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CONTENTS.

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CANADIAN SURVEYS AND MUSEUMS AND THE NEED OF INCREASED EXPENDITURE THEREON. PRESIDENT'S ADDRESS. BY B. E. WALKER, ESQ., F.G.S.

(Read 11th November, 1899.)

We find ourselves possessed in Canada of a country vast in its dimensions, but of which the population is as yet comparatively small. If, therefore, we have good reason to believe that the natural resources of our territory are in any respect commensurate with its area, we may look forward with confidence to a great future. But in order that this may be realized properly and soon, we must devote ourselves to the exploration and definition of our latent wealth, and to the solution of the problems which inevitably arise in the course of its utilization under circumstances which are often more or less entirely novel. For this purpose we are provided at the present day with methods, appliances and an amount of accumulated knowledge not previously thought of, but which we must be prepared to enlist in our service if our purpose is to be achieved.—George M. Dawson, C.M G., etc., Director Geological Survey of Canada. Presidential Address, Royal Society of Canada, 1894.

It is my intention to confine my address to the subject of national surveys and museums. If a private individual were to become the owner of five or ten thousand acres of diversified virgin territory he would, presuming that he was what we call a practical person, make or have made a careful examination of his estate in order to know its resources and possibilities. He would keenly examine the various soils as to their suitability for agriculture, the timber as to its immediate or prospective value, the clays and sedimentary rocks as to possibilities of building materials; or if his estate lay in a mineral area he would look eagerly for an Eldorado. He would consider the lakes and streams and the water powers and watersheds of his property, and the nature of the drainage or the necessity of artificial drainage. In a word, he would take stock of his purchase just as a merchant or manufacturer would of his goods. Now, a new country is but an enlargement of this diversified five or ten thousand acres, and the people of a new country are but an enlargement of this practical individual. If they are as able to recognize their interest in the national problem as he is in the individual problem, they will wish to know of what the national domain consists, what are its resources and its future possibilities. Clearly, they will wish to know what can in any particular part of the domain be first and most profitably marketed or put to use in manufacture as raw material. Just as clearly they will want to know what raw material they possess which although not marketable now will eventually help to build up the national wealth. Also if they are reasonably intelligent they will desire to know the extent of the so-called waste places which have apparently no present or prospective use or value measured by money. I need not tell you that at this moment I cannot stop to discuss the enormous value to man of the waste places of mother earth, so dear to the artist, the sportsman, the naturalist, and the truly intelligent man of any class. I have purposely begun by making a bald statement in defence of national surveys which will be admitted by all because it is based on economic grounds which are recognized by all, and it will be a surprise to many to be told that clear

as is the truth of this bald statement, we possess within easy distance from long settled districts vast areas about which we know nothing, or nearly nothing. For some of this ignorance there is adequate excuse; for much of it there is no excuse whatever. But in addition to the knowledge which is so clearly due to the people on economic grounds, there is knowledge, much of which upon a wide consideration of national interest it would be a true economy to possess, but which may be better understood by being regarded as what is due to the intelligence of the people rather than to their pockets. As an intelligent people we are entitled to learn gradually all that there is to be known about the natural phenomena of our country, and as an intelligent people we are entitled to possess museums in which may be exploited, not only the materials for national wealth, but also the entire range of natural phenomena as far as it can be exhibited objectively. Doubtless, no one in this particular audience will question this last statement, but we should always keep before us the fact that in a new country the majority of the people have their minds filled with material considerations alone. They or their parents have begun life, if not literally seeking their bread, still having as the main purpose the improvement of the material circumstances of their lives, and so it happens that they are deaf to any but what they deem practical arguments. The politicians reflect the people and it is therefore much more difficult than would at first seem natural to obtain a hearing for any expenditure of money which will only indirectly benefit the people. But while this is inevitable in the early days of a country struggling with poverty, it is disgraceful in any country to continue to neglect the higher considerations of national life when there is no longer the excuse of national poverty.

I should like this evening to consider with you what national and provincial surveys should accomplish, and what national and provincial museums should contain, and whether there is any longer a shadow of excuse for Canada persisting, as it has for so long a time, in neglecting these duties.

And first it may be well to review some of the work done in the past by which we have become better acquainted with our country. I shall refer almost entirely to work done by those who were in the public service, whether of Great Britain, the old Provinces, or the Hudson's Bay Company and other fur-trading companies, with only passing remarks on others whose work had no official origin.

In 1814, Admiral Bayfield, his duties in connection with the war being over, began a survey of the Great Lakes, which after the labour of many years resulted in the series of charts covering the entire St. Lawrence system of lakes and rivers and parts of our Atlantic sea-coast, on which charts so much of our navigation still depends. He also found time about 1830 to publish in the first volume of the journal of the Literary and Historical Society of Quebec, papers on the geology of Lake Superior and on coral animals in the Gulf of St. Lawrence. Major-General, then Lieutenant Baddeley, and Sir Richard, then Captain Bonnycastle, both of the Royal Engineers, appear also to have been students of geology, and both contributed papers to the early volumes of the same journal, the services of the former being used, according to Sir William Logan, in a public capacity. He was the first to write regarding the lower Silurian limestones about Lake St. John and Murray Bay, and some of our early knowledge of the Labrador Coast and the Magdalen Islands, is due to him.

About the time when Bayfield was surveying the Great Lakes, Prof. A. Lockwood, who was styled "Professor of Hydrography and Assistant Surveyor-General of the Province of Nova Scotia and Cape Breton," was surveying the coast and harbours of that province, the result of his labours being published in 1818.*

We are not so much concerned with mere topography, but it is interesting to note that Major Samuel Holland, Surveyor-General of British North America, who, as early as 1768, was working out the latitude and longitude of Cape Breton, was the uncle of Lieutenant-Colonel Joseph Bouchette, who was also Surveyor-General and did considerable work regarding the Maine boundary in connection with the Boundary Commission under the Treaty of Ghent, and whose topographical and statistical volumes on the various eastern provinces are so well known.† From our

* Brief Description of Nova Scotia. A. Lockwood, London, 1818.

† 1 "The British Dominions in North America," etc. J. Bouchette, 2 vols., London, 1832.
2 "A Topographical Dictionary of Lower Canada." J. Bouchette, London, 1832.

point of view the services to science in Canada of Dr. John J. Bigsby, who had been commissioned in 1819 to report on the geology of Upper Canada, and became in 1822 Secretary to the Boundary Commission already mentioned, are more interesting. While Colonel Bouchette travelled about the more settled provinces, investigating seigniory boundaries, statistical conditions, and matters mainly incident to the settlement of the country, Dr. Bigsby pushed his way into the wilder parts. He appears to have examined with more or less detail the geology of Lakes Huron, Superior, Simcoe and Nipissing, and the main river systems in connection therewith. The twenty-seven papers written after his return to England and contributed to scientific journals, as shown by the Royal Society Catalogue of Scientific Papers, down to 1873, treat almost entirely of North American geology. He published in 1852 a popular illustrated book in two volumes about Canada, and it is safe to say that in the northern part of Lake Huron he laid the foundation of the knowledge which resulted half a century later in his Thesaurus Silurieus.* His "Notes on the Geography and Geology of Lake Huron," London, 1824, appears to be the first geological report of an official character regarding any part of Canada.

Before dealing with a later period in Eastern Canada we must turn to that great western territory which only came under our control after the Confederation of 1867. Year by year we are becoming acquainted with it, but for a hundred years before the members of our Geological Survey began to thread its wilds it had appealed to the imagination of a few by its very remoteness from civilization, and the volumes published by the most famous of its explorers are therefore fairly well known in literature.

In 1769 the Hudson's Bay Company issued a letter of instructions to Samuel Hearne ordering him to undertake an "expedition by land towards latitude 70° north, in order to gain a knowledge of the Northern Indians' country," etc. From 1769 to 1772 inclusive, Hearne made several journeys, the main object being the discovery of copper mines and to try once more for the North-West Passage, so long and anxiously sought. Before his day, as since, the Company had been accused of being lacking in enterprise and disposed merely to buy furs and keep the country as much a *terra incognita* as possible, but this idea Hearne in the introduction to the account of his travels, endeavours to refute. The published account† shows that in 1770 after a short journey in 1769, Hearne travelled from Churchill into the not far distant country of the Doobaunt and Kazan rivers and back, thus covering part of the barren-lands country through which J. B. Tyrrell travelled on behalf of the Dominion Geological Survey in 1893-94.‡ On his return Hearne immediately set out again and travelling first westward, thus avoiding the barren-lands country, and then northward, he eventually reached the Coppermine River. He recorded little of geological interest but devotes an entire chapter to the description of the animal and vegetable life observed by him. For various reasons his geographical work is out of its reckoning, but apart from the mapping done by Tyrrell it constitutes all that we know about an enormous area of Canada west of Hudson Bay.

In 1789 the active competitor of the Hudson's Bay Company, the North-West Fur Company, sent Alexander Mackenzie who had been for some years factor at Fort Chippewyan on Lake Athabasca, on a journey of exploration, doubtless suggested by himself. We all know that he followed the Mackenzie River to its mouth and returning set out from Lake Athabasca again in 1792, this time up the Peace River to its source, crossing the height of land and reaching the Pacific Ocean at about the fifty-second parallel. Sir Alexander Mackenzie was neither geographer nor naturalist, indeed he was only a trader, but he was one of the men who subdue empire and enrich their country in the effort to enrich themselves. His observation of natural resources and of the highways possible for commerce was very keen and whether it has a reasonable connection with my subject or not, I cannot forbear quoting some remarkably prophetic words, from the closing pages

* "Thesaurus Silurieus. The Flora and Fauna of the Silurian Period." John J. Bigsby, London, 1868.

† "Journey from Prince of Wales' Fort in Hudson's Bay to the Northern Ocean," etc. Samuel Hearne, London, 1795.

‡ "Report of the Doobaunt, Kazan and Ferguson Rivers and the North-west coast of Hudson Bay," etc. J Burr Tyrrell. Geol. Surv. Can. Annual Report Vol. IX. 1896. (Published in 1897.)

of the account of his travels.* After a careful discussion of waterways he concludes as follows :

"By opening this intercourse between the Atlantic and Pacific Oceans, and forming regular establishments through the interior, and at both extremes, as well as along the coasts and islands, the entire command of the fur trade of North America might be obtained, from latitude forty-eight north to the pole, except that portion of it which the Russians have in the Pacific. To this may be added the fishing in both seas, and the markets of the four quarters of the globe. Such would be the field for commercial enterprise, and incalculable would be the produce of it, when supported by the operations of that credit and capital which Great Britain so pre-eminently possesses. Then would this country (Great Britain) begin to be remunerated for the expenses it has sustained in discovering and surveying the coast of the Pacific Ocean, which is at present left to American adventurers, who without regularity or capital, or the desire of conciliating future confidence, look altogether to the interests of the moment." He was not dreaming of steam railways reaching Vancouver from Montreal in five days, but merely of making less arduous such a journey by canoe and foot as he practically finished when having reached the Pacific he wrote: "I now mixed up some vermilion in melted grease, and inscribed in large characters, on the south-east face of the rock on which we had slept last night, this brief memorial: 'Alexander Mackenzie, from Canada, by land, the twenty-second of July, one thousand seven hundred and ninety-three.'"

Captain George Vancouver being commissioned by the King on a voyage of discovery particularly to try once more for a passage between the North Pacific and North Atlantic Oceans, spent the years from 1790 to 1795† at sea during which time he surveyed the coast of North-West America. We are, however, more concerned with the work of another explorer who spent his life between the Great Lakes and the Pacific, but who, because of the indifference of his countrymen, is less famous than Vancouver. I refer to David Thompson, Astronomer and Surveyor, as he styled himself, first to the Hudson's Bay Company, then to the North-West Company, and later acting with the International Boundary Commission, who from 1784 to 1850, as the forty volumes of records and maps made with his own hand and now in the Crown Lands Department of the Province of Ontario show, laboured strenuously for science, practically without a fellow-worker. In the published journals of Alexander Henry† edited by Elliott Coues, footnotes and other information from the unpublished journals of David Thompson appear, and Mr. Coues also gives us facsimiles of three sections and the title part of the great map he evidently hoped would be published. Elliott Coues says in his preface: "It has long been a matter of regret among those versed in the history and geography of the Greater North-West that this luminous record of the life work of so modest, so meritorious an explorer as Thompson was—of so scientific a surveyor and so great a discoverer—has never seen the light, either under government patronage or by private enterprise." And later in the same preface: "The irony of the event is the world's revenge on David Thompson; but the world can never be allowed to forget the discoverer of the sources of the Columbia, the first white man who ever voyaged on the upper reaches and main upper tributaries of that mighty river, the pathfinder of more than one way across the continental divide from Saskatchewan and Athabascan to Columbian waters, the greatest geographer of his day in British America, and the maker of what was then by far its greatest map—that 'Map of the North-West Territory of the Province of Canada. From actual surveys during the years 1792 to 1812' as the legend goes."

During the years 1819 to 1822 inclusive, Captain, afterwards Sir John Franklin, acting under a royal commission, was carrying out an "expedition from the shores of Hudson's Bay by land, to explore the northern coast of America, from the mouth of the Coppermine River to the eastward." This, and subsequent arctic expeditions, not only resulted in some important geographical discoveries, but gave to the

* "Voyages from Montreal on the River St. Lawrence, though the Continent of North America to the Frozen and Pacific Oceans." Alexander Mackenzie, London, 1801.

† "A Voyage of Discovery to the Northern Pacific Ocean," etc. Captain George Vancouver, 3 vols and atlas, London, 1798.

‡ "New Light on the Early History of the Greater North-West," etc. Edited by Elliott Coues, 3 vols, New York, 1897.

world the two most important works on the natural history of northern Canada, the Fauna Boreali-Americana of Dr. John Richardson, Franklin's co-explorer, and others, published 1829–1837, and the Flora Boreali-Americana of Sir William Hooker, 1833–1840.

In 1857, Captain John Palliser was commissioned by the Secretary of State to "conduct an expedition for exploring that portion of British North America which lies between the northern branch of the River Saskatchewan and the frontier of the United States, and between the Red River and the Rocky Mountains," with permission to go through the mountains to the Pacific. He had as associates in the expedition Dr. Hector as geologist, Lieutenant Blakiston as astronomer, and Mons. Bourgeau as botanist, who, acting under instructions from Sir Roderick Murchison and Sir William Hooker, were to be the scientific members of the party. Palliser had in 1847 and succeeding years, hunted among the Indians of our North-West and knew the country, so that during 1857, 1858 and 1859, the various routes travelled by Palliser, Blakiston and Hector, together and separately, pretty well covered the country south of the Saskatchewan from Lake Superior to the Rocky Mountains and also through many of the passes and valleys beyond. In the various blue-books* which resulted, much valuable information is put on record, and of Dr. Hector's work, Dr. G. M. Dawson, in his Boundary Commission report hereafter referred to, says: "To him the first really trustworthy general geological map of the interior portion of British North America is due; and he has besides accumulated a great mass of geological observations, the significance of many of which appears as the country is more thoroughly explored."

Captain Palliser thought it worth while to explore this country and to report elaborately upon the future prospects of civilization, but while his recommendations as to necessary steps are generally sound he certainly did not overestimate its possibilities. On the subject of confederation he writes in the report of 1860: "Much has been talked about, but perhaps less really thought of, the union of the British North American Provinces, a scheme which, although in the present age might be thought somewhat speculative, may yet not only be projected but accomplished. But it must be a work of time, and such time as many may become impatient even in contemplating." Regarding telegraphic communication he writes: "It would be ridiculous to expect for many years to come a continuous railway communication throughout this immense distance, but from the fact of over one-fourth of the distance being now complete, and considering the incalculable benefit the United Kingdom and her distant colonies would derive from connection by telegraph, I am encouraged to advocate warmly the carrying out of this enterprise."

In the same year, 1857, when Captain Palliser received instructions from the British Government, the Canadian Government commissioned George Gladman, Director, Henry Youle Hind, Geologist, W. H. E Napier, Engineer, and S. J. Dawson, Surveyor, to "make a thorough examination of the tract of country between Lake Superior and Red River." This was done in 1857. In 1858 the Government commissioned Messrs. Hind and Dawson to extend their explorations to the country "west of Lake Winnipeg and Red River, and embraced (or nearly so) between the River Saskatchewan and Assiniboine, as far west as 'South Branch House,' on the former river." In addition to the official reports† to the Canadian Government the reports appeared as British blue books and Professor Hind also published in an extended and attractive form the results of his labours in two handsome volumes.‡ Professor Hind, like Captain Palliser and Sir Alexander

* "Papers Relative to Exploration by Captain Palliser of that portion of British North America," etc. British Blue Book, 1859.

"Further Papers," etc., in continuation of above, 1860.

"Journal," etc., in continuation of above, 1863.

"Index and Maps," etc., in continuation of above, 1865.

† "Report on the Exploration of the Country between Lake Superior and the Red River Settlement." Canadian Blue Book, 1857. British Blue Book, 1859.

"Report of the Assinniboine and Saskatchewan Expedition." Canadian Blue Book, 1859. British Blue Book, 1860.

‡ "Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assinniboine and Saskatchewan Exploring Expedition of 1858." H. Y. Hind, 2 vols., Longmans, London, 1860.

Mackenzie, indulges in prophecy. He writes: "As I stood upon the summit of the bluff looking down upon the glittering lake 300 feet below, and across the boundless plains, no living thing in view, no sound of life anywhere, I thought of the time to come when will be seen passing swiftly along the horizon the white cloud of the locomotive on its way from the Atlantic to the Pacific, and when the valley will resound with the many voices of those who have come from the busy city on the banks of the Red River to see the beautiful lakes of the Qu'Appelle." How natural it all sounds now, but doubtless it fell in 1869 upon as deaf ears as similar forecasts made at the present time by members of our geological survey, or as the fervid words of Mackenzie a hundred years ago.

I have not examined the various British blue books from 1832 to 1876, nearly forty in number, relating to the settlement of the boundary between the United States and Canada, but in addition to the work by Bigsby and Bouchette this is the time to mention two scientific results arising from marking the forty-ninth parallel. John Keast Lord who acted as Naturalist to the British North American Boundary Commission when marking the boundary line from the Pacific coast to the eastern slope of the Rocky Mountains, published two illustrated volumes in 1866 on the natural history of British Columbia.* And in 1874 and 1875, Dr. George M. Dawson, not yet connected with the Geological Survey of Canada, made his reports on the geology and resources of the "region in the vicinity of the forty-ninth parallel from the Lake of the Woods to the Rocky Mountains."†

I have thus far indicated, not with precise accuracy, but perhaps sufficiently, the extent of the exploratory work done in the country now included in Canada, under the auspices of the trading companies and the early governments, and not by established geological and natural history surveys. If we consider the publications by their number they stand as an evidence of the inability or unwillingness of Canadians in the past to grasp the future of their country, and judged by the quantity of matter of a purely scientific nature, they betray an indifference to higher considerations not creditable to their intelligence. We certainly owe a debt of gratitude to the few ardent men who braved the terrors of our unknown lands and gave us this scanty literature.

Before referring to the regular geological survey established in Canada in 1843, I should like to compare the exploratory work done in the United States before the establishment of a regular geological survey, by the Federal Government. It must be borne in mind that during nearly half a century before the Federal Government established a regular survey most of the States had established surveys on their own account just as we shall have occasion to remind you that our survey was originally a Provincial and not a Dominion survey. Not referring, then, to the work done by the various States, but merely to the exploratory work of a similarly irregular character to that done in Canada in early days, I shall read a list of expeditions ordered by the United States Government. It does not pretend to be accurate either as to the number or as to the details given of the various expeditions. It was compiled merely in order to indicate how much more earnestly the people of the United States craved for information about their unsettled areas. The majority of the reports are quartos illustrated with expensive plates and often running into several volumes. The Pacific Railroad reports alone exceed in matter all that we have done. The dates given in the following list sometimes indicate the date of the expedition, sometimes of the publication of the reports:—

1804-6. Captains Lewis and Clark. From the mouth of the Missouri River through to Pacific Ocean.

1805-7.—Lieut. Zebulon M. Pike. Through western territories of North America. To head waters of Mississippi River, through Louisiana Territory and in New Spain.

1819-20.—Major Stephen H. Long, Pittsburg to the Rocky Mountains.

1820—Henry R. Schoolcraft. From Detroit through Great Lakes to source of Mississippi River.

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* "The Naturalist in Vancouver Island and British Columbia." J. K. Lord, 2 vols., Bentley, London, 1868.

† "Report on the Tertiary Lignite Formation," etc. B. N. Boundary Commission, G. M. Dawson, 1874. "Report of Geology and Resources," etc. B.N.B.C., G. M. Dawson, 1875.

1823.—Major Stephen H. Long. To the source of St. Peter's River, Lake Winnepeck, Lake of the Woods, etc.

1834.—G. W. Featherstonhaugh. Elevated country between Missouri and Red River.

1835.—G. W. Featherstonhaugh. Green Bay to Coteau de Prairie or from Missouri to St. Peter's River.

1838-42.—Wilkes, U.S. Exploring Expedition.

1839.—David Dale Owen. Geological Exploration of part of Iowa, Wisconsin and Illinois.

1842-44.—Captain J. C. Fremont, Expedition to the Rocky Mountains, Oregon and North California.

1843.—I. N. Nicollet. Basin of upper Mississippi River.

1846-50.—During these years there were seven or eight reports of minor military expeditions in connection with Texas, New Mexico and the Santa Fe route to California.

1848.—Lieut. J. W. Abert. Geographical examination of New Mexico.

1851.—Prof. L. Agassiz. Examination of Florida Reefs, Keys and Coast.

1852.—David Dale Owen. Iowa, Wisconsin and Minnesota.

1852.—Captain R. B. Marcy. Red River of Louisiana.

1853.—Captain Howard Stansbury. Valley of the Great Salt Lake of Utah.

1853-54.—Exploration and survey to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. 12 volumes. Published from 1855 to 1860.

1854.—Captain L. Sitgreaves. The Zuni and Colorado Rivers.

1854.—Captain R. B. Marcy. The Brazos and Big Wichita Rivers.

1855.—David Dale Owen. Minnesota, Iowa and Wisconsin.

1855-57.—Lieut. G. K. Warren. Explorations in Nebraska and Dakota.

1857.—Lieut.-Col. W. H. Emory. United States and Mexican Boundary Survey.

1857-58.—Lieut. Joseph C. Ives. The Colorado River of the West.

1859.—Captain J. H. Simpson. Great Basin of Utah.

1859.—Captain J. N. Macomb. Santa Fe to Grand and Green Rivers.

1859-60.—Captain W. F. Raynolds. Yellowstone and Missouri Rivers.

1871-75.—Lieut. George M. Wheeler. Exploration and Survey west of 100th Meridian. There are over thirty publications as the result of this survey.

1871-77.—Clarence King. Geological Exploration of 40th Parallel. Published in six annual reports of progress, followed by six volumes of scientific contributions by his co-workers.

Although the Federal Government of the United States down to 1867 had not established a regular geological survey and conducted the exploration of the territories by semi-military expeditions generally under control of the engineering department of the army, several of the State governments established surveys before 1835, and Sir William Logan in 1844 refers to "the liberal view of their own interests, which, during the last ten years, has induced not less than twenty of the State Legislatures of the American Union to institute investigations into the mineral resources of their respective territories," etc. I, at one time, intended to prepare a list of the various State surveys now covering almost every State, which have been conducted during the last sixty-seven years, or thereabout, indicating when each survey began and the extent of the publications, but I have found this

impossible in the short time at my disposal and I must content myself with such comparisons as will show how liberal and intelligent almost all other governments in North America have been relatively to our own.

Let us now turn to the establishment of our own regular survey.* In 1842, following the example of about twenty of the States of the American Union, the old Province of Canada instructed Sir William Logan to undertake a geological survey of the Province, work in connection with which began in 1843, Sir William having one assistant, Mr. Alexander Murray. For the ensuing ten years these two devoted men worked in the field, and after a few years Dr. T. Sterry Hunt became their able co-worker in the laboratory as chemist and mineralogist to the survey, for all practical purposes the first officer of that character, although not literally the first. No matter how devoted, two men could not do much judged by quantity, and the ten annual reports from 1843 to 1853 with two separate pamphlets on the mining regions of Lake Superior and the north shore of Lake Huron, make altogether less than 1,250 pages of small octavo, about as much matter as one annual report of the survey now. Two maps of a mine accompany one of the pamphlets, and here and there there is a badly executed illustration, but of fossils there are neither descriptions nor illustrations. It is true that in 1851 and 1852, Sir William Logan contributed importan papers on the "Foot-prints in the Potsdam Sandstones of Canada" to the quarterly journal of the Geological Society in London, which were most adequately illustrated by the Society, but in these papers he thanks a member of the Geological Survey of Great Britain for naming the fossils he has occasion to refer to. If I could lay before you these twelve slender pamphlets and the still more slender reports of Dr. Gesner made in the Maritime Provinces, hereafter referred to, and put beside them the reports made by the various public surveys in the United States down to 1853, you would realize more forcibly than I can express in words how completely the Canadians failed to take that "liberal view of their own interests" which characterized the people of the United States. But somewhat better days were in store for the survey. Mr. James Richardson had been added to the workers in the field, and in 1856 Mr. E. Billings entered the survey as palæontologist. In 1857, Prof. Robert Bell, still a member of the staff, also joined the survey. The survey was now fairly equipped and its publications gave evidence of the larger scope of its operations. The report for 1853-56, published in one volume, was accompanied by the first series of maps, illustrating reports on the geology and topography of the Muskoka, Petewawa, Bonnechere, Madawaska, Maganetawan, French, Sturgeon, and Wahnapitae Rivers and Lake Nipissing and its tributaries, also of the Island of Anticosti, altogether about 25 maps. In this volume appeared the first report of the palæontologist, the beginning of a series which established Mr. Billings' reputation throughout the scientific world. It is not accompanied by illustrations, which fate also befel some of his later reports. This is not so strange as the fact that to this day some of his species have been allowed to remain unillustrated. It is characteristic of our interest in science that his name is doubtless much better known to-day in Europe than it is in Canada. In 1863 the results of the work of the survey from the beginning appeared in the well-known volume of about 1,000 pages, published without a single plate but with about 500 good wood-engravings and an excellent atlas of maps and sections. This atlas contained the first geological map of "Canada and the Adjacent Regions," printed in colours, 125 miles to an inch, and it was followed in 1866 by the large map on the scale of twenty-five miles to an inch, coloured by hand. I wish that every Canadian might read the prefatory note accompanying this atlas, and learn what goes to the making of a reasonably accurate map of a new territory. The ordinary report of progress for the years 1863-66 containing papers by two new contributors, Mr. A. Michel and Mr. Thomas Macfarlane, was the last made to the old Province of Canada. In addition to these reports of progress, seven pamphlets appeared and six important contributions to palæontology. Four of these latter, called respectively Decades 1, 2, 3 and 4,

* "The first effort made toward the establishment of a geological survey in Canada, appears in a petition addressed to the House of Assembly of Upper Canada in 1832, by Dr. Rae. Nothing, however, came of this or of several other attempts of the same kind, till in the first united Parliament of Upper and Lower Canada in 1841, the Natural History Society of Montreal and the Historical Society of Quebec joined in urging the matter upon the government, with the result that the modest sum of £1,500 sterling was granted for the purpose of beginning such a survey." Presidential Address, R. S. C., 1894. G. M. Dawson.

appeared in 1858-59 and 1865. The contributors were Mr. Billings of the Canadian Survey, Mr. Salter of the Survey of Great Britain, and Prof. James Hall, the State Geologist of New York. They were slender octavo volumes containing altogether only 370 pages of text, but with a liberal supply of excellently engraved plates. Three of the Decades are monographs on the subject dealt with, and the four volumes are classics in North American Geology and absolutely essential to students of North American invertebrate palæontology. In 1865 the first volume, 426 pp., of a series entitled "Palæozoic Fossils" appeared, the species described being entirely by Billings. Many of the descriptions are unaccompanied by illustrations and those afforded are wood-cuts. In 1866 the pamphlet, 93 pp., entitled "Catalogues of the Silurian Fossils of the Island of Anticosti," was published. It also consists of descriptions of species, sometimes illustrated, sometimes not. This closes the work done by the survey of the old Province of Canada, the operations of which extended only to portions of what are now Quebec and Ontario. As Sir William Logan said, much of the period was occupied in obtaining topographical knowledge sufficient to enable the first geological map to be made, and indeed this is the main result of his labours.* When we look at the very small quantity of matter in the reports produced during this period of twenty-four years we must deeply regret the indifference of a people who could leave unsupported, save by two or three enthusiasts, a man with such endowments as the Director of the Survey, Sir William Logan, our honoured president in the first year of this Institute. We shall see later what this ignorance and indifference have cost us.

But narrow as was the scope of the work in old Canada it was worse in the Maritime Provinces. As early as 1838, Dr. Abraham Gesner began a geological survey of New Brunswick, which was carried on in some fashion until 1844, when it came to an end, the result being the reports detailed in the footnote below.† There was also, apparently, a report in 1843. 88 pp., not, however, styled the fifth report. Dr. Gesner had already published a volume on Nova Scotia‡ as a private venture in which he was assisted by the province, and the work in New Brunswick resulted in another contribution which reached the public in a similar manner. He was employed in 1846 by the government of Prince Edward Island to report on the geology of that province, which apparently resulted in a short report in 1847, and in 1849 he published a volume on the "Industrial Resources of Nova Scotia," but whether aided by the provincial government or not, I am unable to say. He published other papers regarding gold, iron, coal, and especially petroleum, but evidently to a languid public. In the volume on New Brunswick, published in 1847, and noted below,‖ Dr. Gesner says: "Of the British North American Colonies, New Brunswick was the first to undertake an examination of her mineral resources. Since the commencement of that survey, similar ones have been instituted in Newfoundland and Canada. Prince Edward's Island has also followed the example. Nova Scotia would have engaged in such a work long ago, were not her mines and minerals sealed up by a close monopoly, which withholds from the inhabitants any participation in the mineral wealth of the country."

There were a few apparently official but irregular reports published in New Brunswick which should not be overlooked. In 1850, J. F. W. Johnston made a report on the "Agricultural Capabilities of the Province," etc., which includes geological notes by Mr. Robb. In 1864, L. W. Bailey made a report on Mines and Minerals. In 1865, Messrs. Bailey, Matthew and Hartt, made a geological report on Southern New Brunswick.

We have already mentioned Professor Henry Youle Hind in connection with the Red River and Saskatchewan expeditions. When appointed to this important

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* "In 1854 . . when before the . . select committee of the Legislature . . appointed to investigate the working of the survey. . . Logan was asked what the principal difficulties he had met with were; he replied: 'Independently of those unavoidably incident to travelling in canoes up shallow rivers, or on foot through the forest, are those arising from the want of a good topographical map of the country. Accurate topography is the basis of accurate geology.'" Presidential Address. R. S. C., 1894. G. M. Dawson.

† "First, Second, Third and Fourth Reports on the Geological Survey of the Province of New Brunswick." Gesner. St. John. 1st, 1839, 82 pp.; 2nd, 1840, 72 pp.; 3rd, 1841, 88 pp.; 4th, 1842, 101 pp.

‡ "Remarks on the Geology and Mineralogy of Nova Scotia; with a new map of Nova Scotia, Cape Breton, Prince Edward Island, and part of New Brunswick." Gesner. Halifax and London, 1836.

‖ "New Brunswick with Notes for Emigrants." Gesner. London, 1847.

work he was the Professor of Geology of Trinity University here, and he had for many years edited the journal of this Institute. After completing the publication of the official reports and maps and the other publications which resulted from his expeditions he, in 1861, visited Labrador, the results of his exploration reaching the public in a work published as a private venture* similar in style to the London editions of the Red River and Saskatchewan Expeditions. In 1864 he was authorized to begin a new survey of New Brunswick the only result of which reached the public in the following year.†

We do not find that Nova Scotia ever attempted a geological survey. Reports generally in the shape of legislative documents on her coal and gold mines have been made by J. W. Dawson, Joseph Howe, Henry How, Henry Poole, J. Campbell, David Honeyman, Henry Youle Hind and John Rutherford, but the work in general geology has been done by men who published the results of their investigations at their own expense. In addition to the labours of Dr. Gesner in Nova Scotia we find that in 1832, Charles T. Jackson, afterwards State Geologist of Maine and Rhode Island, assisted by F. Alger, made a report on Nova Scotia‡ and Dr., now Sir J. William Dawson, in addition to a handbook in 1848, which went into at least six editions, published in 1855 the well known Acadian Geology‖ of which there have been three editions, the third in 1878.

In 1873 Henry Alleyne Nicholson, then Professor of Natural History of the University of Toronto, aided by a small grant from the Government of Ontario, made collections of fossils in the Province, and in 1874 and 1875 published reports on the "Palæontology of Ontario," with several plates and other illustrations. These reports, perhaps the most valuable publications of the Government of the Province, are now so scarce as to be out of the reach of most students interested in geology, although indispensable until something more comprehensive appears. Unfortunately the descriptions and illustrations of many of the more difficult forms collected by Professor Nicholson do not appear in these reports but are published in expensive journals and other scientific works in England and Scotland, of which very few copies are to be found—in some cases literally only two or three—in all Canada. Since the excitement in mining has influenced the public, some of the provinces have established Mining Bureaus, and while these are a very inadequate substitute for regular geological and natural history surveys we owe a debt of gratitude to those who have induced unwilling governments to do even this much. The most important series of publications of this nature are those of the Ontario Bureau of Mines, which was created by legislation in 1891 and the publications of which have now reached the eighth volume. Under the guidance of its director, our worthy member Mr. Archibald Blue, it will no doubt grow year by year, limited in scope only by the liberality of the Government of Ontario. Ministers of the Crown in this province need not blind themselves to the fact, however, that since 1867, that is for thirty-two years, such material and intellectual interests in this province as would be represented by a proper survey and public museum, and which, down to Confederation, were being so excellently looked after by Sir William Logan, have been persistently neglected. The next publication regarding mines in importance is that of British Columbia. The Bureau of Mines of that province was established by legislation in 1895 and published its first bulletin in June, 1896. The annual reports for 1896 and 1897, published in 1897 and 1898, respectively, are very creditable productions, quite superior as to printing and illustrations to those of Ontario.

Now if we gather together the pre-Confederation work of Canada, New Brunswick and other provinces, and the publications by provinces since Confederation, including the Mining Bureaus, and compare the entire result with any one of say five or six of the leading States in the United States, the result must make us both astonished and ashamed. But if we add all the work done by the Dominion Survey

* "Explorations in the Interior of the Labrador Peninsula," etc. H. Y. Hind. 2 vols., London, 1863.

† "Preliminary Report on the Geology of New Brunswick." Hind. Fredericton, 1865.

‡ "Mineralogy and Geology of the Province of Nova Scotia." C. T. Jackson and F. Alger. Cambridge, Mass., 1832.

‖ "Acadian Geology: an Account of the Geological Structure and Mineral Resources of Nova Scotia," etc. J. W. Dawson. Edinburgh and London, 1855.

since 1867 to the provincial work, one state, New York, exceeds the whole in quantity of matter. Pray notice that I am not discussing in any manner the respective value of the work itself. I am very anxious to impress the legislatures of the Canadian provinces as to their shortcomings, and in order to do so I shall, at the risk of wearying you, press the point still further. If one were to look over a collection of reports on geology and palæontology of the various states he could at once count between 75 and 100 quarto volumes illustrated with fine maps and literally many hundreds of plates describing many thousands of fossils and other things of course besides fossils. And then turning to octavo volumes, similar to our own, I should be afraid to say how many hundred volumes he could count, but the total result would satisfy you that I am warranted in saying that we stand disgraced until we bestir ourselves and show that we possess ordinary intelligence regarding such matters. I shall not further hurt our pride as Canadians by comparing our position with that of many South American republics whose limited civilization we are wont to deplore.

We now come to the work done by the Geological and Natural History Survey of the Dominion. Although the series of publications from 1843 to date is unbroken I have separated them in order to consider the work done by the Dominion Government apart from that of the old Province of Canada. The change which was caused by Confederation was of very great importance, although it does not seem to have impressed itself on the Canadian people. Just before Confederation we had in operation a survey of what now constitutes portions of Ontario and Quebec, which would have year by year become more minute in its character until we reached such results as those obtained in many of the States where each county is reported upon so fully that the nature of its water courses, the character of its soil, the area of its forests, the value of its minerals, building stones, clays for brick-making, etc., etc., are published in such shape as to be available to anyone interested in such matters. But instead of this very desirable consummation of the early labours of Sir William Logan his work was largely arrested by Confederation, and there was thrust upon the Survey a problem similar in character to that undertaken by him in 1843, but incomparably greater in extent, namely, the survey of an area larger than that of the United States, if we exclude Alaska. I refer to the problem as similar in kind to that undertaken in 1843, because it was destined for many years to be mainly topographical and only subordinately geological. As late as 1880 the present director of the Survey, in demonstrating the inaccuracy of our maps of the northern and western parts of the Dominion wrote as follows:* "It is very commonly supposed, even in Canada, but to a greater extent elsewhere, that all parts of the Dominion are now so well known that exploration, in the true sense of the term, may be considered as a thing of the past. This depends largely upon the fact that the maps of the country generally examined are upon a very small scale, and that upon such maps no vast areas yet remain upon which rivers, lakes, mountains, or other features are not depicted. If, however, we take the trouble to enquire more closely into this, and consult, perhaps, one of the geographers whose name may appear on the face of the map which we have examined, asking such awkward questions as may occur to us on the sources of information for this region or that, we may probably by him be referred to another and older map, and so on till we find in the end that the whole topographical fabric of large parts of all these maps rests upon information of the vaguest kind.

"Of most of the large areas marked upon the map here shown, this is absolutely true, and the interests of knowledge, with respect to these, would be better subserved if such areas were left entirely blank, or, at least, if all the geographical features drawn upon them appeared in broken lines in such a way as to show that none of them are certain. In other regions, the main geographical outlines, such as the courses of the larger rivers, are indicated approximately, with such accuracy as may be possible from accounts or itineraries derived from travellers or from officers of the Hudson Bay Company; or from the descriptions or rough sketches of Indians or other persons by whom the region has been traversed, but who have been unprovided with instruments of any kind, and whose knowledge of the country has been incidentally obtained."

* "On Some of the Larger Unexplored Regions of Canada." G. M. Dawson. Ottawa Naturalist. Vol. IV. 1890.

Apart from the areas of Asia and Africa not yet examined, and possibly of Brazil, the work before the Geological Survey of Canada is the greatest in extent in the world. The topographical work alone is enough to break the heart of any director supported only by the meagre grants of our Government, and if we consider the geological work, confined as it must be at first to the broadest generalizations, it is fairly certain that we shall not in another century reach the position where our people will have before them the information regarding Canada which is possessed to-day by the people of the United States regarding their country.

Our Dominion Survey, since Confederation, has published its annual reports of progress, and these have grown in size until they are among the most important annual contributions to our knowledge of geology, but they are still only reports of progress containing information largely topographical, accompanied by notes on the geological and natural history features. These reports have been accompanied by a liberal supply of maps, the majority of which are topographical and form material for the complete map of the Dominion which we may hope to see in half a century or so. In addition to the report of the director these annual reports of progress contain in separate papers the results of the labours of the various exploring parties and the reports of the section of chemistry and mineralogy and the section of mineral statistics and mines. The work of the palæontological section is published separately. These have appeared under several titles in a manner which makes it difficult to at once appreciate just how much work has been done. There are at least five distinct series, most of which are still in progress. There are the "Palæozoic Fossils" of which the first volume preceded Confederation. The first part of the second volume, containing work by Billings, appeared in 1874 and remains unfinished. Of the third volume three parts have appeared—1884, 1895 and 1897. Then we have the "Mesozoic Fossils" of which three parts of the first volume have been published—1876, 1879 and 1884. There is a series entitled "Contributions to Canadian Palæontology" of which the first volume was published in five parts and is complete—1885, 1889, 1891, 1892 and 1898. The present able palæontologist, Mr. J. F. Whiteaves, Assistant Director of the Survey, succeeded Mr. Billings and these volumes contain his work alone. The first part of the second volume of "Contributions to Canadian Palæontology," which appeared in 1895, is devoted to Canadian Fossil Insects and is by the eminent authority on that subject, Dr. S. H. Scudder, of Cambridge, Mass. The first part of the third volume, published in 1891, is the only quarto publication. It is by the late E. D. Cope and is a valuable but all too small contribution to our knowledge of the fossil vertebrates of the North-West. We have also a series called "Contributions to Canadian Micro-Palæontology," of which have been published four slender parts of a first volume by as many authors, none of whom are members of the Survey, but all experts in the particular subject. In addition to these series Sir William Dawson contributed two monographs on fossil plants, published in 1871, 1873 and 1882. This sounds like a great deal of matter but when put together there are less than 1,500 pages and about 185 plates, equal in quantity to two, or at the most three, average reports in the United States. This is what we have produced in thirty years from a country most notably rich in fossils, and during a period when hundreds of volumes on palæontology have appeared in the United States. In botany there have been six extensive catalogues of Canadian plants and several additional pamphlets mainly the work of the indefatigible botanist of the Survey, Mr. J. Macoun. I do not remember a single illustration, although in the United States Pacific Railway reports already referred to, there are hundreds of engraved plates illustrating western plants. There are a few other publications of the Survey and many contributions by members of the Survey to the volumes of the Royal Society of Canada and to other journals, but they only serve to emphasize the impossibility of making bricks without straw. I am very happy to hear that in addition to the contributions of Mr. Whiteaves we are to have important contributions in the shape of a revision of the Palæozoic Corals of Canada by Mr. L. M. Lambe of the Survey and I hope we may soon see the results of Dr. H. M. Ami's work in print and plates. It is also gratifying to hear that Dr. G. F. Matthew, of St. John, N.B., one of the most eminent authorities in Cambrian geology and whose contributions to the Royal Society of Canada form the most important additions to our knowledge of this branch of palæontology, is to do work

in certain fields for the Survey as he did some years ago. If we could but feel that as the field workers bring in material it would be studied at an early date by the palæontologists of the Survey, so far as it might come in the line of their studies, and that the rest of the material would be submitted to other palæontologists, who are experts in the particular subjects, a new day would dawn for us, but without money this is impossible. I have not alluded to the particular explorations of those who worked in the field under the directorship of Dr. Selwyn and of his successor, Dr. Dawson, and of their fellow-workers in the laboratory and study. It would be impossible to mention the names of all or to make a selection, but we can well afford to thank the few who are left in the field, Messrs. McConnell, Bell, Ells, Fletcher, Low, Macoun, and others, for their devotion.

In 1867, the year in which the Dominion Government took charge of our survey, the United States inaugurated the first regular survey under the Department of the Interior. It was called the "Geological and Geographical Survey of the Territories," and was under the charge of Dr. F. V. Hayden, until it was superseded in 1880 by what is called the "United States Geological Survey." A comparison of the publications of these two surveys alone with those of Canada during the same period, would be unfair to the United States, because we thus overlook the publications of the Smithsonian Institution, the United States National Museum, and other departments at Washington, but the result is overwhelming enough. We must also bear steadily in mind the fact that while these publications were being produced, twenty-five or thirty States were also actively at work, while the Provinces of Canada were doing practically nothing. During Hayden's Survey, 1867-1879, annual reports were issued somewhat similar to ours in size and character, but there were also five volumes of bulletins, containing upwards of 150 papers, thirteen miscellaneous, and fifteen unclassified publications, about seventy-five maps, and thirteen final reports or monographs. The monographs were splendid quartos, liberally supplied with plates and other illustrations, and illustrating and describing vertebrate and invertebrate fossils, including fossil insects, also fossil flora, and existing forms of rodents, acridians, rhizopods, etc., all from the far West. The present survey has published nineteen annual reports. The last report will include, apparently, six parts, and some of the parts cover two volumes. I wish it were possible to explain here the scope of this one annual report. Of bulletins about 150 had been published down to 1897, and of papers on water supply and irrigation, ten. Of monographs, of the same character as those under Hayden's Survey, thirty-four. Of maps, statistical papers, etc., there has been also a liberal supply.

The operations of our Survey for the year ending June 30th, 1897, cost $117,000. For the nearest year in the United States the cost was $1,034,000. Our usual basis of comparison is population, and measured thus we spend the most, but clearly, that is not the measure for this particular item of national expense. The real basis of comparison between the United States and Canada of expenditure for survey and topographic purposes, should be the respective areas of unexplored or insufficiently explored territory. Judged thus, Canada should be spending much more than the United States, and we must not forget that in comparing the $117,000 spent by Canada with the $1,034,000 spent by the Federal Government of the United States, we leave out the large expenditure by the various States carrying on surveys on their own account. I am quite sure that on mere topographic work we should spend more than the United States, but I am aware that we think at all events that we cannot afford to spend so much, and I would not spoil a good cause by asking for what will certainly not be granted. But looking at matters in the hard light of politics, and gauging the possibilities in Canada by other countries not more able to spend, I am quite sure that at least $250,000 annually should be appropriated for our geological and natural history survey. And in addition to this, the Provinces should each spend at least $10,000 annually and carry on their work in concert with the Dominion Survey, so that in all respects there would be united effort and no unnecessary duplication of work. Perhaps some of the Maritime Provinces would think $10,000 too high, and a smaller sum might suffice, but for Quebec, Ontario and British Columbia with their vast areas, the sum suggested is very small. That the people would find the expenditure a good investment in dollars and cents I am certain, quite as good an

investment as our expenditure on canals and railroads. I approve of state aid to railroads and canals in a new country, because transportation is one of our greatest problems, but the first duty, the very first duty of an intelligent country, is to know what it has or may have to transport.

In conclusion I should like to say a few words as to what we might reasonably expect in the way of Dominion and Provincial surveys. We should have the Dominion and Provincial surveys working out the topography in a far more minute manner and on a greatly larger scale than at present. We should never again send out a topographic party, a boundary party or a land surveyor laying out a base line, without being accompanied by trained geologists and naturalists. The history of our own Northern Ontario is an example of what we have failed to accomplish in this respect. We should not only publish annually such broad truths of geology and natural history as are gathered during these rapid topographic surveys, but we should be engaged in our provincial surveys on reports dealing with the features of each county separately, and in our Dominion Survey in working out special problems of geologic or other scientific interest. For instance, in the United States there are many complete monographs dealing with the iron ores of different localities, or the coal, or natural gas, or the forestry conditions, or other problems of great commercial importance. Have we no curiosity about our great areas of iron ore, our really wonderful coal fields, and our other minerals? Should we not appreciate intelligent monographs on the treatment of refractory ores, on modern mining machinery, on brick-making, salt-wells, gas-wells, and the many other things so intelligently presented to the people by the State in more favoured countries? Of course we should. Let our Governments but try.

And as to Public Museums. The Dominion Government at Ottawa and each province, at its city of chief importance, should have a museum belonging to and supported by the people. These museums should contain exhibits of the metallic and non-metallic minerals of the country, both those of economic and of merely scientific value, the forest trees, with the bark preserved, in say six feet sections, cut also and partly polished, and each specimen accompanied by a small map showing its habitat; the fresh water and sea fishes, mounted after the modern methods; the fur-bearing animals, the game birds, and the birds of our forests, fields and sea-coast, many of them mounted so as to tell a child their habits at a glance; the reptiles, crustaceans, insects, plants, indeed as complete a record of the fauna and flora of the country as possible; the rocks of stratigraphic importance and all the varieties of fossils which can be gathered in this country; the archæological and ethnological evidences of the races we have supplanted in Canada, and much more that does not occur to me at the moment. I should not like to suggest a limit of expenditure on such museums. The necessity of a new building at Ottawa is admitted. The crime of leaving exposed to fire, in a wretched building never intended to protect anything of value, the precious results of over fifty years of collecting, has been pointed out in a recent official report. But the Government seem deaf to such claims. I can only repeat that we are rich enough to bear the cost with ease, but we are not intelligent enough to see our own interest in spending the money.

I have been careful to indicate that so far as this is an account of what has been done in geology and natural history in Canada, it is mainly a record of work done officially, that is for the governing bodies and not by individuals unassisted by public money. But it must not be supposed that I am unmindful of the fund of information which has reached the public through the journals of the scientific societies of Canada, some of which have been labouring for over half a century in this field of higher education. Nor must I fail to acknowledge that such societies are, as a rule, aided by public grants of money. It would have been a great pleasure to have mentioned many of the writers and investigators who have contributed gratuitously in the past to this fund of knowledge, but I can do no more than to record here our gratitude to some of the living geologists—to Sir J. William Dawson, Dr. G. F. Matthew, Prof. L. W. Bailey, Dr. J. W. Spencer, Dr. F. D. Adams, Prof. A. P. Coleman, Mgr. J. C. K. Laflamme, and all others who still labour in the good cause, although not members of our Survey. I am aware that I should add the names of many botanists, ornithologists, entomologists and other

workers in natural history, but I fear my knowledge of these subjects is too limited to enable me to give credit where it is due.

I am sure I must have wearied you with such a lengthy address. I have but one excuse—my firm belief that the future of Canada depends to a degree not generally recognized, upon our liberality in spending money to exploit our country.