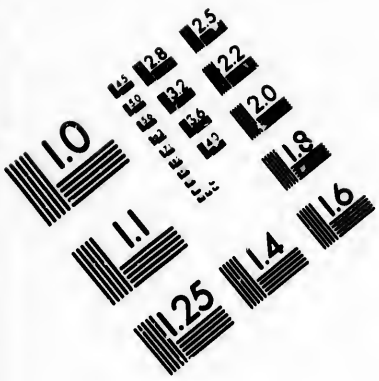

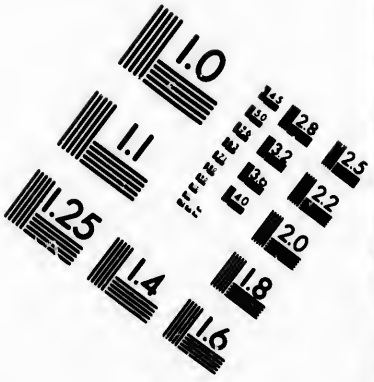

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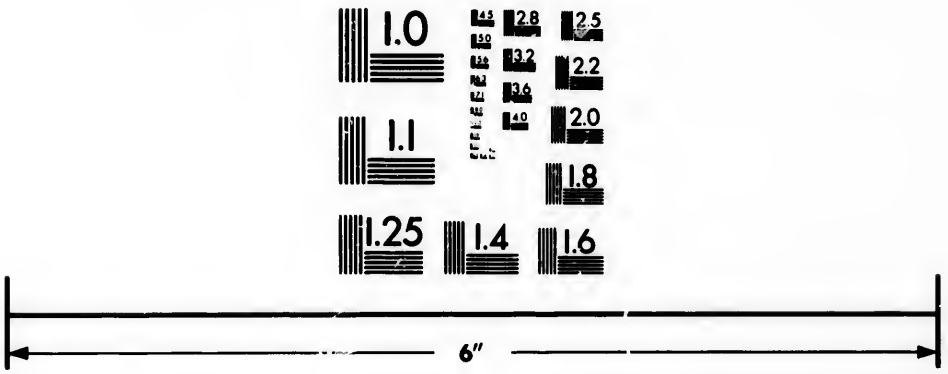

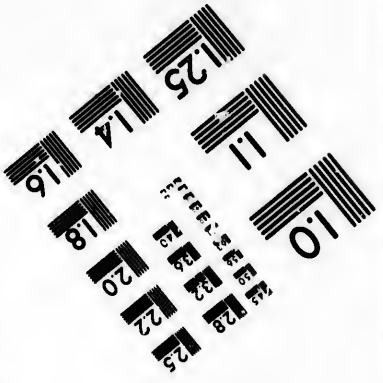

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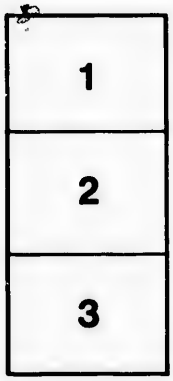

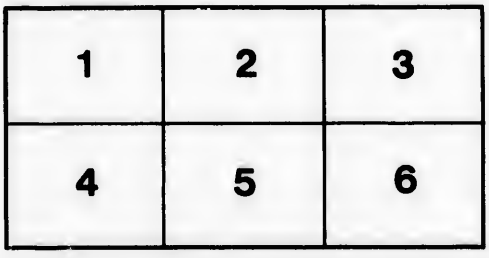

Photo. by A. P. Low, 1896.

VALLEY OF THE WIACHOUAN RIVER, NEAR ITS OUTLET, RICHMOND GULF.

GEOLOGICAL SURVEY OF CANADA
G. M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

REPORT

ON A

TRAVERSE OF THE NORTHERN PART

OF THE

LABRADOR PENINSULA

FROM

RICHMOND GULF TO UNGAVA BAY

BY

A. P. LOW, B. Ap. Sc.

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY
1898

No. 657.

To

G. M. Dawson, C.M.G. LL.D., F.R.S.,

Director Geological Survey of Canada.

Sir,—I herewith beg to submit my Report on a traverse of the northern portion of the Labrador Peninsula between Hudson Bay and Ungava Bay, made during the summer of 1896.

I am, sir,

Your obedient servant,

A. P. LOW.

Ottawa, 12th January, 1897

NOTE.—*The bearings throughout this report refer to the true meridian.*

REPORT

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A. P. LOW, B. Ap. Sc.

Introductory.

The present report is based on the observations and measurements made during the summer of 1896, on a line of traverse carried across the north-western part of the Labrador Peninsula, from Richmond Gulf on the east coast of Hudson Bay to the mouth of the Koksoak River at Ungava Bay, supplemented by subsequent examinations of the rock specimens in the office.

This work may be considered as supplementary to the Report on the Labrador Peninsula, which included the results of the explorations of 1892, 1893, 1894 and 1895 in that region, and the surveys made in 1896 have been added to the map published with that report.* Map.

Acknowledgments are here made to Mr. C. C. Chipman, Commissioner of the Hudson's Bay Company, for a circular letter to the officers in charge of posts along the route travelled, and to the following gentlemen at those posts: Messrs. Wm. Broughton, Miles Spencer, Duncan Mathewson, A. Nicholson, D. Gillies, J. A. Wilson, S. P. Ross, J. Ford and R. Ford, and also to Capt. A. Gray of the Hudson's Bay Company's steamship *Erik*, for their generous hospitality and efficient aid, to which the success of the exploration is largely due. Further acknowledgments are made to Messrs. Nicholson, Gillies, Boucher, J. Ford, Guy and Swafield, for gifts of bird skins, bird eggs, Acknowledgments.

* The line of traverse here described is shown upon the north-west sheet (No. 587) of the map accompanying the report above-mentioned, being Part L, Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), 1895.

and articles of Eskimo manufacture, for the museum, and also for valuable information concerning the natives and natural history of the region.

Assistants.

Mr. G. A. Young acted as my assistant and carried on the surveys, kept the meteorological observations, and helped in the general work of the expedition in a most efficient and satisfactory manner. Mr. W. Spreadborough was attached as collector of plants and natural history specimens, and succeeded in making large collections of this kind, besides performing other duties incident to such a trip. The remainder of the permanent party consisted of three canoe-men, and these were supplemented by extra canoe-men and guides from time to time, as required.

Previous traverses of route.

The route followed between Hudson Bay and Ungava Bay was first passed over in 1824 by Dr. Mendry, when sent by the Hudson's Bay Company from Moose Factory to establish a trading post at the mouth of the Koksoak River. The only known record of his trip is a rough map of his journey, from which a copy was taken at Moose Factory in 1887; since then the original map has been lost.

In 1885, the Rev. J. Peck, of the Church Mission Society, crossed by the same route and subsequently wrote a short account of his trip which was printed in a publication of the Society. A survey from Richmond Gulf, seventy-five miles inland, to the outlet of Clearwater Lake, was made by the writer in 1887, an account of the journey appearing in the report of that season's work.*

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

Missinaibi to Moose.

* Annual Report, Geol. Surv. Can., vol. III. (N.S.), pp. 55-60 A.

† Report of Progress, Geol. Surv., Can., 1877-78, Part C.

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 forest 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 of the cold waters of James Bay. A drawback to settlement exists in the swampy nature of large areas having a heavy 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.

Flat country along Lower Moose.

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.

Voyage in Hudson Bay

Stops were made at several places, including Fort George, Great Whale River and Little Whale River, to examine the rocks in order to extend the knowledge of the geology of the coast, which had been, in part, previously examined and reported on by Dr. Bell in 1877,* and by the writer in 1887 and 1888. A description of the coast and islands is

* Report of Progress, Geol. Surv. Can., 1877–78, pp. 11-19 c.

Observations *en route.*

given in previous reports, and it is only necessary to mention that the south and east coasts of James Bay are generally low, with a wide margin of swampy land above high tide, while between high and low water mark wide mud flats sometimes extend for miles. As the coast is followed northward the flat swampy land is broken by rocky ridges; these increase in height and number, so that in the vicinity of Cape Jones the areas of rock exceed those of swamp and drift. The shore is broken by long irregular points, and in many places is fringed with islands that extend several miles from the mainland; they are rocky or formed of drift. A chain of large islands lies parallel to the coast and about a third of the way across James Bay. These are composed of sand, clay and boulders, representing the higher parts of a terminal moraine of an ice sheet from the Labrador side.

Coast north of Cape Jones.

Beyond Cape Jones the character of the coast changes. The rocky hills are continuous and rise directly from the shore, with, in places, a narrow margin of terraced drift on their flanks. The scattered islands of James Bay give place to a regular chain formed from the bedded rocks of the Manitounuck series of Dr. Bell.* These rocks also occur in patches along the coast to the south of Great Whale River, and continuously so to the northward of that stream. As the rocks dip seaward, the islands present abrupt cliffs on their landward sides and slope more gently with the bedding in the opposite direction. The chain of islands commences immediately north of Cape Jones, and with only a few breaks continues northward to Portland Promontory, a distance of over 300 miles, or considerably beyond the limit of this report.

Vegetation.

The coast and inner islands of James Bay are covered with thick growths of small black spruce and larch, along with white spruce, balsam fir, aspen and balsam poplar and white birch; the outer islands are nearly treeless. To the northward of Cape Jones, the trees become dwarfed and confined to the lower slopes and valleys, and as the coast is followed northward the forest becomes scanty, so that in the vicinity of Richmond Gulf, dwarfed black spruce and larch only are found in protected gullies, leaving the greater part of the coast quite bare.

At Great Whale River, an Indian who had crossed to Fort Chimo with Mr. Peck in 1885, was engaged as guide, but, contrary to the accepted idea, he had, in the course of eleven years, forgotten all that he knew about the route, and proved useless in that capacity.

* Report of Progress Geol. Surv. Can., 1877-78, pp. 11-16 c.

Country Between Hudson Bay and Clearwater Lake.

Richmond Gulf. 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 $\frac{1}{4}$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 shores 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.

Trees. 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.

Clearwater River. 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.

Portages on Wiachouan.

Reach the plateau level.

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.

Return to Clearwater valley.

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.

Character of country.

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 that 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 where they had camped along the route. Fish and game.

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 shores, 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 north-west corner of the main lake. The streams flowing into the lake are all small and unimportant: the largest is called Nocnish River, and enters at the north-east corner, while another large brook flows into Clearwater Lake.

Surrounding country

the head of the south-east bay. The water is remarkably clear, deep and cool, and is 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 highest 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.

Clearwater Lake to Seal Lake.

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 quantity 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.

Exploration of 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

Photo. by A. P. Low, 1896.

VIEW OF SEAL LAKE, FIVE MILES EAST OF NARROWS, LOOKING EAST.

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 continuing 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.

Long bays.

Islands.

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 overland 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.

Seals inhabiting the lake.

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 similar to, but smaller than, those about Clearwater Lake.

Character of country.

Barren-ground caribou were seen plentifully on the island and about the shores of the lake.

Cross the watershed.

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 foot 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 large 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.

Shem Lake is seven miles and a half long from the portage to its discharge at its north-east 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.

Shem Lake to Natuakami Lake.

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 all very shallow, greatly obstructed with boulders and dangerous to descend with canoes.

River valley and plateau.

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.

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 500 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.

Indians.

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.

Natuakami Lake to Kenogamistuk.

The distance from 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.

Larger trees.

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.

Current of river.

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

Photo. by A. P. Low, 1896.

STILLWATER RIVER, LOOKING WEST, TEN MILES ABOVE NATUAKAMI LAKE.

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. Terraces.

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. Lookout River.

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 near by, 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 1000 feet above the stream. The banks of the river are usually steep and often show sections of contorted, Kenogamistuk.

bedded clay, gravel and shingle. The high-level terrace (250 feet) is well marked on both sides of the valley.

Upper waters.

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.

Kenogamistuk to Kaniapiskau.

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-northeast. 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 1000 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

Character of country.

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.

Tributaries from the north

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.

Larch River below Junction 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 1000 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.

Change in aspect of country.

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

Confluence with Kaniapiskau.

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 Manicuagan 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.

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 terraces 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 effects the river to the foot of this rapid.

Rapid at head of tide.

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

*Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), pp. 107-123 L.

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.

Below High-fall Creek.

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.

Lower part of river.

The next and last course of the river is nearly north-northeast 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.

Vegetation.

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 hill-sides 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.

Completion of survey.

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.

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.

Indian trade.

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.

Eskimo trade.

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.

Fisheries.

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.

Opening of rivers.

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 north-west, and they are generally accompanied by clear weather, with passing showers.

Snow.

Temperatures, *etc.*

GEOLOGY.

Laurentian.

General character of rocks.

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.

Eruptive masses.

True eruptive masses are also represented by smaller areas of dark-greenish basic granite composed largely of pale-green plagioclase, quartz, hornblende and mica: and also by dyke-rocks, usually more or

less altered diabase, which appear to be much newer than the rock cut by them, there are also a number of dykes of fine-grained, dark-red syenite in the granite area about Clearwater Lake. There would appear to be a great difference in the ages of the granites, but except where they cut, or unconformably underlie, known bedded rocks of the Cambrian, their age cannot be determined, owing to the close resemblance in structure and composition of the granites of different age. Where they cannot be separated they have been included in the Laurentian, as they are all very ancient, and the newest were errupted and must be assigned to a period antecedent to the Cambro-Silurian.

Oldest stratified rocks.

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.*

Highly altered 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.

The few exposures seen in the valley of the Wiachouan, were all pink and gray, medium textured mica-gneiss. At the summit of the

*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 cherts of the Cambrian by the intrusion of large masses of granite.

Hill portage leading from the valley of the Wiachouan, bands of the mica-gneiss hold dark-red garnets and are associated with coarser, red mica-hornblende-gneiss; all being cut by a great dyke of coarse, dark-green diabase, two hundred yards wide, which runs S. 35° E. and is seen on the south side of the valley several miles away. At the upper end of the portage, another similar dyke runs N. 25° E. and may be an off-shoot of the larger dyke. These and other dykes met with along the route to Clearwater Lake, closely resemble the large diabase dykes of the Hamilton River, that cut the Cambrian rocks as well as the Laurentian gneisses * and are probably much newer than the gneisses with which they are here associated. On the portages between the Wiachouan and Clearwater rivers, frequent exposures are met with and they are mostly medium to coarse-grained mica-hornblende and hornblende-gneiss, but at times without foliation, when they pass into granite. The garnet-bearing mica-gneiss, a short distance east of the Hill portage is displaced by mica-hornblende-gneiss and granites, which have the appearance of great irrupted masses partly foliated by pressure. Coarse, red hornblende-gneiss and granite predominate along the Clearwater River, together with occasional bands of a gray colour and others where the presence of a large quantity of hornblende gives them a darker colour and renders them schistose. The coarse gneiss and granite also often hold segregations of dark-green, schistose hornblende. The direction of the foliation between Richmond Gulf and Clearwater Lake varies from N. 45° W. to S. 80° W.

Rocks on Wiachouan.

On Clearwater River.

Two diabase dykes were seen on the portage leading to Clearwater River, the first is very fine in texture and varies from five to fifty feet in width with a direction of N. 70° E.; the second is coarser in texture and lighter in colour, it is sixty feet wide and runs N. 75° W. At the head of an island in the Clearwater a short distance from the last dyke, there is another thirty feet wide and having a direction of N. 85° W. At the third portage below Clearwater Lake a dyke one hundred and fifty feet wide runs S. 60° W. Near the contact with the gneiss it is very fine-grained, but towards the middle is much coarser; it is dark-green in colour and contains a considerable quantity of disseminated pyrite. The rock is now about half decomposed to serpentine, the decomposed portions forming irregular blotches of an apple-green colour.

Diabase dykes.

The granites are also cut by acidic dykes in the form of fine-grained, dark-red, compact syenite, largely composed of flesh-red orthoclase

Acidic dykes.

* Annual Report, Geol. Surv. Can., vol. VIII. (N. S.), p. 275 L.

with a little hornblende, but no visible quartz. The weathered outcrop of a dyke of this rock formed a trough about ten feet wide and from three to ten feet deep at the southern end of the portage leading to the Clearwater River. Although this was the only syenite dyke seen in place, there are doubtless others of the same kind along the river and about Clearwater Lake, where blocks of the rock are common in the drift.

Exposures on Clearwater Lake.

The many rocky islands and points of Clearwater Lake afford numerous exposures of gneiss and granite. A red coarse-grained hornblende-mica-granite or gneiss predominates, and is associated with a coarse-textured, gray mica-gneiss, which, like the former, is of probable igneous origin. Both rocks cut and inclose bands of finer-grained, pink mica-gneiss, most abundant about the north-west end of the lake, but nowhere plentiful. Towards the eastern end of the lake and along the north shore, mica-gneiss prevails, and is more often pink or red than grey, it is usually very coarse in texture and often has an augen structure with at times large prophyritic crystals of felspar. The general direction of the foliation about Clearwater Lake is N. W.

Between Clearwater and Seal lakes.

On the first portage of the route from Clearwater to Seal Lake, the coarse augen-gneiss is cut by a dyke over three hundred yards wide and running nearly parallel to the foliation of the gneiss. The dyke-rock is a much altered mica-diabase, varying in texture from fine- to medium-grained; it contains much mica in small scales, the felspar is greatly decomposed and the augite largely changed to hornblende. Small veins of red pegmatite penetrate the dyke. At the second portage, the rock is medium to coarse-grained, very felspathic, pink and red augen-gneiss containing broken bands and segregations of finer-grained mica-schist; the direction of the foliation being nearly east-and-west. Coarse- to fine-grained, red hornblende-mica-granite occurs on the islands of a small lake two miles beyond, and from there to Seal Lake all the exposures examined were of similar granite sometimes slightly foliated in a direction N. 50° W.

On Seal Lake.

The granites and gneisses also occur about Seal Lake, where they are red or pink in colour, and are usually, coarse in texture with often an augen-gneiss structure. These rocks usually show lines of foliation which vary in direction from N. 10° W. to N. 80° W. The whole is taken to be part of a great granite area similar to the areas previously found about Lake Nichicun* and in other parts of the peninsula. This area of granite continues eastward from Seal Lake past the

*Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), p. 216-217 L.

height-of-land and down the Stillwater River for seven miles below Shem Lake, where it is in part replaced by mica-schists and gneisses. The mica-schist is cut by numerous dykes of coarse pegmatite and also by the hornblende-mica-granites and gneisses. The strike of the gneisses is nearly N. W. Associated with the mica-gneisses are bands in which grains of magnetite are present instead of mica, thus forming fine-grained magnetite-gneiss consisting chiefly of magnetite and quartz with a little felspar, and having a close resemblance to the bedded iron-ores of the upper Manicuagan River* where the mica-gneisses in which they occur are associated with bands of crystalline limestone. The magnetite-gneiss is too silicious and lean to be profitably worked as an ore, but it contains segregations of almost pure magnetite often of considerable size, which if more accessible would no doubt be valuable. The schists and gneisses with their associated beds of magnetite-gneiss outcrop along the river for two miles, when they are again displaced by the coarse, red hornblende-mica-granite, which usually contains segregations of hornblende-mica and hornblende rendered schistose by pressure. All are cut in places, (notably at the rapid twenty-six miles below Shem Lake and also two miles above Russel River), by bands of dark-green amphibolite from six inches to five feet wide, which differ in appearance from the schist bands and are probably ancient basic dykes crushed, shattered and rendered schistose by pressure.

Granite on watershed.

Magnetite gneiss.

The granite rocks are met with along the river to within five miles of Natuakami Lake, where medium-grained, gray mica-gneiss is found, cut by red hornblende-mica-granite and dykes of red pegmatite. Strike N. 20° W.

The wide valley of Natuakami Lake appears to have been cut out of the softer mica-gneisses, as all the exposures seen along the shore of the lake showed varieties of these gneisses, at times garnet-bearing and sometimes shattered by intrusions of hornblende-mica-gneiss, more especially towards the eastern end of the lake.

Natuakami Lake.

The wide valley, partly filled with clay, through which the river flows below Natuakami Lake, affords no rock exposures on the banks, and a wide margin of almost impassable swamp extends from the river to the hills on either side, so that from one to three hours were spent in going to and returning from the hills, consequently few observations were made on the rocks occupying this portion of the country. When seen the rocks were, however, found to be about evenly divided

Rocks below Natuakami Lake.

*Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), p. 244 L.

between the mica-gneiss and the intrusive hornblende-mica-granite Three miles above the junction of the Stillwater with the Kenogamistuk, the rock is a very coarse, pink mica-hornblende, augen-gneiss.

On the Kenogamistuk.

Along the first five miles of the Kenogamistuk, the rocks come out on the banks in several places, and were found to be very coarse, red hornblende-granite or in places augen-gneiss when the foliation was S. 30° W. About the heavy rapids five miles up this stream, the granite is considerably shattered and the small cracks cemented with epidote and serpentine.

Below Kenogamistuk.

Two miles below the junction of the rivers on the north side, a barren hill was climbed; and extensive exposures were thus examined. They were found to be largely red hornblende-granite varying in texture from a fine-grained, compact rock to a coarse augen-gneiss, the latter forming the small rugged peak at the summit. Several wide bands of mica-gneiss were found interfoliated with and broken by the red hornblende-granite. The hills were again visited on both sides of the valley twelve miles lower down the river. The rocks on the south side were coarse hornblende-granite, while on the north side similar rocks were associated with gray mica-gneiss.

Hornblende-granite.

For the next twenty miles the river flows between very rugged hills which gradually approach the banks, allowing the rocks to outcrop frequently along the shore. These exposures everywhere show coarse, red hornblende-granite to the mouth of Junction River, when the granites give place to the stratified rocks of the Cambrian.

Contact with Cambrian.

The contact between the Laurentian granite and the Cambrian is concealed by the deep clays of the valley of Junction River, where the western wall of the valley is formed of granite while the east side is composed of cherty dolomite and arenaceous shale. Although the contact was unseen, it is supposed to be similar to that on the Kaniapiskau Branch some ninety miles to the southward, where Cambrian red sandstones and argillites rest unconformably upon a boss of granite.* Like the Cambrian of the Hudson Bay coast, the rocks of the eastern area have been deformed by over-thrust faults, caused by pressure developed from the north-eastward, and consequently the contact between them and the underlying granites is likely to be a modified one, the pressure having in places thrust newer beds over the older, into contact with the granites.

Granites cutting schists and gneisses do not again occur along the river for fifty-five miles, or to twenty miles below the mouth of the Kaniapiskau, the intervening country being occupied by little altered Cambrian strata.

*Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), p. 269 L.

There is an interval of eleven miles between the last outcrop of unaltered Cambrian and the first exposure of the schists gneisses and granites. These schists and gneisses are taken to represent a highly metamorphic phase of the Cambrian, together with newer intrusions of granite which have changed the sedimentary Cambrian rocks into schists and gneisses by the heat and pressure due to the intrusion, and, consequently, although closely resembling many of the gneisses classed as Laurentian, these rocks are here classed as Cambrian and are more fully discussed under that heading. Schists and granites of lower river.

Cambrian.

The series of rocks classed as Cambrian was met with along the east coast of Hudson Bay to the northward of Cape Jones, and on the Larch River from its junction with the Kaniapiskau upwards for thirty miles. Cambrian of Hudson Bay.

The Hudson Bay area has been reported on by Dr. R. Bell* and only a few supplementary observations will be here added to those already noted by him.

The dolomites of this series were first seen on small islands to the southward of Long Island, a few miles north of Cape Jones. Cherty dolomites with reddish cherts were noted on prominent points of the mainland for thirty miles to the southward of Great Whale River. The Manitounuck Islands extend in a chain northward from Great Whale River for more than twenty miles, and are composed of rocks of this formation. The rocks dip seaward at low angles and present cliff-faces towards the land. The following section in descending order was noted on the inner face of the third island north of the river :— Section on Manitounuck Islands.

	Feet.
1. Dark-green, compact trap, with many small cracks filled with epidote and lilac-coloured axinite	20 to 200
2. Compact, fine-grained, light-blue dolomite; weathers yellow and holds much blackish chert in irregular sheets and nodules	20
3. Medium-grained, grayish-blue sandstone with translucent quartz-grains and small yellow spots; contains a small quantity of pyrites and is dolomitic in places	35
4. Light- and dark-gray sandstone and chert. The light-coloured chert is well-banded and splits into flags from one to six inches thick	50

The remainder of the series is hidden beneath the water of the sound.

*Report of Progress, Geol. Surv. Can. 1877-78. pp. 11-23 c.

On Castle Peninsula.

The next section examined was on the east side of Castle Peninsula, on the north side of the outlet of Richmond Gulf. The section in descending order is as follows :—

	Feet.
1. Fine-grained, dark-green trap with small amygdules filled with epidote, chlorite and agate	55
2. Light-gray, medium-grained sandstone	55
3. Thin-banded, fine-grained, compact, cherty dolomite, with thin partings and irregular masses of dark-blue chert	105
4. Concealed (probably dolomite)	50
5. Coarse, gray grit, made up of large grains of quartz and white felspar with silicious matrix	5
6. Dark-gray, rusty-weathering, ferruginous, dolomitic sandstone, the dolomite being in thin partings	10
7. Coarse, dark-gray grit with grains and small pebbles of quartz and felspar	5
8. Dark gray, ferruginous, dolomitic sandstone	60
9. Coarse, gray sandstone, with thin beds of dark, grayish-green sandstone overlain by arkose	30
10. Light-gray, cherty dolomite, holding grains of translucent quartz and small, rusty patches; changes to a sandstone near the top	155
11. Coarse, gray grit, composed of small pebbles of quartz and white felspar in a matrix of finer grains	55
12. Pink arkose, varying in texture from fine to coarse, and made up chiefly of more or less rounded grains of quartz and red felspar, evidently not greatly water-worn	670

Character of the rocks.

Dr. Bell gives a section taken on the south side of the entrance to Richmond Gulf which corresponds somewhat with the above, but has a thickness of 150 feet of trap between Nos. 10 and 11, while only 400 feet is given for the arkose, No. 12. He also states that the upper dolomites No. 3, rest unconformably upon the sandstones but no such unconformity was observed in the section above detailed. The rocks given in the section would appear to closely resemble those of the Mesnard quartzites and Kona dolomites of the Lower Marquette series of the south shore of Lake Superior, capped by a later outflow of trap, those rocks being classed as Algonkian by Prof. Van Hise. The great thickness of arkose found at the bottom of the section and the number of felspar pebbles in the grits of the upper bands, show a great amount of disintegration in the underlying gneisses and granites previous to the deposition of the Cambrian, and also that the débris forming these beds had not been transported far or water-worn previous to the formation of the strata in which they now rest.

Unconformity

As before stated, trap quartzites and red felsitic slates are found resting unconformably upon gneisses at the second fall of the Wiachouan River.

Photo. by A. P. Low, 1896.

CAMBRIAN HILLS FORMING COASTAL RIDGE, SOUTH SIDE OF ENTRANCE TO RICHMOND GULF.

Cambrian of Larch River.

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 immediately 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°.

Rocks like those of Kaniapiskau, *etc.*

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 hæmatite, forming a valuable ore, very similar in character and composition to that of the

*Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), pp. 261–280 L.

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, silicious 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.‡

Section nine miles below Junction River.

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:

	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	10
9. Rusty-weathering, disintegrated shale	800

Disturbance and fracture.

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.

* Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), pp. 270, 278 9, 283-6 L.
† Ibid, p. 269 L. ‡ Ibid, 274 L.

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. Silicious limestone.

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°. Dolomite.

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. Section two miles below Larch River.

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	1
2. Light grayish-green, fine-grained, compact diabase, greatly decomposed and altering to steatite	8
3. Shaly dolomite	1
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 limestone of a pearly-green colour	120

*Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), pp. 270L, 313L.
†Ibid, p. 272L.

	Feet.
12. Fine-grained, decomposed diabase	10
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 seracite- 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

Diabase sills.

The diabase has been injected in the form of sills, generally parallel to the bedding 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.

Section thirteen miles below Larch River.

Eleven miles below the last-examined exposure of the unaltered Cambrian, the rocks again outcrop on the south shore of the river, and from their 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

Highly altered clastic rocks.

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 lamina 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 elsewhere.

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 metamorphised 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.‡

Rocks seen below last section.

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

*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.

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 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 miles below High-fall Creek there are several exposures of dark mica-schists and mica-hornblende-schists cut by the porphyritic granite and pegmatite. Pyrite.

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. Rocks near Fort Chimo.

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. Below Fort Chimo.

Superficial Deposits and Glaciation.

The observations of striæ 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 ice-cap.

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, 1200 feet above sea-level, or some 300 feet above the level of the interior watershed.

Névé region.

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 striæ 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 striæ, 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.

Drift.

Glacial striæ.

The following list of glacial striæ observed along the line of exploration, shows that the direction of ice movement on the western slope was almost from east to west, with a slight divergence towards the south. On the eastern slope, the movement was almost directly opposite from the region of névé to near Natuakami Lake, sixty miles to the eastward. It then changed to about E. N.E., and continued so to the junction of the Larch and Kaniapiskau rivers, below which the striæ run nearly N.E., or parallel to the river-valley, to the neighbourhood of Fort Chimo, when the course again changed and the ice flowed north into Ungava Bay.

List of Glacial Striæ.

Cape Hope, James Bay	S. 55 W.
Paint Hills, "	S. 20 W.
15 miles S. of Fort George, James Bay	S. 40 W.
10 miles N. " " " "	S. 70 W.
40 " " " "	S. 55 W.
20 miles N. of Cape Jones, Hudson Bay	S. 65 W. and S. 25 W.
3rd island, Manitounuck Sound	W.
2 miles S. of Little Whale River	S. 87 W.
Foot of Castle Peninsula, Richmond Gulf	S. 15 W.
Summit of " " " "	S. 15 W.
Island inside entrance to Richmond Gulf, direction of outlet	N. 85 W.
North-west end of Clearwater Lake	S. 80 W.
" " " "	N. 85 W.
Top of Burnt Mt., " "	S. 85 W.
Near mouth of river leading to Seal Lake	S. 60 W.
2nd portage on " " " "	S. 60 W.
Narrows 2nd lake " " "	S. 80 W.
Mouth of south bay, Seal Lake	S. 75 W.
5 miles beyond last, " "	S. 70 W.

South side of mouth of east bay, Seal Lake	S. 65° W.
2 miles east of last (top of hill 180 ft.)	S. 80 W.
Shem Lake, 2 miles east of water-shed	S. 55 W.
Stillwater River, 4 miles below Shem Lake	N. 75° E.
" " 3 " " " last	E.
" " 1 " " "	N. 80° E.
" " 9 " " "	N. 80 E.
" " 6 " " "	N. 70° E.
" " 8 " above Natuakami Lake	N. 40 E.
" " (on hill top)	N. 20 E.
" " 5 miles above Natuakami Lake	N. 70° E.
" " 4 " " junction with Kenogamistuk	N. 65 E.
Larch River, 2 miles below Kenogamistuk (on hill)	N. 65 E.
" " at mouth of Junction River	N. 40 E.
Koksoak River, on knoll 1 mile below Kaniapiskau	N. 45 E.
" " 7 miles above Fort Chimo	N. 25 W.
" " opposite Fort Chimo	N. 45° E.
" " 18 miles below Fort Chimo	N. 5° E.
" " 22 " " " "	N. 5 E.
" " at mouth of river, north side	N.

Boulder-clay.

The lower portions of the country passed through are everywhere more or less covered with a mantle of till or boulder clay. The hills for the most part are bare rock, and only on the leaside was a tail of drift deposited by the ice. The unmodified till on the lower areas is usually arranged in a series of low lenticular hills or drumlins, more or less parallel to the direction of the glacial striæ. These ridges are unstratified and are formed largely of the finer material of the drift associated with boulders and blocks of rock. The fine material is a sandy clay resulting from the disintegration of the underlying granites and gneisses. Boulders and partly-rounded blocks, often of great size are common in the till, and are also scattered over the surface of the drift hills and those formed of rock; in fact, these fragments are usually so numerous that it is possible to walk almost anywhere without putting foot to the solid rock or ground. The boulders in the till or scattered over the rocky hills, as a rule belong to the locality in which they are found, and either represent cores of the otherwise decayed rocks which covered the country previous to the glacial period, or have since been produced by the action of frost in the cracks which has broken the rocks in many places to a considerable depth below the surface. These latter blocks are usually easily distinguished from glacial boulders by their more angular shape, and also by their mode of occurrence, as they are usually found in lines along the course of some small buried streams.

Erratics.

The number of erratics or far-travelled boulders in the drift is small in comparison with the number found almost in their original position.

Eskers.

Eskers or ridges of modified drift were observed in several places between Hudson Bay and the watershed, and also in the valley of the upper part of the Stillwater River. These are quite distinct in shape and material from the drumlin ridges. They generally form long narrow ridges resembling railway embankments, very narrow on the top and falling away sharply on both sides. At times several ridges of this description are found together, when they have a more or less parallel arrangement. The surface between such ridges is occasionally deeply pitted with irregular depressions or pot-holes. The material from which the ridges are formed is usually well rounded sand and small gravel, and it is usually partly stratified, the bedding being generally at a low angle from the horizontal. In many places the ridges are thickly strewn with boulders, but as a rule these are not common in the mass, and those that do occur included in the sand and gravel are generally small and well-rounded.

Their position.

Ridges of this description are found along the courses of existing valleys and appear to have been formed by streams flowing on or under the ice during the period of glaciation, and if this is the mode of their origin, these streams as a rule followed the courses of the present valleys, and the system of drainage under the ice would appear to have been practically the same as it is to-day. Along the portage-route between the Wiachonan and Clearwater rivers, small eskers were seen in a number of places, especially along the course of the small tributary of the Clearwater, but none of them were large or persistent.

In Clearwater Valley.

Along the Clearwater River, scarped banks in places revealed the presence of partly stratified sand and gravel in the ridges of drift of the valley, but the amount of modified drift is not large, as the glacial stream flowing out of the basin of Clearwater Lake appears to have followed the course of other channels to the northward of the present main channel. In two deep bays at the north-west end of this lake there is an abundance of well-rounded sand thrown up in narrow ridges from thirty to sixty feet above the level of the lake. From a distance these ridges have the appearance of terraces, but on close examination they are found to have steep faces toward the land as well as toward the water, and their irregular contours show that they are not water-levelled terraces, but rather the deposits of glacial rivers leaving the lake-basin. At the mouth of the small stream by which the portage-route leads to Seal Lake, there is a wide area occupied by sharp irregular ridges and hummocks of well rounded sand, which appear to have been formed by a large glacial stream entering the lake

at this place. Esker ridges are very common and persistent up the valley to the south bay of Seal Lake, where the long narrow ridges extend outward from the west shore and in a number of places nearly divide the bay from the main body of the lake. From the mouth of the south bay to near the narrows of Seal Lake, the esker ridges are not well marked along the shores of the lake, but at the narrows they are again seen along the foot of a rocky hill on the north side, where they rise about sixty feet above the lake, and continue for a mile along the shore; they then form a long string of narrow islands that stretches four miles up the lake, and after an interval again appear along the north shore of the lake continuously to the mouth of the north-west bay. Passing this bay, they again come out on the north shore and islands of the east bay of the lake, and from its head can be traced up the valley of the small stream leading to the watershed and across it, for two miles, into Shem Lake, where a narrow ridge of stratified drift almost divides the lake into two. Beyond this the eskers were not observed until the Stillwater River had been descended a few miles, when they were again noticed in the valley and continue to Natuakami Lake, below which they give place to horizontally bedded sands and clays of river or marine origin.

On Seal Lake.

On Natuakami Lake.

Terraces of marine origin marking the former level of the sea in later glacial time, and also the subsequent elevation of the land, were found both on the coasts of Hudson Bay and of Ungava Bay. On the Hudson Bay side of the peninsula, the best-marked marine terraces and sea beaches were noted on the portage leading from Richmond Gulf to beyond the first fall of the Wiachouan. As previously described, the portage leads up the face of a wide hill of drift that faces the gulf and lies between the rocky hills forming the walls of the Wiachouan Valley, which at its mouth is about two miles across. As it rises from the sea, the route, in a mile and a half, passes up over thirty-five terraces or beaches, the highest of which is 460 feet above sea-level, and some of the others as follows:—1, 36 feet; 2, 54 feet; 4, 63 feet; 8, 89 feet; 9, 98 feet; 10, 143 feet; 17, 270 feet; 27, 332 feet; 28, 360 feet; 34, 424 feet. Many of these terraces are narrow, and resemble steps cut into the hillside, others are wider and have along their outer edges low hummocks of well-rounded pebbles and other signs of ancient beaches. The summit of the highest terrace is of this character and is about one hundred yards wide. Behind it there is a drop of about ten feet to a wide, swampy plain which extends some two miles. The portage from the highest terrace passes along the side of a rocky hill that rises above the drift between

Terraces.

the swamp and the river to the south of it. The rise along this hill in a mile to its eastern end, is 135 feet, where the rock terminates and a sharp narrow ridge of boulders begins with steep slopes on all sides and facing up the valley or toward the direction of ice movement. The material composing this ridge was probably dropped by the glacier at its parting in front of the rocky hill. The summit of the ridge is fifty-five feet above the stratified clays out of which it rises, and the clays consequently rise 540 feet above the present sea-level. On the south side of the valley, the line of junction of the clay and overlying sand is seen at the same level. No fossils were found in these bedded clays in the short time devoted to search for them; but as they can be traced from the present sea-level to this height they are undoubtedly of marine origin.

Height of stratified clays.

Highest terrace on west slope.

For fifteen miles, the hills forming the sides of the valley of the Wiachouan are flanked with clay overlain with sand, and in these deposits terraces are cut to heights of 300 feet above the river. Where the portage-route leaves the valley and ascends to the table-land on the north side, the road rises over terraces, of which the heights above the river are 30 feet, 160 feet and 310 feet. This upper terrace, which is 710 feet above sea-level, forms a plain above which the rocky walls of the valley rise in small hills; it extends backwards about half a mile into the valley of the small tributary followed by the portage-route, and would appear to represent the maximum limit of marine terraces, as none higher were observed between it and Clearwater Lake.

Terraces on east slope.

On the eastern slope, or that facing Ungava Bay, all the evidence of uplift was seen along the Koksoak River and its branches. Below Fort Chimo the hills on both sides of the river do not rise more than 400 feet, and the scant deposits on their sides are terraced up to an elevation of 250 feet above the water. Above Fort Chimo, to the junction of the Kaniapiskau and Larch rivers, the valley is wide and terraces along the hills are not well marked, being seen only in places and never much above 300 feet higher than the river.

Along the valley of the Larch River, to the forks of the Kenogamistuk and Stillwater, the terraces are well marked and almost continuous, especially the highest, which is everywhere nearly 300 feet above the river. This high-level terrace is also very persistent along the Stillwater, and ten miles below Natuakami Lake it rises 165 feet above the river and has its top fronted with an old beach of rounded shingle. At the outlet of Natuakami Lake its elevation is only about 100 feet above the lake or 620 feet above sea-level. Above Natuakami Lake, no well-defined, continuous terrace was noted and any

small terraces seen there were supposed to have been of river origin. In conjunction with the terraces above mentioned, continuous deposits of stratified clay were traced from the sea to within a few miles of Natuakami Lake, or 100 miles from Ungava Bay, and it is probable that the encroachment of the sea toward the close of the glacial period, as marked by the terraces, extended so far or farther inland, covering much of the lower country and filling all the principal river-valleys on both sides of the peninsula; at this time the seals now found in Seal Lake might easily have reached that lake, as the difference in level between it and the sea must have been less than 150 feet. The subsequent uplift of the land would appear to have been about 100 feet higher on the Hudson Bay coast than on the eastern side, but this difference may be only due to imperfect estimations of barometric heights, especially on the long river-stretches on the eastern slope, where the estimated heights of the interior above sea-level, may easily be 100 feet too low. Differential uplift.

Terraces up to fifty feet above the water were noted in many places along the Stillwater River above Natuakami Lake, but none of them were persistent. On the banks of the Clearwater River no definite terraces were noted, and the same applies to Clearwater Lake, where no evidence of a former higher level was noted. In Upper Seal Lake there are broken terraces at fifteen feet above its present level, but they probably mark a former greater height of the lake itself, which might easily have been caused by a barrier of drift at its present outlet.