and granite are usually unconformable and appear to be due to a nearly horizontal movement of the bedded series subsequent to the intrusion of the granite, due to pressure acting from outside the great areas of granite. This series of sedimentary rocks being close to the surface, and consequently above the line of folding, broke, as ice does upon the shore when pressed from seaward, and piled cake on cake not only upon unyielding granite, but upon themselves. Their present positions show that such a horizontal pressure was exerted upon them, as they lie in ridges, roughly parallel, with their dips seaward. The action of a similar thrust force is observed wherever these rocks have been seen throughout the Labrador peninsula, the beds lying in a series of ridges all dipping in one direction with broken cliff faces on the opposite side. Along the east coast of Hudson bay there are three such ridges of the first magnitude; namely, that of the coast line, that of the islands, and another which form the outer islands from fifty to seventy miles off the coast.

On the Koksoak river sixteen such ridges were noted in only the eastern half of the area. The main ridges are themselves broken into minor ones, and in Richmond gulf and on the Nastapoka islands, faults transverse to the direction of the main lines of fracture have fractured the rocks up into immense blocks and interfered with the symmetry of the dips, thus emphasizing the analogy which these rocks bear to shore ice acted upon by pressure from seaward, which not only piles the ice up in ridges upon itself and the shore, but also causes it to break into cakes.

The following sections of the rocks were made from the cliffs on the shores and islands of Richmond gulf, and are useful as giving an idea of the difficulties encountered in forming an ideal section of the series. On the west shore just inside the outlet there is a long peninsula connected with the mainland by a narrow neck.* This peninsula is formed wholly of bedded rocks which vary in colour from nearly white to dark-red, and in texture from a medium-grained sandstone, to a very coarse grit, containing rounded pebbles of quartz and feldspar up to two inches in diameter. These rocks are very quartzose and always carry much broken and rounded felspar, and have evidently been formed from the disintegration of granitic rocks almost in place, the bedding being arranged like deposits in a shallow sea as the finer beds exhibit signs of ripple marking. The rocks are such that with the accession of heat and pressure they would readily return to a gneissic condition.† These beds everywhere underlie the other clastic rocks of the series and are probably the lowest rocks of the series, but nowhere was the gradation into the unaltered lower granites seen, from which they are supposed to have been derived. The total thickness of these beds as exposed on the peninsula is upwards

* A description and view of Castle peninsula are given at page 14 C., Report of Progress, Geol. Surv. Can., for 1877.

† The "Origin of Gneiss". Proc. Am. Assn. for the Adv. of Sci. 1889, pp. 227-31.

of 500 feet and probably near 1,000 feet. The following section in descending order was taken along the cliff on the south side of the narrows of Richmond gulf:

	Feet
1. Dark-brown very fine-grained diabase much cracked and cemented with impure red and green chert (89)	240
2. Very fine-grained dark greenish-gray diabase, much shattered, the fragments often rounded fissures, filled with an impure red chert, so that in places the rock has the appearance of a conglomerate (90)..	350
3. Lighter greenish-gray diabase slightly coarser than (90) much less fractured (91)..	225
4. Brecciated dark green diabase, cut by a few small quartz veins and containing small cavities filled with quartz, and flesh-coloured calcite and small quantities of pyrite	850
Unconformity.	
Concealed	300
5. Dark-green fine-grained fragmented diabase.....	500
Concealed	50
6. Dark red arkose, fine-grained and very siliceous (92).	100
7. Coarse-grained gray arkose containing pebbles of quartz and felspar up to one-half inch diameter...	10
8. Mixed beds of dark red greywacke and arkose with more siliceous and coarser partings (69, 71, 81)..	6
9. Medium-grained pink arkose sandrock (64)	4
10. Dark yellowish-red arkose sandrock	4
11. Light-pink arkose sandstone (79)	10
12. Dark purplish-red fine-grained arkose	1½
13. Greenish medium-grained arkose (70)	2
14. Light-greenish compact quartzite	1½
15. Light-pink arkose sandstone	7
16. Red banded arkose sandstone	3
17. Light-pink arkose sandstone	6
18. Mixed dark and light-red sandstone (80)	10
19. Light-pink and light-red sandstone	4
20. Red banded and light-red sandstones	1
21. Light-pink and light-red sandstones	2
22. Banded red and light-red sandstones	1
23. Light-pink and red sandstones	6
24. Banded red and pink sandstones	55
25. Dark-gray greywacke, containing small quantities of magnetite (76)	2
26. Banded pink to red arkose sandstone (78)	300
27. Red arkose with more angular fragments	50
Unconformity.	
	3,101

The arkose beds of the peninsula appear to rest immediately below the above section, and there is probably but a little break between them.

Resting unconformably upon the above is the following descending section

representing the upper members of the series, separated from the lower by the costal thrust-fault before mentioned:

	Feet
1. Dark-green, fine-grained diabase	100
2. Pink sandstone with numerous partings of dark ferruginous shale	15
3. Light-gray and pink sandstone, with very thin ferruginous partings	75
4. White, very fine-grained sandstone	40
Concealed	25
5. Buff weathering, light-blue cherty dolomite, with concretions of chert, and coarser grained darker coloured limestone	40
6. Yellow weathering, very fine-grained light-blue very cherty dolomite, with thin partings of light-blue chert	60
Concealed	50
7. Buff weathering, dark-gray, silicious limestone, with frequent partings of dark chert. The limestone is full of cavities lined with quartz and calcite, pyrite and blende, and at times galena, but all too scattered to be of economic value	8
To fault.	
	413

The next section was made down a small brook falling into the south-west corner of the bay formed by the peninsula, just inside the entrance to Richmond gulf.

This section is from the fault dividing the upper beds downward, as follows:

	Feet
1. Dark greenish-gray, rusty brown-weathering greywacke (75)	35
2. Dark-green greywacke (73, 74)	5
3. Dark-green greywacke, with brown splotches of jaspery ore	15
4. Light-gray sandrock, mottled with spots of oxide of iron	10
5. Dark-red fine-grained slate greywacke, containing considerable iron ore and small angular fragments of jasper (87)	40
6. Dark-red argillite, with small patches of green (88)	5
7. Dark-green splotched greywacke	10
8. Dark-red ferruginous greywacke, with partings of red argillite	50
9. Dark cherty greywacke	5
10. Pink fine-grained arkose sandstone	4
11. Dark-red ferruginous silicious greywacke	10
12. Mostly dark-green ferruginous splotched greywacke with thin bands of red greywacke and red argillite	50

	Feet
13. Dark green, compact, ferruginous greywacke with a few dark red slatey bands	150
14. Shaly, red ferruginous chert (impure magnetite-hematite)	50
15. Green, cherty rock splotched and veined with red jasper	150
To shore.	
	589

The next section is situated four miles to the eastward on a hill facing northward. It is as follows in descending order:

	Feet
1. Coarsely porphyritic fine-grained diabase	100
2. Light buff-weathering dolomitic full of light-blue chert and carrying small quantities of blende	20
3. Cherty, light-buff limestone containing much pyrite and blue chert	100
4. Dark silicious limestone with partings of dark carbonaceous shale	80
5. Fine-grained, dark and light-gray flaggy sandstone with partings of dark-greenish arenaceous shale capped with a thin bed of light buff weathering cherty limestone	15
6. Light-blue, yellow-weathering dolomitic chert	3
Concealed	15
7. Dark-grayish chert	6
8. Light-gray and white fine-grained sandstone	115
9. Coarse light-gray sandstone splotched with rounded fragments of white felspar	10
10. Light-gray sandstone, medium to fine-grained and thickly marked with minute brown spots, together with light grayish green cherty beds separated by beds of dark brownish calcareous ferruginous sandrock containing small fragments of green jasper. Beds from ½ to 2′ thick (114)	105
Probable unconformity.	
11. Light-pink arkose sandstone	75
12. Light and dark-red arkose sandstone with many partings of red argillite	55
Concealed	185
13. Dark-red arkose sandrock carrying some carbonate of iron; most plentiful in the upper beds, there forming a lean cherty ore	45
14. Dark-red arkose sandrock containing considerable chlorite interbedded with pink more silicious arkose	140
15. Dark-red ferruginous arkose with many partings of dark-red argillite	75
16. Chiefly pinkish sandrock with a few bands of dark red greywacke, sometimes greenish in colour	60

	Feet
17. Very dark-red fine-grained greywacke	50
Dark-red ferruginous arkose splitting into flags (113)..	75
Concealed	80
18. Dark-reddish and grayish arkose with partings of dark-red argillite and a few bands of coarser pink arkose (all ripple-marked)	33
19. Light-pink fine-grained arkose	10
To sea level.	
	1,452

The rocks of Cairn island and other islands in the southern part of Richmond gulf are largely pink and red arkose with (84) red and green micaceous argillite, and green greywackes. Nearly all the beds show ripple marks. The arkose in the upper beds shades into sandstone (93) from the elimination of feldspar.

GLACIAL GEOLOGY

The entire western side of the peninsula of Labrador during the glacial period was overspread by an ice-cap of a thickness sufficient to cover the highest summits, and to flow uniformly over mountain and valley from the interior of the peninsula outwards towards the coast. From the evidence of the glacial striae now found marking the rocks, there would appear to have been movements in the position of the centre of dispersion of the ice, and perhaps periods of only slight glaciation corresponding to the interglacial periods of the United States. Along the east coast of Hudson bay, three marked sets of striae are found, and from these it is seen that the earliest iceflow started from a central gathering ground between the 50th and 51st parallels of N. latitude, near the centre of the peninsula. The second set of striae show that the centre of glaciation had moved in a north-west direction to beyond the 54th parallel, while the latest set shows a continuation of the north-west movement leaving the centre of dispersion between the 55th and 56th parallels, and about one hundred miles inland from the east coast of Hudson bay. In many places only one set of striae is visible, and these, the latest, show along the northern half of the coast that the flow of the ice was radially towards the coast, as the striae on the rocks facing Hudson bay show that the ice flowed westward, while those facing Hudson strait show a northward flow.

On the Moose river which falls into the southwest corner of Hudson bay, a very interesting fact in regard to the glaciers was noted in the direction of the striae found on its banks in the interior. The oldest striae there were from north-west to southeast and prove that the Keewatin glacier overran the region north of Lake Superior before it was covered by the Labrador glacier which has left newer striae from the north-northeast. Subsequent to or accompanying the period of ice accumulation, there was a marked subsidence of the land which was followed by an uplift. This uplift is marked by terraces of sand and clay, often carrying marine shells and accompanied by old sea beaches, the highest of which are upwards of 700 feet above sea-level. The data to hand is not sufficient to determine if the elevation was constant and equal along that coast of Hudson bay, owing to the fact that the land for long stretches along that coast nowhere rises sufficiently high to mark the level of the highest terraces, which are seen at greater elevation elsewhere.

EXTRACTS FROM REPORT

ON THE

GEOLOGY and PHYSICAL CHARACTERS of NASTAPOKA ISLANDS

GEOLOGICAL SURVEY OF CANADA, A. P. LOW, 1900.

GENERAL GEOLOGY OF THE NASTAPOKA ISLANDS

The Nastapoka islands are formed from unaltered sedimentary rocks consisting of dolomites, sandstones, shales, jaspilytes, cherts and ferruginous shales. Associated with these rocks are sheets of dark green trap, which have been injected between the bedding of the stratified rocks or have been surface-flows contemporaneous with the formation of the sediment. A graywacke slate, which appears to have been formed by the deposit of volcanic ashes, is also associated with these rocks. The following is a general section of the rocks forming the islands and is made from the measured sections, given in detail later in the report.

Descending order:

	Feet.
1. Rusty weathering, dark gray, siliceous rock containing ankerite (carbonate of iron and magnesia) and magnetite	20 to 100
2. Dark-gray siliceous rock containing magnetite with small quantities of ankerite	50 to 250
3. Red jaspilyte rich in hematite ore	10 to 100
4. Red jaspilyte poor in hematite ore	5 to 20
5. Purple, or greenish-weathering, dark-green, graywacke shales	10 to 70
6. Red jaspilyte poor in hematite ore	0 to 5
7. Light greenish-gray sandstone and shale	10 to 300
8. Fine-grained dolomite	0 to 50

The rusty weathering, dark-gray siliceous rocks of the first division (1) are found on all the islands from Flint to McTavish, being wanting only on Cotter island. The typical rock is a dark gray chert made up of finely divided silica showing under the microscope small grains of quartz filled in by later accessions of that material in a finely divided state. It contains minute crystals of magnetite scattered through the mass, and also patches of crystalline carbonates. At the southern end of the chain it is cherty and sometimes light green in colour. These rocks are usually in thin beds, the parting between the beds filled with brownish ankerite, which also occurs in flat lenticular masses inclosed in the cherts; many of these masses are several inches in thickness and several square feet in area, so that the rock usually contains from twenty to fifty *"per cent"* of ankerite. These

ores are too much broken and too intimately mixed with the cherts for profitable mining. The rusty character of the rock is due to surface decomposition of ankerite to limonite. The beds increase in thickness as the islands are followed northward, and reach their maximum development on Davieau island and northward to McTavish island, where they have a thickness of fifty feet. These measures can be traced southward from the Nastapoka chain in the outer islands lying along the coast for upward of 150 miles, being last seen on Long island just north of Cape Jones, where they are overlaid by a considerable thickness of trap.

The second division of the section is an arbitrary one, and was made to embrace all the beds containing important deposits of magnetite. The upper beds of the division grade into those of division I, while the lower pass gradually into division III.

The typical rock of these measures is a dark-gray, fine-grained variety of quartzite chert, containing considerable magnetite scattered through it in minute crystals; it also contains small quantities of carbonates of iron, magnesia and lime. The beds are usually thin (from one to twelve inches) and the partings between them are filled with a mixture of silica and magnetite with small quantities of ankerite. These partings vary in thickness, but are generally thin between the upper beds of the division, and quite thick (six inches to forty-eight inches) towards the bottom, where they form important ores of iron; as the beds of chert are often quite thin between two or more thick partings of ore and might easily be neglected in mining. The mixture of silica and magnetite in the ore is an intimate one, with the silica usually in a finely divided state.

The proportion of these substances is not constant, so that the ores vary from a lean ferruginous chert, to a rich ore containing upwards of sixty *per cent* of iron. Large quantities of the better ores occur in the lower beds of the division. The occurrence of these ores between the beds of gray siliceous rock, and their intimate association with finely divided silica point to their deposition and enrichment from the infiltrations of waters carrying solutions of iron and silica which were deposited by the waters in cracks and between the bedding of the already formed siliceous rocks. This mode of formation has been described by Van Hise for similar ores in the Lake Superior region.

On the three southern islands of the chain, there is a gradual change in the nature of these measures. They pass into a brownish-black, silicious shale, rich in iron and containing considerable carbon as small scales of graphite. This is the form in which they are found to the southward of the islands as far as Long island. The thickness of the division is very constant on the islands northward to McTavish, but it does not occur on Cotter island.

The rocks belonging to the third division, as before stated, grade into the division above them and the line between them cannot be drawn sharply.

The typical rock of this division is fine-grained and very siliceous, with minute particles of silica coated with red oxide of iron, forming a coarse impure red jasper.

These jasper rocks usually occur in thin broken bands with the partings between them filled with a finely-divided mixture of hematite, magnetite and jasper. The hematite is greatly in excess of the magnetite. The association of the iron ores and the jasper is intimate and they must have been deposited simultaneously from aqueous solutions probably leached from the cherty carbonate measures

above. Microscopic sections from these rocks are almost identical with those of jaspilyte figured by Van Hise in his monograph on the iron-bearing rocks of the Lake Superior region; and they must have had the same origin as he has assigned to those rocks, namely: enrichments deposited by water subsequent to the formation of the bedded rocks in which they are found as partings, and filling the most minute cavities.

The amount of ore in this admixture of hematite and jasper varies greatly; where the ore is poor, the jaspery rock predominates and incloses lenses of hematite, while where the hematite is most plentiful it incloses similar lenses of jasper. The detailed description of these rocks, given later, shows that the measures of this division contain an immense amount of hematite. The rocks of the division do not occur on all the islands, being wanting on Flint, Belanger and Ross. On Anderson they are represented by a few thin beds not rich in ore, while on Clarke they form the summit of the section with a thickness of eighty feet. They reach their maximum development on Gillies and Taylor, where their ores are richest and most concentrated; farther northward they become thinner and poorer in ore, being twenty feet thick on Davieau and only eight feet thick on McTavish, where they die out. No trace of these measures is found underlying the upper rocks on the islands south of the Nastapoka group.

The fourth division, consisting of red jaspilytes is an arbitrary one, of use only as a subdivision of the iron-bearing rocks. Wherever the jaspilytes are well developed, the richer beds are underlain with leaner measures, unfit for working, and these poorer ores constitute this division. On Clarke island these beds are twenty feet thick, on Gillies they vary from ten to twenty feet in thickness, on Taylor ten feet, while to the northward, they merge into the overlying division, all poor in iron ores.

The rocks of the fifth division differ from those of the rest of the section, in that they are of volcanic origin, probably trap-ash, rocks contemporaneous with an outflow of trap, which, on the northern and southern islands, occurs at the same horizon.

The rock is a purple or greenish-weathering, dark-green, fine-grained graywacke, with a horizontal shaly cleavage. It is formed from finely divided and partly rounded fragments of plagioclase, bisilicates (largely decomposed to chlorite) and rounded grains of quartz, which indicate a sedimentary character, while its other constituents point to an igneous origin, probably, the ashes of a volcanic outburst deposited in a shallow sea.

In places the shales contain small partings of hematite; and at times portions of them are coated on the surface, so as to resemble metallic iron. These are not rich in iron ore.

These measures were first noted on Clarke island, where they have a thickness of seventy-five feet. On Gillies they are sixty feet thick; on Christie eighty-five feet; on Davieau less than fifty feet; on Broughton thirty feet; and on McTavish fifty feet. They disappear in the interval of nineteen miles, separating McTavish from Cotter, being represented on the latter island by twenty feet of fine-grained trap, overlying the sandstone of the seventh division. Twenty-five miles northward of Cotter, the trap is again seen in the Hopewell islands, where it overlies similar sandstones and attains a thickness of upwards of a hundred feet. On Belanger, Ross and Anderson islands sheets of trap, wholly or in part, occupy the

horizon of the graywacke shales on the other islands. On Belanger thirty-five feet of graywacke shales rest upon three feet of trap, which latter overlies twenty feet of graywacke shale, resting upon twenty-five feet of trap.

On Ross and Anderson the trap underlying the iron-bearing rocks only rises slightly above sea level and its thickness is unknown. On Flint island, fifteen feet of trap rest upon beds of arkose sandstone which probably was largely formed from volcanic ashes.

The rocks of the six divisions are limited to Gillies, Davieau and McTavish islands. This jasper rock is in thin beds or flags without hematite ores. On McTavish island the jasper splits into thin flags, is nicely mottled and would prove effective for interior house decoration.

The sandstone and associated siliceous shales constituting the seventh division are found in the lower portions of all the prominent eastern points of the islands. The sandstone is always light coloured, with generally, a greenish or pinkish tinge to the gray. A number of massive beds occur in the measures, but as a rule, the sandstone is thin-bedded and flaggy with the surface of the flags ripple-marked. It is essentially composed of quartz grains, but often holds considerable quantities of the carbonates of lime and magnesia, especially on the northern islands, where it is difficult to determine whether some of the beds are siliceous limestone or calcareous sandrock. Many of the beds contain small splotches of ankerite; and at times small garnets are found in the upper, massive beds. The shales form partings between the sandstone beds, indicating that the whole of the measures were deposited in shallow water. The shales are very siliceous and usually of a light green colour.

The dolomites forming the eighth and lowest division are only met with at the eastern point of Belanger island. They are very much contorted and broken where seen; and the contact between them and the overlying sandstones is concealed by drift, so that it is impossible to state whether or not they conformably underlie the sandstone. The sandstone where last seen above the drift is undisturbed, in marked contrast to the dolomites below, and there may be a line of fault between them.

The rocks forming the Nastapoka islands have a general dip to the westward, or towards the sea; the angle of dip is generally low—from 5° to 15°. This general westward dip is by no means uniform and regular, as the rocks are thrown into roughly parallel ridges running north and south and separated by intervals varying from a few feet to several hundred yards across. These parallel ridges are the result of upthrows along lines of fault, the up-throw being always on the western side, and consequently the rocks on that side are always higher and have steeper faces than those on the opposite side of the fault. The amount of displacement at any of these faults is generally small and rarely exceeds one hundred feet. As a result of the displacements caused by these faults, the surfaces of the islands always give one or more repetitions of the upper measures.

The stratigraphy is further complicated by another series of faults lying transverse to the first system. These two series of faults have broken the measures into huge blocks more or less rectangular in shape, and the unequal throw of the transverse faults has tilted these blocks so that they often dip diagonally to the northward or southward of west, resembling, on a gigantic scale, ice piled along shore by pressure from seaward. The present condition and position of the rocks must have been due to some such pressure acting from seaward, which forced

them against the inert masses of granite and crystalline rocks forming the mainland, causing them to buckle along lines parallel to the coast and forcing huge cakes of rock to over-ride one another.

The buckling at these parallel faults, on the islands, represents on a smaller scale what took place along a great line of fault which extended fully three hundred miles along the east coast of Hudson bay, from Cape Jones to Portland promontory, and caused the uplift of Long island, the outer islands betwen it and the Nastapoka islands and the Nastapoka and Hopewell islands, all of which belong to the same geological horizon. The uplift along this fault line must have been several hundred feet, while the horizontal movement of the rocks was much greater than the uplift. A second great line of fault and overthrust is indicated by the position of other unaltered rocks of this formation which lie upon the granites and other rocks of the mainland, from the north end of Richmond gulf to the vicinity of Cape Jones, a distance of nearly two hundred miles. The rocks of this division also exhibit a series of minor parallel faults like those described above. The Belcher and other islands stretch in lines parallel to the coast, from northward of Cape Jones to beyond Portland promontory, and are from forty to seventy miles off the land. These islands resemble in physical character those lying close to the coast and have probably been thrown up from the sea bottom by a similar great overthrust along corresponding lines of fault. The rocks of the Nastapoka islands are not only faulted, but are also thrown into anticlinal and synclinal folds. These folds are always gentle and only on McTavish island does the angle of such a fold exceed 20° on either side, and even this moderate fold is broken along its crest. This slight folding before the buckling of the rocks shows that at the time the pressure, causing movements in them, was exerted, the rocks were at or close to the surface, and the lack of pressure from super-imposed strata allowed them to break rather than fold, as they would have done had they been deeply buried beneath newer formations.

The geological position of the rocks of the Nastapoka group is difficult to determine, owing to the great and minor faults which have displaced them and other measures of the formation to which they belong. The mainland, from opposite Flint island to Anderson island is occupied by a series of similar unaltered rocks belonging undoubtedly to the same formation. They are largely dolomites, limestones and sandstones, generally resting unconformably upon beds of arkose and arkose sandstone, but opposite Anderson island lying immediately upon granites. A great thickness of bedded trap overlies these stratified rocks. These unaltered rocks of the mainland dip gently westward, and if no line of fault followed Nastapoka sound, the rocks of the islands would rest conformably upon them, and consequently would be newer and higher in the measures of the formation than the rocks of the mainland.

A study of the measures displayed in the southern cliffs of Richmond gulf, opposite Belanger island, was made in 1899. Here an unbroken series was found rising, from a coarse arkose rock, through arkose sandstones and shales into light coloured pinkish and greenish sandstones and siliceous shales very like those of the bottom measures of the islands. Resting conformably on these sandstones and shales was a considerable thickness of lean jaspilytes mixed with graywacke shales having dark gray ferruginous cherts above them, while on top were dolomite, limestone and sandstone capped with trap. From this it is inferred that the Nastapoka group of rocks with their important iron-bearing measures belong to

the middle portion of the so-called Cambrian formation of the peninsula of Labrador. Consequently they are older than the rocks of the coast and underlie them. Although, thrust up by a great fault, they seemingly overlie these rocks which form the summit of the formation along the east coast of Hudson bay.

Large areas of similar unaltered sedimentary rocks occur throughout the peninsula of Labrador, and are probably the equivalents of certain of the iron-bearing series about Lake Superior and of those to the westward of Hudson bay, hand specimens from these localities being undistinguishable, so closely do they resemble one another.

On former maps of portions of the peninsula of Labrador, the areas of rocks belonging to this formation have been coloured as belonging to the Cambrian formation, and in the earlier reports on this region, the rocks were thought to be a part of that system, owing to their unaltered condition, in contrast with all the other rocks of that vast area that were either crystalline granites and other irrupted rocks, or crystalline schists and gneisses, so completely metamorphosed as to have lost all trace of their original sedimentary nature, if any were sediments. These highly crystalline rocks were classed as Laurentian or Huronian and were considered to be much older than the unaltered rocks of the so-called Cambrian areas. More extended and closer study of both the unaltered and crystalline rocks and of their relations to one another has changed the views of the writer; and he now considers the unaltered, so-called Cambrian rocks to be the equivalents of many of the gneisses and schists classed as Laurentian (Grenville Series) and the Huronian areas of the Labrador peninsula to represent a portion of the unaltered rocks and their associated basic eruptives (traps, trap-ash, &c.), altered by the irruption of granite and rendered schistose by pressure. The granites which have been classed as typical Laurentian, always cut and alter the bedded rocks wherever seen in direct contact with them and are consequently newer than the latter. The above observed facts extending over large areas of the peninsula, the result of several years study of the rocks, have led the author to conclude that the term Cambrian as applied to these unaltered rocks is a misnomer, as considered in their relations with the surrounding areas so classed as Laurentian and Huronian, they are of similar or greater age than the rocks so classed; and the term Cambrian is confined elsewhere, to rocks of more recent formation than the Laurentian or Huronian.

The age of these unaltered rocks is unknown, but is undoubtedly very great. No fossils have as yet been determined from them, but there appears to be evidence of low forms of life, both animal and vegetable, in them; as without them it is difficult to account for the deposition of the large quantities of carbon in the shales of this formation. The taking into solution of iron and its redeposition was possibly due to the action of organic acids. Certain of the limestones contain concretions of alternate concentric layers of chert and limestone, which resemble fossils of low animal organization. During the past season, very thin layers of carbon with some resemblance to organic forms were found in the sandstones of Cotter island; these have the appearance of lowly organized plant life. If there are fossils in these rocks they represent a low type of life, lower than the known fossils from the lowest beds of the Cambrian, and consequently this formation is older than the Cambrian. It is proposed, therefore, to class these so-called Cambrian unaltered rocks as Laurentian, as they represent the oldest known sedimentary rocks in the North-East of America and probably in the world.

EXTRACTS FROM

A REPORT ON AN EXPLORATION OF PART OF THE SOUTH SHORE

OF

HUDSON STRAIT and of UNGAVA BAY

By A. P. LOW.

GEOLOGICAL SURVEY OF CANADA, Vol. XI, 1898.

GEOLOGY

GENERAL OBSERVATIONS

The rocks along the south coast of Hudson strait and the West and South shores of Ungava Bay, present many interesting and complex problems. The occurrence of numerous quartz-veins in the bedded rocks near to their contact with intrusive masses of greenstone and granite are important, as such conditions are favourable to the presence of more valuable minerals, and although no such minerals were found during the exploration, there is no reason why they should not be found with more detailed search, as many of the veins carry large quantities of pyrites. Bedded iron ores were found, and although those examined were not of a very high grade, better bodies of ore might doubtless be found in the extensive areas of this iron-bearing series of rocks seen at a number of localities on the coast.

The long line of coast explored in the limited time at the disposal of the expedition, together with the difficulties of navigation in the shallow waters along the greater part of the coast, where the difference between high and low tide varied from twenty-five to forty feet, only allowed of a hurried examination each day of a few points on the shore, at considerable intervals, so that a thorough examination of the rocks was impossible, and consequently only such relations as could be made out from these isolated observations are here given. These northern coasts are ideal places for geological investigation, owing to the absence of trees and often of all vegetation, which leaves the rocks almost continuously bare; while below the 300-foot level, the shores, as they have risen from the post-glacial subsidence, have been smoothed and polished by the pounding of floating ice, which has removed nearly all the drift from the points, leaving the solid fresh rock always exposed.

The rocks met with are all of great antiquity, and all are more or less altered by pressure, induced by intrusions of igneous masses, which has folded the bedded

RAVINE ON BROOK AT HEAD OF WEST ARM—Douglas Harbour.

series and have produced foliation in much of the otherwise massive granites, gabbros, diabases and other greenstones. The foliation of the granites shows that the pressure was exerted from a direction varying from west to south-west. Where massive beds of cherts and quartzite have resisted the folding action, they, with their associated beds of softer shales or slates, have been shoved into ridges by over-thrust faults, giving the hills cliff-faces inland, while their seaward slopes conform closely with the dip of the beds.

Biotite-granite or granitite and biotite-gneiss, especially the latter, together occupy fully three-quarters of the coastal area. The granite and gneiss have commonly a medium texture and vary in colour from light pink to flesh-red, the light coloured varieties predominating. These rocks are usually very quartzose and often grade into impure quartzites, and in the gneissic rocks dark-red garnets are usually present. Masses of hornblende-biotite-granite are associated with the biotite-granite and in places appear to represent only more basic portions of the same magma. The gneisses seem to be metamorphic products of several rocks of different age and origin. Some of them are very ancient and probably represent part of the original Archaean complex. Others may represent granites of a somewhat later date, injected into the first, but still long anterior to the time of deposition of those sedimentary beds of Labrador that have been provisionally classed as Cambrian. A considerable part of the gneisses has, however, been formed from the alteration and quartzose infiltration of the bedded series of the Cambrian near the contacts of these rocks with great intrusions of later granites; and, finally, some of the gneisses are foliated parts of these later granitic intrusions. All these gneisses of different origin are very similar in appearance and composition, and often could not be distinguished from one another in the hurried examination given them, except in a few places where the contacts were clearly seen. These places are mentioned later in the detailed account of the exposures examined. Owing to the difficulty or impossibility of differentiating these gneisses of several ages and origins, they have all been classed together and no attempt has been made to separate the so-called Cambrian bedded rocks from an older basement complex, except to state that in a number of places the bedded rocks appeared to rest unconformably upon rounded bosses of gneiss, which may represent an older series partly composed of clastic rocks, or may be masses of granite intruded below the newer bedded series, as, owing to the highly metamorphic condition of the newer rocks and their frequent intrusion by later granites, it is exceedingly difficult to tell when a contact other than an intrusive one was found.

The bedded series occurs at intervals along the coast from Fisher Bay to the mouth of George River; its degree of alteration depending largely on its proximity to masses of newer granite and gneisses, which near the contact have broken, squeezed and metamorphosed the beds into highly crystalline schists, and gneisses.

There appears to have been an orogenic movement subsequent to the granitic intrusions, which has further altered the bedded series, throwing the beds into folds, or into repetitions of the series by a number of over-thrust faults. The rocks when least altered bear a close resemblance to portions of the unaltered series of bedded rocks classed as Cambrian and found in the interior of Labrador along the Hamilton and Koksoak rivers, and also on the East coast of Hudson Bay. They consist largely of black bituminous or graphitic shales, gen-

erally bearing considerable pyrite; gray micaceous slates, dark hornblendic slate, impure dark ferruginous, and dark siliceous ferruginous dolomite, the two last often carrying large masses of magnetite iron-ore. The great thickness of light-coloured, siliceous dolomite found elsewhere with the series, was not seen along the coast. The rocks bear a close resemblance to that part of the Cambrian series found along the lower reaches of the Kaniapiskau and Larch branches of the Koksoak; and the presence of the great sills or laccolites of gabbro, together with a peculiar light-green diabase and other greenstones, is a further point of resemblance to the rocks of the Koksoak.

The intrusion of the granite appears to have greatly affected these clastic rocks, changing them into gneisses and schists, so that for a considerable distance from the contact, they resemble lithologically, the Grenville series of the Laurentian. The granites appear not only to have produced the schistosity, but to have caused infiltrations of heated waters carrying silica and silicates in solution depositing large quantities of quartz and felspar between the laminae of the mica and hornblende-schists, changing these into typical gneisses, which, as well as the schists, usually carry large quantities of garnet often in very large crystals. When associated with gabbros, diabases and their decomposition-products the bedded rocks are often ramified with quartz veins, generally holding considerable pyrite, these veins are most abundant near contacts with newer granites. Several samples from such veins have been assayed for gold with negative results, but as already explained, these cannot be accepted as in any sense conclusive.

VIEW OF PAYNE RIVER—Thirty miles above its mouth.

EXTRACTS

FROM GEOLOGY AND ECONOMIC MINERALS OF CANADA

By G. A. YOUNG.

THE LAURENTIAN PLATEAU

GEOLOGY.

The "*Laurentian Plateau*" region, surrounding Hudson bay with a U-shaped form, has an area of over 2,000,000 square miles. Limited in the east by the North Atlantic and by the gulf and estuary of the St. Lawrence as far as the city of Quebec, its southern boundary there passes inland and up the Ottawa river to beyond the city of Ottawa, then turns abruptly to the south and crosses the International Boundary at Brockville. Farther west, at the foot of Lake Ontario, it crosses back into Canada and follows a nearly due east and west line to the foot of Georgian bay, from which point the two upper Great lakes form the bounding line. West of Lake Superior the Laurentian Plateau region extends south into the United States. In southeastern Manitoba the boundary again enters Canada, and from there passes along a general northwesterly course through Lake Winnipeg, Great Slave lake, and Great Bear lake, to the shores of the Arctic ocean.

This great region is, for the most part, characterized by its uniform physical features. Considered by districts, the Laurentian plateau is composed of gently sloping regions whose even surfaces, save sometimes for the valleys of the larger rivers, are broken only by low hills rising a few hundred feet or less above the general level. Except in the northeast, along the Labrador coast, the land is generally comparatively low, seldom rising 2,000 feet above the sea. The more extensive elevated stretches of country within the plateau region all lie towards its outer margin, away from Hudson bay. Save towards the headwaters of the Ottawa river in the east, and over the wide depression bordering and extending north of Lake Winnipeg in the west, the higher lands form an elevated belt usually hundreds of miles wide, stretching from the North Atlantic in the east, around the foot of Hudson bay almost to the Arctic in the northwest, with a general elevation always above 1,000 feet, and over large tracts in the Ungava peninsula, approaching 2,000 feet. From this outer, elevated margin the country on all sides slopes inwards towards Hudson bay, surrounding which there is a nearly continuous belt of territory, often 125 miles wide, over which the land never reaches a height of 500 feet above sea level.

The highest land of the Laurentian Plateau region lies along the Labrador coast towards the eastern entrance of Hudson strait, where mountain peaks

attain heights of about 6,000 feet. Southward along the coast, the general elevation decreases, but everywhere the shores are high and penetrated by deep inlets, with precipitous sides rising five hundred to several thousand feet above the sea. Along the Gulf of St. Lawrence shore the land is generally bold, rising inland rapidly to heights of 1,000 feet or more, though penetrated by long, narrow valleys occupied by the main waterways.

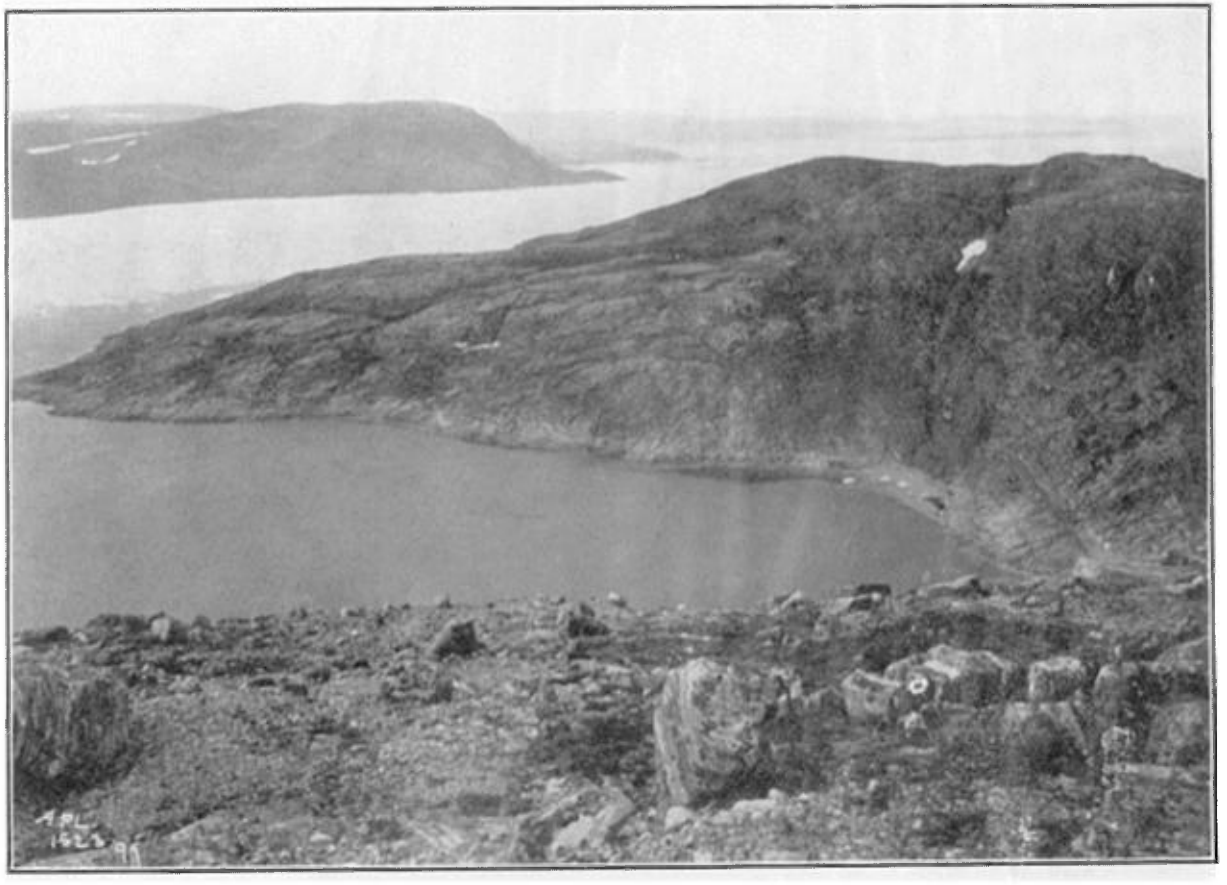
The abrupt rise of the southern boundary is also a notable feature along its course from Quebec inland up the Ottawa valley. It is repeated along the Lake Superior shores, where for miles bold hills and cliffs rise to heights of 300 to 1,500 feet above the lake. In the west, however, the characteristic sudden uprise at the outer boundary, so prominent in the east, largely disappears, or is replaced by a slight drop from the overlapping sediments to the level of the Laurentian plateau.

The Laurentian plateau is in detail characterized by countless lakes, both large and small, muskegs, and numerous branching streams and rivers that occupy the valleys between the hummocky hills. The territory in the east, south of the latitude of the foot of James Bay, is densely wooded, while in the west, the heavily timbered country extends even farther north. Beyond this, to the north, the forest growth gradually decreases, and on the shores of Hudson bay, at about north latitude 59°, the barren lands commence and stretch away to the Arctic ocean. Essentially a forest region in the south, the Laurentian plateau also contains wide areas, the clay belts, that eventually should prove valuable for agricultural purposes.

Noted for its timber resources, the Laurentian plateau, where best known, is no less important from the standpoint of mineral wealth. Along the southern margin occur the noted copper and nickel ores of Sudbury, and to the north of these lie the Cobalt silver deposits. In eastern Ontario, and the adjoining portion of Quebec, are numerous and important deposits of graphite and mica. All through the region occur iron deposits, some now being mined, and many in the near future destined to become commercially important. Besides these, many other ores, both metallic and non-metallic, are known, although the country cannot in any sense be said to have been closely prospected. Nor do these mineralized belts seem to be confined to the southern part of the country, but everywhere through the Laurentian Plateau region the general conditions appear to be similar, and it is certain that many deposits of economic value yet remain to be discovered.

The Laurentian Plateau region, save for a zone of Paleozoic rocks bordering the southwestern side of Hudson and James bays, and a few relatively small outliers of the same system occurring elsewhere, is altogether underlain by rocks older than those of the Cambrian period. Collectively these ancient rocks will be referred to as the pre-Cambrian. The vast territory over which they now outcrop is but a portion of the ancient continent of Laurentia that, prior to Cambrian times, it is believed, occupied much of the present area of the North American continent. Rocks in many respects similar to those composing the Laurentian plateau extend far beyond its borders beneath the surrounding sediments deposited in Cambrian and later basins.

The various assemblages of rocks underlying the Laurentian plateau, by their relations and distribution, testify to a long and complicated history in pre-



MOUTH OF WAKEHAM BAY—Filled with ice.

Cambrian times. They show that, at intervals and over wide regions, assemblages of rocks were formed, afterwards subjected to great earth movements, penetrated by vast bodies of deep-seated igneous rocks, then profoundly eroded, and finally depressed, to be again covered by another set of beds volcanic and sedimentary. This great cycle was, in some instances, repeated one or more times, but the extent of the Laurentian Plateau region is too great, and the knowledge of it as yet too elementary, to allow of a definite correlation of the details of its geological history as a whole.

The region is chiefly occupied by large and small bodies of igneous rocks, which at the time of their formation were deeply buried, but now, because of subsequent erosion, are partly exposed. These igneous rocks are often typically granitic in appearance, but, perhaps, more commonly show gneissic structures. Though of widely different relative ages, penetrating one another and later assemblages of pre-Cambrian rocks, yet over the wide expanse of the Laurentian plateau they preserve a general resemblance. By their nature they show they were not the first rocks to occupy the region, and often they may be seen cutting younger strata. Yet, from their wide distribution and the often vast dimensions of the individual masses, it is evident that these essentially granitic rocks form the foundation, as it were, of the whole Laurentian Plateau region, and now, if they do not appear at the surface, are either covered by a comparatively thin mantle of younger rocks, or else underlie, with intrusive relations, older formations.

Throughout the pre-Cambrian region occur other rocks, forming areas sometimes to be measured in yards, sometimes in scores of miles. These have been penetrated by the granites and gneisses, and are, therefore, the oldest rocks of their respective districts. Usually they are highly altered, but often they may still be determined to have been of the nature of sediments and volcanic rocks that formed on or near the earth's surface. The assemblages of these older, usually much altered rocks, vary in general character from district to district, are doubtless of various relative ages and, in some districts, may represent groups of strata that in other places still remain comparatively unaltered and unpenetrated by igneous bodies. Within the pre-Cambrian region also occur, sometimes over wide areas, assemblages of sedimentary beds that are at times scarcely more altered than recently consolidated measures. These younger pre-Cambrian strata frequently may be seen to overlie and to have been partly formed from older, sedimentary and volcanic rocks and the granitic rocks intruding them.

The general history of pre-Cambrian times within Canadian territory has, perhaps, been most clearly determined in the part of the Laurentian plateau lying within the Province of Ontario, and the adjacent portions of Quebec. In northern Ontario, near Cobalt, and in the districts about Lakes Timiskaming and Timagami, occurs a widely distributed group of rocks known as the Keewatin. These rocks, the oldest in the region, are invaded by large bodies of granite. The Keewatin strata are largely of volcanic origin, but with them, though but sparingly, also occur rocks seemingly of sedimentary origin, such as banded quartzose beds often rich in iron, the Iron formation. The Keewatin, as a whole, is highly altered, its members are frequently in a schistose condition (greenstone schists) and apparently closely folded. Once, doubtless, forming a continuous,

wide-spread, nearly horizontal series of rocks, the beds now occupy isolated, relatively narrow bands or areas, underlain and penetrated on all sides by granites and allied rocks.

The Keewatin strata, at the time of their folding, probably rose into mountain masses, while, at about the same time, vast bodies of granitic rocks intruded them from below. Later, as shown by the horizontal, overlying beds of younger conglomerate still occupying parts of the district, the complex assemblage was subjected to intense erosion and much of the Keewatin entirely removed; the once deeply buried granite masses were partly exposed, and the whole region reduced to a gently undulating country, much like that of the present time. The beginning of this great erosion period marked the close of what appears to have been the first pre-Cambrian era of which there is definite knowledge.

Towards the close of the first prolonged erosion interval, the Timagami district appears to have been depressed, and a widespread group of sedimentary rocks deposited, covering the Keewatin and the granites. This sedimentary group, the lower Huronian still occupies much of the country. It consists of thick beds of conglomerate overlain by a passing upwards into slates, above which sometimes occurs a quartzite or arkose member possibly belonging to a second division, the middle Huronian. With the sediments are associated widely exending, often thick, sheet-like bodies of diabase, of later date, that sometimes cut the sedimentary beds, but more often rest on top of them. The Huronian series, though affected by faults and comparatively gentle folds, is, on the whole, flat-lying, and beneath its basal members may be traced the old, gently undulating, pre-Huronian land surface of Keewatin rocks and intrusive granites.

The conditions obtaining in the Timagami district seem, in part, to be duplicated through much of northern Ontario, and throughout the Laurentian plateau occur rocks like those of the Keewatin, sometimes occupying large areas and exhibiting many varieties of volcanic rocks in varying degrees of deformation. Often the areas form gigantic meshworks enclosing, or partly enclosing areas of intrusive granites or gneissic rocks occupying many square miles of country. At times the Keewatin rocks are greatly changed, and sometimes form wide zones of gneissic or schistose varieties intermingled and interbanded with the granitic intrusives. But though the condition of the Keewatin and its relations to the granitic intrusions is, broadly speaking, everywhere alike, the same is not true of the widely distributed Huronian.

Strata similar to the but slightly disturbed lower Huronian of the Timagami district, and younger than the associated Keewatin, are found to the south and west, as, for instance, near Sudbury and in the Michipicoten district. In these districts the Huronian beds are found to be much disturbed, in places schistose and cut by granites, though not all of the granites of these districts are post-Huronian. Farther west, to the north of Lake Superior, the lower Huronian is as highly disturbed, and as much altered as the intricately associated Keewatin which has furnish detrital material to the Huronian, and both series appear to be cut by the same granitic bodies. In these western districts the Huronian and Keewatin appear to have been conjointly folded, elevated into mountainous areas, and penetrated by immense granitic masses. Subsequently the complex was deeply eroded and planed down to a gently undulating surface. This erosion period marks the close of the second recognized pre-Cambrian era.

After the second great erosion interval, portions of the ancient continent were again depressed, and, as exemplified near Port Arthur, heavy deposits of sediments, largely dark slate, sometimes with a horizon containing iron ore formation, were formed. This series, known as the upper Huronian or Animikie, occupies a large district in Canada, west of the head of Lake Superior. It overlies the older complex of Keewatin, Huronian, and intrusive granitic rocks with a marked unconformity. The upper Huronian beds are virtually unaltered and lie in what appear to be a series of fault blocks, forming ridges with southerly sloping tops and steep northern faces. As in the case of the lower Huronian, extensive, often very thick sills and sheets of intrusive diabase are associated with the Animikie.

After the deposition of the upper Huronian beds in the Lake Superior region, the land was once again elevated, the strata subjected to earth movements, and eroded; but the deforming effects of these forces were slight when compared with the earlier deformation of the lower Huronian and Keewatin. After this third marked period of uplift and erosion the Keweenawan series was formed. This series consists of a sedimentary portion of red sandstones and conglomerates, calcareous shales, and dolomites, well exposed on the Lake Superior shore east of Port Arthur and about Lake Nipigon, and of a volcanic portion exhibited on Michipicoten island as an assemblage, many hundreds of feet thick, of tuffs and volcanic flows.

The Keweenawan is classed by some as of early Cambrian age, perhaps representing desert conditions, but for present purposes it is most conveniently regarded as late pre-Cambrian, the last of the sedimentary groups of that age. Associated with the Keweenawan beds about Lake Superior are immense sheets and sills of diabase, ranging in thickness up to perhaps 1,000 feet. These igneous rocks are distinctly younger than the Keweenawan, in place occurring in sills, or, more prominently displayed, as immense sheets overlying the whole sedimentary group and sometimes extending beyond, over the older rocks.

The account of the more striking features of pre-Cambrian history in Ontario may be supplemented by the discussion of other lines of evidence, but the deductions drawn from these are less certain. The lower Huronian measures, already described, are paralleled along the north shore of Lake Huron by a somewhat similar assemblage containing a considerable volume of limestone. These beds are overlain unconformably, but not strikingly so, by a second group of somewhat similar measures, known as the middle Huronian. Possibly the middle Huronian beds were deposited during a portion of the erosion interval that, elsewhere, separated lower and upper Huronian times.

Along the Hudson Bay shores of the Ungava peninsula, also in the central portions, and again towards the Atlantic side of this territory, occur extensive areas occupied by a considerable thickness of sandstones, slates, dolomites, and siliceous iron ore beds. These measures, though faulted and tilted, are otherwise little changed from their original state, and, with some degree of definiteness, may be correlated with the upper Huronian of the Lake Superior region. To the north, along Hudson strait, are areas of apparently once similar beds, but now much disturbed, altered, and penetrated by bodies of granite. It is not impossible that the period of deep-seated igneous intrusions and deformation of these upper Huronian beds of Hudson strait was contemporaneous with the interval

of uplift, and comparatively slight deformation and erosion separating the upper Huronian and Keweenawan periods in the Lake Superior district.

In eastern Ontario, and over a very extensive region reaching northeastward through Quebec, occurs a group of rocks whose relations with the various members of the pre-Cambrian system in the districts about Lake Superior are still uncertain. These rocks, first described from the district in the Province of Quebec bordering on the lower Ottawa river, and named the Grenville group, comprise large volume of crystalline limestone associated with quartzites and various types of gneisses believed to have had a sedimentary origin. The measures are tightly folded, and are penetrated by great bodies of granite and gneiss. Traced westwards, the members of the Grenville group seem to occur in a less altered state, and in eastern Ontario have been thought to be represented by the Hastings series, through possibly the eastern Ontario assemblage of rocks includes more than the original Grenville. The relations of these Grenville-Hastings rocks with the Keewatin and Huronian rocks farther west has not yet been established. They may include the Keewatin, a portion of the Huronian, or some series not yet recognized in the Lake Superior region.

Other areas throughout the Laurentian Plateau region are underlain by strata whose definite correlation is still impossible. In the Ungava peninsula there are areas of gneisses and schist resembling sometimes the Keewatin, sometimes the Grenville, while in some instances they may represent greatly altered Huronian beds. Near Sudbury, Ontario, occurs a great volume of sediments and tuffs, overlying and cut by the intrusive nickel-bearing eruptive. These stratified beds, so far as is known, are not exactly paralleled by any other pre-Cambrian series, though they have been correlated with the upper Huronian. Northwest of Lake Superior, large areas are occupied by peculiar, uniform quartzose biotite gneisses, sometimes appearing to underlie and be older than the Keewatin, at other times appearing to be its equivalent.

The Nastapoka group, the probable equivalent of the upper Huronian in the Ungava peninsula, has already been mentioned. Similar measures outcrop over a limited area projecting through the Palaeozoic beds just south of Hudson bay. Nearly identical rocks occur over a large areas about Great Bear and Great Slave lakes. A large district bordering the southern shores of Lake Athabaska is underlain by sandstones supposed to be the equivalents of the Keweenawan. Farther to the northeast are considerable volumes of acid and other volcanic rocks, probably also of Keweenawan age. Possibly in the district extending from Great Bear lake to the mouth of the Coppermine river, on the Arctic ocean, both the upper Huronian and the Keweenawan are represented.

Although sedimentary and volcanic rocks are so widely distributed over the Laurentian plateau, yet their volume, as a whole, is much less than that of the associated plutonics, which, though not the oldest rocks, everywhere form the foundation on which the others rest. Frequently these bodies are typical granites, syenites, etc., but often they are composed of, or insensibly merge into gneisses, whose structures in many cases appear to be original. In other cases the gneissic structure is indisputably the result of pressure and the resulting crushing. These granitic rocks show an infinite number of varieties, ranging from very acid to very basic forms. Pegmatite dikes are an almost constant feature. The ages of the rocks must vary widely, though over large areas they often all seem to be

approximately of one period, post-Keewatin, post-Huronian, etc., as the case may be. In eastern Ontario a considerable area is characterized by the presence of batholitic bodies of nepheline syenite, alkali syenites, and related rocks. Over the whole eastern portion of the Laurentian highlands, from the Great lakes to the Labrador coast, occur bodies of anorthosite, sometimes 10,000 square miles in extent.

ECONOMIC MINERALS.

Though only a very small part—the southern border only— of the Laurentian plateau may truly be said to have been prospected, the region has already proved to be one rich in mineral wealth. In Ontario, along the outer margin of the great pre-Cambrian region, many and varied deposits of economic importance have been discovered, though even this relatively limited area has been only imperfectly prospected. Within its bounds occur the noted nickel-copper mines of Sudbury, which now outrival in their production of nickel the New Caledonia deposits. Within 100 miles of Sudbury lies the Cobalt district, containing one of the richest and most easily worked silver camps in the world. In many districts are deposits of iron ore, often low grade, but doubtless soon to become commercially important. Ores of gold, copper, lead, sulphur, and arsenic are worked, while the mica, graphite, and many other mining industries are important.

The mineral wealth of the better known southern part of the Laurentian plateau is virtually confined to those districts in which are found members of the various Huronian, Keewatin, and Hastings-Grenville formations, though the mineral deposits, not infrequently lie in igneous rocks, and often seem to have been connected in origin with the intrusion of plutonic bodies. Thus, the silver ore occurs in or near diabase intrusions, and many ores occur in the older rocks along the contact of an intrusive granitic rock. In the better known southern part of the vast pre-Cambrian area the formations with which the mineral deposits are associated collectively occupy very large areas, as for instance, in the case of an irregular zone that stretches northeast from Lake Huron to Lake Mistassini, a distance of 600 miles. West of Lake Superior to the Manitoba boundary is another noted region of such rocks, while eastern Ontario and the adjoining portions of Quebec form a third.

In the northern, virtually unprospected and by far the larger portion of the Laurentian plateau, the same general geological conditions seem to hold as in the case of the better known southern part. Though in the north the plutonic rocks seem to bulk far greater than in the south, it is highly probable that, with advancing knowledge of the country, the older formations will be found to occupy large areas, and, reasoning by analogy, many of these areas should prove to be rich in mineral wealth.

TABULATED DESCRIPTION OF SOME OF THE CHIEF MINERAL DEPOSITS OF THE LAURENTIAN PLATEAU REGION.

Element or Mineral Sought	Character and Mode of Occurrence of Deposit	Example
Gold, Arsenic.	Free gold and auriferous mispickel occur in quartz veins cutting schists and basic igneous rocks of the Hastings-Grenville series, usually near granitic intrusions.	Deloro, Ont.
Gold.	Free gold and auriferous pyrite with pyrrhotite in quartz veins and stringers cutting altered gabbro of the Hastings-Grenville series.	Belmont, Ont.
	Free gold with pyrite and chalcopyrite in quartz veins in Keewatin schists, etc.	Larder Lake.
		Shakespeare mine near Webbwood, western Ontario.
Platinum.	In the mineral sperrylite in the nickel-copper deposits of Sudbury. *See* under nickel.	Sudbury, Ont.
Copper.	Native in Keweenawan diabase, Lake Superior Shores, also in diabase about Coppermine River, northwest of Hudson Bay.	
	Chalcopyrite, with towards the surface, bornite in veins of quartz with some calcite, cutting Huronian sediments and post-Huronian diabase.	Bruce Mines, Ont.
	Bornite, chalcocite, chalcopyrite, pyrite etc., in impregnated zones in schistose diorite, garnetiferous gneiss, etc.	
	Chalcopyrite. *See* under nickel.	Sudbury, Ont.
Silver.	Native silver and argentite in veins of calcite and barite with varying amounts of quartz and fluorite, traversing Animikie sediments and post-Animikie diabase	Silver Islet, L. Sup.
	Native silver with argentite, smaltite, cobaltite, niccolite, native bismuth, etc., in narrow veins of calcite lying chiefly in Huronian sediments and post Huronian diabase.	Cobalt, Ont.
	Native silver and argentite with hematite and various sulphides in aplite dikes cutting post-Huronian diabase.	South Lorrain. James township, etc., Ont.
Lead.	Galena in calcite veins traversing mica schists of the Hastings-Grenville series.	Hastings Co., Ont.
Zinc.	Zinc blende and galena in irregular bodies in crystalline limestone of the Hasting-Grenville series.	Frontenac co., Ont.
	Zinc blende with iron and copper sulphide forming irregular, lenticular bodies in Keewatin schists.	Rossport, Ont.
Nickel-copper	Pendlandite, chalcopyrite and pyrrhotite, in very large irregular deposits situated at the edge of a norite body intruding pre-Cambrian sediments and igneous rocks.	Sudbury, Ont.
	Niccolite, etc., occurring in the silver-bearing veins of cobalt. *See* under silver.	Cobalt, Ont.
Iron.	Bog ore deposits, still under formation.	Three Rivers, Que.
	Magnetite and, to a lesser extent, hematite inter-banded with variously coloured quartz, forms long bands associated with Keewatin schists often cut by granites, etc.	Lake Nipigon. Lake Timagami. Ont.
	Bands of magnetite, locally impregnated with sulphide, lie in Keewatin schists.	Atikokan range, Ont
	Irregular bodies of magnetite with hornblende and epidote in a formation of magnetite and siliceous material, lie in Keewatin schists.	Moose Mountain, Ont.
	Concretionary-like hematite and limonite with large, sharply defined bodies of iron pyrite in a sandy state, forming a large body associated with banded siliceous rocks containing magnetite, iron carbonate and pyrite, and surrounded by Keewatin schists.	Helen iron mine Ont.
	Irregular, often large masses of magnetite with varying amounts of pyrite, lying along the contact of crystalline limestone (Hastings-Grenville series) and intrusive granites, etc., or within bodies of basic igneous rocks.	Hastings, co., Ont.
	Large and small, irregular bodies of titaniferous magnetite associated with bodies of anorthosite.	Quebec.
	Iron sands derived from the titaniferous magnetite of the anorthosite bodies.	Lower St. Lawrence.
	Bodies of hematite and limonite in beds of cherty iron carbonate belonging to the Animikie sedimentary series.	Loon lake, Ont.
	Seams and layers of magnetite and hematite inter-banded with layers of variously coloured quartz forming part of the Nastapoka sedimentary group.	East shore of Hudson Bay.
Sulphur.	Large elongated lenses of pyrite and quartz in Keewatin schists.	Near Missinaibi, Ont
	Pyrite associated with iron ore. *See* under iron.	Helen Iron Mine, Ont.
Arsenic.	Auriferous mispickel accompanied by pyrite and chalcopyrite and forming large and small bodies in Keewatin schists, in gneisses, etc., of Hastings-Grenville series.	Net lake, near Lake Timagami.
	Deposits of mispickel. *See* under gold-arsenic.	Deloro, Ont.
	Smaltite, etc., in silver veins. *See* under silver.	Cobalt, Ont.
Cobalt.	Cobaltite, etc., in silver veins. *See* under silver.	Cobalt, Ont.
Mica.	Muscovite in pegmatite dikes.	Buckingham district, Que.
	Phlogopite, commonly accompanied by apatite, in veins of calcite, pyroxene, etc., cutting rocks of the Hastings-Grenville series.	Eastern Ontario.
Graphite.	In plates disseminated through bands of geniss, quartzite, etc., of Hastings-Grenville series, usually near intrusive granites. Graphite in veins in granite rocks, or in irregular deposits in crystalline limestone.	Buckingham. district, Que.
Corundum.	Richly disseminated in various alkali syenites, anorthosite, etc., cutting members of the Hastings-Grenville series.	Renfrew, co., Ont.
Apatite.	Associated with phlogopite. *See* under mica.	
Feldspar.	Coarse pegmatite dikes cutting pre-Cambrian gneisses, etc.	Frontenac, co., Ont.
Talc.	In serpentines associated with Hastings-Grenville series.	Hastings co., Ont.

PRECIOUS AND SEMI-PRECIOUS STONES.

Though it can scarcely be said that there is, as yet, any established source of precious or semi-precious stones in the Laurentian Plateau region, yet many beautiful minerals have been found in various localities. There is even a possibility that diamonds may eventually be discovered somewhere in the northern region, for in the glacial drift of Wisconsin, small diamonds up to a few carats in size have been found, and it has been contended that these have been transported by ice during the glacial period from some point in the Laurentian region in the neighbourhood of Hudson bay.

Admirable specimens of the feldspar labradorite have been recovered from the anorthosite masses on the east coast of Labrador. The mineral shows a brilliant play of colours and has been used in jewellery. Labradorite showing many of the qualities of the mineral of the original locality, has been found at various points in a number of the large anorthosite bodies occurring all the way from Wisconsin to Hudson strait.

The pegmatite dikes so common throughout the Laurentian plateau often hold splendidly developed crystals of various minerals, such as tourmaline, idocrase, apatite, zircon, etc. Many such localities are known in the districts bordering the lower Ottawa, also in eastern Ontario, and, doubtless, these crystals eventually will be found in many other districts. Garnets of gem quality have been recovered from Charlevoix county, Quebec. Blue sodalite from the nepheline syenites of eastern Ontario is used as an ornamental stone, as is also perthite and other varieties of feldspar.

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