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REPORT
ON THE
COUNTRY BETWEEN LAKE SUPERIOR AND
LAKE WINNIPEG,

BY
MR. ROBERT BELL, C.E., F.G.S.,

ADDRESSED TO
ALFRED R. C. SELWYN, ESQ., F.G.S.,
DIRECTOR OF THE GEOLOGICAL SURVEY OF CANADA.

MONTREAL, 24th February, 1873.

SIR,—Herewith, I beg to submit my report of the results of the exploration of last summer, which I endeavoured to carry out in accordance with the instructions I had the honor to receive from you.

Since my return to Montreal I have completed the maps, showing the explorations of myself and party during the season. Most of the work is laid down on a scale of one mile to the inch, but some of it on double that scale; and I have reduced all to four miles to an inch.

I have included with the accompanying report, an account of the results of the last exploration of the season, for the reason that, although for a portion of the time you were with the party yourself, our observations were made independently of each other.

I have the honor to be,

Sir,

Your obedient servant,

ROBERT BELL.

REPORT.

The explorations of myself and party during the past season constituted a continuation of those of the three preceding years, the results of which are published in the annual reports of the Geological Survey. They extended from the shores of Lake Superior, westward to the Red River. My party consisted of Messrs. George F. Lount, (who had also assisted me the previous year), Alexander Barnston, B.A., Alfred S. Ball, William Maynard and J. C. Young, with a variable number of Indians.

Duration of field-work.

Acknowledgment of aid.

The various explorations of the season.

Winnipeg River and Lake of the Woods.

Fort Frances to Red River.

Vicinity of Fort Garry.

Return home.

We arrived at Thunder Bay, which we made our head-quarters for the season, on the 17th of June and left it on our return home on the 1st of November. I must here acknowledge our indebtedness for various kinds of assistance to Mr. S. J. Dawson, C.E., the chief superintendent of the Red River Route and some of the members of his staff, to Mr. Jarvis, one of the engineers of the Canada Pacific Railway Survey, and to Mr. E. B. Borron, the Inspector of mines. We are also under many obligations to the Hon. Donald A. Smith, M.P., chief commissioner of the Hudson's Bay Company, John McIntyre, Esq., of Fort William, and other officers of the Company for courtesies extended to us on various occasions.

The early part of the season was devoted to further examinations of the mining district around Thunder Bay, of the Huronian rocks lying to the north and west of it, and of the peninsula lying between Black Bay and Thunder Bay. Some parts of the coast and adjacent islands between the Kaministiquia and Pigeon Rivers were next visited. The rocks were examined along the chain of lakes, streams and portages, which constitute the boundary between the Dominion and the United States, from Lake Superior to Whitewood Lake; also along the Canadian route to Red River from Thunder Bay as far as "Sturgeon Lake" and between Whitewood Lake and "Sturgeon Lake." Explorations of the Black Sturgeon River and of the country lying to the west of it were made in continuation of the work begun in that region in 1869. The last exploration of the season was that made with yourself from Thunder Bay to Red River, by the Dawson Route to Lac des Mille Lacs, and thence by way of (the Great) Sturgeon Lake and Lonely Lake as far as Separation Lake on the English River. At Separation Lake it was considered advisable that two routes should be examined; and while you pursued your journey with one section of the party, I, with the other, crossed the country from Separation Lake southward to Sandy Bay on the Winnipeg above its junction with the English River. From this bay we ascended the Winnipeg River to its source in Lake of the Woods and made such an examination as our time allowed, of the rocks on the islands and shores of this lake, between its outlet and the North-West Angle, from which the Government Road starts to Fort Garry. From the latter point one of my assistants was sent to Fort Frances for letters, and on the trip he collected what geological notes and specimens he could. At the same time I walked to the Red River settlement, and examined the rock-exposures which occur by the way. While waiting for the steamer, which was to take us up the Red River, a few short geological excursions were made in the vicinity of Fort Garry. At the time of our return the steamers from Fort Garry connected with a branch of the Northern Pacific Railway, where the latter crosses the stream which discharges Red Lake into Red River. Here we took the train to Duluth and thence proceeded by steamer to Thunder Bay.

In regard to the topography of the region examined, we availed ourselves of every source of information, besides adding considerably to what had been previously known. The Crown Lands Department of Ontario have lately been extending their surveys of the lands in the Thunder Bay region, and their maps, as well as all others available, were used for our work in this region, the only addition which we made to the topography, having been such as we were enabled to lay down from pacing. In the valley of the Black Sturgeon River, in addition to our paced lines, we had our own plan of the river, made in 1869, and the trial-lines since run for the proposed Canada Pacific Railway. Along the boundary line I made use of the map of the Commissioners under the treaty of Ghent. For the Red River Route, from Thunder Bay to "Sturgeon Lake," and between Fort Frances and Fort Garry, we had copies of the maps constructed for Mr. Dawson, the Chief Superintendent. Between Whitewood and "Sturgeon" Lakes I made a careful track-survey of the route, the plan of which will, I think, be found sufficiently accurate. Lac des Mille Lacs and the Seine River, which discharges it, are shown on Mr. Dawson's maps. The route of our final exploration of the season left the Seine by way of Brush Creek, a small stream from the north three or four miles below its junction with a branch called Fire-Steel River.

Topography
and maps.Thunder Bay
region.Black Sturgeon
Valley,United States
Boundary line.
Red River
Route.Whitewood
Lake to Red
River Route.Mille Lacs and
Seine River.Lonely Lake
route,

Estimated and independent track surveys of the route were made by both of us while travelling together from the mouth of Brush Creek to Separation Lake; and thence similar surveys were made of the respective routes which we followed, yours being via the Winnipeg River to Lake Winnipeg and mine via Sandy Bay and the Winnipeg River to Rat Portage. The distance, according to my plan, from the mouth of Brush Creek to Rat Portage, by the course followed, is 360 miles.

This kind of survey was all that it was possible for us to make in the time and under the circumstances. As far as we are aware, portions of our route had never before been travelled by a white man. No reliable information could be obtained in regard to it, and it proved to be longer and more difficult than had been represented. We required the assistance of Indians as guides and canoe-men, but as they are not easily persuaded to work at all, and as we could not count on retaining their services for a single day, we suffered some inconvenience and loss of time in making our way through this unknown region; but we managed to take with us, from the start, to the end of the journey, all the provisions and camp outfit required for the party, which averaged fourteen in number. The plans of the route, as already stated, constructed independently of each other, agree so well, that they may be adopted for geological purposes and will form a complete guide and source of information for the use of others travelling over the same ground. My own method was to note every change in our course, no matter how short the distance

Difficulties of
the journey.Map of the
route.

might be, and to take bearings constantly to the points, islands, bays, &c., to the right and left of us, recording these and the estimated distances on my sketch of the shores, to be afterwards plotted to a scale. The estimates of distance on these routes were mostly based on the speed of the canoes, which was pretty accurately known, and all the portages were measured by pacing.

Rocks of the route.

The rocks met with on the routes explored belong to the Laurentian, Huronian and Upper Copper-bearing series.

Arrangement of this report.

I purpose in the following pages to give a description of the geology of each of the sections explored, to be followed by a general sketch of the character and distribution of each of the three great sections into which the rocks of the region are divided. The report will conclude with an account of the progress which has been made in mining in the Lake Superior region and a short sketch of the surface geology of the country between the Height of Land and Red River.

Thunder Bay Mining District.

Traverse N. W. from Amethyst Harbour.

A traverse was made from Amethyst Harbor for a distance of fifteen miles to the north-westward, and from this point south-westward to the mouth of Current River. Leaving Amethyst Harbor, the first two and a half miles of this traverse passed over the coarse reddish syenite or granite which I have referred to on page 328 of the Report of Progress for 1869. This rock is found to be cut in one place by a dyke of dark compact trap. Three other ridges of similar granite were crossed at about five, ten and twelve miles from Amethyst Harbor. But the prevailing rocks along the whole line were greyish, rather fine grained mica-schists with rusty partings, and greyish-green dioritic schists, with some grey silicious and feldspathic schists. Returning towards the mouth of Current River, similar granitic rocks were crossed in four places, between which, schists like those just described were found, and, in addition, a band or grey dolomitic schists, occurring about seven miles north of the mouth of Current River. The prevailing strike was everywhere south-westward. These rocks are considered to be Huronian. The cherty slates of the upper copper-bearing series were met with near the forks of the Current River, about three miles north of Thunder Bay.

Granite or syenite.

Micaceous and dioritic schists prevail.

Dolomitic schists. Strike.

Huronian age.

Cherts.

The results of our explorations around the northern and southern shores of Thunder Bay; in the neighborhood of Thunder Cape, and in the township of McTavish, consisted of supplementary details in reference to the rocks described in my report for 1869, and which can only be shewn upon the maps, besides notes on the mines and mineral veins of the region.

Section of Huronian rocks on Kaministiquia River.

The banks of the Kaministiquia River between the junction of the Mattawa and the Grand or Kakabeka Falls, present an extensive section

of the Huronian rocks. In addition to what is stated in reference to them in my report for 1869, Geological Survey Reports of Progress 1866-69, pp. 329-331, the following particulars, from our observations of last year, may be mentioned. At the second portage below the mouth of the Mattawa, which occurs at about six miles from that point, the rock consists of an olive-grey and light greenish-yellow fine-grained, nacreous mica schist, running S. 60° W. At the head of Knife Portage, which is met at about seven miles below the Mattawa, the rock is a dark grey compact quartzite, holding clear grains of the same mineral. Portions of the rock are micaceous. Some of the bands crossed on this portage have rusty surfaces, owing to the action of the weather upon the numerous small grains of iron pyrites which they contain. The dip is a little north of west at an angle of 70° . At the I-is-kapi-sing Portage, about thirty chains below Knife Portage, a fine-grained green mica schist is exposed in a cliff running some distance along the east side of the river. The cleavage, which runs diagonally across the cliff, strikes S. 55° W., the dip being north-westward at an angle of 60° . The schist contains elongated straggling white quartz patches and breaks up into large ligniform splinters. At the head of the Island Portage, about a quarter of a mile below the last, the rock is fine grained ribboned felsite schist, of a dark grey color with purplish and greenish layers. It dips N. 45° W. $<70^{\circ}$ and is underlaid, to the south, by greenish dioritic schist. At a portage about a mile further down, or about four miles above the Grand Falls, the granitic gneiss, referred to at page 329 of my report for 1869, is exposed for a distance of fifteen or twenty chains along the river. Between this point and Lost Portage, about three miles further down, the river runs about W. S. W., or with the stratification or cleavage of the green schist, which dips northward at an angle of 70° . Lost Portage is the first above the Grand Falls, or the second in ascending the river. It passes over a fine grained quartz and feldspar rock, which is usually light grey, but sometimes pinkish in color. Although its stratification is not distinct, it holds elongated schistose patches of a darker color than the rest, and, indeed, large portions of the mass have a schistose structure. The stratification of the hornblende schist, which occurs at the head of this portage is very regular and dips a little north of west at an angle of 60° . It is cut by veins and patches of rock of precisely the same character as that of the great mass lying to the south of it, which has just been described.

About a mile below the Grand Falls, the smoke-colored cherty slates of the Upper Copper-bearing series were observed on the west side of the river, to dip northward, or up stream at a very high angle, and a short distance further on, southward at decreasing angles, and finally to become nearly horizontal and they are then overlaid by the thinner black silicious shales.

Three new townships.

Prevalence of slaty rocks capped by trap

Dyke of crystalline coarse diorite.

eruptive dykes.

Silver Islet dyke.

The surveys which have been made during the past year of the new townships, called Blake, Crooks and Pardee, lying between the Kaministiquia and Pigeon Rivers, have been of much service in giving us the natural features of that region. It appears that the greater part of the area is occupied by the slaty rocks of the lower portion of the Upper Copper-bearing series, and that the trap overflow crowns only the tops of the higher hills. Mr. Hugh Wilson, P. L. S., who made these surveys for the Crown Lands Department of Ontario, informs me that a band or dyke of coarsely crystalline diorite or syenite about twenty chains in width, running south-eastward or in the direction of Victoria Island, is seen in section 9, Concession IX township of Blake, and cuts the slate range lying to the north-westward in section 11, concession VII.

Although eruptive trap dykes are so numerous along the shore and among the islands in front of these townships, Mr. Wilson observed very few in the interior. This would correspond with our own observations to the north and north-eastward. The Silver Islet dyke, which is peculiar in its character and composition, and averages about eight chains in width, appears to run continuously through McKellar's, Thompson's, Spar, Jarvis's and Victoria Islands, to McKellar's Point. From this locality, it has been traced by reliable explorers for some miles inland, curving gradually to the west and finally north-westward.

International Boundary from Lake Superior to Whitewood Lake.

Grand Portage.

Soil.

Trap bluffs.

Dyke at Partridge Portage.

Mountain Lake.

Height of Land.

Gun-flint Lake.

Slate, dolomite and breccia.

Grand Portage, by means of which the rapids and falls in the lower part of Pigeon River are avoided, is about ten miles in length and lies wholly in American territory. No rock *in situ* was observed on the trail itself, which passes through a hilly country overspread with gravelly earth and brown clay with boulders; but the prevailing trap of the country rises in bluffs in a few places at no great distance from it. At Partridge Portage, where there is a beautiful fall on the Pigeon River, a large trap dyke cuts through green arenaceous slate of the Upper Copper-bearing series, disturbing it to some extent. On the upper side of the fall the slates dip south at an angle of about twenty degrees. On the portage at the east end of Mountain Lake, rusty silicious slates with thin layers of impure hematite are exposed, dipping south at an angle of from ten to fifteen degrees, and capped to the southward by the common dark grey trap of the country. The water of the next lake eastward of Rose Lake flows both ways, when high, but only to the Arrow River when low, so that the height of land may be considered as intersecting the portage which leads from it to Rose Lake. The hills along the south side of Gun-flint Lake consist of trap, but on the north side, near the western extremity, a silicious slate occurs, dipping N. $< 25^{\circ}$. It is interstratified with beds of a bright

yellow-weathering grey dolomite and others of a breccia, which is made up of fragments of chert and slate, lying at all angles to each other and resembling very closely the brecciated beds of the same formation which occur near the head of Thunder Bay. A short distance further west on the same shore, at the narrows where the canoe-route turns north-westward, a light pinkish-grey granite begins. It consists of feldspar and quartz, with a little mica, and is divided by natural joints into fine rectangular blocks which would be suitable for building. These rocks rise into a series of hills called the "Giant's Range," which runs for many miles in a N. E. and S. W. course. The same kind of granite continues to be largely exposed all along the route to near the western extremity of Seiganagah Lake where it becomes replaced by Huronian schists. At a point about a mile east of the place where the boundary line leaves Seiganagah Lake, a rusty brown altered sandstone is exposed, containing small white quartz pebbles, about the size of peas, very thickly disseminated in some of the beds, which vary from two to eight inches in thickness and strike N. 30° W. with an inclination to the south-westward of about 70°. At the small channel, by which we leave the western extremity of Seiganagah Lake and enter Poplar Lake, the rock consists of altered yellowish-brown sandstone with beds of soft green argillite, which, under the influence of the weather, become red, to a depth of half an inch. The strike is about N. N. W. At Poplar Portage which leads from Poplar to Otter Lake, and on the shores of Poplar Lake a short distance before coming to the portage, the rock is a massive dioritic schist, some portions being dark and others light greyish-green in color. It is of a conglomerate character in some parts, and associated with compact brittle cherty felsitic slate of a drab grey color, and having a conchoidal fracture. Poplar Lake is the small sheet of water called "Swamp Lake" on the Boundary Commissioners' map. The next lake to the westward marked "Cypress Lake" on the map, is known in the country as Otter Lake. It is about five miles in length, and along its shores are exposed a variety of dioritic, argillaceous and silicious schists, running nearly north and south and dipping generally eastward at a moderate inclination, but in some places westward, at high angles. Little Knife Portage leads from the west end of Otter Lake to Knife Lake. It derives its name from the sharp edges of a dark colored splintery chert-rock, which here forms a considerable band dipping westward at an angle of 70° to 80° and rising into a cliff on the east side of the portage-trail. This rock resembles the dark cherty slates near the base of the Upper copper-bearing series, except that it does not separate like them, along the lines of stratification. At the Little Knife Portage the chert band is overlaid or followed to the westward, by light greenish-grey quartziferous dioritic schist, with bands of dark grey compact felsitic quartzite and altered sandstone. At short distances west of the portage

Granite begins.

Giant's Range.

Seiganagah Lake.
Huronian schists.

Altered sandstone and conglomerate.

Dioritic and cherty felsitic slates.

Poplar or "Swamp" Lake.

Otter or "Cypress" Lake.

Various schists.

Little Knife Portage.

Chert-rock.

Schists.

Knife Lake.

these rocks strike S. 15° to 30° W, and dip to the westward at an angle of about 80° . Knife Lake is about ten miles long. On the north shore at about a mile and a half west of Little Knife Portage, the rock is a light grey granular quartzite or altered sandstone, with small specks of iron pyrites thickly disseminated through it. At the Narrows of Knife Lake, three miles from the east end, a slightly calcareous dark green dioritic schist is associated with a light olive colored cherty or chalcedonic rock which is translucent on the edges. Two miles west of the Narrows or about the middle of the lake a very dark or nearly black chert-rock occurs with dioritic schist on either side. Between this point and the west end of the lake, the rock along the north shore consists of dark hard argillaceous slates with cubic crystals of iron pyrites. The strike is here nearly due west. At the Big Knife Portage at the west end of Knife Lake, argillaceous cherty, dioritic and grey finely granular silicious slates are met with. At the S. E. end of the portage the strike is S. 80° W. and at the N. W. end, S. 75° W. Near the north end of the portage, a dyke of dark crystalline trap, ten feet wide, cuts the slates and runs S. 50° W. Similar slates continue with a south-westward strike for the next two miles, when we arrive at Carp or Sucker Portage at the east end of Birch Lake.

Big Knife Portage.

Carp Portage.

Here we meet with a dark greyish fine-grained glossy clay slate, approaching the character of roofing slate. It holds small lighter grey calcareous patches and strikes S. 55° W., the bedding or cleavage being vertical. My examination of Whitewood Lake only extended to the long point on the Canadian side, between six and seven miles from the eastern extremity. The only rocks observed around the lake consisted of rather fine grained, bright, light grey and reddish-grey syenite. It consists of crystalline white or red feldspar and black hornblende with more or less quartz in some parts.

Whitewood Lake.

Syenite.

Name of the Lake.

Basswood trees were not seen around this lake, nor indeed anywhere in this part of the country; and the lake is said to derive its name, Lac de Bois Blanc, or Whitewood Lake, from the whitewood or balm of Gilead, a kind of poplar, so that the name "Basswood Lake," which is sometimes given to it, would appear to be incorrect.

Eastern section of the Red River Route.

Kaministiquia River to Shebandowan Lake.

In the Report of Progress for 1869, pp. 321 to 331, I have described the geology of the country traversed by the Red River road from Thunder Bay to the crossing of the Kaministiquia River. From the latter point to the outlet or eastern extremity of Shebandowan Lake, greenish-grey, micaceous and dioritic schists are exposed at intervals all along the road. The general strike is west, varying to about ten degrees on either side of that course. Where the road crosses the Mattawa River, about five miles from its junction with the Kaministiquia, thin bands of fine-grained

greenish-yellow nacreous mica schist occur in the greenish-grey dioritic schists, which here strike S. 80° W. About half way from this point to Shebandowan Lake the strike in the same kind of rock has changed to N. 80° W. Around the outlet of Shebandowan Lake, the rocks consist of soft glossy greenish argillaceous mica schist and greyish-green soft dioritic schist, all running S. 85° W., the cleavage or bedding being vertical. These schists continue along the shores of the lake for about three miles west of the outlet, beyond which, the shores for seven miles consist of a light colored syenite, composed of white, pink and green feldspar and green hornblend with grains of quartz in some parts. These rocks appear to form part of the Giant's Range, which presents a breadth of thirteen or fourteen miles of granite rocks between Gun-flint Lake and the northern part of Seiganagah Lake. From the west side of the syenitic belt on Shebandowan Lake to the Kashabowie Portage, a distance of six miles, the shores are occupied by greenish micaceous and dioritic schists. Some of the latter are of a conglomerate character, and many of the enclosed pebbles are of a large size. Patches of granite occur here and there among these rocks. At the Narrows, about three miles east of Kashabowie Portage, the strike of the schists is S. 65° W., and the dip north-westward at an angle of about 80°. In this neighborhood the vegetation has been burnt off the hills, and the stratification of the schists is rendered conspicuous by broad bands weathering to different shades. At the Kashabowie Portage the rock is a rather light greenish-grey, fine-grained dioritic mica schist with strings of quartz running with the strike of the cleavage or bedding, which is S. 60° W., corresponding with the general course of the north-west shore of Shebandowan Lake. We were given numerous specimens of quarts containing copper pyrites, said to have been taken from veins on the shore of the lake, about a mile and a half westward, and two miles eastward of the portage. After crushing all these together a sample of the average yielded 0.146 oz. of gold and 0.292 oz. of silver to the ton, according to an assay made by Mr. Hoffmann.

Around the shores of Kashabowie Lake, banded gneiss occurs in the central part, and what appeared to be Huronian schists for about two miles from the outlet, while around the northern extremity there is a variety of syenitic rocks, none of which show any stratification. The height of land passes between a pond near the head of Kashabowie Lake and the south-eastern bay of Lac des Mille Lacs. A portage, about a mile in length, over tolerably level ground, leads from one to the other. The rocks on this portage consist of moderately coarse grained greenish-grey mica schists. The strike of the bedding is west, and that of the cleavage west-south-west. At the north end of the portage the vertical edges of the schist show numerous small lumps and strings of white quartz. The latter are sometimes crowded closely together and, curving with the contortions in the

Schists at outlet of Shebandowan Lake.

Belt of syenite.

Schists of western part of Shebandowan Lake.

Conspicuous stratification of schists.

Kashabowie Portage.

Copper ore.

Kashabowie Lake.

Syenite.

Height of land.

Portage.

Mica schists.

No fossils. schists, have occasionally a skeleton-like appearance, which has given rise to reports of the discovery of fossils at this locality. Between the Height-of-Land Portage and Barrel Portage, at the south-western extremity of Mille Lacs, the rocks observed along the southern shore consist of rather soft massive greenish-grey diorite till we come to within about four miles of Barrel Portage, when Laurentian gneiss begins. In some places in this interval the bedding appears to run south-eastward, and in others south-westward, but it is difficult to distinguish the stratification from the joints and cleavage. At a point six or seven miles from the Height-of-Land Portage, the diorite is associated with a greenish and yellowish-grey quartz rock, having smooth-surfaced partings and holding clear grains of quartz. From the point on Mille Lacs above mentioned, (about four miles north-eastward of Barrel Portage) in going south-westward all the way to Sturgeon Lake, the only rocks met with are micaceous grey and red gneiss, sometimes passing into mica schist with veins of granite. In this interval the strike was ascertained in about twenty localities along the route, and found to be S. 80° W. except in a few instances, where it varied from S. 50° W. to S. 70° W., and has thus the same general course as the chain of lakes constituting the route. The dip is almost as frequently to the southward as to the northward, and the angles are generally high.

Diorites.

Gneiss begins.

Strike corresponds with chain of lakes.

From Whitewood Lake to Sturgeon Lake, on the Red River Route.

This route leaves the north-eastern extremity of the eastern part of Whitewood Lake and joins the Red River route at a narrow place about three miles south of the head of Sturgeon Lake. The first two-thirds of our course lay nearly north to Pembina Lake, and the remaining third north-westward to Sturgeon Lake. The distance, according to my plan, is twenty-seven miles in a straight line, or forty by the canoe route.

Course of route.

Distances.

North Portage. Leaving Whitewood Lake, by what is called the North Portage, half a mile in length, we arrived at a lake three miles long, running in a north-easterly direction. A red granitic rock was exposed all around the shores of this lake. From the head of this lake, Burnt Portage runs east fifty chains to a pond, from which another portage twenty-eight chains in length, running northward, brought us to the south end of Lake Agnes. In the neighborhood of these two portages the rock assumes a gnessoid aspect, holding a few lenticular bands of grey micaceous and hornblendic schists, and others of fine-grained red quartzite, running S. 25° to 35° W., in a matrix of a reddish granitic character. Lake Agnes has a very straight northern course of thirteen miles, and varies from a few chains to a mile and a-half in breadth. A river from Seiganagah Lake enters the east side about a mile from the southern extremity, falling perpendicularly

Burnt Portage.

Lake Agnes.

River from Seiganagah Lake.

a height of about forty feet, almost directly into the lake. The outlet, which is said to flow to Whitewood Lake, leaves the western side about half way down the lake. The shores are high and bold, the rocks in some parts rounding abruptly down to the water's edge. The red gneiss which prevails all around the lake, has an average run of about S. 10° W., and dips westward at angles varying from 45° to 90°. On the portage from the northern extremity of Lake Agnes, a grey variety of gneiss dips S. 50° E. < 75°. Along the western shore of Pembina Lake a similar gneiss Pembina Lake. runs a little west of north. This lake receives the Ka-wa-wi-ai-ga-mog River, which flows south-westward from the height of land near the west end of Shebandowan Lake. At a sudden bend, or elbow, to the southward, in the outlet of Pembina Lake, we came upon a band, fifty chains Band of mica schist. in width, of fine-grained grey mica schist with garnets, running S. 35° W. and dipping north-westward at an angle of 70°. A vein Vein. of quartz occurs here, varying from one to two feet in thickness, and running more nearly south than the strike. It holds patches of yellowish bitter-spar on the west wall. A specimen from one of these, assayed by Mr. Hoffmann, yielded no trace of either gold or silver. From this point to "Sturgeon" Lake, Gneiss to Sturgeon Lake. massive gneiss prevails. It is sometimes reddish, but generally grey in color. At the Snake Falls, about half way between Pembina and Sturgeon Lakes, the stratification is distinctly seen, and runs S. 40° W., while on the western shore of the upper part of Sturgeon Lake, it runs nearly east and west.

Valley of the Black Sturgeon River.

The additional investigations in the valley of the Black Sturgeon River were performed by Messrs. Barnston and Lount, and consisted of a further examination of rock exposures near the main river as far up as Non-watan Lake, a traverse from the neighborhood of that lake southward to Traverses made. Mud Lake, and thence to Lake Dufferin, a distance of eleven miles, and another traverse from the last lake south-eastward to Cranberry Bay, at the head of Black Bay, a distance of about thirty miles. These explorations resulted in confirming the correctness of the general geological Results. description of the valley of the Black Sturgeon River contained in my report, 1869, (Geological Survey Reports of Progress 1866-69, pages 334-336,) and in extending our knowledge of that region. The Upper Copper-bearing rocks appear to extend to a distance of about twenty miles west of the Black Sturgeon River, all along the section below Black Sturgeon Lake. They consist of a great variety of reddish and greyish sandstones Character of rocks. and marls, more or less indurated, and generally calcareous, together with dark silicious argillaceous and feldspathic slates, the whole lying nearly horizontally. They are cut by dykes of compact crystalline dark greenish-grey trap, and in the higher hills are capped by the great horizontal over-

Aspect of the
country.

flow of trap. The latter is generally more friable and coarsely crystalline than the trap of the dykes, and has usually a yellowish shade, especially near the surface, and also a lighter color. As stated in my report for 1869, (Reports of Progress 1866-69, page 333,) there is a considerable tract of comparatively level land lying to the westward of Black Sturgeon Lake and the Nonwatan Lakes; but south of this region the country is much broken by bluffs of the sandstones, marls and overlying traps. The only Laurentian gneiss met with, consisted of a small ridge protruding through the red indurated marl at a point about fifteen miles north of Cranberry Bay.

Route from Lac des Mille Lacs, via Lonely Lake, to Lake of the Woods.

Gneiss Regions.

As already stated, the southern shores of Lac des Mille Lacs are composed of Huronian slates. Proceeding through the lake from the Height-of-Land Portage, towards the Seine River, which constitutes the outlet, Laurentian gneiss was first met with a short distance north of the entrance to the narrow south-western arm of the lake, which constitutes a part of the Red River route. It was the only rock observed around the north-western shores of the lake, and down the Seine as far as we followed it. The gneiss in this region is of a massive character, with the bedding usually much contorted. A grey color prevails, but there are also some reddish bands. The average strike is about S. 70° W. In the neighborhood of the outlet of Mille Lacs the dip is mostly northward, at angles varying from 45° to 90°; but at Pike Lake on the Seine, ten miles below Mille Lacs, where the bedding is very distinct and less contorted than above, the dip is northward but at very high angles. At one place on the hills on the north side of Pike Lake, a beautifully banded, micaceous but massive variety of gneiss has a local strike, bearing N. 75° W., the bedding being vertical.

Pike Lake.

Brush Creek.

We left the Seine by way of a small brook from the north, named Brush Creek, which enters the river between three and four miles below the branch called the Fire-Steel River, which also enters on the north side.

First Lake.

Huronian
schists begin.

The first small lake on Brush Creek occurs at about a mile and a-half in a straight line north-west of the Seine. The Huronian schists appear to begin near this lake. They are well exposed in the burnt hills about a mile to the north of it. Here they consist of fine-grained greenish argillaceous, micaceous and dioritic bands, in some parts quite calcareous, and holding numerous strings of calc-spar. In one place there is a band of yellowish-grey or drab earthy dolomite thirty feet thick. The weathered surface of this band becomes converted into a brownish-yellow ochre, indicating a large proportion of iron in the rock. The strata are here vertical, and run N. 60° W. They are cut by a vein of quartz six feet in width, which crosses Brush Creek about a mile and a-half above the first

Dolomite.

Quartz vein.

lake and runs N. 80° W. It contains crystals of calcareous spar and ochrey patches near the weathered surface. Seven specimens broken from different parts of the vein on being reduced together so as to represent an average, were assayed by Mr. Hoffmann, and found to yield Assay. neither gold nor silver. A band of yellowish-grey dolomite, which in one place is ten feet wide, accompanies this vein on the south side. Numerous smaller quartz veins, one of them two and a-half feet thick, were found in the hills near Brush Creek for a distance of five miles north of the one just described. At the third portage on Brush Creek which occurs at about two miles above First Lake, the dioritic schist is of a compact dark greyish-green character, holding numerous grains of common and magnetic iron pyrites, and looks promising as a matrix for copper-bearing veins. About three miles further on, or five miles north of First Lake, the greyish-green schists are very dolomitic, and among them Dolomitic schists. a band of pure white quartziferous dolomite was observed. A fine-grained dark grey quartzite, with a westerly strike, was found in a hill Quartzite. about a mile west of Brush Creek, and seven miles north of First Lake. Huronian schists of the various kinds first described as occurring on this brook, prevailed as far as Pyramid Lake at its head, where they became replaced by fine-grained reddish granite; so that the breadth of this Huronian band would appear to be about eight miles at right angles to its strike. Breadth of Huronian band.

Squirrel Portage, half a mile long, leads from the north-west bay of A water-shed. Pyramid Lake across the height of land separating the waters of the Seine from those flowing towards the English River, to a pond at the head of Carr's River, so called after Mr. Carr, C.E., whose section of the Carr's River. Canada Pacific Railway exploration line crosses this stream. The general course of Carr's River is about due north for upwards of thirty miles, in a straight line to Mattawa Lake, into which it discharges. The rocks of Squirrel Portage and of the country on our course for the next eight miles, consist of granite, varying from a light red color and fine texture Granite. to a light grey color and coarse texture. There is then an interval of about two miles of massive reddish gneiss with a north-westward strike. Continuing northward, the gneiss is followed by two or three miles of fine-grained green mica schist and slaty felsites with intercalated veins of Gneiss. reddish granite, running, first to the north-westward, and further on to Mica schist, felsite and granite. the north-eastward and all dipping to the eastern side. These exposures appear to be near the western extremity of a bend in the Brush Creek Probable fold in strata. band of Huronian schists, which probably corresponds with the bend in the Minnetakie band, which occurs at the Lake of the Woods, and will be described further on. The junction of these schists with the Laurentian Laurentian gneiss begins. gneiss to the north, appears to take place about the point where the Canada Pacific Railway trial-line crosses Carr's River, which is at about

twenty-one miles north of the Seine. About four miles further north this river enters Selwyn's Lake. Massive grey micaceous gneiss, with very distinct bedding, running about S. 45° W. with a vertical dip, is well exposed around the shores of this lake. Similar gneiss, but with a general dip to the east-ward, is seen all along the lake-like expansion of Carr's River as far as Mattawa Lake. The canoe-route, which we followed, leaves the north-eastern part of Mattawa Lake by a short portage over a rocky ridge, and passing through Bell's Lake, reaches Sturgeon Lake, eight miles from its south-western extremity. The river which discharges Mattawa Lake flows from its western side, and appears to be identical with the stream I have called Drummond's River, and which joins the Sturgeon Lake River at Kitchi-sagi or Big-inlet Lake. I may here remark that Sturgeon Lake River is not the outlet of Sturgeon Lake, but another river, a part of which is followed by the canoe-route from Lonely Lake to Sturgeon Lake. The outlet of Sturgeon Lake is near its northern extremity. Around Mattawa and Bell's Lakes the strike of the gneiss, which is usually grey and micaceous, varies from S.W. to W.S.W.

Huronian schists begin.

The Huronian schists again appear at the place where we came upon Sturgeon Lake, at eight miles from its head or south-western extremity. Here they consist of fine-grained shining grey mica schist, running S. 70° W., and dipping northward at an angle of 70°. They contain numerous irregular quartz veins holding ochrey patches. A specimen broken from one of these veins, about a foot thick, is found by Mr. Hoffmann to contain neither gold nor silver.

Quartz veins.
Assay.

Sturgeon Lake.

The islands which we examined in the centre of the lake on our way to the south-western extremity consist of dark green, soft dioritic schist, running in the same south-westward direction as the lake itself. The portage at the head of the lake is forty-five chains long and runs west to Young's Lake. At this lake the rock has the same strike and consists of green dioritic schist, studded with small crystals of calc-spar and feldspar, which give it a finely porphyritic appearance. It also holds specks of copper pyrites.

Sturgeon Lake to Minnetakie Lake.

From the head of Sturgeon Lake our general course was due west by compass for about thirty-two miles in a straight line, at the end of which distance, we came to Minnetakie Lake. In the first half of this interval we passed through seven lakes, the waters of which flow westward, the one into the other, and all finally discharge by the Sturgeon Lake River into Minnetakie Lake. The exploratory line of the Canada Pacific Railway touches the south-west extremity of Sturgeon Lake and going westward passes between the third and fourth of the small lakes just referred to and crosses the Sturgeon Lake River at the outlet of the seventh of the chain. This lake receives the river which flows from Night Owl Lake, lying to the south-westward, and is said to be the

Seven Lakes.

Canada Pacific Railway line.

beginning of the canoe-route to Fort Frances. Between this seventh lake and Minnetakie Lake the Sturgeon Lake River receives a considerable tributary from the southward, which we named Jarvis River, after the chief engineer of division L of the Canada Pacific Railway Survey. Huronian rocks were observed around all the seven lakes except the fifth or most southerly of the group called Kitchi-sagi or Big-inlet Lake, on whose shores various kinds of Laurentian gneiss occur. The Huronian rocks in the neighborhood of these lakes consist of green dioritic and glistening greenish mica schist. Light grey granite occurs on the fourth lake near the trial-line for the Canada Pacific Railway, and a finer-grained red variety of the same rock where the line crosses the outlet of the seventh. At the rapids, about two miles below the last named point, the rock consists of a dark green variety of diorite, thickly studded with crystals of black hornblende about the size of peas. In some parts it also holds scales of black mica. It appears to be bedded and to have an eastward dip. The Sturgeon Lake River is very rapid for about a mile before falling into the southern extremity of Minnetakie Lake. The rapids terminate in a perpendicular pitch of about seven feet, called the Minnetakie Fall, just at the head of the lake. Here the rocks consist of green dioritic and glossy greyish-green micaceous, argillaceous and chloritic schists. Some of the bands contain much calcareous spar, which, by dissolving away under the influence of the weather, gives rise to rough and pitted surfaces. The strike is S. 85° W., with a southward dip at an angle of 60°. The greatest length of Minnetakie Lake, according to Mr. Jarvis, is about twenty-five miles in a western course from the Minnetakie Fall. From this fall to the outlet, a distance of ten miles in a straight line, our course lay through an archipelago of islands which fills up the north-eastern part of the lake. In this distance the rocks consist of greenish Huronian schists mostly of a dioritic character. The strike, which was ascertained in numerous places, varies from S. 50° W. to S. 75° W., except at one spot, where it was N. 50° W. A narrow ridge of rock at the north-western extremity of Minnetakie Lake, separates it from Abram's Lake, into which it discharges through Abram's Chute, with a fall of three or four feet. The dioritic schists are here of a conglomerate character, being mottled by small hard reddish patches, which appear to be pebbles. They also contain quartz, epidote and feldspar, and specks of copper and iron pyrites and of specular iron. Abram's Lake has a breadth, on our course (which continued to be north-westward), of upwards of four miles. In this interval the average strike of the green schists is about S. 20° W. At the narrows which separate Abram's Lake from Pelican Lake, lying to the north-west of it, the rocks consist of green epidotic and dioritic schists, with large patches of fine-grained grey granite. The schists are cut by numerous quartz veins, from six inches to a foot

Route to Fort Frances.

Jarvis River.

Huronian rocks.

Granite.

Hornblende porphyry.

Minnetakie Fall.

Various schists.

Minnetakie Lake.

Strike of dioritic schists.

Abram's Chute.

Metaliferous diorite.

Quartz veins.

- thick, running south-south-west and holding specks of iron and copper pyrites. A sample, representing the average composition of two specimens from one of these veins, has been assayed by Mr. Hoffmann, and found to yield no trace of the precious metals.
- Assay.** Pelican Lake is four miles broad in a north-westerly direction. A strong rapid occurs at the outlet, called Pelican Falls. The rock at the head of the rapid consists of crystalline dark greenish-grey hornblende schist, which is cut by rectangular joints and splits into remarkably even slabs along the cleavage planes, which are vertical and strike S. 85° W. Laurentian gneiss, somewhat contorted, but having a general south-westward strike, begins at the foot of the rapids, only seventeen chains further on. Around the northern part of Pelican Lake, the rocks consist of reddish micaceous gneiss and mica schist, standing on edge and striking very regularly S. 80° W. These rocks form the commencement of the great Laurentian area of the Lonely Lake region.
- Pelican Lake and Falls.**
- Hornblende schist.**
- Gneiss begins.**
- Huronian band 80 miles wide.** The Huronian schists which have been described as continuing from the southern shore of Sturgeon Lake to the outlet of Pelican Lake, appear to have a breadth across the strike of about thirty miles. Although the course of the strike is somewhat sinuous, its general direction is about W.S.W., which would bring it to Lake of the Woods, where the Huronian rocks are again largely developed. They have also been noted at various places in the interval by Mr. Jarvis, Mr. W. W. Russell and others, and there appears to be no doubt that the Minnetakie and Lake of the Woods bands are identical.
- Strike towards Lake of the Woods.**
- Canoe route to Lonely Lake.** Two miles below Pelican Falls, the Sturgeon Lake River turns off to the north-eastward, or at right angles, but the canoe-route continues north-westward. After passing over three lakes and two portages, we arrived by a stream called Canoe River at a point on the south shore of Lonely Lake, about thirty-two miles north-west of Minnetakie Falls. From the Pelican Falls to Lonely Lake the only rocks seen were massive Laurentian gneiss, all striking south-westward.
- Gneiss.**
- Hudson's Bay Co's Post on Lonely Lake.** The Hudson's Bay Company's post on Lonely Lake is situated on the north side of the White Pine Narrows, which are about three miles west of the mouth of the Canoe River. A long point, running up from the south side, here contracts the lake to about half-a-mile. The extremity of this point is rendered conspicuous by a clump of white pines, and the name O-bi-ji-ko-ka, or Lake of the White Pine Narrows, which the Indians gave to Lonely Lake, has reference to this locality. This large lake is also called by different persons, or on different maps, by the various names of Lac Seul, Sal and Sel, Lake Saul and Salt Lake; but I prefer to adhere to the name Lonely Lake, by which it was also known in my report of 1869.
- White Pine Narrows.**
- Various other names for Lonely Lake.**
- Course of Lake.** West of the Hudson's Bay Company's post, the general direction of

Lonely Lake is a little north of west. Its width varies from a few chains to eight or ten miles, but we passed some bays which were so deep that we could not see to their extremities. From the mouth of Canoe River to the outlet of this lake, the distance, according to my plan, is about forty-eight miles, and the Indians say that the eastern section of the lake, which runs a little north of east, is nearly as long, so that the whole length of Lonely Lake will not be far short of one hundred miles.

Length of
Lonely Lake.

The rocks observed around the shores of the western section of this lake consist entirely of Laurentian gneiss, all having a west-south-westerly strike. We noted many varieties among these rocks, but none of them are remarkable or require special description.

Gneiss around
Lonely Lake.

From the outlet of Lonely Lake to Separation Lake a distance of about fifty-five miles in a straight line, according to my plan, the English River consists of a chain of twelve lakes connected by chutes, narrows or short stretches of river. At ten miles from Lonely Lake, it receives the Mattawa River on its north side, and at about forty miles, the river which discharges Wabigoon and Eagle lakes, lying to the south.

English River.

Branches.

The rock in this district consists of Laurentian gneiss, having the same west south-westward run as around Lonely Lake. About the outlet the gneiss is very micaceous, and is cut by numerous granite veins, mostly running with the strike, which is here nearly due west. The granite, as in many other places, may here indicate the proximity of a band of Huronian schists. The Indians at the mouth of the Mattawa River showed us specimens of a soft, grey, uncrystalline slate, which they carve into pipes, and informed us that they obtained it from the solid rock at Onimimi Sagaigan or Red Paint Lake, which, from their description, would appear to lie about five miles north of the junction of the two rivers. These facts appear to show the existence of another band of Huronian rocks, which, judging from the strike, would be identical with the one observed below the junction of the English with the Winnipeg River.

Laurentian
gneiss.

Micaceous
gneiss and
granite veins.

Pipe-stone.

Probable Huronian
band.

From the extremity of the southern arm of Separation Lake to Sandy Bay on the Winnipeg River the distance in a southerly course, is only five miles. A canoe-route over five small lakes and five portages, leads from one to the other. The general upward course of the Winnipeg River from the portage into Sandy Bay to Rat Portage is about due south, and the distance, according to my map, about twenty-four miles. Rat Portage is at the head of the Winnipeg River or outlet of Lake of the Woods, and is thirteen chains in length. The only other portage which we passed in ascending this river is the one at the Dalles, eight miles below Rat Portage, and which is also thirteen chains in length.

Canoe-route
from Separation
Lake to Sandy
Bay.

Winnipeg
River.

Rat Portage.

The Dalles.

The Laurentian gneiss, which is the only rock along the section of the Winnipeg River which I examined, strikes generally about south-west.

Gneiss.

Conformable
junction with
Huronian
rocks.

The junction of the Laurentian rocks on the north with the Huronian schists of the Lake of the Woods on the south, takes place on Rat Portage. The two rocks are seen almost in contact with each other, and have the same strike and dip.

Lake of the
Woods.

Gneiss begins.

Dr. Bigsby's
map.

Course of
boundary
between Lau-
rentian and
Huronian rocks.

In going south-westward from Rat Portage to the entrance to the North West Angle of the Lake of the Woods, a distance of about forty miles, the rocks observed on all the islands consist of Huronian schists, with associated granites. Laurentian gneiss begins just where we entered the creek leading to the government station on the route to Red River. Dr. Bigsby, in his map of Lake of the Woods, published in the journal of the Geological Society, Vol. VIII, p. 400, shows gneiss all along the main north-western shore of the lake. At Rat Portage the strike of the Huronian schist, as well as of the Laurentian gneiss to the north of it, is S. 75° W., but it curves gradually round to S. 45° W. before reaching the North-West Angle. An island, lying about twenty miles from the North-West Angle, on the travelled route to the mouth of Rainy River, was found by Mr. Maynard, one of my assistants during the past season, and also by Mr. W. W. Russell, who assisted me in 1869, to be composed half of Laurentian gneiss and half of Huronian schists. Dr. Bigsby's map, above referred to, and other sources of information show the Huronian schists to run easterly along the northern shore of the southern part of Lake of the Woods. At this part of the lake, according to Dr. Bigsby, they turn round to the southward, leaving Laurentian gneiss between them and the eastern shore of the lake all the way to the mouth of the Rainy River. Laurentian gneiss is known to exist elsewhere around the southern part of Lake of the Woods, and I found it exposed at intervals along the road to Red River, for about thirty miles westward of the government station at the North-West Angle. Mr. Maynard found a fine-grained dark green mica schist running across the Rainy River at the Long Rapids, and Laurentian gneiss at Fort Frances. All these facts appear to show that the boundary between the Huronian and Laurentian rocks, skirts the north-western shore of Lake of the Woods from Rat Portage to the north-west angle, and then, curving round, strikes eastward to the eastern bay of the lake, and thence southward to Rainy River.

Gneiss on Red
River Road.

Rainy River.
Fort Frances.

Geological
details on Lake
of the Woods.

On the islands between Rat Portage and the North-West Angle we met with a great variety of chloritic, micaceous, talcoid, hornblendic, dioritic, silicious and dolomitic schists of various shades of green and grey. At the western extremity of a large island, called Manitou-Minis, about fifteen miles south-west of Rat Portage, a reddish-grey talcoid schist, running S. 80° W. dip to S. < 80°, is followed to the south by green dioritic schist, full of white-weathering pebbles and boulders, the largest of which are about two feet in diameter. The green schists are associated with masses, apparently intrusive, of fine-grained reddish-grey granite, which

Slate conglom-
erate.

again are cut by quartz veins. On an island about twenty-five miles south-west of Rat Portage the bedding was observed to be horizontal, while the Bedding and cleavage of schists. slaty cleavage cut it at a high angle and ran about south-west. At another place about thirty miles south-west of Rat Portage, where grey calcareous mica schist and dark calcareous hornblende schist occur, the dip is S. 45° E. < 60°, and both varieties are of a conglomerate character, the pebbles or lenticular patches ranging from an inch to a foot in diameter. On the above route we found some bands of a fine compact even-grained light olive-coloured nacreous mica schist, suitable for hones, and we Compact nacreous mica schist. were given a specimen of the same kind of rock from an island which lies a few miles, in a southerly direction from Rat Portage. The green chloritic schist at Rat Portage is cut by small lenticular veins of quartz. Quartz veins. A specimen from one of these on being assayed by Mr. Hoffmann was found Assay. to contain no gold or silver.

GENERAL DESCRIPTION OF THE GEOLOGY OF THE REGION NORTH-WEST OF LAKE SUPERIOR.

Upper Copper-bearing Series. This series attains its greatest development in British territory in the geological basin of Nipigon, which Geological basin of Nipigon. includes the valley of the Black Sturgeon River and the shores of Black and Nipigon Bays on Lake Superior. The outline of the area occupied by these rocks appears to have the form of an arrow-head lying due north and south, the point lying north of the north-western bay of Lake Nipigon, and the opposite extremity at the entrance of Black Bay. Lake Nipigon itself lies in the eastern half of this area. The length will be about 170 miles, and the breadth, in the latitude of the southern part of Lake Nipigon, about 80 miles. The floor of this basin is overspread by the slates, marls and sandstones of the series, lying nearly horizontally Horizontal strata. on the edges of the Laurentian and Huronian rocks, but they are covered up and concealed in a large part of the area by the great trap overflows, which are thickest towards its central and southern parts and appear Source of trap- to become gradually exhausted towards the north. The source of these great trappean flows is probably marked by the widely spread cracks and fissures which are now filled with dense trappean rock, appearing in the form of dykes that may be regarded as the roots, so to speak, of the overlying sheets of igneous matter: there may also have been vents in the form of craters, and the same fissures and craters may have served as the outlets through which the successive trappean outbursts made their way to the surface. Some of the main vents from which the trap has flowed, are probably to the southward within the space now covered by the waters of Lake Superior, indeed it is probable that the several trappean flows met with in this series had their origin within the area referred to.

The evidence of this lies partly in the fact that these rocks are found on all sides of the lake, but not at any great distance from it, and their arrangement appears to indicate that they have been pressed, as it were, against the older rocks forming the margin of the basin from a point lying towards the centre. On the east side of Lake Superior, Sir W. E. Logan has observed wrinkles on the surface of a bed of trap indicating an easterly flow; and, on the east side of St. Ignace Island, similar wrinkles occur indicating a north-eastward flow, or towards and at right angles to the main shore opposite. (Geology of Canada, pp. 71 and 72.) The structure of a bed of trap which I observed on the Wabinoosh route in 1871 appeared to shew that the material composing it had rolled forward in a north-westerly direction, while still in a viscid condition. The greater length of the area occupied by these rocks in the Nipigon basin is nearly at right angles to the strike of the Laurentian and Huronian rocks lying beneath them. If it were found desirable to give a shorter name to the rocks of the upper copper-bearing series of Lake Superior, I would suggest that of Nipigon. These rocks, as shewn on Sir W. E. Logan's Geological map of Canada, form a broad band along the north-west side of Lake Superior, running all the way from Thunder Bay to Duluth, at the western extremity of the lake. Within our own territory their north-western limit runs inland in a general south-western course from the north shore of Thunder Bay to Gun-flint Lake.

Huronian Series. In the region under consideration, the rocks which are classified as Huronian consist principally of a great variety of crystalline schists, in which a greenish color prevails. In addition to these there are greyish quartzites and schists, sometimes with iron ore, massive green diorites which are sometimes porphyritic, and imperfect gneisses, which are usually finer-grained and less crystalline and hard than those of the Laurentian series. The areas of granite and syenite of this region, which vary in extent from small isolated patches to ranges, many miles in length, and differ considerably in composition, appear to be always more or less intimately connected with the Huronian bands.

As mentioned in the present and in my previous reports on this region, the Huronian rocks appear to succeed the Laurentian conformably, the distinction between the two being chiefly of a lithological character. As nearly as the distribution of the two series can be mapped by means of our present data, it would appear that the various bands of each set of rocks in contact with each other, correspond in their general run, and partake of the same curves and flexures. The general strike of both series of rocks throughout the whole region is W.S.W.

In going north-westward from Thunder Bay to Lake Winnipeg, six apparently distinct belts of Huronian rocks are crossed. They appear to occupy

Prevalence of greenish schists.

Other rocks in Huronian series.

Granite areas.

Conformity of Laurentian and Huronian rocks.

General strike.

Six bands of Huronian rocks.

long V-shaped basins in the folds of the Laurentian strata, and their aggregate breadth is about half that of the Laurentian bands between them. The first, or Thunder Bay band, has a breadth of about fifteen miles behind Thunder Bay, but appears to spread out to a greater width west of the Kaministiquia River. I have observed Huronian rocks in the northern part of the Battle, or Copper group of Islands, east of St. Ignace Island. These may belong to the Thunder Bay band, while the Huronian schists which cross the Black Sturgeon River about sixteen miles from its mouth, and which are again seen at Lake Maria, on the Nipigon, may constitute a spur from the same band. The Huronian schists of the second, or Upper Lake Shebandowan band, on which the new gold field is situated, and which are so largely developed along the national boundary line between Seiganagah and Whitewood Lakes, are separated from those of the Thunder Bay band by the granite and syenite of the Giant's Range.

The third, or Mille Lacs band, has a breadth of ten to twelve miles. The narrow belt of schists which has been mentioned as crossing the outlet of Pembina Lake is in the strike of this band and apparently represents it. Huronian schists with gold-bearing veins are said to occur at Cross Lake on the Red River Route. These would belong to a band between that of Mille Lacs and the fourth band which we crossed. A band of schists said to occur on the Seine below the point at which we left it appears to be identical with the latter. The Huronian schists, which are described as occurring around Vermilion Lake, in Minnesota, may belong to the Cross Lake band, or that of Mille Lacs, or partly to both.

Our fourth, or Brush Creek band began about a mile north of the point at which we left the Seine River, and has a breadth of about eight miles. As already stated, the schists met with on Carr's River to the northward may belong to a fold in this band. The Huronian schists described by Dr. Bigsby as crossing the middle of Rainy Lake (Journal of the Geo. Soc., vol. X., p. 215,) would appear to be connected with this band. The fifth, or Minnetakie band, beginning on the south side of Great Sturgeon Lake and ending at the Pelican Falls, is the broadest one we traversed, having a width of about thirty miles across the strike. At the Lake of the Woods it has a breadth, from north to south, of about forty miles, but this increase in width is due to its folding round upon itself in the manner already described. The sixth or Winnipeg band appears to pass not far to the north of the outlet of Lonely Lake, and was found by you as already stated to cross the Winnipeg a little below its junction with the English River.

The Laurentian series in the country under description presents few points of much interest. It is made up for the most part of common varieties of greyish and reddish crystalline gneiss. They are generally massive and frequently approach a granitic character, but there are also broad micaceous belts and some bands of dark coarse mica schist. They

Not rich in
useful minerals.
No limestones
known.
General strike.

have, as yet, afforded no useful minerals, nor any bands of limestone such as are met with in the Laurentian series in central Canada. Like the Huronian rocks, their general strike throughout the whole region is about W.S.W.

PROGRESS OF MINING ON LAKE SUPERIOR.

Since the date of my previous report on this region, there has been much activity in exploring for mines and making trials in places supposed to be valuable, as well as in working some of the mines which were then known to exist. In pursuing our regular geological investigations, it was impossible for us to visit the whole of the localities at which work was being done, but I shall briefly notice some of the more important of them.

Lead Hills Mine. I visited the Lead Hills Mine, situated on mining-lot C., in the township of McTavish, about three miles in a straight line west of the shore of Black Bay, and found the vein, as described by Professor Chapman, (see Geological Survey Reports for 1869, page 359) to hold, in one part of its course, a solid lode of intermixed galena and copper pyrites, at least four feet in width. The vein runs about N. 60° E. and S. 60° W., and cuts the red indurated marl, which is here associated with grey sandstone; but, at about 300 yards north of the part which is being worked, the red granite of the region rises in the form of a low bluff. The granite is here moderately coarse-grained, and consists of white quartz, light red feldspar and scales of black mica, with a little hornblende in small specks. Where it comes in contact with the red marl in this neighborhood, the latter appears to be somewhat altered.

Red marl and
granite.

Silver Islet.

The workings under Silver Islet had attained a depth of about 150 feet below the level of Lake Superior, the vein continuing productive and giving the miners comparatively little trouble from water. Silver, to the value of about one million dollars, had been extracted since the opening of the mine.

**McKellar's
Island.**

A shaft had been sunk to the depth of about 20 feet on the large calc-spar and barytes vein which occurs on McKellar's Island, a short distance from Pie Island (see Geological Survey Reports for 1869, p. 359) and promising specimens of native silver and silver glance had been obtained.

Jarvis' Island.

A large vein of barytes, calc-spar and quartz crosses the southern part of Jarvis' Island. It runs in a north-westward course and underlies to the north-eastward at a considerable angle. At the time of my visit, a shaft was being sunk upon it, which had reached a depth of about forty feet. Small streaks of silver glance were then being found in a gangue of light grey barytes.

**McKellar's
Point.**

The large calc-spar vein which crosses McKellar's Point has also a north-westward course. A shaft had been sunk upon it to a depth of about

twenty feet, but in the material which had been thrown out I did not observe any ore. A vein holding silver ore and running in the same course was reported to have been discovered upon an island at Pine River Bay. Other discoveries of veins are said to have been made in the new townships in the neighborhood of Cloud River, at Sturgeon Bay, and at a lake lying a short distance south of Loch Lomoad formerly called Lake Ka-za-zee-kee-gee-wa-ga-mog. Reported
discoveries.

On the north shore of Thunder Bay, beginning to the eastward, a vein which was being opened on lot 11, Con. VIII, in the township of McTavish, was visited by one of my assistants, who found it to contain some galena. The "Beck," or Silver Harbor Mine, a short distance from the shore, opposite the east end of Mary's Island, is situated on a brecciated quartz vein, about five feet thick, running north-eastward, and cutting the smoke-colored cherts and black argillaceous shales, which were there seen to run nearly horizontally under what appears to be a thick bed of dark grey trap. From the information given you by Captain Talon that at the "Algoma" Mine, half-a-mile to the east of this spot, the horizontal slates abut against a wall of trap, it would seem that what appears to be a bed at the Silver Harbor Mine may possibly be a dyke with an angle projecting over the slates seen at the base of the cliff. A shaft had been sunk to a depth of about thirty feet, and an adit run to a short distance along the vein on either side of it. In addition to the quartz, which is of a white, granular character, the vein holds barytes, calc-spar, fluor-spar, amethyst, blende, galena and silver glance. Silver Harbor
Mine.

The workings on the vein which had been discovered on mining lot 3 A, about half a mile northward of the Silver Harbor mine, were flooded with water at the time of my visit to that locality, but I was informed by Mr. Borron, Inspector of Mines, and Mr. Peter McKellar, that the vein cuts Huronian slates, and that although small upon the surface it appeared to be widening rapidly in going down. Judging from the specimens which I have seen, this vein must be rich in silver, which occurs native in the form of nuggets, and is associated with sulphide of nickel in a gangue of calc-spar and quartz. 3 A Mine.

The Shuniah Mine, situated on lot 8 in the township of McIntyre, about four miles north of Prince Arthur's Landing, was being actively worked at the time of my visit in July. The vein is here about thirty feet in width, and cuts the granular, silicious, cherty and dark argillaceous slates of the upper copper-bearing series. It has a south-westward course, and is supposed to be identical with the large vein on mining-lot M in McIntyre, the Algoma vein on the north-west corner lot of Neebing, and the large vein at the Paresseux Rapids on the Kaministiquia River. (Geological Survey Reports for 1869, p. 358.) On the Shuniah location a north-facing cliff of trap runs parallel with the vein at a short distance to the south of it. Shuniah Mine.

and the same rock spreads over a considerable area to the southward. The gangue at the Shuniah mine is coarse crystalline white calc-spar, with some lilac patches. The silver occurs both in the native form and as silver glance, but, so far, not very abundantly. Three shafts had been sunk on the vein to the depth of about 15, 50, and 65 feet respectively, and an adit driven between the two deepest.

Singleton Mine. An opening, known as the Singleton Mine, was made during the summer to the depth of a few feet on a quartz vein in the north-west corner of the town-plot of Prince Arthur's Landing, and some fine specimens of disseminated native silver obtained.

Thunder Bay Silver Mine. The Thunder Bay Silver Mine, described in my report for 1869, has not been worked since the winter of 1869-70.

Shebandowan gold region. I had not an opportunity of visiting the Shebandowan gold region. Mr. Peter McKellar, who was engaged with me on the Geological Survey in 1869 and 1870, has described it so well in a letter which he wrote me on the 14th of November, 1871, that I cannot do better than copy his description in this place. He says: "Last spring I was exploring in the new gold-field. It is situated between fifteen and twenty miles south-west of the western extremity of Lake Shebandowan, on Huronian strata of the same kind as those which cross the old Dog Lake trail in the vicinity of the twelve-mile post," (see Geological Survey Reports for 1869, p. 329.) "They are composed of highly inclined beds of diorite, dioritic, chloritic, argillaceous, silicious and talcoid slates, massive greenish porphyries and porphyritic slate, and thick beds of greenish slate-conglomerate, with granite. The latter is intrusive and may have something to do with the metalliferous character of the lode in question. There are bands of magnetite and of quartzite interstratified with these rocks. The strata dip north-westward, the angles being from 60° to 80°. The gold is found in grains and thin leaves, associated with the ores of copper, silver, lead, iron, &c., in a quartz vein from two to six feet wide, which is well defined and carries a highly metalliferous character for more than half a mile to my knowledge. There is also a layer of soft talcoid slate along with the quartz, which I believe will also be rich in the precious metals. The vein, in general at least, conforms with the strata. I have had the pleasure of being the discoverer of the free gold and also of the silver in this new region." Mr. McKellar also observed that the slates in the vicinity of this vein contain a good deal of dolomite.

Heron Cove Mine.

Gold and silver have also been found in a quartz vein, which was being worked, about a mile east of Heron Cove, near the Pic, in a horizon in which Mr. McKellar had predicted, from the geological relations, it would be found. I had an opportunity of paying a hurried visit to Heron Cove on our way home from Thunder Bay in the autumn. The rock at the landing, in the bight of the cove, consists of

rusty-weathering greenish-grey, dolomitic schist and other Huronian schists of a similar color, all striking westward. Some specimens of the ore which I took from a heap at the landing, on being assayed by Mr. Hoffmann, have yielded gold 0.058 oz., value \$1.19, and silver 7.03 ozs., value \$9.06 per ton of 2000 lbs.

SURFACE GEOLOGY.

The superficial geology of the Nipigon and Thunder Bay regions was described in my report for 1869. In proceeding westward by the Red River Road, the stiff red clay of the Kaministiquia valley was found to extend westward up the valley of the Mattawa to the outlet of Shebandowan Lake, becoming apparently less abundant all the way, and finally disappearing on reaching Shebandowan Lake. Around the shores of this lake, and indeed of nearly all the lakes we passed through on our journey to Lake of the Woods, by way of Lonely Lake and the English and Winnipeg Rivers, wherever the vegetation is burnt off, the rocky mammillated hills are seen to be strewn with rounded and angular boulders, from the size of a man's head, to to a diameter of thirty or forty feet. Many of these are perched in positions, from which they look as if they might be easily rolled into the water below.

The glacial striæ might be observed on the surface of the rocks almost everywhere in the region examined between the height of land and Lake of the Woods. I noted their course in a great number of places and found it to vary from south to south-west, averaging perhaps S. S.W.

ROBERT BELL.

Office of the Geological Survey,
Montreal, February 24th, 1873.

All the bearings in this Report have reference to the Magnetic Meridian.