SUMMARY REPORT

OF THE

OPERATIONS OF THE GEOLOGICAL SURVEY.

FOR THE YEARS 1884 AND 1885.

The last published Report of Progress of the Survey, that of 1882-83-84 is prefaced by a summary report for the year 1883 to which are added observations on the work of 1884. The present summary report constitutes a statement of work carried on by the survey to the close of 1885, and is practically a reprint of the summary reports forming part III in the reports of the Department of the Interior for 1884 and 1885. Facts of interest noticed in the summary report are thus placed in the hands of the public in advance of the completion of detailed reports and maps, which frequently require to embody the field work of several years. The summary reports also form a connected historical outline of the field and office work of the survey, and a record of the progress of the museum.

1884.

Publications.

The Report of Progress for 1882-83-84 is a royal octavo volume of 783 pages, containing fifteen separate reports and is accompanied by thirty-four maps of which all but two are geologically coloured.

Besides the annual report, a sketch geological map of the whole of the Dominion, on a scale of 40 miles to 1 inch, was prepared, and was published for the meeting of the British Association, together with an explanatory descriptive sketch of the physical geography and geology of the Dominion, in a pamphlet of 55 pages, royal 8vo., by the writer and Dr. G. M. Dawson. This map and pamphlet was

distributed gratuitously to the visiting members of the British Association.

A complete catalogue of the publications of the Survey, from its commencement in 1843 to 1882, was prepared and published in March. (28 pages, royal 8vo.)

Other publications in the biological section were also prepared and issued during the year. These are referred to on a subsequent page.

The greater part of my own time was occupied in matters of administrative detail, which, with duties in connection with the meeting of the British Association in Montreal, left me but little time for personal investigations in the field. From the 11th to 23rd of July I made an excursion along the line of the Canadian Pacific railway, from Ottawa west to Pogamasing, carefully examining the many interesting and instructive cuttings that have been made through the Laurentian and Huronian rocks. A large number of specimens were collected both along the main line by myself, and along the branch from Sudbury to Algoma by Mr. H. P. Brumell, who accompanied and assisted me. In the whole distance, 364 miles, only one metalliferous vein of any importance has been exposed. This is in a small cutting, about four miles west of Sudbury. The ore-bearing rock or vein has a width of 40 yards in the cutting. It apparently consists of iron and copper pyrites, rather coarse diabase or diorite forming the walls. Specimens were collected for analysis, and were found by Mr. Hoffmann to contain 9·08 per cent of copper. (See p. 19 M.) I am informed that the vein has been traced for a considerable distance on both sides of the track on a bearing of 335°. The great thickness of this pyritous vein and its proximity to the railway may render it of considerable importance. In August, before the meeting of the British Association, I accompanied Professor Bonney, who has been for some time engaged in a study of the Archæan rocks of Britain, over the same ground.

The kindness and courtesy of Mr. Archer Baker, General Superintendent Eastern Division Canadian Pacific railway, and also of Mr. Abbott, Chief Engineer at Sudbury, in placing hand-cars at our disposal, greatly facilitated our examination. Indeed it would have been otherwise impossible to have effected it in the short time which Professor Bonney could devote to this excursion.

After the close of the meeting of the Association in Montreal on the 5th of September, I proceeded with the excursion party to the Rocky Mountains, and after our return was engaged in examinations at Rat Portage and along the line of the Pacific railway eastward to Nipegon. I left Port Arthur on the 26th of October and reached Ottawa on the 30th.

Eighteen separate geological explorations were carried out during the summer of 1884, relating to which the following summary reports were submitted.

Explorations and Surveys.

British Columbia and North-West Territory.

On the 9th of May, Mr. Amos Bowman left Ottawa for British Columbia to continue the geological exploration and survey in that province. The first part of the summer was devoted to the lower portion of the Fraser River, its tributary valleys and the adjacent mountain region. The scene of operations was then changed and the remainder of the season devoted to the continuation of the work for the map of the southern interior of British Columbia, referred to in my report for last year. This map covers an area of about 30,000 square miles.

Dr. G. M. Dawson was engaged during the summer of 1884 in continuing and extending the reconnaisance work in the Rocky Mountains, south of the Red Deer River.

Dr. Dawson, with Mr. Jas. White as assistant, left Ottawa on the 21st of May and returned on the 20th October.

Field work was begun from Morley, and the valley of the Kananaskis first examined. Finding a practicable pass from the head waters of this river to those of the Elk, a track-survey was made down the valley of the latter stream, and thence across the watershed eastward to the sources of the Old Man River, and down to the "Gap" of the North Fork. The almost impenetrable character of some parts of this country, together with the very heavy rains of the early summer, rendered progress so slow that it was necessary to make a detour from this point to Pincher Creek to obtain a new supply of provisions. The head waters of the Highwood River, Sheep Creek and the Elbow River were then explored on the way north to Morley. A traverse was next carried through by the Vermilion Pass to the Kootanie and Beaverfoot Rivers, and thence by the Kicking Horse and Columbia valleys and back to the Bow valley by the White Man's Pass.

Dr. Dawson having been requested to meet the party of members of the British Association which visited the West, was then obliged to leave for a few days for that purpose, while Mr. White occupied himself in making a topographical survey of the vicinity of the anthracite coal deposits in the Bow valley.

Later in the season a traverse was made up the Cascade River to the Red Deer and thence westward to the sources of the Bow; and in des-

cending the Bow valley various points of geological interest were examined.

In October, snow storms became so frequent at the high elevations at which it was necessary to carry on the work, that the operations of the season were brought to a close.

The work of the past season, with that of 1883, and surveys of other isolated tracts previously made, furnish data for a reconnaisance map—geological and topographical—of that portion of the Rocky Mountains between the Red Deer and the 49th parallel, embracing an area of about 10,000 square miles. As this portion of the mountains is at present attracting much attention, in consequence of the proximity of the railway, and the maps now existing are quite unservicable, it is proposed to publish the information now in hand, in the form of a preliminary map. This will serve as a guide to prospectors and others, and may eventually form the basis for a more complete map as the surveys progress.

The explorations of the past summer have still further increased the known area of coal-bearing Cretaceous rocks in the mountains, and resulted in their pretty complete definition. The anthracite-bearing rocks in particular, while forming a narrow trough, have now been traced a long way north and south of the originally discovered locality. Deposits of copper ore have lately been found at a number of new localities in this district and efforts are now being made to develop some of the more accessible of these. Fossils were collected in several localities from the Lower Cambrian rocks which underlie the great limestone series of the mountains, and the existence of extensive masses of intrusive (dioritic?) rocks, which in some places contain sodalite and other interesting minerals, determined. About sixty photographs illustrating the magnificent scenery of this part of the mountains and their geological features were obtained, together with a collection of such plants as appeared to be new or interesting.

The work done by Mr. R. G. McConnell during the season of 1884 consisted in completing the geological examination and topography of the country lying between the International boundary and the 51st parallel, and extending eastward from the eastern boundary of Dr. Dawson's map to the third principal meridian. The work in this area also occupied the summer of 1883. All the geological formations occurring in it, ranging from the Middle Cretaceous to the Miocene Tertiary, have been carefully examined and their boundaries, except where masked completely by the drift, determined and mapped with a tolerable degree of accuracy.

Great attention was also given to the topography of the region, and more especially to the hills, ridges and plateaus occuring in it, many of

these being but very imperfectly represented on existing maps, though of great importance in connection with geological outlines. Most of the topographical work, during the summer, was done by his assistant, Mr. D. B. Dowling.

Notes were made on the various soils observed in different parts of the area, and also on the character and quantity of the woods contained in it. [See Report C.]

Mr. J. B. Tyrrell was engaged during the summer in making a geological and topographical examination and survey of the country lying between the 110th and 115th degree W. longitude, and stretching north from the 51st parallel to the North Saskatchewan River, including portions of the drainage areas of the Red Deer and Battle Rivers.

Men and supplies were obtained at Calgary, and field work was commenced on 30th May. From that time till 26th October, the party were travelling on the open plains in the southern portion of the district, or in the wooded country further north, coming into Calgary three times during the season for supplies.

In the early part of the summer a canoe survey was made of the Red Deer River from the crossing of the Edmonton trail to the mouth of the Rosebud, and during the rest of the season, track surveys, with odometer measurements where possible, were made of the country passed over. Notes were taken of its general character, and the southern edge of the woods can now be denoted with some degree of accuracy.

Several compact seams of lignite were met with, which will furnish an abundant supply of fuel, and in some places, in the vicinity of the Red Deer River, a large amount of ironstone was also seen.

The conglomerates discovered last year by Mr. McConnell in the Cypress Hills were found to occur also in the Hand Hills, covering a considerable area.

Collections were made of the different rocks seen in the district, as well as of any fossils that could be obtained without too great delays.

The measurements, and traverses made with estimated distances during the year aggregated 2625 miles.

ONTARIO.

Mr. A. C. Lawson's work in the Lake of the Woods region was in continuation and completion of that undertaken by him during the previous season as Dr. Bell's assistant, viz.—the prosecution of a detailed topographical and geological survey of the northern half of the Lake of the Woods, or that portion of it embraced within the limits of the Huronian belt of rocks, which are here of much interest, not only from an economic point of view as comprising the gold-mining area,

but also as exhibiting, by the great extent of their exposure and ease of access, the leading lithological and structural features of this metalliferous series, as well as its relations—here clearly shown—to the underlying Laurentian rocks, thus affording us a key to the elucidation of similar belts in less accessible regions.

Mr. Lawson, accompanied by Mr. J. W. Tyrrell, C. E., and Mr. W. F. Ferrier, left Toronto for the scene of operations on 27th May, and engaging canoe-men at Sault Ste. Marie commenced work at Rat Portage 31st May, returning from the field October 29th.

In the course of the season the whole of the shores of the portion of the lake under survey, together with Shoal Lake and the numerous islands which occupy to so large an extent both lakes, were carefully examined and surveyed, and specimens of all the typical rocks of the Huronian belt collected. Particular attention was paid to the character and structure of the rocks in the neighborhood of the chief auriferous veins, with the object of ascertaining, if possible, the general law governing their occurrence; and in this some measure of success has been attained, since it seems to be generally true that the largest and richest lodes are in proximity to intrusive masses of igneous rocks. The general confines of the Huronian belt were defined with greater certainty, and our knowledge of its distribution extended to the southeast.

In the country adjacent to the Lake of the Woods, log surveys and geological examinations were made of the lakes stretching eastward from the Lake of the Woods towards Vermilion Bay, and of Crow Lake to the south-east. An examination was also made of the country crossed by the canoe route between Sabaskong Bay and Rainy Lake. While in the vicinity of Fort Francis, Mr. Lawson took the opportunity of opening two of the mounds on the Rainy River, situated on Mr. McKinstry's farm, and succeeded in obtaining a number of ancient Indian relics of archæological interest.

Mr. E. D. Ingall proceeded, on 1st July, to Lake Superior, to report on the mining developments of that region. He first coasted down the north shore of the lake, from Port Arthur to Sault Ste. Marie, examining all the chief mining locations. Then, after visiting the mines in the Sault Ste. Marie district, he returned to Port Arthur, from whence he made trips to the recently opened mining district at Kaministiqua, on the Canadian Pacific railway, and the mineral discoveries in the vicinity of the Rabbit Mountain and Whitefish Lake. After remaining there a short time, to collect information from persons interested in and conversant with the mines of the district, he returned to Ottawa on the 18th November.

Mr. E. Coste has been engaged in investigations in the gold and iron

ore bearing region in the counties of Hastings and Peterboro,' on which he reports as follows:—

"From the 1st of May to the 10th June, the iron ore deposits in the townships of Madoc, Marmora and Belmont were examined, and the iron mines being developed in the townships of Tudor and Wollaston were inspected. This preliminary work demonstrates that there is a very good, though small, auriferous district around Deloro, in Marmora, and also that the iron ore deposits, both of hæmatite and magnetite, are numerous and important.

"On the 10th June a systematic survey of this region was commenced and steadily pursued until the 25th October, when bad weather and snow terminated field operations. During these four months the northern boundary of the limestone formation (Cambro-Silurian) has been traced and mapped in detail from Stocco Lake, in Hungerford, to Burleigh Falls, in the township of Smith, as well as the numerous detached patches which were found to be greater in number than shown on any existing map. It is of practical importance to define exactly the limits of these limestone deposits. As sources of limestone and perhaps also of lithographic stone they are themselves valuable. They rest horizontally on the crystalline rocks, and their margins thus limit the areas in which the gold veins and iron ores may be looked for. These, in North Hastings, and probably elsewhere in this region, are associated with certain granitic masses, around which they all occur. To trace out and map these eruptive masses is, therefore, also important. Three such masses, the Huckleberry Rocks, the mass forming Coe Hills in Wollaston, and the one called Red Mountains, in the township of Lake, were mapped, and steps were being taken to map the two masses, on the borders of which are the Emily and Baker mines, when field operations were suspended.

"During all these excursions close attention was given to the crystalline Archæan rocks and the conclusion was arrived at that the true Huronian series is represented in North Hastings, but conformably following the inferior crystalline limestones, schists and gneisses of the Laurentian, and thus agreeing with the result of observations in the Lake of the Woods region, where auriferous veins and iron ores also occur under corresponding conditions in the Huronian rocks."

In November Mr. Coste visited West Portland township to examine and report on some phosphate mines.

From the 14th to the 21st of November he was engaged inspecting some of the mines in the Eastern Townships, including the Capelton copper mines, an iron ore deposit at Sherbrooke, two asbestos mines at Black Lake, in Coleraine, and the lime works at Marbleton, in Dudswell township. Two of the copper mines of Capelton were in active

operation; the Crown mine, Orford Copper and Sulphur Company, and the Albert mine, G. H. Nicholls & Co. The former has a shaft 1150 feet deep. The ore averages 3 per cent. to 4 per cent. of copper and 40 per cent. sulphur. The vein or bed is a long one, and in places as much as 35 feet wide. A third company, the Canadian Copper and Sulphur Company, whose works are on the same vein, and on another parallel one, about 800 feet to the southeast, suspended operations in May last, because they were losing the sulphur, and the low prices obtainable for copper did not pay. This company now proposes to amalgamate with the Huntington mine in Bolton, and to erect sulphuric acid works for the complete utilization of the ore.

A number of specimens were collected, and reports of the season's work, with observations on the laws, and customs, and regulations affecting mining development in Canada, were prepared by Mr. Coste during the winter.

Mr. A. Cochrane was entrusted with the topographical measurements and surveys required in connection with Mr. Coste's exploration. This work embraced micrometer surveys of lakes and rivers, and many of the travelled roads. over an area of about 350 square miles in the townships of Rawdon, Huntington, Madoc, Marmora, Wollaston and Belmont; also, accurate instrumental surveys of various gold and iron mines.

Quebec and North-East Territory.

Surveys and explorations have been carried on during the year in several parts of Quebec and the North-east Territory. Mr. R. Ells made a micrometer survey of the Causupscull River, a tributary of the Metapedia, for 45 miles, to its head waters, with a view to making the topography of the quarter sheet map, now being engraved, more perfect, and at the same time to determine with greater accuracy the limits on this river of the great inland Devonian area previously described * in the Gaspé Peninsula.

Early in the year, steps were taken to organize an expedition for the purpose of extending the exploration and survey—commenced in 1870 and continued in 1871—of the, as yet, but little known region to the north of Lake St. John, including the completion of the survey of Lake Mistassini, and an examination of the country between it and the shores of James' Bay. The co-operation of the Provincial Government in carrying out the expedition was solicited, and after considerable negociation, a sum of $1,500 was granted by it. After consultation with the Honorable Mr. Lynch and with E. E. Taché, the

* Report of Progress, 1880-81-82.

Assistant Commissioner of Crown Lands, Mr. John Bignell, P. L. S., was selected to take charge of the party, and Mr. A. P. Low, of this branch, was appointed as geologist and second officer in charge.

On the 13th of May, a credit was issued by me to Mr. Bignell for $3,000, and he was instructed to engage men and make all necessary arrangements to start as soon as possible, with the understanding that the expedition would pass the winter at Mistassini. He was furnished with tracings of the plans of the surveys of 1870 and 1871, and for his further guidance a memorandum was given him, stating generally the objects of the expedition, and also instructions drawn up by the Assistant Commissioner of Crown Lands at Quebec, and approved by myself.

Memorandum, Mistassini Exploration.

The expedition should start as early in July as possible. The objects of the expedition are:—

1st. A thorough survey, hydrographical and topographical, of Lake Mistassini, especially of the northern and eastern portions not examined or surveyed by the Geological Survey parties under Messrs. Richardson and McOuat, in 1870-71.

2nd. A geological examination of the lake shore and of as much of the adjacent country as may be practicable.

3rd. The collection of specimens, vegetable, mineral and animal, illustrating the resources of the region.

It is also important that a survey should be made of the Rupert River, through which the waters of Lake Mistassini discharge into James' Bay. This will probably require another season's work, unless the party can conveniently separate, and while one was engaged surveying the lake, the other could descend the Rupert River and perhaps return by the East Main River or by any of the other large rivers which discharge into the east side of James' Bay. This plan would afford a larger amount of information relating to those portions of the north-eastern territories of the Dominion and adjacent portions of the province of Quebec south of the height of land, which lie between the 72nd and 79th degrees of longitude and the 50th and 52nd degrees of latitude, an area of about 42,000 square miles, of which at present very little is known, but which, there is reason to believe, may contain valuable minerals and areas of land fit for settlement. Two routes from Lake St. John to Mistassini have already been explored and surveyed by the Geological Survey, as well as a large extent of the shores of the lake northward to the outlet on the west side. The

reports of these expeditions are published in the Progress Report Geological Survey for 1870-71 and 1871-72, and the plans of them on a scale of 4 miles to 1 inch are in the office of the Survey.

Surveys could be carried on at intervals this winter around the lake, and in the spring these could be extended by the Rupert or East Main River to James' Bay; and while the expenditure for the second season would be very considerably less than will be required this season, the result might be expected to be infinitely greater. The precise route to be followed after starting must be left to the discretion of the leaders, who will in this be guided by circumstances.

The following are the instructions given, as stated, to Mr. Bignell by the Department of Crown Lands, Quebec :—

Letter of Instructions.

SIR,—The Legislative Assembly of this province having voted a sum of $1,500 in favor of an exploration to Grand Lake Mistassini, which is about to be undertaken by the Federal Government, I am directed by the Honorable the Commissioner of Crown Lands, to inform you that you have been nominated to take charge of one of the exploring parties under the general control of Dr. Selwyn, Director of the Geological Survey of Canada.

The route you are requested to adopt is the following :—

Starting from Grand Lake Pipmuakan, you will go up the River Betsiamites as far as Lake Manouanis, near the source of that river, and the position of which has been determined by you some years ago. From Lake Manouanis to Grand Lake Mistassini, you will travel in a westerly direction, following the streams and lakes forming the heads or sources of rivers flowing south into Lake St. John, or in the opposite direction, and you will also pass by Grand Lake Manouan, of which mention was made to you by the Indians at the time of your last survey of that region.

On your whole way to Mistassini, as above indicated, you will make a regular survey or scaling of the different rivers, lakes, portages, &c., you will follow as your route, estimating the distances with the "micrometre Rochon," and measuring the angles with the theodolite.

During the course of your survey you will make astronomical observations as often as circumstances will allow you to do so, in order to determine the meridian and latitude of different points of your route.

You are also requested to give the usual information respecting soil, timber, &c., in the same manner as you have done for your survey of

the Outardes, performed some years ago. You will also furnish this office with a complete copy of your plan of survey and of all similar work performed by any of your party.

Signed,

E. E. TACHÉ,

Assistant Commissioner.

I fully expected Mr. Bignell would start not later than July, and was much surpri-ed to learn from Mr. Low that he did not leave Bersimis—the route by the Bersimis or Betsiamites River having been determined on—till the 20th March. I had received no communication from Mr. Bignell since the 18th of August, at the close of the year. I had, however, received letters from Mr. Low, dated Lake Pipmuakan, August 25th and September 1st, and Lake Manouan the 9th of October. The following are extracts from these letters :—

"Pipmuakan Lake, 1st September.—At a distance of 65 miles up the river Bersimis a yellow gneiss occurs. This rock is highly charged with magnetite, and its action, combined with that of the weather, upon the felspar, may account for the decomposition of the latter, for beyond this place these rocks were found to be quite friable, and made up of grains of yellow quartz and magnetite; and from this I believe the great beds of yellow sand and black magnetic sand are formed, which are found everywhere along the river and coast. In some cases, the rock consists almost entirely of magnetite, in beds from 1 to 20 feet thick, as seen along the river and on the portages for a distance of 40 miles, and these must contain a vast amount of valuable ore.

"At 105 miles from the coast a pink crystalline limestone occurs, containing crystals of mica, sphene and Labrador felspar A short distance beyond this exposure a dark bluish, fine grained labradorite was found. From this point, 135 miles from the coast, I have seen only a succession of coarse and fine grained labradorite rock. I have collected specimens of the different rocks, and send them with this letter to Bersimis, whence Mr. Burgess has promised to forward them to Ottawa.

"The river, for forty-five miles from its mouth, is quite navigable; and its banks and the neighboring mountains are clothed with a good growth of timber, consisting chiefly of spruce, red pine, birch, tamarac, poplar and balsam. At the distance named there is a fall of about 100 feet, and above this, for forty miles, the river is a succession of falls and rapids. It then becomes quite navigable to the lake, there being only one rapid past which a portage is requisite. The timber extends only about eight miles above the first fall. Above this there is only a

second growth, seldom exceeding eight inches in diameter, and principally spruce, birch and poplar, with a few tamarac, pine and balsam. The whole country has been burnt over not many years ago.

"The hills along the river, for 100 miles from the sea, vary from 800 to 1,200 feet in height; beyond this, they diminish gradually in altitude till, around this lake, they are not more than 300 or 400 feet high.

"The river above the falls abounds with fish, and we have taken large pike, suckers and brook-trout in the nets. Below the falls there are a few sea-trout and salmon.

* * * * * * *

"Since my last letter from Lake Pipmuakan, 1st September, I returned down the line forty-five miles to meet Mr. Bignell, who did not leave Bersimis until 20th August, and we did not leave Lake Pipmuakan until the 10th of September. Then I again left Mr. Bignell for Lake Manouan *via* the Manouan River. Mr. Bignell continued up the Bersimis River. I have now completed my work and am waiting Mr. Bignell on the west side of Lake Manouan. The distance passed over I estimated at nearly 100 miles. Much time was lost on account of being unable to cross the large lakes in high wind, as our canoes are too small to stand the sea.

"The weather has also been very unfavorable. From this point, Lake Manouan, there is a portage route to Lake Onouistagan on the Peribonka River, which takes three days; thence we go up the Peribonka for three days, and then proceed by a western branch to a chain of lakes on the height of land, and from there by several lakes to Lake Mistassini. We will be unable to get further than the height of land in canoes, as all the small lakes will be frozen over. The labradorite rocks I found to extend only about two miles west along the shores of Lake Pipmuakan, and from that point to here I have found only red and grey gneiss, with no economic minerals, except in a band of crystalline limestone, on two small lakes east of Lake Manouan, which contained large crystals of mica, some of them eight to ten inches across. The country between Lakes Pipmuakan and Manouan is flat and covered with many lakes, only one range of hills, of about 800 feet high being passed on the Manouan River. The country has all been traversed by fires and the timber is all burnt. Game is very scarce here and but few fish are caught in the nets.

"We expect to reach Mistassini between the 15th and 30th of November. We had the first snow storm yesterday, 8th of October, and the ground is covered with about three inches of snow. Since the 10th of September the thermometer has fallen below 32° every night."

A supply of provisions, for the uses of the party during the winter and spring, was forwarded to the post on Lake Mistassini. Mr. F. H. Bignell, who had charge of this expedition, left Lake St. John with the provisions on the 16th of July, with six canoes and nineteen men. Ten of these were discharged on the 6th of August, thirty-five miles up Chief River, and the post was reached with all the provisions on the 10th of September. There seven more of the men were discharged and were allowed seven days provisions and twelve days pay to return direct to Lake St. John. Mr. F. H. Bignell, with two men, then proceeded towards where it was supposed the main expedition would enter Little Lake Mistassini.

His report of this trip is as follows :—

"I then travelled towards Themiscomie Lake to meet the main expedition, as that was the only practicable route for the latter to first strike Little Mistassini. In so doing I navigated Great Mistassini for 120 miles from Foam Bay, also retracing my journey some sixty miles, as there was another route which the main expedition might possibly follow. I then effected the crossing to Little Mistassini, a distance of some six miles, by portages and four small lakes, and travelled eighty miles towards its head. The general trend of the smaller lake seems the same as that of the great lake—south-west to north-east.

"About thirty-five miles from the head of Little Mistassini, the Rupert enters and flows out of it again, the inlet and outlet being almost opposite each other, and both bearing the same name. The outlet from Little into Great Mistassini is not more than 1¼ miles long, but it is exceedingly broken by rapids. Little Mistassini is supposed to be 100 miles in length, but, if I saw its greatest width, it is not more than six miles broad at its broadest point. I did not visit the southern shores of Little Mistassini, except where I struck them near the head, to portage to the Rupert, and there I remarked that they are sandy; but the southern shores look very beautiful from the north, the land coming down to the water's edge in a gradual slope, and being clothed with spruce and other trees—which seemed of a fair size—but no pine.

"Along the north shore, which I coasted, islands are numerous; the banks are generally low, and in most parts composed of solid limestone, forming a natural wharf, with numerous fissures, varying in width from 1½ to 10 inches.

"I did not run up the Rupert River from Little Mistassini, but struck it from towards the head of the lake by a portage of about 2½ miles. The part of the Rupert that I travelled, some twenty-five miles, comes from an east direction, and the river is a large and noble one.

"Leaving the Rupert we reached Themisconic Lake on the 23rd September, and found there an old abandoned Hudson's Bay post, built

of square spruce logs. Although the building looked old, it seemed still good. We discovered no traces of the main expedition, but we did not yet relinquish hope of meeting it, and though the region was a wild one, and perfectly unknown to us, we managed to extricate ourselves very creditably by pushing on through the portages and lakes till we crossed the height of land and struck the waters flowing into the Shipshaw River, into the Manouan, and by the Manouan into the large Peribonka, finally arriving back at Lake St. John on the 8th of October, without having the satisfaction of meeting the main expedition, which appears to have reached the Shipshaw River after we had passed that place. I should mention that the guide of my party, who was to have remained to guide the main expedition around Great Mistassini and down the Rupert River to James Bay and return, objected so to do and returned to Lake St. John. I wrote a letter to the main expedition, warning them of all this, but I am not aware whether it will be easy for them to replace him. The delay in sending in my report is due to the fact that I expected and have since received a letter from the main expedition, which I thought would be of more importance and call for insertion in my report. However, I may be permitted to extract from it the intelligence that on the 12th October they were at Lake Manouan, some 285 miles from Bersimis River, by canoe route; that they were then all well and fully expected to reach Mistassini in canoes. I should not omit to mention that I was greatly indebted to Mr. John H. Commins, officer in charge of the Hudson's Bay Company's post, at Lake St. John, and Mr. Miller, officer in charge at Mistassini post, for kind assistance in every way within their power."

[For a detailed report on Lake Mistassini see report D.]

The Rev. Professor Laflamme, of Laval University was requested to continue and extend the investigations which he commenced in 1883, the report on which appeared in the volume of Geological Reports for 1882–83–84.

Respecting his work of the present season, the following short notes have been received, and translated from the original manuscript, by the writer:—

"I regret that serious illness, arising chiefly from the bad weather experienced, obliged me to discontinue the researches which you asked me to undertake in the Saguenay region, during the past summer. Notwithstanding this, I have been able to determine, with sufficient precision, the limit of the Cambro-Siluran strata, which occur on the south-east side of Lake St. John, and also to note the patches of the Utica and Hudson River formations, which, in various places, cover the Trenton limestone.

"Nothing of special interest was observed relating to the Trenton formation, except that in several localities it affords an excellent building stone. The banks of the River Ouiatchouan, from the lake to the great fall, which marks the commencement of the Laurentian gneiss, may be specially mentioned. The beds are horizontal and thick, and the stone is easily dressed. It is, however, in some respects inferior to that obtained elsewhere. The Deschambault stone, especially, is very superior.

"In my report for 1883,* the probability of the existence of another basin of Cambro-Silurian age, besides those of Lake St. John and Ste. Anne, was stated. This conviction is confirmed by observations, and it is now proved that the Trenton limestone occurs over a large area in the parishes of St. Alphonse and St. Alexis, though it is often concealed by a considerable thickness of the overlying glacial clay deposits.

"A marked character of the Utica shales which I have examined, is the large quantity of bitumen they hold. One of the large islands in Lake St. John, Ile Traverse, is largely covered with *débris* of these schists. These were, some time since, accidently ignited by a fire made on the shore, and burned for eighteen months, neither rain or snow being sufficient to extinguish them, and it required nothing less than an extraordinary rise of the lake to completely drown this strange furnace.† The "*giairers*" which have been thus burned have changed color, and through a thickness of five or six feet they now constitute a compact conglomerate.

"Some have supposed that these Utica shales could be used for roofing slate, but they have neither the consistence nor strength sufficient for that purpose.

"On a long excursion made up the Ashuapmouchouan River, I convinced myself of the immense extent of arable soil in this part of the country. These quaternary marine clays are all extraordinarily fertile, and colonization can find an important outlet in this direction. There are areas, bordering on the large rivers, in which the clay is covered by a thick layer of sand. Though I was not able to find a single fossil, I am induced to regard these sands as being more recent than the Saxicava sand of Dawson. They appear to resemble the sands now being formed by the rivers.‡

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* Report of Progress for 1882-83-84, Report D.

† This bituminous character of the Utica shales has long been known, and is fully described in the Geology of Canada, Chapters X, XVII and XXI.—A. R. C. S.

‡ They are probably similar in character and origin to those described in Chapter XXII, Geology and Canada, 1863, as the Saugeen clays and sands, in which also no shells have been found.—A. R. C. S.

The distinct traces of shore lines which were observed at about 250 feet above the actual level of the lake, afford some idea of the depth of the quarternary ocean which invaded this region after the retreat (*passage*) of the glacier.

The foregoing are the principal facts observed during this brief examination. I regret not having been able to complete my investigations, especially in reference to the Cambro-Silurian basin of Ste. Anne."

In the report for 1883 it was mentioned that Mr. Adams had spent about two and a half months in field work about Lake St. John and Kenogami and the discharges of the Saguenay. This work was continued and extended during the past summer, and his report on it is as follows :—

"In accordance with instructions, I spent four months during the past summer in the Saguenay district. The area explored, containing about 3500 square miles, lies to the north of Lake St. John and the discharge of the Saguenay River, and is traversed by the Rivers Peribonka, Little Peribonka, Aulnais and Shipshaw, all of which were examined. It was ascertained that the anorthosite rocks, found by Mr. Richardson in 1857 about Lake St. John, extend much further to the north and east than has been hitherto supposed. They were found exposed along the Peribonka for over one hundred miles from Lake St. John, and on the Shipshaw to a point four miles north of Lake Pamouscachiou, which was as far north as these rivers were examined, and in neither case was the limit of the anorthosite rocks reached. As similar rocks are largely developed on the River Moisie, it seems not improbable that the anorthosite rocks in these two areas are really continuous. To ascertain whether this is really the case, it will be necessary to examine the upper portions of the rivers Bustard and Manicouagan, and they should also be found on the Bersimis River.

"Numerous deposits of iron ore, some of them very extensive, were observed about the Discharge of the Saguenay. The specimens of these ores which were collected have not yet been examined, but judging from the iron ores occurring in similar rocks elsewhere, they will probably be found to be titaniferous."

It having been decided in the spring to send an expedition to Hudson's Bay to make investigations in reference to the navigation of the bay and straits, and to establish stations for observation during the winter, it was thought desirable that Dr. R. Bell, who had already made several explorations around Hudson's Bay, should accompany this expedition, to act as medical officer, and to make observations on the natural resources of the region—mineral, vegetable and animal—and such collections as time and opportunity should permit.

Lieutenant Gordon, R.N., commanded the expedition. It left Halifax on the 22nd July, in the Newfoundland sealing steamer "Neptune," and returned to St. Johns on the 11th October. Dr. Bell states as follows respecting this expedition :—

"The Labrador coast was reached at Blanc Sablon, thence followed round to Ford's Harbor and Nain, where one day was spent. Nachvak was the next place touched at, and thence the vessel proceeded to Cape Chudleigh, near which the first observing station was built. Crossing to the north side of Hudson's Strait, Resolution and the Lower Savage Islands were sighted, but the stormy weather prevented landing. The Upper Savage Island was then reached, and here, a short distance east of North Bluff, the second station was established. Thence we crossed to Cape Prince of Wales, the site chosen for the third station; and the fourth was built on Nottingham Island. Recrossing the straits and entering Hudson's Bay, a suitable site for a station was unsuccessfully sought for on Mansfield Island. Thence passing close along the south-east side of Southampton Island, the entrance of Chesterfield Inlet was made. We landed on Marble Island, and then made for Cape Churchill, and anchored in Churchill Harbor, from the 6th to the 9th of September. York Factory was next visited, and left on the 12th September. From there we made Digges Island, on the south side of the western entrance to Hudson's Strait, on the 15th. Here the fifth station was established. On the return voyage through the straits, all the stations were visited, and a second unsuccessful attempt was made to land on Resolution Island. We then proceeded down the Labrador coast to Nachvak, where the sixth observatory was established, and on 6th October we left there for St. Johns."

It will be readily understood that the few places touched at and the short time spent on shore at each, precluded the possibility of any large amount of geological or other scientific observation being effected. About sixty interesting photographs were taken by Dr. Bell.

New Brunswick and Nova Scotia.

In New Brunswick some time was spent by Mr. Ells in examining the copper deposits of eastern Westmoreland, which, in consideration of the large amount of capital now being expended here, must be regarded as of economic importance. In this connection it may be remarked that the peculiar copper deposits which have been so largely developed at Dorchester, are of considerable extent, traces being found at many points on Cape Maringouin peninsula, as well as in the southern parts of Albert county, and at various places in the counties of Cumberland and Colchester, in Nova Scotia. At none of these locali-

ties, however, are the deposits apparently so extensive as at the Colonial Copper Mining Company's area, and that adjoining to the south. On this property a large amount of work has been done, and at the time of Mr. Ells' last visit, in October, about forty-five men were employed. This copper deposit has already been described in former reports as occurring near the contact of the millstone grit with the Lower Carboniferous red marly shales. The ore occurs in small pockets or bunches, where it has been precipitated by the deoxidising action of the organic matter of the plant stems upon copper in solution, and is often associated with small layers of coaly matter. A band of grey sandstone, about 8 to 10 feet thick, is now being mined, which carries grey copper ore in a fine state of division, disseminated through the bed, to the extent of from 4 to 6 per cent., according to the manager's assay. Experments are now being made with a view to concentrate this ore on the spot, the result of which has not yet been made known. The band of sandstone containing this copper ore extends for several miles. The ore was seen in beds of both Upper and Lower Carboniferous age.

The coal seams reported to occur to the north of Sackville were found on examination to range from two to six inches, and are therefore of no economic value. The productive coal measures are apparently wanting in this locality, the Upper Carboniferous resting upon the millstone grit in which the coal seams referred to occur.

A sample of gold was seen in a piece of quartz, said to have been blasted in digging a well in New Annan. The ledges whence it was said to be taken could not be seen, but the rocks in that vicinity—talcose, micaceous schists of pre-Cambrian aspect—are intersected in places with irregular veins of quartz similar to those in the pre-Cambrian of New Brunswick, and may be gold bearing.

Professor Bailey continued the surveys in New Brunswick. His work in the field extended over a period of two months and a-half, and in addition to the duties of general direction and supervision, embraced the special study of the contact lines of the different formations, the systems of movement to which these have been subjected, their various degrees of alteration and the collection of their contained fossils. A detailed report on those several points is being prepared. His assistants for the season were Mr. W. McInnis and Mr. J. W. Bailey. The former took the field on the 1st of June and continued work until about the third week in October; the latter beginning on the 1st of July, continued work to the same date. Mr. McInnes, in addition to affording Professor Bailey special assistance when required, undertook the entire charge of the topographical part of the work. This included the measurement with the odometer of 252 miles of roads, and the making surveys by pacing about 18 miles of other roads and streams that were too rough for the odometer.

In all these surveys, notes were taken of the geology and surface features, sufficient for the compilation of an approximately correct topographical and geological map of the region examined, which embraces the larger portion of Carleton county and parts of the counties of Victoria, Northumberland and York, and is included in sheet 2, S.W.

Mr. J. W. Bailey assisted both Mr. McInnis and Professor Bailey in the ordinary routine of camping, in the collection of fossils and in the exploration of streams and comparatively inaccessible regions. Special attention was also paid by him to the surface features of the regions explored, including the determination of altitudes and the outlining of prominent ridges and valleys, the results of which observations will be incorporated in the map already referred to.

In addition to the fossils collected in different portions of Carleton and Victoria counties, which are mostly of Silurian age, others of the same age were also collected from certain localities in Charlotte county, together with still others from rocks of Cambrian age in St. John county. The former have been sent to the Survey office for determination; the latter have been entrusted to Mr. G. F. Matthew, by whom the Lower Cambrian fauna has been made a subject of special investigation.

The exploration relating to the surface geology of New Brunswick, carried on by Mr. Robert Chalmers during the season of 1885, extended to all parts of the province, and a number of interesting observations were made. The work commenced on the 7th May. During that month, portions of Albert and Westmoreland counties were examined, and early in June Mr. Chalmers proceeded to the Baie des Chaleurs district, spending ten days between Bathurst and the mouth of the Metapedia. He then went to Kent county for three or four days; thence proceeded to Northumberland, where he was occupied till the 21st of June. From the latter date to the 10th of July was spent in making further examinations around the Baie des Chaleurs, from Caraquet to the mouth of the Upsalquitch, on the south side, and westward on the north side as far as Paspebiac, visiting all the back settlements between the Nipisiquit and the Restigouche, and ascending several small rivers short distances. On 15th July, he left St. John for the Tobique River, and hiring two Indians with canoes there, he started from Andover on the 19th, accompanied by Mr. George U. Hay, botanist of St. John, as a volunteer. The trip occupied fifteen days, in the course of which the river was ascended to its source. Nictor Lake was crossed to Nipisiguit Lake, measuring their heights barometrically. Some of the highest peaks along the route were ascended, and many facts were obtained relating to the flora and agricultural character of the region traversed. On the return trip

to St. John, a short time was spent re-examining the terraces below Grand Falls and in the Keswick valley, and the necessary data obtained for preparing drawings of the sections illustrating Mr. Chalmers' report of progress, [1882-83-84, Report G.G.] St. John was reached on 18th August, and a few days spent there preparing the drawings referred to, and making detailed examinations of Lily Lake and other places in that vicinity.

On the 26th of August Mr. Chalmers left for the northern part of the province, and having secured two canoemen at Bathurst, started on a canoe trip up the Nipisiguit, ascending that river to its source, thence returning to Portage Brook, and crossing over to Upsalquitch Lake he descended Upsalquitch River, reaching Campbellton on the 19th September. Between that date and the 26th, the time was occupied in making some additional observations on the Restigouche and at other points on the Baie des Chaleurs. He then started up the South-west Miramichi, following it from Newcastle to the head of settlement—10 to 12 miles above Boistown, and obtained some important facts. From Boistown he proceeded across the country to Fredericton, and thence to St. John. In the early part of October, a few days were occupied in correcting proof sheets of his report and in examining Lawlors, Douglas, Latimer and other lakes lying in the north-east part of St. John county. On the 13th October he left for Sackville and Amherst, and while there, thought it advisable to go to Herbert River, N. S., which he did by way of Spring Hill, to see the "Boar's Back," a remarkable kame described in Acadian Geology. Returning, he examined the brick clay at Moncton and remained a day at Petitcodiac, reaching St. John on the 18th.

On the 20th he went to St. Stephen and thence proceeded up the St. John to Edmundston. Examined the valley of the Madawaska north to the Quebec boundary, finding striæ and evidence of post-glacial lakes or lake expansions along the course. On the return trip he re-examined the St. John valley at the mouth of the Aroostook and at some points below that place.

The remainder of the season, with the exception of two days spent going to Fredericton to obtain barometric readings from Professor Harrison, was devoted to the study of the region around the mouth of the St. John, and westward to the head of the Long Reach, also along the Bay of Fundy coast to the Charlotte county boundary. Specimens of clays were collected at several of the principal brick yards, and quaternary fossils from the Baie des Chaleurs district.

On the 12th November he left St. John for Belledune; on the 13th he went to Bathurst to get some meteorological data at the station kept there, and on the 14th started for Ottawa.

The surveys and explorations made during the year 1884 by Mr. Ells, in the province of Nova Scotia, were confined principally to the counties of Cumberland and Colchester, with the view of completing the quarter-sheet map adjoining those already published of southern New Brunswick, and of getting the large amount of work already done by Messrs. Barlow and McOuat* ready for publication. The first half of the season was devoted to the examination of the structure of the Cobequid mountain range, including the relations and extent of the iron ore deposits along its south side, which were traced from the North River, to the northward of Truro, to the Harrington River, below Five Islands, a distance of over forty miles. Surveys were made of most of the streams flowing from the mountains to the Basin of Minas. These afford excellent sections of the various formations in this area. The horizon of the iron ore is easily recognized, both by its lithological character and its associated minerals. Veins of iron ore of considerable size were found as far west as Five Islands, beyond which the formation was not traced.

The baryta which was formerly mined on the Bass River undoubtedly belongs to the same formation, and the mineral also occurs in connection with the iron ore at the Londonderry mines. The extension of the iron-bearing belt east of Truro has not yet been traced continously, but from the character of the iron ores and their associated rocks, it seems very probable that the deposits lying to the north of the West River of Pictou are a part of the same band. It will therefore be seen to be a formation of great extent and economic importance.

In connection also with the iron ores, an examination was made of the deposit found near Brookfield, about eight miles south of Truro, where masses of iron ore, similar to much of that found at Londonderry, lie scattered over the surface. Explorations during the past season by Mr. R. E. Chambers have resulted in finding the vein of ore from which these loose masses were probably derived.

On the north side of the Cobequid Mountains, the copper deposits of the French River, Malagash, and other points were examined, but these were not found to be sufficiently extensive to be of much economic value. The country to the north was carefully surveyed by Messrs. Giroux and Barlow, who ran extensive chained lines in order to complete the map of this area commenced by Mr. Scott Barlow some years ago. The structure of the Spring Hill coal area was studied with the object of determining the prospect of finding the thick seams of that locality further to the north and west.

The presence of infusorial earth of great purity and in large quan-

* Vide Report of Progress, 1873-74.

tity was noted in Folly Lake, on the line of the Intercolonial Railway, near the summit of the Cobequids. The bed of the lake, over a great part of its extent, appears to be composed of this substance. Its value for the manufacture of fine brick and non-conductive boiler covering is very great, and the deposit will doubtless be speedily utilized for these and other purposes.

Towards the close of the season, a visit was made to Digby, to examine the iron ore deposits of the North Mountain, or Triassic trap range, near that town. The iron was found to be a magnetite of excellent quality, and to occur in considerable quantities, with the prospect of cheap and easy surface mining.

Deposits of magnetite occur in this range throughout the greater portion of its length, but in general they have been considered too small and uncertain to be developed to any extent. The deposit at Digby appears to be the most considerable of any heretofore seen in that formation.

During the season, Mr. Ells was assisted by Messrs. N. J. Giroux, C. E., and A. E. Barlow, B.A., both of whom were with him during the preceding season; also, for a short time, by Mr. R. E. Chambers, B.A.

The field work extended from 13th May to 21st November.

In connection with the exploration, about 1,000 miles of roads and streams were measured, as follows:—

	Miles.
Chained Roads	264½
Micrometer surveys	64
Paced Roads	275
Paced streams	100
Odometer surveys	300

Mr. H. Fletcher was occupied, during the summer of 1884 in the counties of Guysboro' and Antigonish, N.S., east of the West River of Antigonish, and East River of St. Mary's, west of the district examined in 1879, about Havre au Bouche and the Strait of Canso, and north of that surveyed in 1883, along Guysboro' Harbor and the Salmon River.

The country to the westward of the St. Mary's River and south of the West Branch, including the Liscomb River and other steams near the Halifax county line, was surveyed by Mr. E. R. Faribault, C.E., of the geological staff, assisted by Mr. A. McLeod, Archibald Cameron and John Smith; while to Mr. John McMillan, assisted by J. A. Robert, B.A., sen., and W. T. McLeod, was entrusted the country south of the Melrose road, between St. Mary's River and Country Harbor. Both

areas, embracing about 773 square miles, are occupied by the whin slate (Lower Cambrian) and accompanying granite of the auriferous series of Nova Scotia, the boundaries of which have been carefully traced and material collected for the preparation of a map of this interesting region, within which lie the important gold mines of Sherbrooke, Fifteen-mile Stream, Wine Harbor and Cochin's Hill. The whole area is generally rocky, studded with lakes, and for the most part barren, the inhabitants obtaining their living chiefly from the sea or from the mines. The land of the Gulf shore, on the contrary, is productive, well cultivated and thickly settled, and much greater variety prevails in the rock formations, Carboniferous, Devonian and pre-Cambrian being represented, similar in most respects to the strata, the limits of which have also been traced and described in the report for 1879–80.

To the Carboniferous, which occupies the coast from Blue Cape to Antigonish, belong the large deposits of excellent gypsum about Antigonish, Powquet, Tracadie and elsewhere; the limestone largely used for railway bridges and buildings—as in St. Wiman's Cathedral, at Antigonish—and also for making lime; clays used in the manufacture of bricks; and the small unimportant coal seam of Powquet Harbor. A small quantity of copper ore has also been obtained, mixed with coal, in the bark of fossil trees, as at Powquet Forks; at other times, at the contact of a Carboniferous limestone with conglomerate, mixed with both, in the form of purple pyrites or copper glance, as described in previous reports on Cape Breton. Deposits of this nature have been mined at Brierly Brook, Addington Forks and St. Joseph. Many of the limestones of the Ohio River contain traces of galena in addition to copper, and have been mined, but without profit.

The Devonian rocks which underlie the Carboniferous to the southward contain specular iron ores, similar to those of Salmon River, Boylston, Ragged Head and other places already described, which have been worked at Caledonia mills, Springfield and elsewhere. The copper ores of Lochaber and Polson's Lake are also of Devonian age, and appear to be associated with dykes of basic intrusive rock, which are numerous throughout the Devonian area. No work has been done at these mines lately.

Few economic minerals have been found in the pre-Cambrian rocks which occupy small bosses on the eastern shore of Antigonish Harbor, and a large area in the Kippoch Mountain, which extends to the East River, in Pictou county. Below the Ohio cross roads is an irregular vein carrying a considerable quantity of yellow copper ore.

Field work was begun on the 13th of May and terminated on the 1st of December.

Chemical, Mineralogical and Lithological Sections.

Mr. Hoffmann's report on these sections is as follows :—

"The work carried out in the laboratory during the year was almost exclusively of a practical character.

"The investigation referred to in the report of 1881–82–83 in regard to the characters and economic values of the coals and lignites of the North-West was completed [see Report of Progress 1882-83-84 Report M]. A number of stones were examined and reported on with reference to their durability as building materials. Numerous gold and silver assays, including an extensive series of specimens from the Lake of the Woods gold mining district, were made; also analyses of copper, iron and other ores, as well as a variety of miscellaneous examinations. Two hundred and ninety-three mineral specimens have been received—brought or sent—either for identification or for information in regard to their economic value. Apart from the time devoted to personal interviews in this connection, it further entailed the writing of 103 letters, which, in a good many instances, partook of the nature of reports.

"During the year Mr. F. D. Adams acted in the capacity of assistant chemist for seven months, and four months were devoted by him to field work. *

"In the mineralogical section of the museum very marked progress and improvement may be reported. Valuable additions have been made to the collection. Mr. Broadbent devoted himself continuously and most assiduously to the work of labelling the specimens, with most satisfactory results. To complete the work, a large amount of labor is, however, yet required.

"Mr. C. Willimott, assisted by Mr. H. P. Brumell, has arranged, labelled, catalogued and dispatched thirty-one collections, comprising 2,813 specimens of minerals and rocks for which application had been made by various educational institutions. He also, during the winter, prepared a report of the examinations he made the previous season. This is published in the annual volume of Survey reports for 1882–83–84. During the summer he again visited, with Mr. Brumell, the township of Wakefield, Quebec, and also the townships of Kingston, Thurlow, East and West York, Caledon and Barton, in Ontario, for the purpose of collecting specimens and obtaining information in regard to certain mining industries. These visits resulted in large and very desirable additions to the mineralogical section of the museum, to which also a number of accessions were made by presentation."

* This work has already been referred to under the head of surveys.

Biological Section.

In this section Mr. Whiteaves reports that the first part of the third volume of the "Palæozoic Fossils" of Canada was published in March. It contains forty-four pages of text, and is illustrated by eight octavo lithographic plates and four woodcuts. The third part of the first volume of Canadian "Mesozoic Fossils" was published in April. It consists of seventy-two pages of letterpress, with twelve octavo lithographic plates. A considerable portion of the MSS. of the second part of the third volume of "Palæozoic Fossils" was written, and many of the drawings required to illustrate it was made. The fourth and concluding part of the first volume of "Mesozoic Fossils" was also in course of preparation during the year 1884.

At the meeting of the Royal Society of Canada, in May, two papers were read before the Geological section, viz., one a "description of a new ammonite from the Cretaceous rocks of Fort St. John, on the Peace River," the other "on a decapod crustacean from the Cretaceous shales at Highwood River, Alberta."

On the occasion of the meeting of the British Association in Montreal, and at the request of the committee of the Geological section, a short verbal communication on the present state of our knowledge of the Cambro-Silurian rocks of Manitoba and Keewatin was made to the section, in connection with a paper by Mr. J. Hoyes Panton. This communication was based exclusively upon explorations and collections made by various officers of the Survey, from 1870 to 1883 inclusive.

In anticipation of the visit or visits of members of the British Association and their friends to Ottawa, every effort was made to get this section of the museum into as perfect order as possible, and the fine collection of Canadian aboriginal antiquities, recently acquired from Mr. C. A. Hirschfelder, was temporarily arranged in the mapping room. As the museum work of the year, however, was done conjointly with Messrs. Weston and Ami, it will be described more in detail in connection with the work of the latter. An unusual number of specialists, from Europe and the United States, visited the museum during August and September, and some time was spent in endeavoring to explain the specimens in which these gentlemen were most interested. During the absence of the Director, on field work, in September and October, the duties of Acting Director devolved upon Mr. Whiteaves.

Collections of fossils from the Hudson River formation at Oakville, Ont., from the Devonian and Cretaceous rocks of the Athabasca River, and from the Silurian and Cambro-Silurian of Back Bay and other localities in New Brunswick, were examined and reported on, for

Messrs. Lawson, Dr. R. Bell and Prof. L. W. Bailey. The recent invertebrates obtained by Dr. Bell at Hudson's Bay, were examined, and most of the species identified. A list of the latter was prepared for publication in Dr. Bell's report. In the zoological collection, twenty-five species of Canadian mammals and fifty of Canadian birds were named and labelled.

The study, which was commenced in 1883, of the large series of Laramie and Cretaceous fossils, now in the museum, from the Bow and Belly Rivers district, was continued, and the additional collections made in 1884, from the same region and rocks, by Messrs. R. G. McConnell, J. B. Tyrrell and T. C. Weston, were examined, and most of the species determined. A portion of the MSS. of a report on the whole of these fossils was written, and about half of the necessary drawings were made.

The extensive collections of Cambro-Silurian fossils made in 1884 by Messrs. T. C. Weston and J. M. Macoun, at various localities in the valley of the Red River, Manitoba, on the west coast of Lake Winnipeg, and in the islands adjacent thereto, consisting of nearly 1,000 specimens, were subjected to a preliminary examination.

From the 1st of January to the 20th of May, Mr. Weston's time was employed in re-arranging and labelling specimens, in general museum work, and in the preparation of a number of microscopic sections of rocks collected by various members of the staff. From the 21st of May to the 10th of September he was occupied in the field. The localities first visited were Swift Current Creek, Irvine Coulée and the Saskatchewan coal mines. The rock exposures along the west shore of Lake Winnipeg were afterwards carefully examined, from Cat Head to the mouth of the River, and on Punk, Deer and other islands in the lake, as were also the Cambro-Silurian limestone of East Selkirk and Lower Fort Garry. Large collections were made at most of the localities visited, not only of fossils, but also of hand specimens of rocks, clays, silts, concretions, &c. After his return to Ottawa, on the 10th of September, Mr. Weston went to Quebec and made a collection of fossils from the Cambro-Silurian slates of the Citadel Hill, the first fossils of any importance that had been collected at that locality. He also went to the best *Eozoon* locality and made a collection of specimens for distribution. The following is an approximate estimate of the number of fossils collected by Mr. Weston during the year:—

From the Laramie and Cretaceous Formations of Alberta, N.W.T.

40 Portions of jaw bones.
49 Teeth—mammalian and reptilian.
46 Vertebræ.
216 Portions of limb-bones.
20 Rib and other bones.

371

60 Cretaceous mollusca from three miles north of Ross Coulée.

From the Cambro-Silurian Rocks of Manitoba.

394 Fossils from Stony Mountain.
56 " " East Selkirk.
84 " " Lower Fort Garry.
384 " " various localities on west coast of Lake Winnipeg, and on the islands near that coast.

918

From the Lévis and Hudson River Formations—Point Lévis and Quebec.

40 Graptolites from Point Lévis.
50 " from the Cove Fields, Citadel Hill, Quebec.

Mr. Weston has also taken about forty photographs of geological sections, &c., in the North-west Territory.

Mr. H. M. Ami was occupied chiefly in the re-classification and re-labelling of the fossils in the museum, under the supervision of Mr. Whiteaves. The whole of the species from the Hudson River formation, from the Cambro-Silurian rocks of Manitoba and Keewatin, from the Guelph formation, from the Oriskany of western Ontario and the Lower Devonian of Campbellton and the Cascapedia, N.B., from the Hamilton formation, from the Upper Devonian of Quebec and New Brunswick, from the Neocomian of British Columbia and the Gault of the Queen Charlotte Islands; also the fossil plants of the Upper Cretaceous of the Nanaimo and Comox coal fields of Vancouver Island, and of Peace River, were re-arranged, and in all cases re-labelled. A commencement was also made of a systematic re-arrangement of the Laramie and Miocene plants and insects of the Souris, Nicola and Similkameen Rivers, N.W.T., and British Columbia, and of the Devonian fossils of the Corniferous formation of western Ontario.

With a view to determining the exact geological horizon of the rocks in which they are found, the following collections of fossils was examined by Mr. Ami, under Mr. Whiteaves' supervision. The species were determined as far as possible, and lists of them prepared :—

A. R. C. Selwyn :—
Fossils from a Black River limestone outlier forming islands in Lake Nipissing.

R. W. Ells and Assistants :—
Fossils from various localities in the Devonian and Silurian rocks of the Gaspé peninsula.

L. W. Bailey and Assistants :—
Fossils from the Silurian and Cambro-Silurian of Carleton, Charlotte and Victoria counties, New Brunswick, with several collections previously made at those localities by C. Robb, G. F. Matthew and T. C. Weston ; also fossils from the Eastern Townships and the neighborhood of the city of Quebec, collected by T. C. Weston.

Named collections of fossils were also sent to educational institutions during the year, and a few small ones to private collectors, in exchange for other specimens. About twenty boxes of specimens in the basement have been opened and a number of types found that had been mislaid many years ago. The number of specimens and of species of fossils exhibited in the cases in the upper flat of the museum were found to be upwards of 11,000 specimens and about 3,000 species. Of these, fully two-thirds, or about 2,000 species, have been re-arranged and re-labelled since 1882. Records of donations and additions to this branch of the museum have been regularly kept and the palæontological and zoological publications issued during the year have been distributed.

Mr. S. Herring was engaged as taxidermist to the Survey on the 1st of February last, and since that date he has been occupied in mounting specimens for the museum.

In addition to the fossils already mentioned as having been collected by Mr. Weston, the following collections were received during the year from members of the staff:—

G. M. Dawson :—
One hundred and fifty specimens of palæozoic fossils from the Rocky Mountains.

L. W. Bailey :—

Seventy species of Cambrian fossils from Stanford Brook, St. John county, New Brunswick, identified and named by G. F. Mathew, St. John, N.B.

R. G. McConnell :—

A number of Cretaceous invertebrates from the Wood Mountain region, district of Assiniboia.

J. B. Tyrrell :—

About 400 specimens of plants, invertebrates and vertebrates (including the skull of a dinosaur), from the Laramie and Cretaceous rocks of the Red Deer and Battle River districts.

A. C. Lawson :—

Thirty specimens of stone and copper implements, pottery, &c., from ancient mounds at the confluence of Little Lake and Rainy River.

R. Bell :—

An interesting series of marine invertebrates, insects, birds, mammals and fishes from Hudson's Bay. Seven mammals, twenty birds, two fishes and one fossil bone having been given him by P. W. Matthews, M. R. C. P., (Lond.), L. R. C. S., (Edin.)

A considerable number of specimens were also added to this section of the museum by presentation and a few acquired by purchase, the latter including an important collection of Indian relics from Mr. C. A. Hirschfelder.

Botanical Work.

This work is reported on, by Professor Macoun, as follows :—

"On the 1st of December, 1883, my assistant, J. M. Macoun, commenced, in accordance with your instructions, to label, mount and arrange the herbarium. This work, involving the writing of 6,500 labels, was completed, and the greater part of the polypetalæ registered before the 20th of May, when he left with Mr. Weston for the Northwest. After his return, on the 25th September, he mounted, ticketed and arranged in the herbarium, 1,118 sheets of specimens, which are chiefly part of my own and his collections during the past summer.

These, at commercial rates, are worth $333·50. Specimens of 800 species have also been sent to various institutions and individuals. Besides necessary correspondence, I examined and named all the collections made by the field parties in 1883, and also prepared the second part of the Catalogue of Canadian Plants—the Gamopetalæ. In the spring you expressed a wish that I should examine the country lying north of Lake Superior, and along the line of the Canadian Pacific railway. I therefore visited the country west of Lake Nipissing in the end of May, and early in June, proceeded to Lake Superior, where the country from Port Arthur to Dog Lake, north of Michipicoten, was examined. The Nipigon River was ascended, and Lake Nipigon circumnavigated. These excursions have afforded data sufficient to show the character of the climate and the botanical features of the region. In August I returned to Ottawa, and after attending the meeting of the British Association in Montreal, the members of the Biological section proceeding to the Rocky Mountains, asked permission for me to accompany them. After my return, on the 21st of September, I was engaged correcting the proofs of the catalogue prepared last winter. It contains 202 pages, royal 8vo. The collections made during the past summer are now being examined and named. The examination of Dr. Bell's collection, from the shores of Labrador and Hudson's Straits and Bay, was completed, and the list of species prepared to accompany his report.

Some time was devoted during the year to collecting good specimens of Canadian woods, and there were in the museum at the close of 1884—280 sections, representing 115 species of our useful forest trees. An extended catalogue of the trees and shrubs of the North-west was made out and furnished, by request, to the Minister of Agriculture, Manitoba, for publication in the report of his Department.

Library.

The Librarian, Dr. Thorburn, reports that during the year 1884, from 1st January to 31st December, 5,471 copies of the Geological Survey publications were distributed. Of these, 2,729 were distributed in Canada, the remainder—2,742—were sent to scientific and literary institutions, and individuals in America, Europe, India, Japan and Australia.

Three hundred and sixty-five French copies of the Report of Progress were distributed during the year.

A larger number of these would have been distributed had the printing not been delayed. English copies were, in consequence, sent to a

number of individuals and societies who would otherwise have received French ones.

Six hundred and forty publications, including books, transactions, memoirs, periodicals, pamphlets and maps were received as exchanges.

Fifty volumes have been added to the library by purchase and forty-three magazines and periodicals have been subscribed for during the year.

Three hundred and ninety-three volumes have been bound since the 31st of December, 1883,

The catalogue has been completed, but it is considered unnecessary to incur the cost of printing it. And for future reference in the library, it is proposed to make a card catalogue, such as is now used in most well arranged libraries.

Visitors.

The number of visitors to the Museum in 1884 was 13,946.

Staff, Appropriation, Expenditure and Correspondence.

There have been no changes in the permanent staff during the year. It consists of twenty-five persons, including the Director.

The position of artist is vacant since the retirement of Mr. A. H. Foord, the drawing having since been done by Mr. L. H. Lambe, of Montreal, and Mr. J. Watts, R.C.A., of Ottawa.

The appropriations for the fiscal year ended 30th June, 1884, were :—

Civil list salaries	$31,604.00
Contingencies	60,000.00
Total	$91,604.00

against which the expenditure for the Geological and Natural History and the maintenance of the museum is charged.

The expenditure may be summarized under the divisions named as follows :—

Pay-list salaries	$30,504.00
Wages of temporary employees	13,280.70
Exploration and survey, including travelling charges, purchase of horses and equipment	25,218.40
Printing and lithography	10,381.60
Purchase of specimens	1,496.15
Purchase of books and instruments	1,367.43
Chemicals and laboratory apparatus	188.39
Stationery	663.04
Fuel	106.86
Incidental and other expenses, including museum and other office fittings	3,685.80
	$86,892.37

The correspondence of the branch shows 2,611 letters sent, and 3,432 received.

The following remarks relating to mineral statistics and mines and the economic bearing of the work of the survey, which were appended to the survey report of 1884, may appropiately be reproduced here:—

As the subject of the collection and publication, by the Survey of statistics of mines and mineral products has of late been much discussed in the Press and elsewhere, and much misconception appears to have arisen respecting it, I may be permitted to refer to my views and action in this connection—the first, expressed as follows in my summary report to the minister, dated 2nd May, 1870, and the second, shown by the results as published in the Geological Report for 1871-72, pages 146 to 154.

Extract from Report dated May, 1880.

"In view of the importance and usefulness of mining records, and of complete and accurate statistics of mineral produce, it is thought desirable to endeavor, in future, to publish yearly, with the reports of the Geological Survey, a return of the mineral production of the Dominion. With this object in view, the annexed circular and blank form have been issued, and copies of it have been sent to all persons who, it has been ascertained, are actively engaged in mining, or in raising or manufacturing mineral products, and whose addresses were known. In circulating the printed form, either personal or written application has, in most cases, also been made to have the information asked for under the respective heads given in as complete a form as possible, and the object of the inquiry has, at the same time, been more fully explained. No great success can be expected at first; neither is it likely that the replies received will be of such a nature as to afford the requisite material for the compilation of as complete a statistical return as could be desired. The precise object of the inquiry will have to be familiarized, and its probable utility more generally understood and appreciated. On the whole, however, the results already obtained are very encouraging, and I have no doubt that by degrees a large amount of valuable information relating to the mineral produce of the Dominion will be collected.

"Mr. Edward Hartley has issued ninety-seven circulars, with explanatory letters. Eleven only of these have been returned filled up, in most cases, very satisfactorily. He has also received fifteen letters, acknowledging the circular, and promising to return the form filled in with the information asked for. Two hundred copies of the circulars

have been sent to the Honorable Robert Robertson, Commissioner of Mines and Public Works in Nova Scotia, who has kindly promised his assistance in distributing them there, and undertakes to see that they are put in the hands of every person engaged in mining, connected with his department, who would be likely to make any use of them.

"Professor R. Bell has sent 169 circulars to eighty-four persons in Ontario and Quebec, some of whom have undertaken to distribute the duplicates sent to them to mine-owners in their respective districts, whose addresses were not known at the Geological Survey office. Of these, only fifteen have yet been returned; they are filled up very satisfactorily. Twenty more have been acknowledged, and the information promised. Sectional drawings of two mines have been sent with the returns, showing the nature of the deposit and the extent of the working.

"The scheme, so far, appears to meet with general approval, and no one to whom application has been made has declined to give the desired information.

Extract from Report, 1871-72.

"The following tables, compiled by Mr. C. Robb, exhibit in a concise form the results of mining operations during the last three years throughout the Dominion of Canada and British American Provinces. They have been compiled chiefly from information obtained by the officers of the Geological Survey, under the arrangement specified in Mr. Selwyn's Summary Report, addressed to the Legislature, and dated 2nd May, 1870, pp. 13 and 14; and partly from the reports of the Commissioner of Mines for Nova Scotia, supplemented by other authentic sources of information. In some cases, in order to render the tables more complete and uniform, it has been deemed necessary to fill up some of the items by estimating according to the compiler's best judgment. In such cases the figures are marked by an asterisk. It is to be regretted that the returns are so incomplete as to render such an expedient necessary; and it is hoped that, when the importance and value of such records are duly recognized, the parties more immediately interested will give their cordial co-operation. These tables comprise the records only of such mines as have been in operation during the whole or any part of the three years referred to; and in some instances, where it has been impossible to obtain any information, all notice has necessarily been omitted. In the column indicating the year, the brackets denote that the "aggregate" production, number of men, &c. for each year, of all the mines of the class referred to, is recorded."

It may naturally be asked why this work was not continued, and on

this point I may say the reasons were numerous, chief among them, however, being, that after the third year but a few of the circulars issued were returned, while at the same time I was instructed to direct my own attention and that of the staff to the exploration of the North-west and British Columbia. That the development of mines and economic minerals in the Dominion generally, however, has not at any time been, as has been stated, "entirely neglected," or "received no attention whatever," is sufficiently proved by the following list of reports published by the Survey, and which relate exclusively to this subject:—

SELWYN. Notes and Observations on the Gold Fields of Quebec and Nova Scotia.

BROWNE On the Phosphate of Lime and Mica found in North and South Burgess.

RICHARDSON. On the Coal Fields of Vancouver Island.

VENNOR. On Geology of Leeds, Frontenac, &c., with notes of Gold of Marmora, &c.

ROBB. Mining and Mineral Statistics.

SELWYN. On the Acadia Iron Ore Deposits of Londonderry.

RICHARDSON. On the Coal Fields of Vancouver and Queen Charlotte Islands.

VENNOR. On Counties of Frontenac, Leeds, &c., with plan of Dalhousie Mine.

ELLS. Operations in Boring for Coal, New Brunswick.

ROBB. On Coal Mines of Sydney, C.B.

HARRINGTON. On Samples of Brick Clay from Manitoba.

HARRINGTON (Appendix to Selwyn). On Western Coals.

HOFFMANN (Appendix to Bell). On Lignites.

VENNOR. On Frontenac, Leeds, &c. Notes on Plumbago, Apatite, &c.

BARLOW. Springhill Coal Field.

MCOUAT. On a portion of the Cumberland Coal Field.

HARRINGTON. On the Iron Ores of Canada and their development.

ELLS. Second Report on Borings for Coals in New Brunswick.

ELLS. On Iron Ore Deposits of Carleton County, New Brunswick.

VENNOR. On Frontenac, Lanark, &c., with notes on some of the Economic Minerals of Ontario.

ROBB. On Explorations, &c., with Table of Sections of Measures in Sydney Coal Field.

SMITH. On History and Statistics of Canadian Salt.

ELLS. On Boring Operations in the North-west.

BARLOW. On Progress of Survey of Coal Fields of Cumberland County, Nova Scotia.

DAWSON. Mines and Minerals of Economic Value in British Columbia.

RICHARDSON. On Coal Fields of Nanaimo, Comox, &c.

HUNT. On Goderich Salt Region.

VENNOR. On Renfrew, Pontiac, &c., with additional notes on Iron, Apatite, Plumbago, &c., of Ottawa County.

BAILY AND ELLS. On L. Carboniferous Belt of Albert and Westmorland Counties including the Albert Shales.

HOFFMANN. On Canadian Graphite.

HARRINGTON. Report on Minerals of some of the Apatite-bearing Veins of Ottawa County.

SELWYN. Report on Boring Operations in the Souris Valley.

DAWSON (Appendix to Selwyn). On Lignite Tertiary Formation from the Souris River to the 108th Meridian.

DAWSON. Preliminary Report on Bow and Belly River region, with special reference to the Coal Deposits.

WILLIMOTT. Notes on some of the Mines of the Province of Quebec.

Special Reports (Published Separately).

Descriptive Catalogue of Economic Minerals of Canada, &c., Philadelphia Exhibition, 1876.

Catalogue des Minéreaux Économiques du Canada, Exposition Universelle, Paris, 1878.

Preliminary Note on Geology of Bow and Belly Rivers District, with special reference to Coal Deposits (published separately), 1882.

General Note on Mines and Minerals of Economic Value of British Columbia. (Published separately. Also first printed in Canadian Pacific Railway Report, 1877.)

The above enumeration shows a total of thirty-seven reports (without counting two, which were also printed as special reports) making known in their titles their special bearing on mines, mineral deposits and statistics of mineral production.

Besides the above it will be found that in almost every report published in each of the twelve volumes issued during the past fourteen years, the closing pages are devoted specially to an enumeration and statement of all the economic minerals observed, or reported to occur, in the districts to which the report itself relates. This is precisely the same system as was adopted in this connection by my predecessor, Sir W. E. Logan.

Without, however, now further referring to the past, we may perhaps offer some suggestions for the prosecution of this work in the future, and I may say that after carefully considering the matter in all its aspects, I am led to the belief that the system I originally adopted, namely, that of issuing a circular, with questions to be answered on a form printed for this purpose, and when convenient or considered necessary, to be accompanied by personal application on the ground, is that which is most likely to afford the desired result. There are two gentlemen, trained mining engineers, now employed on the Survey, to whom the work of issuing, collecting and compiling the returns might be entrusted, and who might also each year visit and critically examine and report on one or two mining districts. In this way, every mining district in the country would be visited at intervals of one or two years, unless some special development called for more frequent examination.

At present the chief mining developments are in the Provinces of Nova Scotia, Quebec and British Columbia, and in each of these Provinces the Local Government employs a mining inspector or engineer, who collects statistics and reports on the mines of the province.

It would not, therefore, seem desirable or necessary that the work should also be done in these provinces by the Geological Survey, but with the co-operation and consent of the provincial authorities the results obtained by their officers might be incorporated in the general statement issued annually by the Geological Survey, and thus gain wider publicity.

So far as the special examination of mining districts is concerned, a commencement was already made in 1883 and continued in 1884, the districts examined being:—In 1883, the Lake of the Woods gold region and the phosphate region in the townships of Wakefield and Templeton; and in 1884, the Marmora gold and iron bearing region, and the mining region around the north shore of Lake Superior; also some of the mines in the Province of Quebec.

If the scheme now proposed is carried out, no further assistance would be required, but the two gentlemen named—Messrs. E. Coste and E. D. Ingall—should be appointed on the permanent staff, with the title of mining geologists.

1885.

The summary reports of the officers in charge of the field parties show that in 1885, the work, as in former years, has been prosecuted over portions of every province and territory in the Dominion, from Nova Scotia to the west coast of Vancouver Island. Valuable information, both as regards the topography and the geology, has been secured, and a number of important additions to the collections in the museum has been made, both by gift and by purchase, as well as by the efforts of the officers of the Survey. These are referred to in detail further on, under the mineralogical and biological sections.

In regard to the survey and exploration of Lake Mistassini, referred to in my last summary report, I regret to say that my anticipations respecting it, as then stated, were subsequently verified. On the 2nd February, Mr. Low left the party encamped on the lake shore, and came out on snow-shoes to Lake St. John, whence he proceeded to Ottawa, arriving there on the 3rd March. From his report I considered it expedient that he should at once return, and take charge of the survey. He accordingly left Ottawa on the 28th of March, accompanied by J. M. Macoun, as assistant, and reached Lake St. John on the 5th of April. Thence they proceeded on snowshoes to Lake Mistassini. Owing to the lateness of the season, however, travelling at night became necessary, and with much difficulty and considerable hardship they reached the lake on the 28th of April. Up to that time no attempt had been made to ascertain the size of the lake or to survey its shores. A summary statement of the work of Mr. Low is given on a subsequent page. Detailed reports relating to some of the work of 1884, referred to in my last summary report, which will embody the work of two seasons, are now in the press, while others, including that of the Lake Mistassini expedition, are being prepared, and all will, it is hoped, be ready for publication during the winter.

It is, proposed, in future, to issue a certain number of copies of each report separately, and as soon as they are printed, while the remainder of the edition will be issued later, as heretofore, in one volume, containing all the reports published during the year from January to December. For economicial reasons, this course has not hitherto been adopted, but it will, it is hoped, prove more convenient.

In addition to the work of editing reports, &c., and general superintendence, much of my time and attention during the past year has been occupied with correspondence and other matters connected with the Antwerp exhibition and the Colonial Indian exhibition.

Explorations and Surveys.

My own work in the field during the past summer, comprised examinations, partly alone and partly in company with Messrs. Weston, Ells, Coste and Ingall. From the 20th June to the 17th July, in the vicinity of Quebec and on the Island of Orleans; from the 17th to the 31st July, around Massawippi and Memphremagog Lake and in vicinity of Sherbrooke. On the 8th of August I left for Port Arthur, and accompanied Mr. Coste to the Slate Islands.

On the 22nd, the "Zenith Zinc Mine" was visited and examined. It is situated about twelve miles inland to the north of McKay's Harbor, on the Canadian Pacific Railway. The route to it is by a series of lakes and portages on the course of the White Sand River. The deposit is an exceedingly interesting one, and when more easily accessible may prove of considerable value. A short report on it was given to the owners. Already some 400 or 500 tons of ore have been raised, but there being at present no available road from the mine to the lake shore, it cannot be sent to market.

On the 27th of August, while making examinations along the line of the Canadian Pacific Railway, I met with an accident, which prevented continuance of active field work till the 7th of October, when I left Winnipeg, accompanied by Mr. C. Moberly, to examine some outcrops of Cretaceous rocks on the Assiniboine River, in Township 8, Range 11, Section 36, where strong indications of petroleum were reported to occur, and which had been first observed while an attempt was being made to open a freestone quarry. The outcroop extends along the bank of the river for about 500 yards, and consists of beds of highly fossiliferous sandy limestones, brown freestone, and dark—almost black—soft shales. The sandstone and limestone, when broken or struck, emit a strong odor of petroleum, but whether it exists here in quantity or not can only be ascertained by boring. It might be worth while to test the question in this manner, as the geological features are not unlike those on the Athabasca, and Clearwater Rivers, where both lignite-coal and petroleum occur, the latter impregnating a great thickness of Cretaceous sand-rock and also forming considerable deposits on the surface of the ground.

On returning east I again spent a few days at Port Arthur, and accompanied by Mr. Ingall, visited and cursorily examined the Rabbit and Silver Mountain mines, where magnificent specimens of silver ore have been obtained by the original prospectors, some of which are, through the kindness of Mr. Keefer, now in the museum of the Survey. The geological structure and relations at these mines are,

so far as I can judge, precisely similar to those observed at some of the older mines around Thunder Bay. These latter, have, however, been successively abandoned, presumably, because they proved unprofitable; but whether this arose from mismanagement, lack of enterprise, or some other cause, it is not easy now to determine, and we can only hope that a similar result will not attend those prospects now being developed in the district referred to. Mr. Ingall is preparing a detailed report on this district, based on his examinations and surveys made during the seasons of 1884 and 1885. The veins are well defined, and have a most promising appearance, and there seems no reason whatever why they should not continue to yield ore in depth as rich as any that has been found on the outcrops.

British Columbia.

Dr. G. M. Dawson has been engaged during the past summer in the geological exploration of a portion of the coast of British Columbia. The work so far carried out by the survey on the seaboard of this province, has been comparatively limited. The late Mr. James Richardson visited and cursorily examined a number of points, but his detailed and connected surveys were practically confined to the part of the Cretaceous coal-bearing rocks which extend south-eastward from Comox. Dr. Dawson had previously (in 1878) explored and surveyed the greater part of the coast-line of the Queen Charlotte Islands, and in the same year carried out some reconnaisance work in the northern part of Vancouver Island; but this, being of a preliminary character, and incomplete, was not published in detail. The exploration of the past season was undertaken with a view of adding to and extending the area of this work with special reference to the definition of the areas of coal-bearing rocks known to exist in the region in question. Dr. Dawson's summary report on the operations of the season is as follows:—

"Accompanied by Mr. D. B. Dowling, as assistant, I left Ottawa on the 3rd of June, arriving in Victoria on the 11th. It had been intended, if found practicable, to hire a steam-launch or small schooner with auxiliary steam-power; the experience of previous years having shown that much loss of time was likely to occur if dependence had to be placed on a sailing craft for locomotion, while work carried on by boat or canoe along shore entails frequent long return journeys to the few points at which supplies can be obtained on this coast. It was, however, found that no suitable craft with steam-power was available in Victoria within the necessary limitations of expenditure, and after ex-

hausting enquiries in this direction, the schooner "Carolena" (32 tons) was eventually chartered for use during the season. We sailed from Victoria on the 21st June, some days having been necessarily employed in procuring equipment for an absence of several months. Two days were also devoted, before leaving, to the examination of a deposit of iron ore at Sooke, near Victoria.

"The examination of the coast was begun at Comox, where Mr. Richardson's work had terminated, and the Cretaceous coal-bearing rocks were traced thence along the coast of Vancouver Island for about thirty miles. These rocks were at this point—a short distance north of Cape Mudge—found to be replaced on the shore by an older trappean series on which they rest unconformably, and it would appear from information received from timber explorers, and as the result of our subsequent examination, that the continuation of the Cretaceous trough or basin of the Comox region here trends inland, having a breadth of several miles on the Campbell River, and, very probably, running through behind the ranges which border the coast as far as the headwaters of the Salmon River.

"Having examined the shores of Discovery Passage as far as Seymour Narrows, it became important to ascertain whether there was any recurrence of the coal-bearing rocks of the Comox basin on the north-eastern shores of the Gulf of Georgia. These, together with Malaspina Inlet and both shores of Malaspina Strait as far south-eastward as the entrance to Jarvis Inlet, were next systematically explored—the number of islands and intricacy in outline of the coast, rendering it necessary to traverse a great aggregate length of shore-line. Coal, which had been vaguely reported as occurring on Valdez Islands and in Malaspina Inlet, was not found in either place, nor were any outliers of the Cretaceous sandstones observed. It had also been supposed that the coal-bearing rocks might underlie Mary, Hernando, Savary, or Harwood Islands, the low, flat appearance of these favoring this view. It was, however, found that this appearance arises from the fact that these islands are composed of boulder-clay and other drift deposits, below which granite rocks come to the surface at a few places. A small area of sandstone rocks was, however, observed running inland from the north-east shore of Malaspina Strait, which is probably Cretaceous, but contains, so far as observed, no coal seams of any value. Several large lakes exist in this vicinity in the promontory between Desolation Sound and Jarvis Inlet. From one of these, a river of considerable size issues, and forms a fine fall within half a mile of the shore. The existence of these lakes is not indicated on the published charts, and though I had intended to devote some days to their exploration in the autumn, the project had eventually to be abandoned for lack of time.

"A portion of the north-eastern shore of Texada Island (forming the south-western side of Malaspina Strait) was next examined, including a locality at which openings had been made on copper ore, one at which marble had been quarried, and an important occurrence of iron ore. No work is now being prosecuted at any of these places, but there is in this vicinity an immense quantity of grey, banded and blotched marble, which passes into a nearly white variety, in some places. The marble is very well situated for quarrying, forming low cliffs along the shore for several miles. Later in the season the whole remaining shore of Texada Island, with that of Lasqueti and neighboring islands, was traversed, and the iron mine near Gillies Bay visited. To avoid reverting to this district, it may be stated that one locality of Cretaceous rocks, in addition to those indicated on Mr. Richardson's map, was discovered. It also appears probable, from the extent of low drift-covered country in that vicinity, that the Cretaceous area at Gillies Bay may be somewhat larger than shown on the map, and it may some day be worth while to bore either at this place or on Sangster Island, in order to ascertain definitely whether any coal seams occur in these small borders of the sandstone series which have here escaped denudation.

"Beyond Seymour Narrows, the shores of Johnston and Broughton Straits, with portions of those of adjacent water-ways to the northward were examined and found to consist of granitic rocks, with areas of an overlying series, which is for the most part volcanic in origin, but which has been much altered, and is at least in part of Triassic age.

"From Alert Bay, while Mr. Dowling continued the examination of the coast, I made an excursion up the Nimpkish River to Nimpkish or Karmutsen Lake, and finding the lake to be very imperfectly represented on the map, made a survey of the entire shore-line with Massy's floating boat-log. Marble occurs in considerable quantity on the shores of the lake, but as the same stone is found much more conveniently situated for shipment at the head of Beaver Cove, where some blocks have already been quarried, it cannot be regarded as of immediate importance.

"The Cretaceous coal-bearing rocks which extend along the coast from Port McNeill to Fort Rupert—a distance of 16 miles—which had been cursorily inspected by me on the way back from the Queen Charlotte Islands in 1878, were now more closely examined. This area is that in which coal was first discovered in British Columbia, and worked to a small extent by the Hudson Bay Company, which, also, as far back as 1852, caused some borings to be sunk to a limited depth. Though work was abandoned here on the discovery of the Nanaimo deposits, and the seams so far discovered are not thick, the regularity and light degree of inclination of the rocks are such as to promise well for the

value of any thicker beds which may be found to exist, and it is very desirable that further intelligently directed boring operations should be undertaken. The low, level character of Malcolm Island, suggested that Cretaceous rocks, forming an extension of those of this area, might underlie it, and though its shores exhibit for the most part drift deposits only, the correctness of this supposition was established by Mr. Dowling having discovered, in a single locality, conglomerates of the Cretaceous series. This is of importance, as indicating a much wider spread of the possibly coal-bearing rocks than had previously been known in this region.

" In following the shores of Vancouver Island and those of Hope, Galiano, and the the islands of the Gordon group, numerous facts of interest, from a geological point of view, were ascertained; but no further Cretaceous areas were met with, except two of quite inconsiderable size in Hardy Bay. At Nawitti, on Hope Island, two Indians and a canoe were engaged, and with them I examined the northern extremity of Vancouver Island, round Cape Scott, and as far south as Quatsino, the schooner meeting us again at the last-named place. We were fortunately favored with very fine weather on this expedition, which rendered it possible to land at a greater number of points usually difficult of approach, on account of the heavy sea on this exposed coast. The rocks belong, for the most part, to the altered volcanic series before referred to, and include bands of shale and limestone holding *Monotis*. A small patch of Shasta Cretaceous, with its characteristic *Aucella*, was found on the north shore of Raft Cove.

" Some time was next spent in examination of Quatsino Sound, and particularly of that portion of it in the vicinity of Coal Harbor, where boring operations have lately been in progress. Cretaceous sandstones and shales characterize rather wide-spread areas in this region, and several coal seams are known; though none have so far been discovered of such thickness as to justify extensive mining operations. It is believed that the knowledge now gained of these rocks is such as to be of service in directing future exploratory operations in search of coal.

" On returning from Quatsino to the inner coast of the island, the archipelago of small islands forming the eastern end of Queen Charlotte Sound, and the north-east shore of the sound as far as Blunden Harbor, was examined, and the distribution of the various rock series mapped, but no extension of the Cretaceous was met with in this direction.

" On the return voyage to Victoria we stood across to Lasqueti Island, and leaving the schooner at anchor in False Bay, I made the examination of that and Texada Island previously referred to.

" The result of the season's work has in general terms thus been the examination of the main shores of Queen Charlotte Sound, those of

the northern extremity of Vancouver and adjacent islands and Quatsino Sound, together with all the main shore of the Gulf of Georgia which had not heretofore been geologically mapped, with the exception of that portion between Jarvis and Burrard Inlets. While it was impossible to traverse the shores of all the numerous inlets and fiords ramifying into the mainland, it was endeavored to make the work actually done so complete as to obviate the necessity of re-examination till such time as geological mapping of a much more minute character than any yet contemplated is undertaken. It must be understood, however, that the work as it now stands is of a strictly preliminary character. Having been provided with a schooner, and the means of examining the coast (which affords the most easily accessible and instructive geological sections), it was deemed best to postpone lengthened excursions inland, though traverses were made for several miles into the bush, in a number of places, for the purpose of ascertaining the width of the coal-bearing rocks. Much information of a general character as to possible routes, and nature of the country, was also obtained, such as to render it easy to lay out future work for the completion of any given part of the region, and to indicate which of these will be of the most importance in the near future.

"The present report is intended as a sketch merely of the operations of the summer. It may, however, be not inappropriate to add a few general observations on this part of the coast from an economic point of view. It is scarcely, I believe, yet realized what a large quantity of valuable timber Vancouver Island and the adjacent mainland are capable of yielding. That at the shore is generally more or less wind-shaken and gnarled, but a short distance inland, where the surface is at all level, fine trees are found in abundance, and the wide valleys of the mountainous districts almost invariably hold extensive and well-grown forests. Toward the northern end of the island the Douglas fir is not so common, being to some extent replaced by the hemlock, and two species of spruce. The cedar (*Thuya gigantia*) is, however, here abundant, and the white pine (*Pinus monticola*) is commonly met with down to the shores, while the yellow cypress (*Chamæcyparis Nootkatensis*), a mountain tree in the vicinity of Burrard Inlet, comes down to the sea-margin in the latitude of Blunden Harbor, and is found in some abundance a few hundred feet above the sea-level over the whole northern end of Vancouver Island.

"North of Seymour Narrows, though extensive low tracts occur, there can scarcely be said to be any land fitted for immediate agricultural occupation, most of the surface otherwise suited for this use being so densely wooded that it would scarcely pay at present to endeavor to clear it. The north coast of Vancouver Island, however, between

Nawitti and Cape Scott, might be utilized to support a considerable number of cattle, owing to the quantity of grass which there grows along the shore, and the less dense character of the forest; while, running across behind Cape Scott is an extensive lagoon not shown on the charts, with tracts of grassy marsh, now subject to overflow at high tides, but of which, I believe, several thousand acres might be reclaimed by dyking.

"The Indians of all this region derive an easy subsistence from the products of the sea, but with this exception, and that of a few salmon canneries, the fisheries of the entire coast may yet be considered as untouched. The dog-fish is now, however, beginning to be taken in considerable numbers, at a few points, for the manufacture of oil, and before the lapse of many years it is easy to predict that the many inlets and coves of the west and north coasts of Vancouver Island will be occupied by a numerous and hardy population of fishermen. As a first step towards this desirable event, it is much to be wished that some adequate and scientific investigation of the banks and fishing grounds of the coast should be undertaken. Off the west coast of the island, in the spring, considerable numbers of fur seals are annually taken, while a few skins of sea-otter are still obtained by the Indians. This extremely valuable fur-bearing animal appears, however, as the result of indiscriminate and persistent hunting, to be verging on extinction, and its pursuit is not only a dangerous, but a very uncertain one.

"In connection with the geological work of the season, a large number of illustrative rock specimens were obtained, some of which, representing stones likely to be of economic value for building purposes, are of such size as to afford dressed six-inch cubes. A small collection of fossil molluscs from the Shasta beds was made in Quatsino Sound, together with a number of Cretaceous fossil plants from other localities. About sixty photographs, illustrative of the character of the country, were taken, and meteorological observations, including the temperature of the sea-surface twice daily, were kept up during the season by Mr. Dowling. When circumstances rendered geological work impossible, some attention was given to dredging and the collection of natural history specimens. A large number of marine invertebrates, including twenty-two jars of collections in alcohol, together with forty-four skins of birds and mammals were thus obtained. A small collection of dried plants was also made.

"After my return to Victoria, about three weeks was devoted to work in connection with the representation of the province in the Colonial and Indian exhibition. Ottawa was reached on the 20th of November."

In the interior of British Columbia, Mr. Amos Bowman, assisted by Messrs. McEvoy, Voligny and Tuck, commenced the survey and investigation of the well-known placer mining region of Cariboo. This work was undertaken at the request and with the co-operation of the Provincial Government, and it is hoped it will be continued in the same manner during the ensuing season. Although the district has yielded, in the past twenty-five years, about thirty million dollars of gold so much geographical information had to be procured as a first step towards its delineation, that the Geological Survey has not been in position heretofore to effect more than a cursory examination towards this otherwise desirable work. The Government of British Columbia having thus removed the principal obstacle by meeting half the cost, the conduct of the joint work was placed in the hands of the Director of the Geological Survey, and the execution was entrusted to Mr. Amos Bowman, mining engineer. The field work lasted from July to October, and covered the principal gold-bearing country, an area of fifty by seventy-five miles. The instrumental work done, embraced, besides the work of the triangulation and latitude stations, the measurement of 255·5 miles of traverse of the roads and trails of the country with the wheel, supplemented by a still larger mileage of track surveys; resulting in thirty sheets of plotted surveys of the diggings on a detailed scale, and of the roads and trails on a smaller scale, to be embodied in the general map.

The quartz mining interest was (incidentally) investigated. In returning southward from the field of survey, a feasible route was sought, and found, through an agricultural country the entire distance, for a branch railway line connecting with the Canadian Pacific at Ashcroft. To complete the mapping of the mining region proper, comprising an area of 3,700 square miles, on a sufficiently large scale to be valuable to the miner, will require another season in the field. While during the past summer it was necessary to devote almost the entire time of the party to geographical and topographical work, it is intended next season to use this as a basis on which to work up the geological and mining aspects of the district.

North-west Territory.

Mr. McConnell, assisted by Mr. James White, was engaged during the past summer almost entirely in the Rocky Mountains.

The work consisted in examining geologically and making a topographic survey of that part of the range which lies between the Canadian Pacific railway and the North Saskatchewan River, from the watershed eastward to the plains in this region, embracing an area of

about 5,000 square miles. All the passes that were accessible, and the head-waters of all the principal streams, amongst which are the Red Deer, Sheep Creek and the Saskatchewan, were traversed, and the bordering mountain ranges were carefully triangulated. Before publishing the map of this area, which is now being prepared, the field work should be extended west to the Columbia and north to the Athabasca Pass. This would fully occupy two more seasons.

The mountains, east of the main watershed, in this portion of their length, consist of a number of parallel and very regular limestone ranges, striking north-west, and separated by wide valleys, which usually present areas of Mesozoic shales and sandstones holding occasional beds of good coal. The limestones belong, for the most part, to the Devonian and Carboniferous systems, and rarely contain so far as known, minerals of economic importance. The main watershed range and the mountains to the west of it, which are partly composed of older strata, and include areas of igneous rocks, appear to present a much more promising field for discoveries in this connection.

About two weeks in the latter part of the season was spent on the plains, collecting a few details which were required to complete the map of some 30,500 square miles of the district of Assiniboia.

The fossils collected are referred to on a subsequent page.

Mr. J. B. Tyrrell, assisted by Mr. E. H. Hamilton, continued the examination of the country north of the Bow River and south of the North Saskatchewan, including an area of about 27,000 square miles, lying between 110° and 115° west longitude.

After making a canoe traverse of the Battle River, from the Edmonton-Calgary trail to the trail from Fort Pitt to Sounding Lake, and an examination of part of the telegraph trail west of the 110th meridian, he examined the country around Sounding Lake and in and around the Neutral Hills, and, in passing, re-examined the conglomerates and associated beds in the Hand Hills. On the Battle River, coal seams varying from 3 feet to 4 feet 6 inches in thickness, were found to crop out along the banks for about 35 miles, from a short distance below Dried Meat Lake to the mouth of Paint Earth Creek. These seams hold about the same geological positions as those on the Bow River near Blackfoot Crossing.

Towards autumn, a moderately detailed investigation of the country in and along the edge of the foot-hills of the Rocky Mountains, was proceeded with, adding considerably to our knowledge of the mineral, timber and grazing wealth as well as to the geography of that portion of the district which is drained by the Red Deer and Clearwater Rivers between the 112th and the 115th degrees of longitude.

Mr. Tyrrell also visited the so-called petroleum claims, located on the east bank of the Red Deer, a short distance below the mouth of Tail Creek, and reports that after a careful examination no signs of the presence of petroleum could be detected.

The disturbances in the North-west during the past year rendered it impossible to commence field work sufficiently early in the season, the month of May and half of June having passed before anything could be done. However, about 20,000 miles have now been examined, and if the map is published of the size originally intended, a small area along the Saskatchewan alone remains to be explored. The topography of the southern and eastern portions of the district is now plotted on a sheet which is ready to be put into the hands of a draftsman to be reduced and prepared for the engraver. If this work is proceeded with at once, the map could be ready for publication in the early part of the winter of 1886-87.

The palæontological and natural history specimens collected by the party are referred to in the report on the biological section by Mr. Whiteaves.

ONTARIO.

Mr. A. C. Lawson was occupied during the season in western Ontario, assisted by Messrs. A. E. Barlow, W. H. Smith and Mr. C. S. Morton. The work embraced two divisions:—

1. The prosecution of additional topographical and geological surveys for the map of the Lake of the Woods.

2. The commencement of a detailed topographical and geological survey of Rainy Lake and the adjoining water-stretches. The first of these entailed several weeks geological work by Mr. Lawson, in the same field as last year, rendered necessary in the light of the results arrived at previously. While thus engaged Messrs. Barlow and Smith were detailed to make a careful micrometer and compass survey of Whitefish Bay, a large body of water filled with islands, hitherto unmapped, except from sketch survey by Dr. Bell, while Mr. Morton was entrusted with a similar survey of the bays and inlands of the Winnipeg River from Rat Portage to the northern limit of the sheet, near the Dalles.

After the completion of the Winnipeg River survey, and while Messrs. Barlow and Smith were yet engaged on Whitefish Bay, Mr. Lawson and Mr. Morton proceeded with a survey of the shore and islands lying between Falcon Island and Sabaskong Bay, over which it had been decided to extent the limits of the sheet, the details of the topography devolving upon Mr. Morton, while Mr. Lawson's attention was directed to the geological features of the country.

The survey of Whitefish Bay having been completed in the meantime, Messrs. Barlow and Smith carried their line across Sabaskong Bay, and proceeded to make a survey of the chain of lakes, rivers and portages that constitute the back canoe route between the Lake of the Woods and the North-west Bay of Rainy Lake. This work involved, besides the surveying of the topographical features, a careful examination of the rocks along this line of survey with the view to mapping their distribution. The continuation of the survey of the west end of Rainy Lake, was then proceeded with, and by the close of the season a continuous survey had been established between Rat Portage and Fort Frances, and the geological conditions of the country traversed from the mouth of Whitefish Bay to the United States boundary at the outlet of Rainy Lake, noted.

Mr. Lawson, having completed this work on the Lake of the Woods by the end of July, he and Mr. Morton were engaged for the remainder of the season on Rainy Lake. The former traversed the whole of the north shore of the lake to Kettle Falls, and for some distance beyond, into Nemeukan Lake, and made exploratory surveys of the Sand Island, of Turtle River, and of the Seine River to Sturgeon Falls, while the latter made a survey of the south shore of the lake and of the islands lying between Fort Frances and Kettle Falls. Mr. Lawson's attention was chiefly devoted to working out the structure of the rocks referred to the Huronian, a belt of which, with a width of more than 20 miles, traverses the lake. Many interesting geological features were brought to light and good indications were noted of the presence of mica, iron, molybdenum and other valuable minerals.

Mr. E. D. Ingall and party proceeded on 4th June last to Port Arthur to continue the work in the Lake Superior mining region, and returned to Ottawa 19th November.

The first half of the season was occupied in surveying along the coast line of the lake from Port Arthur towards the international boundary at Pigeon River, with the intention of mapping the details of this section of the Animikie series with a view to its sub-division, if possible.

The return to Port Arthur was made by way of the group of islands in the mouth of Thunder Bay, so as to visit and examine the mineral-bearing veins found on them, thus completing the examination of the chief mining ventures of the Lake Superior region.

During the latter half of the season, the party was engaged in making a contoured lithological map of the block of mining locations around the new finds of silver-bearing veins at Silver Mountain, intended to show the distribution of the different "country" rocks around this point, and the position of the veins and mining developments.

During the greater part of the season Mr. Ingall was assisted by Messrs. A. W. Hopkins and J. H. Moore.

The work connected with the preparation of the map and report of the Silver Mountain District is being proceeded with, and will probably take the greater part of the winter. When this is completed, the work of finishing the maps and report on the whole Lake Superior mining region will be continued.

Mr. E. Coste, assisted by Messrs. Vautelet and Mathewson for topographical work, was engaged during the months of June and the first half of July in continuing and extending the work of the previous season in Hastings, to the counties of Peterboro' and Victoria. In the second half of July, the Archæan rocks in the townships of Methuden, Burleigh and Harvey chiefly occupied his attention.

In July I received instructions to send Mr. Coste to make an examination of the Slate Islands in Lake Superior, after completing which he resumed his work in the townships of Lutterworth, Snowdon, Galway, Cavendish and Anstruther, and also made a careful examination of every locality in the area embraced by the map under preparation, where economic minerals were reported on good authority to have been found, or were being worked. The northern boundary of the fossiliferous (Cambro-Silurian) rocks is now delineated in all its details from Stocco Lake, in the township of Hungerford, to Head Lake, in the township of Digby, a distance, in a straight line, of eighty-five miles. There are in that distance twenty-five patches or outliers, some of which are five or six miles distant from the main mass, and form flat-topped hills, being from forty to seventy feet above the adjacent country, showing the enormous amount of denudation these strata have suffered since the close of the Cambro-Silurian period. Some of the beds afford an excellent yellowish-grey building stone, known as the "Dummer stone," and the lithographic beds of Madoc and Marmora are also met with further west in Harvey township.

Respecting the Archæan rocks in this region, the observations made by Mr. Coste this season tend to confirm the opinions he expressed as the result of those made last year, and he now states: "After carefully examining these crystalline rocks, I am of the opinion that folded together and perfectly conformable with gneisses and other rocks, which every one would class in the typical Laurentian, are often found rocks identical with those in Hastings, classed first by Vennor as the Hastings series, and which, as I stated last year, correspond with the typical Huronian of Logan. Therefore, it appears to me there is no distinction of group and period to be made between Huronian rocks and Laurentian rocks, and the former, so far as can now be determined, are only the upper portion of the latter, and appear to have been colored

differently on the maps only when they occupy large areas and show a series of great thickness."

As regards actual mining operations in this region, Mr. Coste reports as follows:—

"Very little was being done last summer in the region examined, two mines only being at work—the Canada Consolidated Gold Mine, near Marmora, and the Coe Hill Iron mine in Wollaston township. At the end of the season, work was started on a new deposit of magnetic iron ore, called the St. Charles. It is in the township of Tudor, within a mile of the Central Ontario Railway. I heard also of work having been resumed on the famous Richardson mine, where gold was first discovered in 1866, in the Madoc region.

"No ore was shipped from the Coe Hill mine from the beginning of July until the end of October, the ore extracted being piled up at the mine, where about 20,000 tons were waiting, I suppose, better market prices. The depths of the three shafts were, as under, in October last (1885), No. 1, 95 feet; No. 2, 130 feet; No. 3, 100 feet. At the Canada Consolidated Gold Mine, the large roaster erected last fall was in operation; also a refining furnace for the arsenic, and a new three-ton capacity chlorinator. The mine itself, unfortunately, had not been improved, no sinking or drifting having been done since last year, only some stoping work above the first level, sixty-five feet deep."

QUEBEC.

Mr. R. W. Ells, assisted by Mr. N. J. Giroux, was occupied during the summer in the examination of a large part of the country bounded on the north and west by the pre-Cambrian ridge, which extends from Memphramagog Lake north-eastward, and on the south and east by the States of Vermont, Maine and New Hampshire. In addition, a large part of the metamorphic or mineral-bearing belt was carefully investigated, and the structure and outlines of the interior Silurian basin, comprising a large portion of the townships of Wotton, Windsor, Brompton and Oxford were examined. The limits of the principal Silurian areas, in the counties of Stanstead, Compton and Beauce, were definitely fixed, as well as the outlines of the granitic masses included therein, as far as was practicable.

The intimate connection between the granites and the altered Silurian slates, in actual contact, proves that the age of these granites is, as in New Brunswick, probably Devonian. That they are extensive and probably continuous at certain depths not far from the surface is evidenced by the frequent outcrops, which often comprise large areas, of twelve to twenty square miles in extent, while others are in the

form of long dykes both along the lines of bedding of the slates and, in places, directly across the strike.

A large suite of rock specimens, illustrative of the various formations, was collected and several important corrections in the geological boundaries as laid down in the map of 1866 were made.

In all about 2,000 miles of roads were travelled, principally by buckboard.

The various mining centres of this portion of the township were visited. Among localities specially examined were:—

Iron deposits at Belvedere and Sherbrooke.

Copper mines of Capelton and the vicinity of Massawippi Lake.

Asbestos mines of Danville, Thetford, Black Lake and Belmina.

Silver mines of Roxboro' and Marlow.

Gold mines of Ditton, Ireland, Dudswell and the Chaudière.

Marble and lime works of Marbleton.

A traverse was also made along the line of the International Railway to a point ten miles east of the boundary into the State of Maine.

The most flourishing industry at present in this portion of the country appears to be asbestos mining. At Thetford, where the largest and most important operations are carried on, nearly 250 men are employed, with an annual output of about 1,100 tons, divided among four companies, viz., King Bros., the Boston Co., Johnston's Co., and Ward Bros.

At Black Lake three companies are at work, viz., Lionais', Hopper's and Frechette's, employing in all about 100 men, with a monthly output of not far from sixty tons; a considerable amount of exploring work being also carried on.

At Belmina the force is small and the work up to the present mostly exploratory, but veins of workable size have been lately struck. At Thetford some of the veins have a width of from five to nearly seven inches, but the material in the large veins is not first quality, being off color. The work at all these places is prosecuted only during the summer season.

At Jeffrey's mine, Danville, about seventy men were employed, with an average weekly output of about fifteen tons, the quarrying being carried on all the year round.

The price of asbestos during the past year was, for No. 1, $75 to $80 No. 2, $50; No. 3, $10; the latter being largely used for paper stock.

Gold mining (washing) has been carried on in a small way on the Little Ditton for some years, the yield at intervals being very good. During the past summer four men only were employed in re-working and sluicing old tailings. Results unknown.

At Dudswell a shaft was sunk in drift near the foot of the Stoke

Mountain range, to a depth of 25 feet. The bed-rock was not reached. Gold was found at several points, and apparently well distributed. A ten-stamp mill was erected at this place by an American company, some months ago, with the apparent intention of crushing and washing the drift gravel, much of which consists of quartz schist, said to carry a small quantity of gold, but nothing of consequence has been done since its erection, the mill being run for a very short time.

On the Chaudière, the St. Onge Mining Company have at last succeeded in reaching the bed-rock at the bottom of a shaft 165 feet deep, evidently in an old stream channel. The work was most difficult, owing to the great thickness of the quicksand and gravel encountered; but at the bottom a layer of pay dirt about six feet thick was found, evidently of considerable richness, and giving promise of large returns. No attempts have been made lately at any of these places to test the quartz by assay, but that some of the veins are auriferous was clearly proved by researches of Messrs. Hunt and Michel, twenty years ago. (Report of Progress Geological Survey, 1863-66.) That much of the gold found in the washings is local is evidenced from the finding of ragged nuggets, both as to quartz and gold, the pieces being often found in close proximity to the quartz reefs from which they were evidently derived.

The existence of these old river channels is conclusively established in the valley of the Chaudière, by the work of the St. Onge Company, at St. George, as well as on the Gilbert some years ago. Such channels doubtless occur not only along the side streams, but also along the Chaudière itself, many of which, from the very large size of the nuggets already found, must be exceedingly rich in gold near the bed-rock. The operations of the St. Onge Company, will, therefore, be watched with a great deal of interest.

From the observation of the past season it is evident that the country rock of Ditton, while its auriferous quartz veins, is continuous directly across the country into Roxborough and Marlow. Many of the quartz veins are small, but then generally numerous, and the gold will probably be found to occur in quantity in the small rather than in the large veins.

As in Ditton and on the Chaudière, the quartz veins of Marlow contain gold, as samples can be picked up in nearly every brook, while the assays of the silver ores from the "Marlow silver mines," show in several cases a considerable amount of gold. It is, however, probable that this gold is not distributed uniformly through the quartz-veins, but may exist in the form of pockets. Assays of hand specimens, therefore, do not give a fair idea of the value of the respective veins. What is evidently greatly needed now in the Chaudière district is a good stamp-mill, by which trial crushings of quartz may be made from different localities,

and in this way only can a just idea of the richness of the leads be obtained. The silver-bearing veins of Marlow and Roxborough, though not yet sufficiently developed to pronounce definitely on their value, are evidently of considerable importance. Some half a dozen veins occur, ranging from a few inches to eighteen in thickness. Shafts have been put down in some places to a depth of thirty feet, the vein continuing constant and the quantity and quality of the ore apparently increasing. Assays of samples from different veins show from 29 to 43 ounces silver per ton of 2,000 lbs., and some from the outcrop of the "Senator" vein, a cross vein about one mile south of the main shaft, gave the same assayer 260 ounces. Assays of samples from the main vein by Richards, of the School of Technology, Boston, gave a little over 29 ounces per ton. The property is situated about seven miles south of the Kennebec road near the Maine boundary, and near the proposed extensions of the Quebec Central to join the International railway.

Deposits of iron ore, apparently of large extent, were examined in the vicinity of Sherbrooke—the largest at Belvedère, owned by Mr. E. Clarke, of that city, occupying the summit of a hill about 1,000 feet above the St. Francis at Lennoxville. The country rock is quartzo-chloritic and felspathic schist. Assays of the ore, which is a magnetite, have been made by Mr. Hoffman. It contains 28·39 per cent. of metallic iron.

A second deposit, also a magnetite, owned by Mr. Stephen Smith and others, of Sherbrooke, occurs, with hard jaspy rock and schist, three-fourths of a mile from the Grand Trunk railway. The vein is apparently of large size, and the ore of good quality. About 500 tons of ore have been taken from the outcrop, but though the lack of cheap fuel has prevented its profitable smelting on the spot, the quality and value of the ore and its accessibility are such that a good market should be obtained for a large quantity at paying figures in the neighboring states.

The copper deposits of Capelton are at present quite extensively worked, two companies operating in that locality. The ores are shipped to New York for the manufacture of sulphuric acid, the residue being afterwards worked for copper.

Mr. Adams spent about three months during the past summer in making a careful geological examination of portions of the counties of Terrebonne, Montcalm and Two Mountains, in order to gather the necessary data for perfecting the ¼-inch scale geological map of this portion of the province now being prepared for publication.

Four new areas of anorthosite—a formation hitherto erroneously designated Upper Laurentian—were found within this district. Their

boundaries were ascertained, and their stratigraphical relations determined. Several hitherto unknown depcsits of crystalline limestone were also discovered; one of them, occurring at Lac Quarreau, being of special value. The settlers in the vicinity were not aware of its existence, and had hitherto been obliged to draw lime from St. Jerôme, a distance of about forty miles. They were informed of its position and true character, and will now build a kiln and burn their lime on the spot. Several deposits of iron ore were also visited, and specimens taken for examination in the laboratory. One of these from near St. Jerôme is now being analyzed, and will probab ly prove to be an ore of excellent quality.

A number of specimens of building and ornamental stones were also collected for the Colonial and Indian Exhibition.

The Rev. Professor Laflamme, of Laval University, kindly undertook to examine certain doubtful points along the north shore of the St. Lawrence, below Quebec, work needed to perfect the geological mapping of this part of the area embraced in the north-east sheet of the ¼-inch scale map of this portion of the province of Quebec.

Respecting this work, Monsieur Laflamme reports as follows:—

"The formations which were met with are, in the first place, the Laurentian with a well-marked area of labradorite in rear of Château Richer. The labradorite only faintly resembles that which occurs on the upper Saguenay. It is of much lighter color, and above all occurs in bands of greater or less width associated with others of well characterized orthoclase gneiss. Further, it contains small fragments of titaniferous iron ore, like those which occur in the labradorite of the Sagnenay, but in much smaller quantity.

"The band of crystalline limestone mentioned in the "Geology of Canada" (1863, p. 46), at Cap Tourmente, extends as far back as the parish of St. Tité. It is a marble, generally full of crystals of green pyroxene, which gives it an appearance like the limestone of Grenville.

"The Cambro-Silurian formations. which occupy all the country between the Laurentian hills and river, are extremely interesting. And they are not wanting in importance from a practical point of view, inasmuch as they furnish the stone, so extensively quarried for lime and for building purposes, at Château Richer, Ange Gardien and Beauport. The Hudson River division also contains beds of freestone along the Little River, which have already been quarried on a considerable scale.

"In relation to the structure, the most interesting fact is the remarkable series of faults which succeed each other from Montmorency to Cape Tourmente. They are probably only the secondary phenomena, caused by the great fracture which has, on the Island of Orleans and elsewhere, carried the Utica formation over the Quebec or Lévis for-

mation, and which is such an important feature of the stratigraphical geology of the province of Quebec.

"Along each of these faults the formations of the Trenton group abut against the Laurentian at a high angle, while, owing to the throw of the faults being irregular, the Trenton limestone often appears between the Utica and the Laurentian. There are three of these faults, shown by Sir W. Logan, north of the St. Lawrence, between Montmorency and Cape Tourmente.

"This region is truly remarkable from the regularity of its post-tertiary terraces. They succeed each other in long undulations, at various elevations down to those which are still submerged at high tide in the salt marshes which border, for a considerable distance, the left bank of the river St. Anne. In many places, excellent bricks are made from the clays of these terraces."

As already stated. Messrs. Low and J. M. Macoun arrived at Lake Mistassini on the 28th of April, but, owing to the breaking up of the ice, were unable to commence work till the 28th of May, when the men were sent back to Lake Apouapmouchouan to bring up the provisions which had been sent there from Lake St. John during the winter. This occupied the men till the 26th June, and, in the meantime, Messrs. Low and Macoun were engaged collecting specimens of natural history and making meterorological observations.

On the 3rd of July, all necessary arrangements were completed, and the party started to continue the survey from the point to which it had been carried by Mr. McOuat in 1871. This work was completed on the 22nd July, the total distance being 139 miles, showing that the length of the lake is less than 100 miles, and it has an average breadth of about twelve miles. The only soundings made gave a depth of 374 and 279 feet; these were between the Hudson Bay post and the mouth of the Rupert. The party being now short of provisions, the men were paid off and returned to Lake St. John, while Messrs. Low and Macoun awaited the arrival from Rupert's House of the Hudson Bay Company's canoes, by which they had made arrangements to descend the Rupert River to James' Bay. The canoes did not arrive till the 20th August, and on the 22nd they left Mistassini, and arrived at Rupert House on the 3rd of September. A track survey was made of the route, the distance being over 300 miles.

From Rupert House they crossed to Moose Factory and thence returned *via* the Moose River and the Canadian Pacific Railway to Ottawa, where they arrived on the 3rd of October.

Hudson Bay and Straits.

Dr. R. Bell again accompanied, in the same capacity as in 1884, the Hudson's Bay expedition, in the steamship "Alert," under the command of Lieut. Gordon, R. N. In the early part of January he was for some time in Toronto in connection with the work of the Hudson Bay expedition of 1884, and advantage was taken of the open weather to make some geological examinations in the townships of Toronto and Trafalgar, the object being to trace the boundaries of certain formations with a view to complete the geological mapping of the counties of Peel and Halton, at which Dr. Bell spent some time in the years 1859 to 1861, and the maps of which in sheets on a scale of ½ of an inch to a mile are now being prepared for publication. The result of the previous work was given in Sir W. E. Logan's map of Canada (1866), on a scale of twenty-five miles to one inch and described in the "Geology of Canada" (1863.)

Respecting the Hudson Bay expedition, Dr. Bell reports as follows:—

"The steamship "Alert" was sent out for the purpose of relieving the parties in charge of the stations established in 1884 in Hudson's Strait and replacing them by fresh men, also to make geographical exploration and surveys in Hudson's Bay, as well as to collect as much more information as possible in regard to the same class of subjects as in the previous year.

"In order the better to accomplish these objects, it was deemed advisable to start earlier than in the previous year. I was assigned the same duties as on the previous expedition by the steamship "Neptune." But instead of returning home by the "Alert," I was instructed, if circumstances permitted, to come back overland, leaving Hudson's Bay 'at some point between York Factory and Cape Henrietta Maria.' For this purpose I was instructed to take with me an assistant, Mr. James MacNaughton, M.A., and five or six voyageurs with two canoes. It was found, however, that there was no room in the ship for these men and I was therefore obliged to trust to being able to pick up suitable ones after getting to Hudson's Bay.

"Leaving Halifax on the 27th of May, we passed through the Gulf of St. Lawrence and the Straits of Belle Isle, several days being spent at Blanc Sablon. In passing up the Labrador coast, a belt of field-ice appeared to lie between us and the land nearly all along. An unsuccessful attempt was made to enter Nachvak Inlet, but we subsequently learned from the observer there that at that time there was open water between his station and the ice-belt which intercepted us. The "Alert" steamed slowly, and it was the 16th of June before we entered Hudson's

Strait, keeping the north side. From that date till the 6th of July, we remained embayed in the ice, with open water around us occasionally, and drifted up and down off the southern part of Resolution Island. On this day we started for St. John's, Nfld., in order to replenish our stock of coal and to have a new iron plate fixed upon the stem of the ship, the better to withstand the heavy ice we expected to encounter off Nottingham Island, but which we did not meet with. We arrived at St. John's on the 16th and remained there for the above purpose till the 27th, when we again started for the Straits. While the ship was in dock, I utilized the time in making excursions into the country around St. John's and as far as Brigus, to study the geology for comparison with that of certain parts of the Dominion.

"On the 1st of August we arrived at the observatory-station in Nachvak Inlet, and finding all well, we left the next morning, taking with us Mr. Skynner, who had passed the winter there. On the 4th we visited Port Burwell station, to the south-west of Cape Chudleigh, where the party in charge were also all well, and we sailed again early the following morning. On the 22nd we called at Stupart's Bay, Cape Prince of Wales, but found that the party had left for Fort Chimo in their own boat the previous day. Port DeBoucherville, on Nottingham Island, was visited on the 24th, and here we learned that one of the station-men, Inglis, had died of survey, on the 3rd of June. The other two members of the party were relieved and three fresh men left to take their place. Port Laperrière, on the west end of the outer Digges Island, was reached early on the 25th. On the 26th I made a track-survey, by the aid of a steam-launch, around this island, which proved to be eight miles long, and on the 28th we sailed for Churchill, where a meterorological station had been established last year, and arrived there on the 1st of September. Here we experienced great gales of wind, and it was deemed prudent to remain in harbor until they abated, which was on the 7th, and we then steamed out, towing the Hudson's Bay Company's brig "Cam Owen," as she would otherwise have been unable to get to sea and proceed on her way to York Factory. We afterwards learned that, owing to the stormy weather, she did not reach that place for fourteen days, although the distance is less than 200 miles.

"After a careful consideration of the matter, the Severn River was selected as the best route by which to start inland for our canoe voyage southward to some point on the Canadian Pacific railway. The lateness of the season, however, rendered it inexpedient for Lieut. Gordon to go so far out of his way in order to land me at the mouth of this river, and the stormy weather added to the difficulty, as the coast is very low, with shallow water extending far out everywhere in this

neighborhood. Even if it had been possible to land me there by the middle of September, it is questionable if there would have been time to cross this unexplored country, a distance of 500 miles, before the close of canoe navigation, as the waters about the height of land are known to freeze up by the 1st of October. In any case I had no men for the journey, and none could have been obtained at the Severn River at that season of the year. From Churchill we recrossed Hudson's Bay to a large group of islands, off the east coast, between Cape Dufferin and Mosquito Bay. These islands, hitherto almost unknown, run in a northeasterly direction for about 100 miles; they lie mostly between latitude 59° and 60°, and are marked "Sleepers" on some maps, although the next groups to the south of them are called the North Sleepers and the South Sleepers. We made a rough survey of part of the group, at the same time giving names to a number of the larger islands composing it; and Lieut. Gordon and myself suggested that, in order to avoid confusion, this group be hereafter called the Ottawa Islands. They are all of a bare mountainous character, and rise to heights of between one and two thousand feet above the sea.

"I landed upon one of the outermost of the group and found it to consist entirely of a green trappean rock, apparently diorite. The rocks of most of the islands in the northern part of the group had exactly the same appearance, and they are, no doubt, of the same nature; but the most westerly of the larger islands, to which we approached close enough to see it plainly, consisted of stratified masses in distinct layers of great thickness and of different colors and external appearances, all dipping westward or towards the centre of the bay.

"The trap of the island on which I landed was cut by small veins of quartz, containing copper pyrites and it also held thin short seams of asbestos. A small mass of gypsum was detected in a loose fragment. The rocks of this island were distinctly worn by glaciation near the sea-level and the grooves had a northward course, thus confirming my supposition of last year that part of the ice, which probably filled the basin of Hudson's Bay in glacial times, escaped northward into the great valley now occupied by Hudson's Straits.

"We arrived at Digges again on the 12th of September, and while the "Alert" lay in Port Laperrière, I had an opportunity of examining the East-main coast to a point about twenty miles south of Cape Wolstenholme. Gneiss, which in places is mixed with a fine-grained red granite, was the only rock seen.

"On returning through the straits we revisited all the stations at which we had touched on the inward voyage and also called at Ashe's Inlet, North Bluff, which we had been obliged to pass by when coming west. Mr. Ashe, the officer in charge here, had obtained specimens of

mica and graphite from the Eskimo of the mainland on the north side of "North Bay," of the charts. He had himself ascertained the existence *in situ* of a great mass of a very coarsely crystalline greenish-grey hornblende rock on the south side and near the western end of Big Island, on which North Bluff is situated.

"The station at Nachvak was abandoned, and the two men who had remained there for the rest of the summer were brought away. We reached St. John's, Newfoundland, on the 14th of October, and sailed next morning for Halifax, where we arrived on the 18th, and I reached Ottawa on the 26th, having paid off my assistant in Montreal.

"I am indebted to the officers of most of the stations for having collected plants in their neighborhoods. Among the numerous specimens so obtained, Professor Macoun finds a few species to add to those collected by myself in 1884, of which 290 are enumerated in his list published as an appendix to my report of last year. A few bird skins were obtained from some of the station officers and men, the greater number being from Mr. Arthur Laperrière, who should also be mentioned as the principal collector of plants. A number of bird skins and a considerable collection of plants were also obtained by myself, and some valuable notes were made on the natural history of a few of the mammals of the regions visited, partly from my own observations and partly from information supplied by the stationmen and the natives."

New Brunswick.

Professor Bailey continued the work of exploration in New Brunswick, assisted by Messrs. McInnes and J. W. Bailey.

"The principal object of these explorations was to secure the data necessary for the completion of the report and map of the area examined the previous season, and which is now in course of publication; together with the extension of the work to the area immediately to the north, which is embraced in the next section of the geological map of the province in course of construction. With these objects in view, the necessary topographical measurements over both areas were made, including several large and difficultly accessible tracts not previously surveyed, and a study was at the same time made of their geological features. These, within the strict limits of the maps referred to, were found to be very uniform, almost the entire area examined being occupied by Silurian rocks, presenting but little diversity; but it being thought desirable to obtain whatever evidence might be afforded by adjacent regions, bearing upon the succession of the Silurian system and its relations to the Cambro-Silurian, our examinations were extended to embrace portions of such areas both in the State of Maine

and in the Province of Quebec. In the former, a short trip was made through the remarkable chain of the Fish River lakes, adjacent to and connected with the river St. John. The formations about Square or Sedgwick Lake, which have been supposed to include both Silurian and Devonian rocks, were examined, and a large collection of interesting fossils was obtained from them. On the other side of the St. John, the base of the formation was sought, both on the St. Francis and Little Black Rivers, as far as the Quebec boundary, but without success. It was, however, ultimately found upon Lake Temiscouata, and the facts there obtained were thus brought into comparison with those of northern Maine, described by Packard and Hitchcock, and those previously studied by ourselves on the Beccaguemic river in Carleton county. Very remarkable resemblances between these three widely separated localities were observed, suggesting some most important conclusions, but as these are at variance both with the observations of the geologists referred to and with those detailed in the report of 1863 of Sir W. E. Logan, I hesitate to advance them without a fuller and more minute examination of the facts upon which they are based, but shall content myself with stating that some of the observations and statements made by the authors referred to, and tested by us over wider areas, are certainly wrong, while it is now believed that the general conclusion drawn from them are also untenable. In view of these facts, and the further modifications of the views held as to the so-called Gaspé limestones and their relations to the Quebec group suggested by the explorations of Mr. Ells, the desirability of a more detailed and elaborate examination of the Temiscouata region, and of the country, thence to the St. Lawrence, is respectfully suggested for the coming season."

Mr. Chalmers was requested to work out the surface geology of the district comprised within the two quarter-sheet maps, 3 N. E. and 3 N. W. He left Ottawa on the 3rd June for the field of labor, and reports as follows:—

"With the view of obtaining all available information regarding the extent of the quaternary subsidence in the region to be examined, a short time was first spent in the St. Lawrence valley. Between Rivière du Loup and Métis it was discovered on the evidence of fossils, terraces and old shore-lines, that the sea in post-Tertiary times had invaded that valley to a height of, at least, 345 feet above its present level. While pursuing this investigation, another fact of importance was brought to light, viz., that the ice of the glacial period had moved from the Notre Dame Mountains, or the adjacent watershed northward into the St. Lawrence basin, striæ and *roches moutonnées* with the stoss-side to the south having been observed at Trois Pistoles, St. Simon, Rimouski and St. Flavie. These striæ were seen on rocks at different

levels from 100 to 800 feet above the sea. Other striæ, however, having a N. E. and S. W. bearing, were observed below the 345 feet contour line. Great numbers of boulders of Laurentian rocks, which must have been transported thither from the north side of the St. Lawrence, are strewn over the lower grounds. Above the 345 feet contour, the boulders seemed to be largely derived from local rocks and were less rounded. Terraces were also absent, except along river valleys.

"In the Baie des Chaleurs basin a most careful examination failed to detect marine beds at a greater height than 175 to 200 feet above tide level, except, perhaps, at Port Daniel, Quebec, where terraces near the shore were observed at heights of 225 to 240 feet.

"The evidence respecting the quaternary subsidence of the region examined, therefore, as far as it goes, is in agreement with the views already advanced by some geologists, viz., that it is greater towards the north or north-east than in the area south-east of the Appalachians; but the oscillatory movement does not appear to have been uniform, its upper limit not presenting the form of a regular curve either in a north and south direction or transversely to that of the mountain chains. On the contrary, each of the great Palæozoic basins would seem to have been unequally affected by it.

"Glacial striæ were found in the Upper Restigouche valley and on the north side of the Baie des Chaleurs, *i.e.* at Nouvelle, New Richmond, Port Daniel and Point Maquereau, which show that the ice producing them moved from the water-shed in the Notre Dame Mountains towards the Baie des Chaleurs basin. Correlating these with striæ observed on the southern shore of this bay, they indicate that a local glacier of considerable size occupied the western portion of its basin and the estuaries and valleys connected therewith during the ice age, which had its source in the elevated region referred to and moved nearly in a due easterly course. The facts thus far obtained on both sides of the Notre Dame Range, however, point to the conclusion that the existing water-shed near these mountains also shed the ice of the glacial period northward and southward, nearly as the waters due to precipitation are now shed; and further, that the principal part of the Baie des Chaleurs and the estuary of the St. Lawrence were open during the same period, glaciers debouching into them.

"In reference to the season's operations, it may be stated further, that the Restigouche and its affluents, the Quatawamkedgewick, Patapedia, Upsalquitch, &c., were ascended and a series of borometric and other observations taken and the general elevation of the drainage basin of the river ascertained. The forest growth, character of the soil, the extent and fertility of the river-flats or intervales, &c., were also

investigated. All accessible parts of the district, indeed, included in the sheets, were examined, the surface, contour, elevation, extent of arable land, of salt and other marshes, peat bogs, clay and gravel beds, deposits of boulder-clay, kames, &c., were noted so as to be available for mapping them. Attention was also given to the relative values of the soils derived from the different geological formations and kindred matters.

"Bricks and brick clays were collected at Bathurst, Chatham, Moncton, Sussex, St. John and Fredericton for the museum and exhibition.

"Photographs of a dozen or more of the principal forest trees of New Brunswick were taken, and a number of quarries visited to obtain specimens of building stone, &c."

Nova Scotia.

The work done by the Geological Survey during the season of 1885 in Nova Scotia comprises an examination of the country lying to the westward of that described in the summary report of operations for 1883 and 1884. It embraces portions of five counties:—Antigonish, Guysboro', Pictou, Halifax and Colchester. The country along the West River of St. Mary's, west of Sherbrooke gold-field, and north of 15-mile Stream, was entrusted to Mr. Faribault, assisted by Messrs. J. A. Robert and M. H. McLeod. Mr. Fletcher was engaged in the district west of St. George's Bay, the West River and Harbour of Antigonish and along the East River of St. Mary's and East River of Pictou, as far as Pictou Harbour, and was assisted by Mr. John McMillan, and also, later in the season, by Mr. Faribault and his assistants above named. In the southern part of this district is the belt of Devonian rocks, full of fossil plants, already described as extending from L'Ardoise, in Cape Breton, through Madame Island, and from the Strait of Canso to Lochaber, where it is underlaid by fossiliferous Silurian, and by pre-Cambrian rocks, as described by Dr. Honeyman several years ago. From Lochaber, the Devonian rocks keep south of the East River of St. Mary's and the East River of Pictou, and strike the International railway west of Glengarry, from the high land south of Truro, and are unconformably overlaid by the Carboniferous, limestone and associated rocks of the Stewiacke River. They are divisible into several groups, and are frequently cut by veins of iron ore, some of which are of great promise.

To the northward, lie the Silurian, Cambrian (?) and pre-Cambrian rocks of Arisaig, Antigonish Mountains, and McLellan's Mountain, with large beds and veins of iron ore and manganese, which have been worked to some extent in the East River of Pictou, and to which a rail-

way is now projected to connect the mines with the Intercolonial railway and the Pictou coal-field.

North of and overlying the rocks just named, are the Carboniferous strata of Northumberland Strait, two small spurs or basins of which, run, the first up West River of Antigonish as far as James River railway station, the second up the East River of Pictou as far as Sunnybrae. Both of these basins consist of Lower Carboniferous rocks, and hold fine workable beds of limestone and gypsum, and similar rocks underlie the country from McAra's Brook, near Arisaig, to the vicinity of Avondale railway station. These are overlaid east and south of Merigomish by millstone grit, containing beds of sandstone, fit for building and grindstones. A third series of Upper Carboniferous rocks occupies the coast from Big Island, Merigomish, westward to and beyond Pictou Harbour, having the New Glasgow conglomerate at its base and yielding the celebrated grindstones and building stone of Quarry Island, Big Island, Roy's Island, Little Harbour, Pictou and other localities, together with a small seam of coal and beds of an inferior kind of limestone. These Carboniferous rocks, as well as the coal-measures, are fully described in Logan and Hartley's report on the Pictou coal-field. (Report of Progress, Geological Survey, 1866-69.)

Much yet remains to be done, however, among the strata of the mountain range between Cape St. George and McLellan's Mountain before the geology of this interesting and intricate district can be clearly described. Two series at least of volcanic intrusions render the relations of the sedimentary rocks obscure, but it is not too much to assert that the comparatively small thickness of fossiliferous Silurian rocks present on the coast at Arisaig represents but a small part of the volume of the formations anterior to the Carboniferous in the counties of Pictou and Antigonish.

Mr. Faribault gives the following account of his portion of the work :—

"The West River St. Mary runs through an isolated basin supposed by Sir William Dawson to be millstone grit, bounded to the north by the Devonian and to the south by the gold-bearing rocks (Cambrian) of the Atlantic coast.

"Two prominent bands or dykes of granite were observed, associated with the gold-bearing rocks. Like the quartz leads, they follow the strike—east and west magnetic—of the strata. The northern one is one eighth of a mile wide and four miles long. On the north it is bounded by the overlying millstone grit which, near the contact, is largely composed of granitic detritus. One mile to the south is the other dyke mentioned. It has been traced twenty-four miles, and is from one-quarter to one-eighth of a mile wide. To the east it passes

under the millstone grit, and to the west ends in the gold-bearing rocks.

"The silver mine which was worked some years ago at Smithfield, and reported to have yielded rich ore, is in a narrow belt of the gold-bearing rocks, between the southern dyke and the overlying conglomerate of the millstone grit.

"Excellent sandstone for building purposes is found in the millstone grit. Two quarries were seen; one, three-quarters of a mile up McDonald's Brook, and the other on the main West River St. Mary's, a mile and a half below Upper Caledonia."

Six hundred and twenty-one miles of streams and 512 miles of roads were measured by Mr. Fairbault's party, in Antigonish and Pictou counties.

Field work commenced on the 4th June, and was continued into December.

Chemical, Mineralogical and Lithological Section.

Mr. G. C. Hoffmann furnishes the subjoined report of work in this section:—

In the chemical laboratory, attention has been mainly directed to the examination and analysis of such minerals as were deemed likely to prove of economic importance. The work included:—

I.—Analyses of numerous specimens of lignites, lignitic coals, coals and semi-anthracites from the North-west Territory. The greater number of these were found to be fuels of excellent quality. This work constitutes an appendix to the report on "The Coals and Lignites of the North-west Territory."

II.—Analyses of several mineral waters.

III.—Analyses of iron, copper, and manganese ores.

IV.—Gold and silver assays. Of the specimens examined, a great many were from the Rocky Mountains, from localities recently opened up by the line of the Canadian Pacific railway.

V.—Miscellaneous examinations.

"During the period in question, 339 mineral specimens were received —brought or sent—for identification or for information in regard to their possible economic value. In addition to the time devoted to visitors seeking information in this connection, the imparting of such information, in a great many instances, necessitated correspondence by letter. The total number of letters written amounted to 170, by far the greater number of which partook of the nature of reports.

Mr. F. D. Adams has, for the space of nine months, acted in the capacity of assistant chemist. The remaining three months were de-

voted by him to geological examination of the counties of Montcalm and Terrebonne in the province of Quebec.

"The additions to the specimens in the mineralogical section of the museum amounted to 203, including donations from the following individuals:—

F. C. Crean; J. R. Costigan, of Calgary; R. H. G. Chapman, Belleville, Ont.; John Connors; J. K. Davies, township of Eardley, Que.; L. C. Garnett, of Fort McLeod, N.W.T.; J. Moore, Ottawa, Ont.; Alexander Mackenzie, C. E., of Montreal, Que.; J. McArthur, of Hull, Que.; T. McKellar, Port Arthur; W. Ogilvie, D.L.S., N.W.T.; Hiram Robinson, of Ottawa; T. Sheridan, manager Boston Asbestos Packing Company's mines, Thetford, Que.; Richard Trethwey, Ottawa; Ottawa Granite Company, Ottawa; D. B. Woodworth, M. P.

"Mr. P. L. Broadbent has displayed most commendable assiduity and zeal in the labelling of the specimens in this section of the museum, and, as a consequence, considerable progress has been made in this direction, and much has been done tending towards a more perfect arrangement of the whole collection.

"In the early part of the year, Mr. C. W. Willimott, was engaged in the receiving, cataloguing, packing and shipment of mineral specimens for the Antwerp Exhibition, in which work he was assisted by Mr. H. P. Brumel. At a subsequent date he was engaged in making a collection of Canadian economic minerals which was—at the request Mr. H. Wade, the Secretary—loaned to the Dominion Exhibition, held in London, Ontario. In the course of the summer, he visited, in company with Mr. E. A. Evans, C. E., various mines and quarries in the counties of Hastings, Frontenac, Addington and Lanark, in the province of Ontario, and the township of Thetford, and Dudswell in the province of Quebec. The result was the procuring of a great many desirable mineral specimens, and much useful information. More recently he has been actively engaged in the work of receiving, cataloguing and sending off a collection of specimens, intended to represent the mineral wealth of the Dominion at the forthcoming Colonial and Indian Exhibition. In furtherance of this object he has opened up correspondence with the owners of mines and quarries, for the purpose of obtaining specimens of ore, building stones, &c., and such information as they might feel disposed to communicate in the way of mining statistics. Mr. Willimott has throughout been actively assisted by Mr. E. A. Evans."

Biological Section.

In this section, Mr. Whiteaves reports that the first part of the first volume of "Contributions to Canadian Palæontology" was published in August. It contains a descriptive "Report on the Invertebrata of the Laramie and Cretaceous rocks of the Bow and Belly Rivers and adjacent localities in the North-west Territory," and consists of eighty-nine pages of letterpress, illustrated by eleven large octavo lithographic plates. As stated in the text, it is "intended primarily as a palæontological supplement or appendix to Dr. G. M. Dawson's report on the region in the vicinity of the Bow and Belly Rivers, published in 1885, in the Report of Progress of the Geological Survey for 1882-83-84." It is mainly based upon collections made by Dr. Dawson and Messrs. R. G. McConnell, J. B. Tyrrell and T. C. Weston, in the years 1881-84, but in order to make it as complete a presentation as possible of the present state of our knowledge of the invertebrate faunæ of the Laramie and Cretaceous rocks of the Canadian North-west, it contains also a revision of the species from these formations obtained by Dr. Dawson in 1874, in the capacity of geologist to H.M. North American Boundary Commission, and identifications of a few Cretaceous fossils collected by Professor Macoun in 1879."

An article entitled "Notes on the Possible Age of some of the Mesozoic Rocks of the Queen Charlotte Islands and British Columbia" has been contributed by Mr. Whiteaves to the June number of the *American Journal of Science and Art*. Some progress has been made with the manuscripts of the second part of the third volume of "Canadian Palæozoic Fossils," and a commencement has been made of a paper on the land and fresh-water mollusca of the Dominion, based mainly upon collections made by members of the staff of the Survey since 1863.

Acting under my instructions, a systematic catalogue of the zoological specimens on exhibition in Ottawa by the Department of Fisheries has been prepared by Mr. Whiteaves, prior to their being sent to the Colonial and Indian Exhibition. As many of the species had not been accurately determined before, and as some of the labels (especially those of the marine invertebrata) had obviously got misplaced, it was found necessary to make as critical a re-examination of the whole as was possible, of specimens, many of which were stuffed and mounted in closed cases, or which required a microscopical examination for which there was no time. The collection appears to consist of five species of *Pinnipedia* (walruses and seals), two of *Cetacea* (porpoises and whales), ninety-one of fishes, twenty-four of *Crustacea*, one hundred and four of *Mollusca*, three of *Brachiopoda*, three of *Tunicata*, four of

Polyzoa, fifteen of *Echinodermata*, three of *Alcyonaria*, and four of sponges, besides a few specimens of mammals and birds, some of which will be incorporated in another part of the government natural history contribution to the same exhibition.

Twenty-seven mounted specimens of Canadian mammals, and fifty-three of Canadian birds have been added to the museum during the year, all of which have been identified and labelled. Considerable progress has also been made in the re-classification and re-labelling of the fossils in the museum, and many additions have been made to this part of the collection; but further details of the work done in this direction will be found in Mr. Ami's report, by whom (and by Mr. Weston) the larger part of it was done. About two hundred and fifty species of Canadian marine mollusca have been placed upon exhibition in the museum and labelled, of which upwards of one hundred species are from the Atlantic, and nearly one hundred and fifty from the Pacific coast of the Dominion. Efforts have been made, not without success, to make this part of the collection as complete as possible. Two new table cases for recent shells have been constructed early in the year, and these have since been filled, the one with one hundred and eighty-five named specimens of North American *Unionidæ*, and the other with about four hundred and seventy specimens of United States and exotic fresh-water shells, most of which have been re-labelled.

A preliminary examination has been made of the Neocomian fossils from Forward Inlet, V.I., and of the extensive series of recent marine invertebrata from the Strait of Georgia, Queen Charlotte Sound and Quatsino, collected by Dr. G. M. Dawson in the summer.

During the absence of the Director, on field work, for about three months, the duties of Acting Director were performed by Mr. Whiteaves.

The following collections have been received during the year from members of the staff:

G. M. Dawson:—

One hundred and fifty specimens of fossils from the Neocomian rocks of Winter Harbor, Forward Inlet, Vancouver Island.

A large series of fossil plants from the Cretaceous rocks of Port McNeil, V.I., also a similar but smaller collection from Nanaimo, V.I. Small collections from two other localities.

A large number of marine invertebrata dredged or collected in the Strait of Georgia, Queen Charlotte Sound and Quatsino, V.I.

Forty-four skins of birds and mammals from British Columbia.

One Indian canoe and other articles of Indian manufacture from Vancouver Island and its vicinity.

R. G. McConnell:—

One hundred and fifty specimens of Devonian and Carboniferous fossils from various points in the Rocky Mountains, east of the summit and between the Canadian Pacific railway and the North Saskatchewan.

J. B. Tyrrell:—

Four hundred specimens of fossils (mostly of plants and invertebrates) from the Cretaceous and Laramie rocks at twenty-four different localities between the Bow and Saskatchewan Rivers. Also, a collection of insects (recent) from the same district.

R. Bell:—

Twenty specimens of birds and twelve of fishes from Hudson Bay and Straits. Forty-three specimens of lepidoptera from Hudson's Straits and Newfoundland. One harp seal (*Phoca Groenlandica*). One fœtal walrus. One "Wenusk" (*Arctomys pruinosus?*). Three meadow mice. Two skulls and other bones of walrus. One skull of bearded seal (*Erignathus barbatus*). One young harp seal and one shark.

Collected by request of Dr. R. Bell and presented to the museum by the gentlemen mentioned:—

From Mr. Arthur Laperrière, of Ottawa:—

Twenty-one specimens of birds and a collection of insects from Digges Islands, Hudson Bay.

From Mr. F. F. Payne, of Toronto:—

Three specimens of birds, eight of crustacea, and thirty of coleoptera, from Labrador and Hudson Straits.

From J. R. Spencer, of Churchill:—

Eleven specimens of fishes from Hudson Bay.

From Dr. P. M. Mathews, of York Factory:—

One specimen of *Sorex belli*, a new species recently described by Dr. Dobson.

J. Macoun:—

Skins of three species of mammals and seven of birds (since mounted) from the Rocky Mountain region, on the line of the Canadian Pacific railway. Four species of mice, one ground squirrel, four species of frogs, and two of snakes, in alcohol, and a few land shells from the same district.

Several specimens of Unionidæ and land shells from Lake Erie and the St. Clair River, Ont.

Eugène Coste :—

Twenty specimens of fossils from the Black River limestone of Victoria and Peterboro' counties, Ont.

F. D. Adams :—

Twenty-five specimens of fossils from the Trenton group at Lake St. John, Que.

A. P. Low :—

Skins of marten, mink and otter, from Lake Mistassini.

This branch of the museum is indebted to the following individuals for additions by presentation :—

Rev. W. Winter Seaborn, London, Ont; Prof. E. D. Cope, Philadelphia; A. McCharles, Toronto; W. Ogilvie, D.L.S.; G. R. White, Ottawa; E. B. White, Ottawa; F. H. Harvey, Walsh, N.W.T.; Peter Hill, Hartford, Ont; Master Jeff. Chapleau; L. J. Coursolles, Ottawa; T. G. Coursolles, Ottawa; W. N. Mackenzie, Derby, Ont; W. Purdon, McDonald's Corners; Dalhousie, Ont; Smithsonian Institute, Washington, U.S.; Francis Bain, North River, P.E.I.; W. Craig, Russell, Ont; W. J. Morris, Perth, Ont; Prof. H. Alleyne Nicholson, Aberdeen, Scotland; Rev. G. W. Taylor, Cedar Hill, Victoria, B.C.; Mrs. G. Barnston, Montreal; James Fletcher, Ottawa; W. W. Rochester, Ottawa; Prof. E. J. Chapman, Toronto; G. F. Mathew, St. John, N.B.; W. F. Ganong, St. Stephen, N. B.; J. Townsend, Durham, Ont; S. Herring, Ottawa; Prof. T. Nelson Dale, Toronto.

Some additions by purchase have also been made, including a large collection of insects from Captain Gamble Geddes. This collection consists of over 7,500 specimens, of which about 2,600 are lepidoptera.

Mr. H. M. Ami has continued the work of revising and re-classifying the collection of fossils on exhibition in the museum, under Mr. Whiteaves' supervision. The systematic classification and labelling of theLaramie and Miocene plants of the Souris, Nicola and Similkameen Rivers, and of Quesnel, B. C., which was commenced last year, has been completed, as has also the arrangement and labelling of the fossil plants of the North Thompson reserve and of the Mackenzie River. The fossils of the Gaspé sandstones have been re-classified and labelled, those of the Lower Carboniferous or "Windsor Series" of Nova Scotia have been arranged, mounted and labelled, as have also three cases of the corals of the Corniferous limestone of Ontario. Labels have also been

prepared and printed for the Laramie and Cretaceous fossils of the Bow and Belly Rivers district, described or identified in Mr. Whiteaves' report.

A number of collections of fossils have received a preliminary examination by Mr. Ami and the species has been determined as far as practicable. Among these collections are the following.

Dr. G. M. Dawson:—
Devonian and Carboniferous fossils from various localities in the Rocky Mountains, collected during the past three years.

Prof. A. P. Coleman, Victoria University, Cobourg, Ont.:—
A series of fossils from limestones (probably Silurian) in the vicinity of the junction of the Kicking Horse and Columbia Rivers.

Prof. L. W. Bailey:—
A number of fossils from Oak Bay, Broad Cove, St. Andrews, Little Pokiok Creek and other localities along the Beccaguimic River, New Brunswick.

F. D. Adams:—
Trenton and Utica fossils from the Saguenay and Lake St. John.

T. C. Weston:—
A series of graptolites from the "Cove Fields," and Citadel Hill, near Quebec.

R. McKenzie:—
Cambro-Silurian fossils from Peterboro', Ontario.

Collections of fossils have been selected, labelled and sent to St. Hyacinthe College, P. Q., to the Trinity College, Toronto, and to Mr. W. C. Van Horne. A set of characteristic Canadian fossils, which was sent to the Smithsonian Institution in 1876 and of which the accompanying list was lost at Washington, has been re-labelled and returned to the Smithsonian. Mr. Ami has also devoted some time to a study of graptolites from various localities and geological horizons in the Province of Quebec. He obtained leave of absence for three months during the year, to enable him to visit Europe, and was absent from the 29th of May to the 7th of September.

Most of Mr. T. C. Weston's time has been occupied in museum work. The ethnological collections, formerly exhibited in the upper flat, have been removed to the middle flat, to make room for the collection of Canadian birds and mammals. The former have been re-arranged. The large recent accumulations of fossil bones, and particularly the remains of mammalia from the Miocene of the North-west, have been

prepared for study, and forwarded to Prof. E. D. Cope, of Philadelphia, who has kindly undertaken their examination. The entire series of Carboniferous plants in the possession of the Survey has been cleaned and prepared for exhibition in the museum, and labels for all the species recognized have been prepared. Numerous additional specimens of interest from other formations have also been developed, labelled, mounted and placed on exhibition. About fifty microscopical sections or other preparations of rocks or clays, collected by various members of the staff, have been made. The whole of the wood-cuts used in the reports of the Survey have been classified and arranged in a cabinet made for that purpose.

In June, Mr. Weston devoted three weeks to an examination of some of the exposures of the Island of Orleans, Point Lévis, and the Citadel Hill at Quebec. Collections of fossils were made at each of these points, and especially at a new locality near the Parliament buildings, which has yielded a small assemblage of peculiar interest. In July, Mr. Weston examined the rocks on the St. Francis River, from Melbourne to Hereford. No fossils were detected in these deposits, but a good series of lithological specimens was secured.

Botanical Work.

Prof. Macoun, in his last report, gave details of the botanical work up to 31st December, 1884. At that date he was at work on the second part—Gamopetalæ—of the "Catalogue of Canadian Plants." This was completed and published last spring. It consists of 202 pages, and gives the range and synonomy of 908 species, besides other useful information. After its publication, he worked on the third part of the same catalogue—Apetalæ—until it was time to take the field in the latter part of May.

About the 1st of June he started for the Rocky Mountains, for the purpose of examining the fauna and flora of that little known region which had been opened up by the Pacific Railway the preceding summer.

Thirteen weeks were spent in the mountains and many interesting and valuable discoveries were made. Collections of plants, as well as of birds, etc., were made.

About 1,200 species of plants were secured, including many new to Canada. The flora of the Columbia valley shows conclusively that it is climatically suitable for agriculture.

Particular attention was paid to the avian fauna of the mountains, and 115 species were shot and determined. All the smaller mammals observed were procured and some land shells were collected.

On his return from the mountains he spent a month in western Ontario, ascertaining the distribution of trees along Lake Erie, and procuring wood specimens for the Colonial and Indian Exhibition.

Since then he has been working at the Rocky Mountain collections and those of Dr. Dawson and Mr. J. Fletcher, F.R.S.C., made in British Columbia last year. Mr. J. M. Macoun also made extensive collections at Lake Mistassini, which have been examined and arranged.

On the return of the expedition sent to Hudson Strait and Bay in 1884, Dr. Robert Bell placed in his hands the collections of plants made during the summer. These were examined and named and the results published in the last report of the Geological Survey. The collection of plants brought from Hudson Bay by Dr. Bell last October has also been examined and reported on.

He has also determined about 1,100 species sent from the Department of Public Instruction, Quebec, by D. N. St. Cyr, F.R.S.C. Numerous small parcels from New Brunswick and Manitoba were also examined and named.

Professor Macoun was assisted by Mr. J. A. Macoun for two months and a-half last spring and three months this winter.

There have been mounted and placed in the herbarium during the past year 3,082 sheets of specimens as follows:—

Canadian	1,983
United States	1,061
European	38
Total	3,082

Two thousand nine hundred and fifty-seven species labelled and named have been distributed to various colleges in Canada, or sent in exchange for other plants, to individuals during the year. Two fine collections were sent to Downton College of Agriculture, Salisbury, England. One to the College of Agriculture, Guelph, Ontario, and another to Laval University, Quebec.

Maps.

Much of the time of Mr. Barlow, chief draftsman, has been occupied in the general superintendence of mapping work in the office and laying down projections, and otherwise assisting various members of the field staff in their work. Mr. Barlow furnishes the following memorandum of maps and topographical work in progress or completed during the past year:—

British Columbia. Mr. Bowman has the revised map of the southern interior part of British Columbia in an advanced stage, and it is hoped that work on it may be completed during the present winter.

British Columbia and North-West Territory. Surveys by Dr. G. M. Dawson and assistants, in part of the Rocky Mountains, included between latitudes 49° and 51°30′; longitudes 114° and 117°, are being collated and drawn by Messrs. A. E. Barlow and L. N. Richard. This work is approaching completion, and it is intended to publish a preliminary map of the region on a scale of 8 miles to 1 inch.

North-west Territory.—Mr. McConnell's map of part of the district of Assiniboia is completed and in the hands of the engraver. In addition to the surveys of the Dominion Lands Branch, a great amount of detail in topography has been added by Mr. McConnell and assistants to this area. Mr. J. B. Tyrrell has a sheet similar in area to the last, between the Bow and Saskatchewan Rivers, well advanced. Scale, 4 miles to 1 inch. This it is proposed to publish on a scale of 8 miles to 1 inch.

Manitoba and Western Ontario.—On the area including Lake of the Woods, and in its vicinity, work is still in progress by Mr. Lawson and assistants. The area covered by the map is 3,456 square miles.

Ontario. — A scheme for the geological mapping of the peninsular portion of Ontario in sheets of uniform size, like those employed in Maritime Provinces, has been laid down, and some progress has been made in the compilation of surveys to form a basis for the geological representation. The progress of this work bas been delayed by the inaccuracies and incompleteness of the available maps and township surveys of the region, and the almost complete absence of topographical information. The following memoranda indicate the present state of the several sheets: One sheet, No. 115, drawn and engraved, but found unsatisfactory, and Mr. Cochrane was instructed to check the work and make the necessary additions to it on the ground. The work occupied Mr. Cochrane from the 15th of August to the 21st of October, embracing in all an area of 450 square miles. About 50 miles of roads were paced, and 25 miles instrumentally measured, and tracings of a number of townships procured from the Crown Lands Department, Toronto. One sheet, No. 107, prepared for engraving, but found incomplete and inaccurate. Sheets Nos. 112, 113, 118, 119; projection laid down and a considerable amount of topographical work prepared for compilation by Messrs. Coste and Cochrane. Six sheets, Nos. 101 to 106, laid down, and a portion of material prepared

for compilation by Mr. S. Barlow. For five sheets Nos. 114, 117, 118, 122, 123; twenty-three township plans copied, and other information collected by Mr. S. Barlow.

Quebec.—Maps of counties of Ottawa and Pontiac; scale 4 miles to 1 inch. Twenty-two township plans have been copied, and other information collected toward the completion of this work, the compilation of which may go on during 1886.

Quebec and North-east Territory.—Map of Lake Mistassini and adjacent regions, in progress, by Mr. A. P. Low.

New Brunswick.—One sheet (plan 2 S.W.), by Prof. Bailey and Mr. McInnes.

Nova Scotia.—One sheet (plan 4 N.W.) compiled, traced and ready for engraver, by Mr. Ells and assistant—area 3,456 square miles. In connection with the geological mapping of this province, Mr. Fletcher and assistants have made surveys and revised topography of Guysboro' and Antigonish counties with a portion of Pictou county and small parts of other counties.

Library.

The librarian, Dr. Thorburn, reports that during the year 1885, from 1st January to 31st December, 5,339 copies of the Geological and Natural History Survey publications were distributed. Of these, 3,789 were distributed in Canada; the remainder—1,550—were sent as exchanges to scientific and literary institutions and individuals, in America, Europe, India, Japan and Australia.

During the year, 531 copies of the "Report of Progress," in French, were distributed.

Nine hundred and seventy-two publications, including books, transactions, memoirs, periodicals, pamphlets and maps were received as exchanges. There were added to the library, by purchase, 113 volumes, besides fifty scientific magazines and periodicals, on geological, mineralogical and natural history subjects, which were subscribed for.

During the year ended 31st December, 217 volumes were bound; there are still, however, a large number that require to be bound before they can be made fully available for the members of the staff.

There are now in the library about 6,000 volumes, besides a large miscellaneous collection of pamplets.

VISITORS.

The number of visitors to the Museum during the year ended 31st December, 1885, was 13,443. A falling off, as compared with the previous year, of 503.

STAFF, APPROPRIATION, EXPENDITURE AND CORRESPONDENCE.

The strength of the staff at present employed is 50, viz:—professional, 34, ordinary, 16.

During the year, the following were appointed to the permanent staff:—

Mr. Lawrence B. Lambe, as artist, from 1st March.

Messrs. Eugéne Coste, and E. D. Ingall, as mining geologists, from 1st July.

The amount available for the fiscal year, ended 30th June, was:—

Civil-list salaries, appropriation	$ 32,784 00
General purposes, do.	60,468 97
Total	$ 93,252 97

The expenditure may be summarized under the divisions named as follows:—

Pay-list salaries		$31,967 33
Wages temporary employées	$20,541 60	
Exploration and survey	21,258 53	
Printing and lithographing	10,163 20	
Purchase of specimens	4,928 56	
Purchase of books and instruments	951 33	
Chemicals and laboratory apparatus	261 06	
Stationery	731 37	
Incidental and other expenses, including museum and office fittings	2,824 85	
	$61,660 50	
Less paid in 1884	12,651 13	
		49,009 37
Advances to field explorers and others on account of 1885-86		11,003 59
Unexpended balance, civil list appropriation		816 67
Unexpended balance, contingency appropriation		453 01
Total		$93,252 97

The correspondence of the branch shows 8,131 letters sent, and 5,310 received.

In conclusion, I would again refer to the inadequate accommodation, both for museum and office purposes, which is afforded by the building now occupied at the corner of Sussex and George streets. The natural history collections are increasing year by year, and it has already been found necessary to make accommodation in the passages for important collections—the woods and the medicinal plants, the herbarium, and the fine entomological collection purchased during the year from Captain G. Geddes. The numerical strength of the staff has likewise been increased to such an extent that when, as during the winter, all are at work in the office, the available space for drawing-tables and desks is wholly insufficient, and the interruption incidental to a large number working in one room seriously hinders the progress of the work in hand. I trust that for these reasons some steps may be taken at an early date to obviate the inconvenience now existing. A ready and comparatively inexpensive mode of doing so was suggested in my summary report for 1883, which, if adopted, would, at the same time, greatly improve the external appearance of the museum building.

In a recent report by V. Ball, M.A., F.R.S., Director of the Science and Art Museum, Dublin, on the museums of America and Canada, the following notice of the Ottawa Geological Museum appears.

"Of the smaller museums which I visited in America and Canada, there was not one which I saw with as much pleasure and interest as that which owes its origin* and development to the energy and ability of Dr. Selwyn, Director of the Geological Survey of Canada.

"Although known as the Geological Museum, and although the principal part of the available space is devoted to the illustration of the minerals, rocks and fossils of Canada, still there is room for the display of a small ethnological collection and the nucleus of a series of Canadian mammals and birds.

"The method which has been adopted for the display of the specimens is orderly and attractive, and the system of labelling, if not the best, is good, but is especially noteworthy as being unique—at least, so far as my experience goes.

"For the geological formations, glass slips, with the names painted in black, are backed with coloured paper, the tints used being the same as are used to indicate the formations on the official maps. Thus the eye may become trained to read at a glance the meaning of a geological map, without the necessity of having frequent recourse to an index of colors. Other labels are painted in black on slips of ground glass. The advantage of this method would be most apparent in a damp climate—

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* This is a mistake. It owes its origin in Montreal to my predecessor, Sir W. E. Logan. A. R. C. S.

such, say, as Calcutta, where paper labels suffer from the depredations of insects.

"The several series representing stratified rocks of Canada are very complete, and just such as a local museum ought to have. They proved of great interest to many of the English and American geologists who visited Ottawa during the Montreal meeting of the Association.

"Specially noteworthy is a magnificent block, exhibiting the structure of what is known as *Eozoon Canadense*. In an adjoining case are specimens of igneous rocks which, as they possess a somewhat similar structure, tend, in the opinion of some authorities, together with other facts, to throw discredit on the opinion maintained by Sir William Dawson and Dr. Carpenter, as to the organic origin of this structure.

"The useful minerals of Canada are well illustrated in this museum by admirable series of specimens, and polished slabs of the ornamental stones are displayed on brackets on the walls, with good effect.

"Though unpretentious and practical, the general effect and appearance of this museum is such as to attract non-scientific as well as scientific visitors, a matter of no slight importance in a country where its very existence may be said to depend on the popular vote. Its continuance and development are matters of great importance to the mineral industries of the Dominion, and if, on this account alone, it is supported liberally by the state, science will not fail to reap a share of the benefit so conferred."

Referring to museums, it may not be out of place to call attention to what is being done elsewhere in this connection. In New South Wales, one of the Australian colonies, with a population of only about 850,000, I find, from a report recently received, that the appropriation for the year 1884, for the maintenance of the museum in Sydney, was £8,750 stg., or about $43,750.

The figures relating to visitors to the Sydney Museum are also somewhat remarkable. They are for 1883, 137,401, being: week days, 86,-114; Sundays, 51,287, apparently showing that there is a very large class of persons whose daily avocations prevent them from taking advantage of the means of instruction, and the ennobling influences which the study of nature's wonders, as displayed in a well arranged museum, cannot fail to afford. In this matter the Australian Colonies must be conceded to have made an advance in the promotion of knowledge and civilization. I would respectfully suggest, for the serious consideration of the government, the desirability of permitting the museum to be open for visitors on Sunday afternoons.

ALFRED R. C. SELWYN,
Director.

ADDITIONS TO THE LIBRARY.

FROM JANUARY 1ST TO DECEMBER 31ST, 1885.

BY PRESENTATION.

CANADA.

Department of Inland Revenue, Ottawa :—
Reports, Returns and Statistics for 1884.
Report on Canal Statistics, Supplement No. 1 to Report for 1884.
Report on Inspection of Weights, Measures and Gas, Supplement No. 2 to Report for 1884.
Report on Adulteration of Food, Supplement No. 3 to Report for year 1884.
Return of claims for Drawback on goods for export, 1885.

Department of Finance, Ottawa :—
Report of the Superintendent of Insurance for year 1884.
Abstract Statements of Fire and Inland Marine Insurance Co.'s in Canada for 1884.
Shareholders in the Chartered Banks of the Dominion of Canada, 1884.

Auditor General's Office, Ottawa :—
Report on Appropriation Accounts for year 1884.
Public Accounts of Canada for year 1884.
Estimates of Canada for year 1884.

Department of Justice, Ottawa :—
Report for year 1884.

Department of the Interior, Ottawa :—
Annual Report for 1884, two copies.
Report of the Commissioner of the N. W. Mounted Police Force, 1884.

Department of Public Works, Ottawa :—
Report of the Chief Engineer of Canals for 1884.

Department Railways and Canals, Ottawa :—
Annual Report for year 1884.
Railway Statistics of Canada for year 1883-4.
Reports on the Proposed Short Line Ry. from Montreal to the Maritime Provinces, 1885.

Department of the Secretary of State, Ottawa :—

Annual Report for year 1884.
Return for all orders in Council relating to Licenses to cut timber on lands of Fort William Reserve, 1885.
Reports relative to manufacturing interests in existence in Canada. 1885.
Report of the Royal Commission on Chinese Immigration, 1885.
Report of the Board of Civil Service Examiners of Canada for 1884.
An Act to amend the Civil Service Acts of 1882, 1883.
Returns of Names, Salaries, &c., of all promotion appointments to C. S. for year 1883-4.

Post Office Department, Ottawa :—

Annual Report for year 1884.
Official Postal Guide, Canada, January, 1885.

Department of Indian Affairs, Ottawa :—

Annual Report for 1884.
The Treaties of Canada with the Indians of Manitoba, the N. W. T. and Kee-wa-tin, by Hon. Alex. Morris, 1880.

Department of Marine and Fisheries, Ottawa :—

Preliminary Report on the Fisheries of Canada for 1884.
Seventeenth Annual Report for year 1883-4.
Tables of the Trade and Navigation of the Dominion of Canada, 1884.
Report of the Hudson's Bay Expedition under command of A. R. Gordon, R. N., 1884.
Report of the Meteorological Service of the Dominion of Canada for 1882, by C. Carpmael, M. A.
Report Department of Fisheries, 1884.

Department Militia and Defence, Ottawa :—

Annual Report for 1884.

Department of Agriculture, Ottawa :—

Report for year 1884.
Report on Canadian Archives for 1884.
A Guide Book containing information for settlers, 1885.
Annex No. 3 to Report for year 1884, Abstracts of Returns of Mortuary Statistics and Evidence.
Dominion von Mineralien und ihre Localitaeten, 1885, by H. B. Small.
Dominion von Waldungen Bauholz und Waldprodukte, 1885, by H. B. Small.

EDOUARD J. LANGEVIN, *Ottawa :—*

Debates of the Senate, Dominion of Canada, Vols. 1, 2, 1885.

J. G. BOURINOT, *Ottawa :—*

List of Members of the House of Commons, 1885.

House of Commons, Ottawa :—

The House of Commons Debates. Vol. 17.

Library of Parliament, Ottawa :—

Supplements to the Alphabetical Catalogue, from Jany. 1880 to Jany. 1885.

Natural History Society, New Brunswick :—
Bulletin No. 4.

Historical and Scientific Society, Winnipeg :—
Annual Report for year 1884-85.
Transactions, Nos. 2, 3, 4, 5, 12, 13, 14, 15 session, 1883-4.
Nos. 17, 18, 1884-5 Session 1884-5.

Royal Society of Canada :—
Proceedings and Transactions, Vol. 2, 1884.

Public Library, Toronto :—
First Annual Report, 1883-4.

Department of Mines, &c., B. C :—
Report of Minister of Mines for 1884 (six copies.)

Canadian Mining Review, Ottawa :—
Vol. 3, No. 2, 1885.

Department of Agriculture, Quebec :—
Report on Statistics and Health for year 1883.

Department of Agriculture, Winnipeg :—
Crop Bulletin Nos. 10, 11, 12, 1885.
Our Crop Markets, by Capt. Scoble, 1885.

Department of Mines, Nova Scotia :—
Report, 1884.
Regulations of Mines in Nova Scotia, 1884 (seven copies.)
Revised Statutes of Nova Scotia (Fifth Series), 1884.

Nova Scotia Institute, Halifax :—
Proceedings and Transactions, Vol. 6, pts. 1, 2, 1882-3.

A. C. LAWSON :—
Ancient Rock Inscriptions on the Lake of the Woods, 1885.

WM. KINGSFORD, C. E :—
The Canadian Canals ; their History and Cost, &c., 1865.

JOHN BIRKENBINE :—
Report of certain Iron Ores in Lanark Co., Ont., on lands in Townships of Darling and Lavant, 1883 (three copies.)

L'ABBÉ PROVANCHER :—
Le Naturaliste Canadien, Vol. 15, Nos. 4. 5, 6, 1885.

The Canadian Entomologist :—
Vols. 1-16, 1869-84.

The Canada Gazette, Ottawa :—
Vol. 18, Nos. 27-52.
Vol. 19, Nos. 1-26.

Manitoba Gazette, Winnipeg :—
Vol. 14, 1885.

The Canadian Militia Gazette, Ottawa :—
Vol. 1 No. 4.

Hy. Montgomery :—
Three Weeks in Dakota, 1884.

A. McCharles :—
The extinct Cuttle Fish in the Canadian N. W., 1885.

Wm. Saunders :—
Insects injurious to fruits, 1883.

Annuaire du Seminaire de Chicoutimi :—
No. 5, 1884-5.

The Canadian Record of Science, Montreal :—
Vol. 1, Nos. 2, 3, 1885.

McGill College, Montreal :—
Calendar, 1885-6.

Annuaire de l'Université Laval :—
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Sir W. Dawson :—
On New Tree Ferns and other Fossils from the Devonian, 1871.
On the Conditions of the Deposition of Coal, more especially as illustrated by the Coal Formation of Nova Scotia and New Brunswick, 1866.
Notes on some Scottish Devonian Plants, 1878.
Remarks on Mr. Carruthers' Views of Prototaxites, 1873.
Notes on New Erian (Devonian) Plants, 1881.
Further Observations on the Devonian Plants of Maine, Gaspé and N. Y., 1863.
Note on a Fern associated with Plate phemera antiqua (Scudder.)
On a specimen of Diploxylon from the Coal Formation of Nova Scotia, 1877.
On the structure and affinity of Sigillaria, Calamites and Calamodendron. 1871.
Notes on Prototaxites and Pachytheca discovered by Dr. Hicks in the Denbighshire Grits of Corwen, N. W., 1882.
On Rhizocarps in the Palæozoic Period (no date.)
On the Flora of the Devonian Period in North Eastern America (no date.)
On the Graphite of the Laurentian of Canada, 1870.
On the Occurrence of Eozoon Canadense at Côte St Pierre, 1876.
Möbius on Eozoon Canadense, 1879,
Note on recent controversies, respecting Eozoon Canadense, 1879.
New facts relating to Eozoon Canadense, 1876.

Rev. D. Honeyman :—
Glacial Distribution in Canada, 1885.

Canadian Institute, Toronto :—
Reports on the Improvement and Preservation of Toronto Harbour, 1854, Supplement to Canadian Journal.
Proceedings (N. S.) Vol. 15, Nos. 1-8, 1876-78.
" (N. S.) Vol. 1, Pts. 1, 2, 1879-81.
" (3 ser) Vol. 3, Fasc. 1, 2 (whole No. Vol. 21, Nos. 142-3), 1885.

Government of Ontario :—
Forrestry Reports, 1884, by R. W. Phipps.

Crown Land's Department, Quebec :—
Report of Commissioner for year ending June, 1884.

W. H. SMITH :—
Hand-book, containing details relating to Senate and House of Commons, 1885.

P. W. MATHEWS, *York Factory* :—
Notes on Diseases among Indians, 1885.

N. S. GARLAND, *Ottawa* :—
The Parliamentary Directory and Statistical Guide, 1st Ed., 1885.

COMMISSIONER OF MINES, *British Columbia* :—
An Act to Consolidate and amend the laws relating to gold and other minerals excepting Coal, B. Columbia, 1883 (six copies.)

FARWELL & Co., *Victoria, B. C.* :—
Townsite of Farwell, Kooteny District, 1885.

Historical Society of Montreal, per L'Abbé Verreau :—
Abrégé de l'Histoire du Canada par F. A. Garneau, 1873.
Exposition du Canada, Montreal, 1880, Exposition Scolaire de la Prov. de Quebec, Catalogue.
Lois Sur l'Instruction Publique dans la Province de Quebec, 1877.
Notre Constitution et nos Institutions, par Nap. Legendre, 1878.
Loi et Notes Explicatives Concernant le fonds de retraite et de secours en faveur des fonctionnaires de l'enseignment primaire, 1880.
Traité d'Elocution, 2nd Ed., 1871.
Réplique au Second Memoire de Mgr., L'Evêque de Trois-Rivières, par L'Abbé Verreau.
Etats de Services de l'Ecole Normale Jacques-Cartier, 1857-84, par L'Abbé Verreau.
La Perle Cachée : Drame en deux Actes, par le Cardinal Wiseman, 1876.
Lexique de la Langue Iroquoise, par J. A. Cuoq.
Mémoires de la Soc. Historique de Montreal, 6 Liv. Voyage de MM. Dollier et Gallinée, 1875, 7 Liv. Voyage de Kalm en Amerique, Analysée et traduit, par L. W. Marchand. 8 Liv. Voyage de Kalm en Amerique, 1880, 9 Liv. Les Véritables Motifs de Messieurs et Dames de la Soc. de Notre Dame de Montreal, 1880.
Notice sur les Fondateurs de Montreal, par L'Abbé Verreau, 1884.
Des Commencements de L'Eglise du Canada, per L'Abbé Verreau, 1885.
Notice sur l'Eglise de Notre Dame de Montreal, 1880.
Journal du Siège de Quebec en 1759, par Jean C. Panet, 1866.
Quelques Notes sur Antoine de la Mothe de Cadillac (no date.)
Recit d'Aventure dans le Nord-Ouest, par J. E. P. Barrette, 1881.
Mémoires et Documents relatifs à l'Histoire du Canada, Livs. 1, 2, 3, 1859, 1860. De l'Esclavage en Canada, Liv. 4. Histoire du Montreal, par M. Dollier de Casson, 1868.
Invasion du Canada : Collection de Memoires recueillis et Annotés, par L'Abbée Verreau, Pts. 1, 2, 1873.

Mémoires de la Soc. Historique de Montréal: Règne Militaire en Canada ou Administration Militaire de ce pays par les Anglais du 8 Sept., 1760, au 10 Aout, 1764. (Manuscrits recueillis et annotés, par le Commandeur J. Viger, 1872.)

A Dictionary of the Otchipwe Language, Pt. 2, Otchipwe-English, by R. R. Bishop Barraga, 1881.

Vingt Années de Missions dans le Nord-ouest de l'Amerique, par Mgr. Taché, 1866.

L'Instruction Publique au Canada, par M. Chauveau, 1876.

Le Libéralisme; Leçons données à L'Université Laval, par L'Abbé Benj. Paquet, 1872.

Histoire de Cinquante Années, 1791-1841, par T. B. Bedard, 1869.

The Canadian Quarterly Agricultural and Industrial Mag. Vol. 1, Nos. 1, 2, 1838, by W. Evans, Montreal.

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United States Geological Survey:

Monograph. Vol. 2. Tertiary History of the Grand Cañon District, 1882. By C. E. Dutton.

Monograph. Vol. 3. Geology of the Comstock Lode and the Washoe District, with Atlas. By G. F. Becker. 1882.

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