

of the same shore-line." Somewhat similar conclusions are drawn from the examination of two Neocomian boulders.

In the second part the palæontology of the fossils found in the boulders is worked out with great care and discrimination, and, in fact, occupies the greater portion of the entire work. The formations are dealt with in order from Lias to Gault inclusive. Much pains is bestowed on the synonymy and distribution of each species recorded, whilst the list of the principal works referred to may serve to show the number of authors consulted. There are eight plates of fossils from photographs executed by E. Wilson, of Cambridge. This method is now largely employed on the Continent, and in cases like the present, where the point is identification rather than description, the results may be regarded as decidedly good. It is clear that some of the fossils cannot have been badly preserved. The Gasteropoda are the least satisfactory.

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III.—GEOLOGICAL SURVEY OF CANADA. G. M. DAWSON, C.M.G., LL.D., F.R.S., Director. Annual Report (New Series), vol. ix, Reports A, F, I, L, M, R, S, for 1896. With plates and maps. 8vo. (Ottawa: Dawson, 1898.)

THIS volume comprises 816 pages and contains five maps and twenty plates. It begins, as usual, with a summary report, addressed to the Minister of the Interior, by the Director, Dr. George M. Dawson, C.M.G., F.R.S., dated 1st January, 1897, which sets forth the work done in the year 1896 at the Museum and headquarters of the Survey in Ottawa, and that accomplished in the field, the latter including zoological and botanical as well as geological work.

Among other matters of greater or less importance relating to the Museum, the Director insists strongly on the advisability of a new Museum being built, which should be safer and more commodious than the present one, which he alleges to be, both by construction and situation, in grave danger of destruction by fire.

Dr. Dawson brings into prominence once more the essential functions of the Geological Survey by remarking that its chief work is "that of providing geological maps and reports of the several parts of the country, such as to be of value to the explorer, the miner, and others," and he adds that "the demand for information of the kind has been greater than ever before." He further states that the Geological Survey is the only organization under the Dominion Government which undertakes a general mapping of the country as a whole, work which has been carried on from the commencement of the Survey in 1843.

Very notable progress was made during the year 1896 "in the development of the mineral resources of Canada, both in the way of actual work and in attracting the attention and interest of capital. British Columbia has begun to evidence its value as a permanent producer of the precious metals, in a manner long foreseen by those

who have paid attention to its geological structure and position. In Ontario, wherever the Huronian system is developed and has been examined, valuable mines, more particularly those of gold, are being discovered and opened up. In Nova Scotia renewed interest has been shown in gold-mining, and with improved machinery and methods the output is likely soon to be greatly increased. Other mineral industries throughout the country, whether already established or in course of development, share in a general appreciation."

After a short account of the explorations of the field corps, there follow some details of the work done in the Museum, in the sections devoted to chemistry and mineralogy by Dr. Hoffmann, to lithology by Mr. W. F. Ferrier, to mining and mineral statistics by Mr. E. D. Ingall, and to palæontology and zoology by Mr. J. F. Whiteaves, Dr. H. M. Ami, and Mr. L. M. Lambe. Under the last head Mr. Whiteaves' valuable contributions to Canadian palæontology are included, especially the well-known "Palæozoic Fossils." Dr. Ami applies his extensive knowledge of the fossils of the Palæozoic rocks of Canada to aid in the elucidation of stratigraphical problems relating to the geology of Ontario, Quebec, and the Maritime Provinces, and in the preparation of systematic lists of fossils to accompany field reports. Mr. Lambe takes up the study of the Canadian fossil corals, the results of which will be looked forward to with interest by specialists in this difficult group.

The first field report is that of Mr. J. Burr Tyrrell "On the Doobaunt, Kazan, and Ferguson Rivers, and the North-West Coast of Hudson Bay, to Lake Winnipeg." The region explored (in 1893 and 1894) is embraced in an area of about 200,000 square miles, and lies north of the 59th parallel of latitude, and west of Hudson Bay. The report is accompanied by a coloured map on a scale of 25 miles to 1 inch, and by a number of illustrations, reproduced from photographs, which give a very fair impression of the character of the scenery. Many observations on the natural history of the region are interspersed in these pages which are very interesting reading. Of such is the description given by the author of the immense herds of the barren-ground Caribou (*Rangifer Grænlændicus*) met with on the shores of Carey Lake, an expansion of the Doobaunt River about 40 miles south-west of Doobaunt Lake. Thousands of these animals were collected together in single herds where the explorers had pitched their tents. "The little fauns were running about everywhere, often coming up to within a yard or two of us, uttering their sharp grunts as they stood and looked up at us, or as they turned and ran back to the does. . . . Later in the afternoon a herd of bucks trotted up to us, and stood at about forty yards distance. This was a most beautiful sight, for their horns are now [30th July] full-grown, though still soft at the tips; but unfortunately we had not the camera with us. We did not shoot any to-day." But this is not the story of the hills, and so perhaps thought our explorer, for he returns in the next paragraph to his geological notes.

The two explorations occupied together 15 months, and included the determination of the geographical features of the vast wilderness

travelled over, as well as the character of the rocks and minerals underlying it.

These rocks consist of the following systems :—(1) The Laurentian, which is here “applied almost exclusively to the crystalline, massive or altered, crushed and contorted rocks of the Fundamental Gneiss or ‘Basement Complex,’ consisting of granites and diorites, and granite- and diorite-gneisses, which it has been impossible to separate in any definite time-series.” (2) The Huronian is represented by the Marble Island (Hudson Bay) white quartzite, which Mr. Tyrrell regards as not improbably the oldest part of the Huronian in the region near the north-western shore of Hudson Bay from Marble Island northward to Dawson Inlet southward. This quartzite has associated with it diabase and other basic eruptives, which have been intruded beneath it and have also flowed over it. (3) The Cambrian rocks consist of the Athabasca sandstones and conglomerates occupying the northern part of the region explored. The rock varies from a coarse conglomerate to a fine-grained, red, mottled sandstone, and as no fossils were found in it the age of the formation was determined on stratigraphical and lithological grounds alone. Mr. Tyrrell concludes, however, that as they “hold a position unconformably above the Huronian and below the Cambro-Silurian, they may be assigned with probability to the Cambrian.” (4) Two small outliers were the only representatives of the Cambro-Silurian (Ordovician) found within the area surveyed, the one being on an island in Nicholson Lake, the other near Fort Churchill. The fossil contents of these rocks showed them to be of the age of the Trenton Limestone. (5) Silurian rocks were not seen *in situ*, but masses of white limestone scattered along the river-bank near Churchill are referred to that system on the strength of their fossils, one of which, a *Leperditia*, had been submitted to Professor T. Rupert Jones. (6) The Pleistocene period is here indicated by a great glacier (a map of which is given) called by Mr. Tyrrell the Keewatin Glacier, the most northern of three great centres of glaciation—the Cordilleran, the Keewatin, and the Labradorian, constituting a great *névé* or ‘gathering-ground,’ from which the ice flowed outward in all directions.

A description of the till, moraines, eskers, ancient beaches, etc., concludes the geological part of this report, to which three appendices are attached, one on Chippewyan names of places, another a vocabulary of words used by the tribe of inland Eskimos inhabiting the banks of Kazan and Ferguson rivers, and the third containing a list of the plants collected.

Mr. Tyrrell’s report is followed by a short one by Dr. Bell on the geology of the French River-sheet of the Survey Map, representing the country at the northern end of Georgian Bay (Lake Huron). The object of this report is to condense the information obtained from various reports by the writer and others, the coloured map accompanying it (on a scale of 4 miles to 1 inch) indicating the geological facts, which are therefore sparingly dealt with in the text. If a vertical section could be made from the mainland along

the western part of the area surveyed and produced southward through La Cloche Island and the eastern end of Grand Manitoulin Island, it would exhibit the following ascending succession :—

	Feet.
Chocolate marls and fine sandstones (Chazy ?) ...	100
Trenton group ... ..	320
Utica formation ... ..	60
Hudson River formation ... ..	250
Clinton formation ... ..	177
Niagara formation ... ..	405
Guelph formation (?) ... ..	100
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	1,412

The Laurentian rocks met with consisted of mica- and hornblende-gneisses in even and regular beds, together with coarse hornblende- and mica-schists and bands of quartz-rock with schistose partings. These dip usually at angles of medium inclination.

The most conspicuous feature of the Huronian system is a whitish quartzite which forms great ridges extending eastward from a point on the mainland north-west of Georgian Bay, and again in a south-westerly direction to Lake Huron. Between these two arms of the quartzite, and northward, the most abundant rock is greywacke, which is associated with varying quantities of quartzites, quartz-conglomerates, agglomerates, breccias, sericite- and mica-schists, impure dolomites, and eruptive greenstones. The whole series, including the quartzites, dips at high angles.

The economic minerals in this region include iron, copper, and nickel, but they are not in sufficient quantity to encourage mining operations.

Mr. A. P. Low's report is based upon a traverse of the northern part of the Labrador Peninsula, from Richmond Gulf (Hudson Bay) to Ungava Bay (Hudson Strait). The route taken lay through Clear Water and Seal Lakes and the Stillwater, Larch, and Koksoak Rivers, the last-named emptying into Ungava Bay. The text is illustrated by remarkably good reproductions from photographs, from which a vivid idea is formed of the essentially barren nature of this northern wilderness.

Some general examination into the geology of the country was obtained as time and opportunity permitted, the object being to supplement the results of the explorations of 1892, 1893, 1894, and 1895 in this region embodied in the Report on the Labrador Peninsula.

Laurentian rocks were met with along the greater part of the route. They consisted chiefly of more or less foliated granite, and of eruptive masses of dark-greenish basic granite and diabase. The contact between the Laurentian granite and the stratified and unaltered rocks of the Cambrian is concealed by the deep clays of the valley of Junction River, where the western wall of the valley is formed of granite, while the east side is composed of cherty dolomite and arenaceous shale. Certain schists and gneisses are also classed as Cambrian, of which they represent a highly

metamorphic phase, and to these are added newer intrusions of granite, which have changed the sedimentary Cambrian rocks into schists and gneisses by the heat and pressure due to the intrusion. The unaltered Cambrian rocks, represented by dolomites, shales, and dolomitic sandstones resting unconformably upon Laurentian gneisses, occur on the east coast of Hudson Bay, where at Richmond Gulf they have a breadth of twenty miles. They are traceable also up the Larch River for thirty miles from its junction with the Kaniapiskau. Detailed sections showing the character of the rocks were measured at various places, and these are inserted in the Report, which concludes with a record of the superficial deposits and glaciation of the region traversed.

Dr. L. W. Bailey's report, which is accompanied by a coloured map drawn on a scale of eight miles to one inch, treats of the geology of South-West Nova Scotia, embracing the counties of Queen's, Shelburne, Yarmouth, Digby, and part of Annapolis. This area comprises 3,370 square miles, in which the following groups of rocks are represented:—

1. Granite.
2. Quartzites and slates resembling those of Halifax and Lunenburg Counties, like them auriferous, and believed to be of Cambrian age, but without ascertained fossils.
3. Micaceous, hornblendic, and staurolitic strata, supposed to be the metamorphic equivalents of the Cambrian rocks.
4. Fossiliferous slates and iron-ores of Oriskany or Eo-Devonian age.
5. Red sandstones of Post-Carboniferous age—Triassic?
6. Trap (dolerite, amygdaloid, etc.), associated with No. 5.

The physical features and surface deposits of the region surveyed are next described; its irregular coastline, with long and narrow inlets, whose resemblance to the fiords of Norway was pointed out by Sir Charles Lyell on his first visit to America in 1841; the dunes or sand-hills, moraines, boulders (often of large size), rivers and lakes, kames, and peat bogs; and the glaciation, very strongly marked in the rocks upon the coast, forming in some places deep, trough-like hollows.

The underlying rocks, largely consisting of those provisionally referred to the Cambrian, exhibit evidence of profound metamorphism in some parts of the area, while in others they are but little altered; these two conditions passing into each other by insensible gradations. They are separated by Dr. Bailey into three divisions: I, the Quartzite Division; II, the Banded Argillite Division, consisting of grey and purple slates; and III, the Black Slate Division. These rocks have been affected by the earth movements which have influenced the rock formations along the whole eastern coast of America, and present a series of domes or ridges, usually anticlinal in structure, around which are enwrapped the remains of the higher and less resisting slaty beds. The total area covered by the Cambrian rocks in the district examined is computed at 1,000 square miles.

Siluro-Devonian beds occur in small patches in Annapolis and Digby Counties. It is concluded from the fossils derived from these

deposits, determined or re-examined by Dr. H. M. Ami, "that the beds hold forms referable, some to a transitional series, and others to a horizon at the base of the Devonian [Eo-Devonian of H. S. Williams]," and this is "in accordance with the stratigraphy of the district, which indicates a perfectly continuous and conformable series of beds."

Red sediments, assigned with a query to the Triassic epoch, underlie the Annapolis Valley, and traps occurring in the long but interrupted ridge forming the North Mountain of Annapolis County, Digby Neck, Long and Briar Islands, are regarded as possibly of contemporaneous origin.

Among the economic minerals of this part of Nova Scotia gold occupies an important place. The results of mining the precious metal, though apparently somewhat checkered, seem to have been on the whole of an encouraging nature, and there are some properties yielding good returns and promising still better. A detailed account of the gold-mining industry is given by Dr. Bailey in his report, and he also refers to the ores of iron found and worked in the area under review. Excellent 'process' illustrations enrich this report similar to those of the other reports in this volume.

Dr. G. Christian Hoffmann's report of the section of Chemistry and Mineralogy contains a record of the more interesting results obtained by the examination and analysis of various rocks and minerals submitted to him, in which his assistants, Messrs. Waite and Johnston, bore their share.

In the section of Mineral Statistics and Mines (Annual Report for 1896) Mr. E. D. Ingall, assisted by Messrs. Cole and McLeish, makes an important contribution to this subject, so vital to the interests of a country possessing the mineral wealth of Canada. A few words from the introduction to this report will suffice to show what rapid strides the country is making in mineral development. "In 1886 the total mineral production of the country, as per direct returns, supplemented by close estimates where complete returns could not be obtained, was valued at a little over ten million dollars. In 1896 the value of Canada's mineral production had increased 125 per cent. or to over twenty-two and a half million dollars."

The Report closes, as usual, with a good Index.

ARTHUR H. FOORD.

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## REPORTS AND PROCEEDINGS.

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February 17, 1899. — W. Whitaker, B.A., F.R.S., President, in the Chair.

### ANNUAL GENERAL MEETING.

The Secretary read the Reports of the Council and of the Library and Museum Committee for the year 1898. In the former the Council congratulated the Fellows on their increase in numbers and on the continued financial prosperity of the Society.