

**SUMMARY REPORT OF THE OPERATIONS
OF THE GEOLOGICAL AND NATURAL
HISTORY SURVEY TO 31ST
DECEMBER, 1889, BEING PART III,
ANNUAL REPORT OF THE DEPARTMENT
OF THE INTERIOR, 1889**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649284030

Summary Report of the Operations of the Geological and Natural History Survey to 31st december, 1889, being Part III, Annual Report of the Department of the interior, 1889 by Various

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DEPARTMENT OF THE INTERIOR,
GEOLOGICAL AND NATURAL HISTORY SURVEY AND MUSEUM BRANCH,
OTTAWA, 31st December, 1889.

The Hon. EDGAR DEWDNEY, M. P.,
Minister of the Interior,
Ottawa.

SIR,—I have the honor to submit herewith the customary summary report of the work of the Geological and Natural History Survey corps during the past calendar year.

From January to May was occupied in the preparation of the reports and maps that have since been published, forming a volume, in two parts, of about 1,400 pages, with numerous maps and illustrations. It contains thirteen separate reports, relating to the geology, the mineral resources and the natural history of various portions of the Dominion, from British Columbia and the North-West to Hudson's Bay and Nova Scotia.

The following publications have also been prepared and published during the year:—

1. Vol. I., Part 2, Contributions to Canadian Palaeontology.
2. Description of eight new species of fossils from the Cambro-silurian rocks of Manitoba, with six plates.
3. Contributions to the Micro-Palaeontology of the Cambro-silurian rocks of Canada: by Ulrich.
4. List of publications of the Geological and Natural History Survey of Canada from 1843 to 1889, with prices, and a brief description of the contents and the arrangement of the Museum and Library. 36 pp., R. 8vo.

There are also in preparation and in part ready for press:

1. Enumeration of Canadian Liverworts, with Notes.
2. Part V. of the Catalogue of Canadian Plants.
3. Catalogue of Canadian Birds, with their Habits and Range; also, list of species now represented in the Museum.
4. The Vertebrate fossil fauna of the Tertiary rocks of the North-West, with plates: by Prof. E. Cope.

Early in April, 16 parties were organized for field exploration, and were distributed as follows:—British Columbia, 3; North-West Territory, 2; Manitoba, 1; Ontario, 2; Quebec, 4; New Brunswick, 2; Nova Scotia, 2. A brief summary of these explorations is given in the following pages, as well as of the work that has been performed in connection with the Museum, the Chemical Laboratory and the Library.

Up to the end of June my own time was fully and constantly occupied in attending to executive details, in answering enquiries verbally and by letter, and in work connected with editing the Annual Report and maps above referred to. On the 5th June I left Ottawa, for the purpose of making some observations at various points along the north shore of the lower St. Lawrence and in the Strait of Belle Ile. This was effected by securing a passage on board the Lighthouse Service steamer "Napoleon," but afforded opportunities for examination only at widely separated points, mostly at or in the vicinity of the lighthouses, along the great stretch of over 500 miles of coast line, extending from Point des Monts to Belle Ile. Some interesting facts were, however, ascertained, and I have acquired such a general knowledge of the character of the country as will enable me better to direct any future explorations that may be undertaken in this region with a view to ascertaining what its mineral resources are. In this connection it may be stated that Belle Ile itself, hitherto supposed to be composed of Laurentian gneiss, was found to consist largely, if not wholly, of various crystalline and sub-crystalline strata, like those of the

Huronian mineral-bearing belts of the country north and west of Lakes Huron and Superior, and it is not improbable that considerable areas of these rocks may yet be found on the main land of Labrador; and, if so, they may be expected to be accompanied by deposits of valuable economic minerals, like those which characterize them in all the areas where they have yet been recognized and explored.

Hasty examinations were made, and specimens collected, at the following places:—Point des Monts, Egg Island, Pentecoste, Sheldrake, Seven Islands, Perroquette Island, Equimaux Island, West, South-west and South points of Anticosti, Greenly Island, Point Amour, Chateau Bay and Belle Ile; and in Newfoundland at Cape Bauld and Quirpon Harbor, and at Capes Norman and Rich. The geological formations of the northern peninsula of Newfoundland have been described in the *Geology of Canada, 1863*, and are there all referred to one or other of the divisions—Levis, Lauzon and Sillery—of the Quebec group. From what I have seen this summer I am led to believe that the true order of succession of the strata has been misinterpreted, as it was in the Eastern Townships, and that much of the so-called Sillery and Lauzon is probably Huronian, but certainly not more recent than Lower Cambrian. Diorites and serpentines appear to be somewhat largely developed, and it seems quite likely that valuable deposits of asbestos may accompany them, as they do in the Eastern Townships of Quebec.

In this connection it may be interesting to quote some passages from a Memoir by A. S. Packard, Jr., read before the Boston Society of Natural History, October, 1865, and published in Vol. I of its Memoirs.

On page 216, under the heading "Huronian Group," he says: "A system of quartzite and trap rocks which lie in a depression of the Laurentian rocks, about 125 miles long and probably 25 miles broad, stretching along the coast between Domino Harbor and Cape Webuc, I refer with some hesitancy to the Huronian series of Sir Wm. Logan, and consider as probably equivalent to the Quartzose division of the primitive slate formation of Newman and Keilhau. It agrees in part with the Domino gneiss of Mr. Lieber." The author then gives further interesting details of these strata, and in conclusion, page 218, says: "Should further search prove the existence, in connection with this quartzite, of beds of a true conglomerate, which we should look for in the interior, and of the presence of copper ore in connection with quartz veins near the trap rock, the identity of this formation with the Huronian rocks of Canada and of similar rocks in Sweden would seem satisfactory; and, if proven, will be interesting, not only to the geologist, but be of practical value in the search for ores on this coast."

Mr. Packard also describes the remarkable columnar basaltic, trap rocks of Castle and Henley islands, in Chateau Bay, but I think erroneously assigns them to the Laurentian. From their attitude and appearance, they are, I think, more probably of Cambrian age, and equivalent to the Animikie of Thunder Bay, Lake Superior, Lake Nipigon, and the islands on the eastern shores of Hudson's Bay. No such rocks are, so far as I am aware, associated anywhere with the Laurentian system. If this proves to be correct, we may expect to find areas in East Main and Labrador of both the Archaean (Huronian) and the Cambrian (Animikie) metaliferous-bearing zones of Lake Superior. The white quartzites of Marble Island, described by Dr. Bell* as Huronian, seem to correspond closely with those described by Mr. Packard at Domino Harbor and Cape Webuc, while the columnar basalts of Castle and Henley Islands, Chateau Bay, are almost identical with those of Castle Peninsula, Richmond Gulf, † the Outer and Inner Barns of Lake Nipigon and the better known trap formation of Thunder Cape, Pie Island and McKay's Mountain, on Lake Superior.

At Sheldrake near the eastern end of the Seigniory of Mingan, and both east and west of the settlement, the coast is occupied by massive Labradorite rocks. On shore, where tidal action has polished these rocks, some fine examples of the beautiful opalescent anorthosite or labrador spar were observed, but specimens could not

Boston Society Natural History, Vol. I, 1866-69.

* Report Geological Survey of Canada, 1882-83-84. P. 35 D.D.,

† Bell—Geological Survey of Canada, Report 1877-78, p. 14c.

be easily obtained without appliances for blasting the rock. Inland for a considerable distance, where the vegetation has been burnt, the weathered surfaces of these rocks are perfectly white, making the country look as if there had been a heavy fall of snow. The extent of the area of these rocks in this region is entirely unknown. It is not impossible that it is continuous with that described by Prof. Hind, on the Moisie River and its branches, † and that this again extends continuously south-eastward to Pentecoste River, where similar rocks occur as described by Richardson.* We should then have in this region the largest known area in Canada of these Norian rocks, and here doubtless it would not be difficult to determine their true relations to the red and grey granitoid orthoclase gneisses, which they have been supposed to unconformably overlie. There can, however, be little doubt that they are intrusive igneous rocks. On the 29th July I returned to Quebec, where Prof. C. Walcott, of the United States Geological Survey, met me by appointment, for the purpose of examining some of the typical sections around Quebec, on the correct interpretation of which so much has of late years been said and written by the geologists of the United States and Canada.

From the 14th to the 23rd August I was occupied, in company with Professor Walcott, in studying the relations of the Cambrian and Cambro-silurian formations on either side of the boundary between Vermont and Canada, with a view to uniformity of mapping by the respective surveys, and which, it is hoped, will now be secured.

After attending the meeting of the American Association for the Advancement of Science, in Toronto, from the 28th of August to the 2nd of September, a few days were spent—with a similar object in view to that above referred to, but in connection with the work now in progress along the Minnesota boundary, in company with Professor N. H. Winchell, of the United States Survey, and Dr. Lawson—studying the Huronian rocks around Sudbury and Algoma, and in an endeavor to show that the metaliferous Huronian strata of the Sudbury-Algoma region do not differ in any important particular from the similarly metaliferous schists, etc., which occur in the country between Lake Superior and Lake Winnipeg, including the Lake of the Woods, and Rainy Lake and River. In connection with this matter, and the importance of the work of tracing out and mapping these bands or belts of Huronian rocks, I may here quote what I wrote respecting it in 1873: * *

"Apart from the geological interest which attaches to the determination of the distribution of these rocks and their precise relations to the underlying Laurentian gneiss, the foregoing facts show that it is economically important that the extent of these bands should be defined; and that their mineral characters should be closely investigated is equally so, inasmuch as the gold, the copper and the iron of the region, as far as known, are associated with similar strata, and thus not only the best land, but likewise valuable mineral deposits, are to be looked for within the limits which they occupy." * *

Since the above was written, nearly all the discoveries and developments of mines and minerals in the Huronian areas that have been indicated by the Survey have been made. That these facts are somewhat of the nature of cause and effect may, I think, reasonably be surmised; and whether they prove the truth or otherwise of the reiterated and apparently somewhat popular statements that of recent years the Survey has paid no attention to and takes no interest in the development of the mineral resources of the country may perhaps be left to the decision of the public and to the testimony of the sixteen volumes of reports, maps and other documents that have been published by the Survey since 1870.

In the enormous area which stretches from the Georgian Bay north-west to the Mackenzie River, and from the same point north-east to the Straits of Belle Ile and Cape Chudleigh, there are probably many such areas to be investigated and located; and a

† Explorations in the interior of the Labrador Peninsula, 1863.

* Geological Survey of Canada, Report 66-69, p. 367.

* Geological Survey Report of Progress, 1872-73, pp. 13-14.

map on which they are even roughly indicated will always be a valuable guide to the mineral prospector.

The rest of the season, from the 9th of September to the 10th of October, the date of my return to Ottawa, was devoted to investigations and enquiries bearing on water supply in the North-West. The artesian wells of the James River valley and Devil's Lake, in Dakota, were visited, and also the boring now in progress at Deloraine. The quality of the water in the Dakota wells varies considerably. Most of the wells give a copious supply of excellent water. At Devil's Lake, however, though a copious supply was obtained at about 1,750 feet, the water, though good for stock, contains too much saline matter for ordinary domestic uses. There seems every probability, when a sufficient depth has been reached at Deloraine, of a good supply of artesian water being obtained. What the quality will be there is no evidence to show, but this is not now important, because even if as saline as is much of the surface and the artesian water of the Red River valley, it can, by a simple and inexpensive process of filtration, be made sufficiently pure for all domestic uses. This has recently been proved by experiments made at my suggestion on some of the most saline water of the Red River valley south of Winnipeg. It consists in simple filtration through from 50 to 60 feet of sandy gravel. Further experiments will perhaps suggest additions to the material used that would render the process still more perfect. Even as it is, the importance and value of this discovery to the whole of Manitoba and the North-West in such seasons as that of 1889 can scarcely be estimated.

The history of the discovery and development of natural gas in Ontario, to which I briefly referred in my last summary report, is interesting; but as it is somewhat of a personal character, I shall not now refer to it. The results attained during the past year are stated under the head of mineral statistics. They are highly satisfactory; but it would be well to bear in mind that the supply is not inexhaustible, and that wells that are now sending out their millions of cubic feet a day will gradually decline and become extinct. The greater the number of wells bored in a district the sooner will this inevitable event occur. Unlike water, neither gas, nor oil, nor coal, are constantly replenished, and must therefore sooner or later be exhausted. I called attention to this in my summary report for 1887, pages 24-25; and on page 30 of my summary report for 1888, in commenting on Mr. Coste's report on investigations I had directed him to make the spring of that year. I said: "There seems no reason why further trials, especially in that part of Ontario between Lake St. Clair on the south-west and Lake Simcoe on the north-east, should not prove more successful and yield as abundant a supply of gas or petroleum as do some of the Ohio wells." Since that expression of opinion, all the large gas wells now referred to have been bored.

Dr. G. M. Dawson was, during the past season, again occupied in continuing the geological exploration of the southern part of the province of British Columbia. In consequence of the recent important mineral discoveries in the West Kootanie district, it was considered desirable that he should visit that district in the first instance, and should afterwards give as much time as possible to the completion of the more systematic work on which he had previously been engaged in the Kamloops region. Dr. Dawson, who was assisted by Mr. J. McEvoy, B. Ap. Sc., and by Mr. P. Edgar, furnishes the following summary account of the explorations carried out:—

"About a month, in the earlier part of the summer, was devoted to the examination of the more important localities in the West Kootanie district, which have lately been proved to afford valuable ores. While I was occupied in this work, accompanied by Mr. Edgar, Mr. McEvoy was independently engaged in examining a stretch of country between the North Thompson and Bonaparte Rivers, along the northern edge of the geological map-sheet now in course of completion. Work during the remainder of the season was practically confined to the area of the sheet just referred to.

"It should be explained that, in conformity with the suggestion made in last year's Summary Report, the area covered by the original reconnaissance map of the Southern Interior portion of British Columbia, was divided into four equal parts, each forming a square of eighty miles side, and including a superficies of 6,400 square miles. The scale was at the same time increased from that of eight miles to that of four miles to the inch, and a preliminary compilation on that scale was made by Mr. McEvoy before field work commenced. The sheet to which the field work of last summer related, extends in longitude from the vicinity of the North Thompson to that of Lillooet (long. $120^{\circ} 10'$ to 122°), in latitude from $50^{\circ} 10'$ to $51^{\circ} 20'$. The exploratory work required for this sheet may now be considered as completed, with the exception of a belt of mountainous country to the west of the Fraser between Lillooet and Lytton. The enlargement of the scale of the map will enable greater justice to be done to the somewhat complicated geological and topographical features of the country.

"The Kootanie district, to the south of the line of the Canadian Pacific Railway, is naturally separated by the high, rugged, axial portions of the Selkirk and Purcell ranges, into eastern and western sub-districts. The first of these may be reached by ascending the Columbia from Golden, the second from Revelstoke, by way of the Columbia River and Arrow Lakes. Much prospecting has been going on in both East and West Kootanie for the past two or three years, and a large number of promising discoveries—chiefly of silver-bearing ores—have been made. The West Kootanie sub-district was that visited by me last summer, and in it no previous observations by officers of the Survey had been made, with the exception of a traverse of the Columbia and Arrow Lakes by Mr. Bowman in 1884.

"Attention was first prominently drawn to the mineral wealth of the West Kootanie region when the discovery of rich ore by the Hall Brothers on a mountain which has since been known as Toad Mountain became known in 1887. Many prospectors soon flocked to the vicinity and a large number of claims have since been taken up, not only on and near Toad Mountain, but also at Hot Springs or Ainsworth, on the west side of Kootanie Lake, at Hendryx on the opposite side, and at many outlying localities. At Nelson and Ainsworth town sites have been laid out, and the first steps toward the establishment of permanent mining centres have been taken.

"Speaking generally of the district, I may say that the result of my examination has been to convince me that the importance of the mineral discoveries made has not been exaggerated, while their number and the area over which they are distributed is such as to guarantee a large and continuous output of good ore so soon as adequate means are provided for the transport of the product to market. As a number of details respecting the various deposits, (chiefly obtained through the kindness of Messrs. G. B. Wright and G. M. Sproat,) have already been given in my report on 'The Mineral Wealth of British Columbia,' recently printed, it will not be necessary in the present summary to speak of the individual claims and deposits visited by me. These particulars I hope to embody in a more comprehensive report shortly to be published. It may be noted, however, that in nearly every instance the result of my personal examination has been to verify the accuracy of the statements made in the publication just alluded to.

"The majority of the ores met with are to be classed as silver ores, and in the vicinity of Hot Springs and Hendryx these are for the most part argentiferous galenas, which, in a number of instances near Hot Springs, are decomposed to a considerable depth, forming so-called 'carbonate-ores.' These possess a special value owing to the ease with which they are worked and their importance in the process of smelting the unaltered galenas. The aggregate quantity of such 'carbonate ores' to be found in the deposits already proved must be great, but all will no doubt pass in depth into sulphide ores.

"At Hot Springs or Ainsworth a truly remarkable number of metalliferous veins has already been brought to light within a very limited area, and additional discoveries are still being made from time to time even within this

area. Near the lake-shore, the country-rock is a coarse mica-schist which is overlain further back by green and grey schists, and these in turn are followed by limestones and black argillaceous schists, a mass of granite bounding the whole at a distance of two to three miles inland. In evident relation to this change in the country-rock is the circumstance that the ores improve almost uniformly in respect to content of silver in crossing the series of veins in a westward direction from the lake and rising higher above the lake-level. Some of the deposits associated with the limestones hold more or less native silver in a filiform condition, and very high assays are frequently obtained from these. It is not yet possible to quote assays of the ores of this vicinity made from specimens collected by myself, but it is safe to say that from several of the claims, considerable quantities of ore can already be obtained by ordinary hand picking which yield from 50 to over 100 ounces of silver to the ton, in addition to a high percentage of lead.

"At Hendryx, the only considerable developments made are those of the New Haven Mining and Smelting Company. The principal feature at this place is a lode of very great size, consisting largely of galena, but classing in respect to silver as a low-grade ore. So soon as efficient means are provided for handling and smelting this ore and shipping the product, a very large output may be counted on.

The Toad Mountain ores differ from the foregoing in containing a large amount of copper and less galena. The Hall Brothers' property, known as the 'Silver King Mine,' from the name of the claim on which most work has been done, is so far the leading one here, and has turned out a considerable quantity of ore which has approached or surpassed \$300 to the ton in total value as sold at the smelter. Other claims are, however, being opened out, some of which present a very favourable appearance.

"At the east end of Toad Mountain, a wide belt of rusty schistose rocks, containing more or less quartz and much iron pyrites, has been discovered. The superficial portions of this belt have been completely oxidised and afford free-milling gold. This property has been acquired by an English company, known as the Cottonwood Company, and a Huntington mill has been erected for the purpose of treating, in the first place, the decomposed surface material, of which there is, in the aggregate, a great quantity in sight. The results of trials so far carried out have not been made public. Should it prove, however, that the deeper pyritous portion of the deposit contains sufficient gold to pay for concentration, roasting and chlorination, the quantity of the ore appears to be almost unlimited. Another gold-bearing deposit, in the form of a well-defined vein traversing a granitic rock, is situated on Eagle Creek, toward the west end of Toad Mountain. Work is being carried on here and a stamp mill is in process of erection.

"Beyond the neighborhood of the better known centres, a great number of discoveries, chiefly of silver ores, are reported throughout the district. Most of these isolated localities time did not permit me to visit. Mention may be made, however, of an extensive deposit of copper-pyrites, on the north side of Kootanie River, nearly opposite Forty-nine Creek, and of a peculiar and apparently important occurrence of magnetic iron-ore on the same side of the river below the lower fall.

"No large quantity of ore has yet been shipped from the deposits of the vicinity of Kootanie Lake and Toad Mountain, but small shipments of hand-picked rich ores have been made from time to time during the two past summers, representing a total value of over \$75,000. The ore has been carried down to the lake-shore on horses or mules, taken by steamer to Bonner's Ferry in Northern Idaho, thence over thirty miles by waggon to the nearest point on the Northern Pacific Railway, and then, as a rule, to Montana, where it has been sold and smelted. The cost per ton of transporting the ores to smelter by this route has been not less than \$30, and when to this is added the cost of mining and cobbing the ore, it is evident that very high-grade ore alone can thus be utilized, while even in the case of deposits capable of yielding a considerable proportion of such high-grade material, the greater part of the ore extracted, embracing the lower grades and requiring concentration, must at present be put to one side.