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SUMMARY REPORT
OF THE
OPERATIONS OF THE GEOLOGICAL CORPS.

TO 31st DECEMBER, 1880.

BY

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The work of the Geological Corps during the season of 1880 embraced explorations and surveys in :—

1. The North-West Territories; Souris River Coal Fields. Districts examined.
2. Manitoba. (Hudson's Bay Basin.)
3. Quebec ; on both sides of the St. Lawrénce.
4. New Brunswick.
5. Nova Scotia.
6. The Magdalen Islands.

No field work was done during the season of 1880 in British Columbia, British Columbia. Dr. G. M. Dawson being occupied in the early part of the year in working up the results of his Peace River Expedition of 1879, and during the Director's absence in the North-West in May, June and July, in attending to correspondence, and to the printing of the Annual Report. In August he received leave of absence to attend the meeting of the British Association and to visit the Continent. Returning early in November, he has since been occupied with the printing of his report on the Peace River explorations, and the preparation of the map to accompany it. This map embraces all the available information regarding a region about 130,000 square miles in extent, from the Pacific Ocean to the 112th meridian, and from the 54th to the 57th degree of north latitude. Considerable time has also been devoted to arranging specimens from British Columbia previous to packing them for removal to Ottawa.

The report and map above referred to form a part of the present volume, and will be found to embody the best and most reliable information regarding this vast and interesting region.

In March, 1880, it was decided to make an investigation by boring to obtain more precise information respecting the Tertiary lignite-coal seams of the Souris River, more especially as regards their eastern extension from the known outcrops in the vicinity of Roche Percée. With this object in view, a contract was entered into with Messrs. McGarvey & Highman, of Petrolia, Ontario, to make two or more borings in the valley of the Souris River, the aggregate depth not to exceed 800 feet, for the sum of six thousand dollars; the sites, not more than 25 miles apart, to be selected after a careful examination of the ground. This examination was undertaken by the writer, and occupied him from the 13th May to the 30th August. Expenses, \$1,204.30. The boring commenced about seven miles east of the Roche Percée on the 12th July, and finished on Turtle Mountain on the 6th October, 1880. The details of this work are given in the accompanying report (A), and also as closely pertaining to it, the report of Dr. G. M. Dawson on his examination of the same district in connection with the International Boundary Survey. This was first published in 1874.* The volume referred to is now out of print. It has, therefore, been considered desirable to reprint here that portion of it which relates more especially to the distribution and value of the Tertiary lignite coal beds of this region; and for this purpose it has been revised and partly re-written by Dr. Dawson. Vide Appendix I.

Dr. Robert Bell, with Mr. Cochrane as assistant, and Messrs. Molson and Langford, volunteers, left Montreal early in June, with instructions to continue his explorations of previous seasons in the Hudson's Bay basin, and if practicable to return to Canada by proceeding in the Hudson's Bay Company's ship from Churchill or York Factory to London, with a view of making observations on the navigation of the Hudson's Bay and Straits. This, through the kind assistance and facilities afforded by the officers of the Company, Dr. Bell has accomplished. The passage, owing to calms in the straits, and head winds on the Atlantic, occupied from the 10th September to the 17th November, or nearly three times the average duration. The three weeks during which the vessel was passing through the straits afforded good opportunities for observing both shores in many places, as well as the islands. Dr. Bell returned to Montreal on the 14th February, 1881, and his report now presented contains full particulars of the season's explorations, which cost \$1,945.35. This report and the annexed weather statistics

* Geology and Resources of the 49th Parallel, by G. M. Dawson

The North
West
Territories.

Souris River
borings.

Hudson's Bay
basin.

will be found especially interesting in connection with the navigation of Hudson's Bay and the oft stated impossibility* of constructing a railway to Forts Churchill or York from Manitoba.

In the Province of Quebec, on the north side of the St. Lawrence, Quebec. Explorations of Mr. Vennor. explorations were continued by Mr. Vennor in the counties of Argenteuil, Terrebonne, Montcalm and Joliette, embracing about 900 square miles. A number of details of interest and importance in connection with the distribution of the bands of crystalline limestone and the labradorite rocks were ascertained; and in association with the latter promising deposits of iron ore were discovered at a number of new points, at one of which, near St. Jerome village, a considerable amount of work has since been done by a United States company with a view to its development. Mr. Vennor's exploration occupied from the 2nd June to 27th November; expenses, \$909.43.

In anticipation of a final report promised by Mr. Vennor, giving the detailed results of his two seasons' work in this region, the following statement of the general conclusions he has arrived at may be given:

"In these explorations, perhaps, the most important results arrived at were in connection with the bands of crystalline limestone on the western side of the labradorite area, and the junction of these with the great mass of anorthosite rocks already mapped and described by Logan † These limestones, as a whole, appear to be perfectly conformable with the stratified anorthosites, but are occasionally interfered with and disturbed by intrusions (?) of the more massive and granitoid variety of labradorite. This last rock—in which there are no indications of stratification—occupies a very considerable area in the townships of Abercrombie, Howard, Morin, Wexford, Wolf, Beresford and Doncaster. Its exact outline is not easily ascertained, but I have laid down a provisional line that will indicate sufficiently closely the area occupied by it—some 250 to 300 square miles.

The anorthosite (stratified) formation appears to come in beneath the first or lowest band of limestone (Trembling Lake band) and a very considerable part of "Trembling Mountain" is composed of gneiss of this character.

The St. Jerome band of limestone was discovered at a number of additional localities to the north-westward of the village, and was traced to a connection with that of St. Godfrey and St. Sauveur, and this last through Howard to a junction with the 'Trembling Lake' band in De Salaberry. Between this *lowest* or 'Trembling Lake' band and the *second*, or 'Green Lake' band of Logan there are also occasional

* Statement of the Deputy Governor of the Hudson's Bay Company, annual meeting in London, 1879.

† Geology of Canada, 1863.

recurrences of the granitoid labradorite, and many of these exposures have the general appearance of eruptive rocks. One of these masses has been indicated by Logan as occurring on the north-west corner of De Salaberry; and was here supposed to cover (unconformably) and conceal the further run of the limestone, but we succeeded in tracing this latter continuously around the western side of the former to a connection with the 'Lake Sam' band."*

If the foregoing determinations by Mr. Vennor, which are given in his own words, are correct, they seem very conclusively to prove what I have already stated to be my opinion, viz: that the labradorite or Norian rocks of Hunt do not constitute an unconformable upper Laurentian formation, but occur in part as unstratified intrusive masses, and in part as interstratifications with the orthoclase gneisses, quartzites and limestones of the Laurentian system, as developed in the Grenville region, and mapped by Sir W. Logan.

Explorations of
Messrs. Ord
and McConnell.

To the east of the region examined by Mr. Vennor, a large area, 1,600 to 1,700 square miles, was examined by Mr. Ord and Mr. McConnell, in the counties of Berthier, Maskinonge and St. Maurice, and 350 miles of road, not shown on any existing plan, were measured by pacing. The Matawin River was examined in canoe from the township of Brassard to the St. Maurice, also its tributaries from the north and northeast: rivers du Millieu, au Lac Claire and à la Chienne, as well as some of the lakes forming the head waters of Rivière du Loup. The greater portion of this area is occupied by almost flat-lying Laurentian gneiss, forming the summit of an anticlinal axis. One band of limestone, supposed to represent the lowest on the west side of the anticlinal, was found on the St. Maurice with an easterly dip, and it seems probable that the higher bands which occur to the west of the great area of massive labradorite in the townships of Howard, Morin, Abercrombie, etc., may yet be discovered east of the St. Maurice River, together with some of the valuable mineral deposits with which they are usually associated. The explorations of Messrs. Ord and McConnell occupied from the 6th June to the 26th September; expenses, \$728.35.

Describing the region of country between the Assomption River and the St. Maurice, Mr. McConnell says: "Among the more important varieties of rock observed in this region may be mentioned gneisses, ordinary grey, garnetiferous, hornblendic, etc., massive red syenite, bedded and massive norites, pyroxenites, and a few more or less impure bands of crystalline limestone.

The syenite spreads over an area of about 100 square miles, extending from St. Norbert to Lac Pin Rouge, a distance of about twenty-five

* See Logan's map, Atlas Geol. of Canada, 1863.

† Geological Survey of Canada, Report of Progress, 1877-78, pp. 10-13 A.

miles. Everywhere it maintains a distinctly massive character, and shows no traces of stratification, though in texture it is far from uniform, being both fine and coarse grained, and in one or two instances the crystals were flattened in such a manner as to give the rock an almost shaly or schistose structure. In one place only was actual contact observed between the syenite and the surrounding gneisses; there the bedded rock dipping at an angle of about 70° appeared to strike against the syenite at an angle of 20° and to be cut off by it.

Norites—Several small bands of the bedded variety of this rock occur between St. Jean de Matha and Lake Maskinonge, all alternating with, and conformable to the gneisses of the region.”

On the south side of the St. Lawrence Mr. Webster has made explo-^{The Eastern Townships. Explorations of Mr. Webster.} rations over a large area, about 3,000 square miles, extending from Lake Memphremagog northward and north-eastward along the New Hampshire and Maine boundaries. The whole of this region is auriferous, and no examination had hitherto been made of a large part of it. It seemed very desirable to ascertain more definitely the probable economic value of these auriferous deposits, also to determine the extent of the granitic areas, their relation to the adjacent strata, and the influence of the granitic intrusions on the auriferous character of the surrounding formations, which correspond in all respects with those of some of the richest of the Australian gold fields.

Another season's work in this region will be required before the distribution of the formations can be correctly laid down. The greater part of the area is occupied by strata of Silurian age, interrupted, however, by others which are apparently repetitions of the crystalline schists of the great Sutton Mountain anticlinal to the north-west, and probably of lower Cambrian or upper Huronian age.

The granites are for the most part pretty uniform mixtures of white orthoclase, quartz and black mica, forming a good and durable building material. Their general characters have already been described by Sir W. Logan.* There is no doubt they are of later origin than the Silurian rocks which surround them, and which are everywhere, on approaching the granite, considerably altered; chialstolite, andalusite, garnet, mica and other minerals appearing in the slates, which are also occasionally changed to quartzose or felspathic mica schists, and the associated fossiliferous limestone to crystalline and micaceous dolomites with the fossils still perfectly distinct. It has been customary and orthodox to regard these granites as “intrusive,” and they are so design-^{Intrusive granites.} ated by Sir W. Logan. I hold that there is absolutely no proof of their being so, either in the Eastern Townships, in Nova Scotia, or in

* Geology of Canada, 1863, Chapter XVI.

Australia, and that all the phenomena connected with them may be more readily explained and understood if we regard them as completely metamorphosed portions of the strata which now surround them; while the mere displacement of strata involved in the intrusive theory appears, in view of the enormous areas now occupied by the granite, wholly inexplicable, as does also the manner in which the surrounding strata often dip down against and on to the granite, and show no signs of having been deflected or otherwise affected as regards strike and dip by the supposed intrusion.

There is, however, often seen along the contact lines of the granite and the slates a considerable breaking up and crushing of the latter, and this has been held to indicate, and be the result of the intrusion of the granite. It appears to me to be mainly due to the unequal resistance that the two rock masses have offered to the disturbing forces of upheaval, depression and consequent pressure which have repeatedly affected them long after the formation of the granite. The effect thus produced is analogous to that which occurs where the forces producing slaty cleavage encounter interstratified hard layers of sandstone, when the elsewhere perfectly regular and parallel cleavage planes are immediately crushed, crumpled and deflected.

In regions where the granite or other hard, crystalline rock is older than the adjacent or alternating softer strata, perfectly similar contact lines may be seen, but unaccompanied by any change in the mineralogical character of the adjacent strata, such as occurs when the crystalline rock is the youngest; and therefore this phenomenon cannot be taken as conclusive evidence of the intrusive origin of granite or other crystalline rock.

The work in New Brunswick was continued in the north-east in the counties of Northumberland, Gloucester and Restigouche by Mr. Ells, and south of the river St. John in the counties of York and Carleton by Mr. Broad, who also connected his work with that of Mr. Ells by a survey of the road, about 100 miles, from Fredericton to Newcastle. Altogether more than 400 miles of roads were surveyed during the season by odometer and chain; about 950 miles of the courses of the south-west Miramichi, the Nipisiguit, the Upsalquitch and the Restigouche Rivers and their tributaries, by canoe; and numerous traverses made through the woods to examine and define the limits of the several geological formations. Mr. Ells' explorations occupied from the 3rd May to the 25th November; expenses, \$926.74. Mr. Broad's exploration occupied from the 3rd May to the 25th November; expenses, \$517.94.

Mr. Ells' detailed report is submitted with this, see pages D. 1 to 47, but it is considered desirable to defer the publication of Mr.

Broad's report till the topographical survey of the region is further advanced.

In Nova Scotia, Cape Breton Island, the work of the survey under Mr. H. Fletcher comprised further explorations and measurements in the Richmond and Port Hood coal fields; also surveys of roads and brooks between Whycocomagh and Mabou River, and between Cheticamp and St. Ann's Harbor. The courses of the Margaree, Middle and St. Ann's Rivers were also surveyed. The gold mines of Middle River occur in a series of schistose rocks, which extends far to the northward, and is probably the source of the gold previously discovered by Mr. Campbell in the sands of the Cheticamp River, Jumping Brook, and other streams. The formation should therefore be carefully examined and its limits accurately defined and of even greater importance is the accurate determination of the lines of contact of the Carboniferous and the pre-Cambrian formations, as along these lines all the valuable deposits of iron and manganese ores occur, such as those recently discovered at Fork's Lake, on the flank of the Coxheath hills, and at the head of Loch Lomond. The season's explorations in Cape Breton occupied from the 4th May to the 25th December; expenses, \$1,259.31. For detailed report of these investigations see pages F. 1 to 125.

Work in Nova
Scotia by
Mr. Fletcher.

The examination of the fossil plants of the Carboniferous rocks of Canada, in the collection of the survey, commenced in 1879, has been completed. The species not hitherto determined have been identified by Principal Dawson. The whole series is now properly named and labelled.

Palaeontological
work.

The following collections have been examined during the year :

1. A small series of fluviatile mollusca from the Lignite Tertiary, or "Fort Union Group" of the Souris River, Manitoba, collected by the Director.

2. About 90 specimens of fossils, or fragments of fossils, from the Palaeozoic and presumably Devonian rocks of the Pine, Battle, Burnt and Elk Rivers, B. C., collected by Dr. G. M. Dawson, in 1879.

3. Rather more than 100 specimens of Cretaceous fossils from the Burnt, Battle, Pine and Smoky Rivers, and Coal Brook, B. C., also collected by Dr. G. M. Dawson, in 1879. Notes on the two last mentioned collections have been prepared and published in Dr. G. M. Dawson's report in this volume.

4. 79 specimens of Lower Silurian and Devonian fossils from the Red River, Manitoba, and the valleys of the Nelson and Churchill Rivers, collected by Dr. R. Bell, in 1879. A report on these fossils has been prepared by Mr. Whiteaves, and published as a supplement to Dr. Bell's account of his explorations on the Churchill and Nelson Rivers.

5. 50 specimens of fossil fishes, from the Devonian rocks of Scaumenac

Bay, Restigouche River, Baie des Chaleurs, collected by Messrs R. W. Ells and T. C. Weston, in 1880. A paper describing the species in these two collections has been published in the August number of the "American Journal of Science" for 1880.

During the months of July, August and part of September, Mr. A. H. Ford was engaged in an examination of the fish-bearing beds of Scaumenac Bay, P. Q. From this locality he has collected 282 specimens of fossil fishes, most of them of great interest, although the actual number of species is not very large. This collection has been subjected to a preliminary examination, and some notes on the specimens have been read at a meeting of the Natural History Society of Montreal, held on the 25th of October, 1880.

One hundred and fifty-five fossils from the Clinton and Niagara formations (Silurian), of Hamilton, Ontario, have been presented by Colonel Grant during the year.

Since the commencement of October, 1880, a considerable portion of the time of Messrs. Whiteaves and Ford has been occupied in labelling specimens, and in supervising the packing of fossils, and other preparations for the removal to Ottawa.

Work of Messrs.
Weston and
Willimot.

The work of Messrs. Weston and Willimot, in the Museum, has consisted largely in preparations for removal, including the packing and cataloguing the contents of upwards of 900 boxes and barrels, 326 of which were removed to Ottawa before the close of navigation in November, 1880.

Chemical
branch.

The work in the laboratory of the Survey has included:—

1. Analyses of lignite or brown coal, from the N. W. Territory and British Columbia.
2. Analyses of iron, copper and manganese ores.
3. Analyses of graphitic rock.
4. Gold and silver assays.
5. Miscellaneous examinations, embracing the qualitative examination of a mineral water, the estimation of nickel and cobalt in pyrrhotite from various localities, &c., &c.

In addition to the foregoing work many other miscellaneous examinations have been made of mineral specimens either sent to or left at the Museum for that purpose. A very appreciable amount of time has been devoted to visitors having minerals for identification, or desirous of acquiring information in regard to the economic importance of others. The details of the work are given in Mr. Hoffmann's report. See pages H. 1 to 21.

Library.

Twenty volumes have been added to the library by purchase, and 152 books, pamphlets and maps have been presented during the year, in return for the publications of the survey; 745 copies of which have

been distributed from the office of the Survey in Montreal, in addition to those distributed by the Interior Department from Ottawa.

1,183 names were registered in the visitors' book during the year, ^{Visitors to the Museum.} being 447 fewer than during the corresponding period in 1879. This falling off is probably due to the very general impression which has prevailed for some time, that the Museum was already removed to Ottawa.

The staff of the Survey as now classified under the Civil Service Act, consists of:—

- 1 Chief Officer,
- 4 First Class,
- 8 Senior Second Class,
- 5 Junior Second Class,
- 2 Third Class.

Mr. James Richardson and Mr. Robert Barlow have retired under the superannuation provisions of the Civil Service Act.

The Annual Report for 1878-79 was issued early in 1880, in a volume ^{Annual Reports.} of 375 pages, 8vo., with 29 illustrations and eight geological and topographical maps. It is, as usual, published in English and French. The English edition, 3,500 copies, cost \$1.15 per copy; and the French edition, 500 copies, cost \$3.90 per copy.

In connection with the foregoing the Director desires to call attention to the fact that while the cost of publishing the results of the labor of the Geological Corps, and likewise the salaries of the Staff are annually increasing, no corresponding increase has yet been made in the annual appropriation for the work, which has continued for the past four years at the sum of \$50,000, which, to carry on explorations extending from the Atlantic to the Pacific, to support a Museum, Laboratory and Library, and to publish the results of the work accomplished, in two languages, is, it is submitted, wholly insufficient, and must be accepted as an excuse for many of the imperfections and shortcomings of the published work.

MONTREAL, 1st May, 1881.