

Canada. Parliament. H. of C.
Select Committee to obtain
information as to geological
surveys.

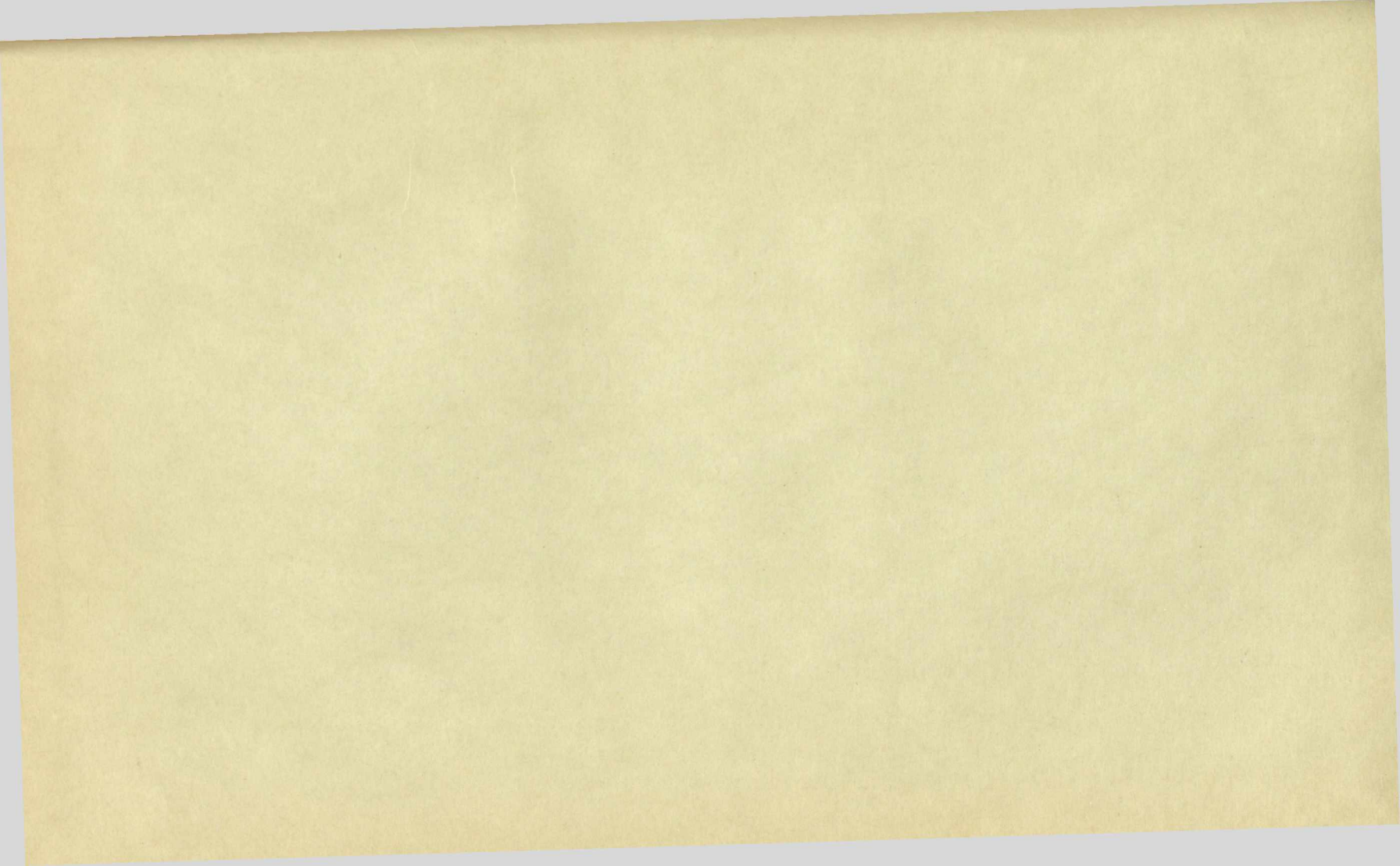
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REPORT

OF THE

SELECT COMMITTEE APPOINTED by the HOUSE OF COMMONS

TO OBTAIN INFORMATION

AS TO

GEOLOGICAL SURVEYS,

&c., &c.

Printed by Order of Parliament.



OTTAWA:

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1884.

HOUSE OF COMMONS, Monday, 25th February, 1884.

Resolved,—That a Select Committee, composed of:—

Mr. Baker (Victoria),	Mr. Cameron (Inverness),
“ Dawson,	“ Ferguson (Welland),
“ Hall,	“ Holton,
“ Laurier,	“ Lesage,
“ Lister,	“ Mulock, and
“ Wood (Westmoreland),	

Be appointed, to obtain information as to the methods adopted by the Geological Surveys of this and other countries in the prosecution of their work, with a view of ascertaining if additional technical and statistical records of mining and metallurgical development in the Dominion should not be procured and preserved; with power to send for persons, papers and records.

Attest :

JOHN GEO. BOURINOT,
Clerk of the Commons.

FRIDAY, 29th February, 1884.

Ordered,—That leave be granted to the said Committee to employ a shorthand writer to take down such evidence as may be considered necessary for the purposes of their inquiry.

Attest :

JOHN GEO. BOURINOT,
Clerk of the Commons.

REPORT.

The select Committee appointed by Resolution of the House of Commons, on the 25th February last, "to obtain information as to the methods adopted by the Geological Surveys in this and other countries in the prosecution of their work, with a view of ascertaining if additional technical and statistical records of mining and metallurgical development in the Dominion should not be procured and preserved," beg leave to report.

The enquiry suggested by this Resolution has received the careful attention of the Committee. Its prosecution involved the necessity of procuring the evidence of members of the present staff of the Geological Survey as to its organization and internal administration; of persons not connected with the Survey, but whose scientific opinions or relations with mining operations gave practical weight to their views upon the subject of the enquiry, and of the chief officers of the Surveys in other countries, as to the methods adopted in the prosecution of their work. All the evidence adduced before the Committee accompanies this Report.

From this evidence, and the careful consideration of the history and present position of the Canadian Geological Survey, your Committee deduce the following facts and conclusions.

In the first Parliament held in 1841, after the union of Upper and Lower Canada, attention was called to the importance of a Geological Survey of the Province, and a grant of £1,500 sterling was made for that purpose. In the succeeding years, Mr., afterwards Sir W. E. Logan, was appointed to the principal position on this Survey, and Mr. A. Murray, as his assistant. The actual work commenced on 1st May, 1843. It was not until 1845 that an Act was passed (cap. 16 of 8 Vic.) determining the functions of this Survey, which were as follows:—

"To make an accurate and complete Geological Survey of the Province, and furnish a full and scientific description of its rocks, soils, and minerals, which shall be accompanied with proper maps, diagrams, and drawings, together with a collection of specimens to illustrate the same."

This Act was, by its terms, only to be continued for five years, and the expenditure under its authority was limited to £2,000 sterling per annum. Dr. T. Sterry Hunt was attached to the Survey as Chemist, and with this small staff and moderate expenditure the work commenced and was prosecuted with increasing zeal from year to year. The reports which were presented to Parliament show how usefully and exhaustively the work of the Survey was conducted. Every known location was visited, the general geological features investigated, a careful chemical analysis of the minerals completed, and its results, and information as to the probable extent and direction of the deposits furnished, not only to the parties interested, but to the general public, whose attention was thereby directed to the existence, quality and probable extent of our mineral resources. In addition to this work, the Chemist of the Survey devoted his attention to the examination of the character and constituent elements of the soils of different parts of the Province, in relation to their agricultural value, and suggestions as to the best plan of cultivating and enriching them, together with other important contributions to the science of agricultural chemistry, appear regularly in the Reports. In addition to this attention to the useful mineral and other economic resources of the country—which evidently was considered the leading and most important function of the Survey—its general geological structure was investigated with such results, that this small but zealous staff, by their interesting research and brilliant discoveries, drew towards Canada the attention of the whole scientific world. Such progress had been made that in 1851, only eight years after the establishment of the Survey, the collection of mineral specimens shown by

Canada at the World's Exhibition in London of that year, drew from a distinguished member of the Mineralogical Institute of France, the following tribute in his official report to his Government:—

“De toutes les colonies anglaises, le Canada est celle dont l'exposition est la plus intéressante et la plus complète; on peut même dire qu'elle est supérieure à l'exposition minérale de toutes les contrées qui ont envoyé des produits à Londres; cette supériorité vient de ce qu'elle a été faite d'une manière systématique; il en résulte que son examen fournit des moyens d'apprécier, à la fois, la constitution géologique et les ressources minérales du Canada.”

It is quite evident that the practical success of the Survey at home, and its scientific reputation abroad during those early years of its existence, were due to the remarkable zeal and practical common sense of Sir William Logan, and the enthusiasm and *esprit de corps* which he succeeded in imparting to his colleagues, and it is no reflection upon his successor, as was frequently pointed out in the evidence taken before us, that he does not attain Sir William's success in this respect. Sir William Logan had probably no equal in those peculiar qualities which gave distinctive character to the Survey under his charge.

The scope of the Survey as established by the Act under which it is at present governed (40 Vic. Cap. 9), is certainly ample and unobjectionable. Its object is declared to be:—

“To elucidate the geology and mineralogy of the Dominion, and to make a full and scientific examination of the various strata, soils, ores, coals, oils and mineral waters, and of the recent *fauna* and *flora*, so as to afford to the mining, metallurgical and other interests of the country, correct and full information as to its character and resources.”

The instructions to the Director are of an equally general nature:—

“To collect, classify and arrange such specimens as may be necessary to secure a complete and exact knowledge of the mineralogical resources of the several Provinces and Territories of Canada, and to make such other researches as will tend to secure the carrying into effect the object and purpose of this Act.

“To report from time to time, in such manner and form as the Minister may direct, the proceedings under the Act, and to furnish proper maps, diagrams, &c., to illustrate the same.”

With instructions of so general and vague a character as these, the system and organization of the Survey must necessarily depend upon the judgment, tact and skill of the Director, and the only mode of testing the efficiency of the Survey, available to your Committee, is by an examination of its practical result. Applying this test, your Committee have no hesitation in reporting that the administration of the Department under its present management, is unsatisfactory.

This results, as your Committee believe, principally from the following causes—lack of system in conducting the work, the defective method of publication, the delay in communicating the results to the public, a lack of accord between the Director and his staff, and inattention to the economic mineral resources of the country; and they refer, in illustration of this conclusion, to the following facts, drawn either from the published Reports of the Survey, or from the evidence adduced before them.

The practical result of the work of the Survey is shown by the published Reports, and these, with the Museum, are the only channels through which the public derive any good from it. The advantage derivable from the Museum is necessarily limited to a comparatively small number, and the public, therefore, look naturally to the Report as the principal evidence and record of the work of the Survey, and after a careful examination of the contents of these volumes and a comparison of them with the time when the work was done which they record, your Committee are obliged to report that they are extremely dilatory in publication, meagre in amount, and unsatisfactory in practical usefulness. The small volume just published (Report for 1880-81-82) professes to give the useful work of the Survey for two years. It contains a reprint of Dr. Dawson's report of his explorations in 1881, of the Bow and Belly

River region, North-West Territories (23 pages); Dr. Bell's report of his explorations of the Basin of Moose River and Lake of the Woods, in 1881 (15 pages), with Prof. Macoun's list of the plants collected by him in the same expedition; Mr. Ellis' report of his explorations in New Brunswick, in 1881 (24 pages); and in Gaspé, in 1882 (32 pages); Mr. Willmott's report on the mines in the Province of Québec, in 1882 (14 pages); Mr. Hoffman's report of the Laboratory work, in 1882 (15 pages); Dr. Selwyn's account of the progress of the Survey, for 1881 and 1882 (28 pages); his paper on changes suggested by him in the nomenclature and colouring of geological maps, without date (4 pages); his notes on the geology of south-eastern Québec, without date (7 pages), with Mr. Frank Adams' appendix thereto, containing 15 pages of notes on the microscopic structure of some of the rocks of the Québec group.

This volume, of 211 pages in all, is accompanied by six maps, illustrating work done in 1875, 1877, and 1881.

Your Committee recognize the valuable nature of much of this information, but for that reason, especially, they are of opinion that its publication should not be delayed over a term of two or three years for the reports, and from three to nine years for the maps illustrating the work.

Judged even as to quantity, it is a meagre result of two years time, for a staff of about thirty highly educated geologists, chemists, paleontologists and botanists, maintained at a cost to the public, during those two years, of over \$110,000.

Your Committee are obliged, too, to report that, in their opinion, the result of this expenditure is not at all commensurate to its cost. While many of the explorations were exceedingly important, and the reports of them interesting and useful, their cost was moderate as compared with the appropriation. That of Dr. Dawson, in the North-West Territories, is reported to have been accomplished at a cost of \$3,560; Dr. Bell's, in the Hudson Bay District, at a reported cost of \$2,734; Mr. Ellis' trip, in 1881, cost \$1,068, and in 1882, \$1,376. The removal of Museum from Montreal to Ottawa cost \$10,000; the purchase of Indian curiosities amounted to \$1,232, an addition to the Natural History collection, \$2,719, and the purchase of books and instruments from Sir William Logan's estate, \$4,500, making a total of \$27,189, leaving a balance of \$82,811 for the two years, applicable only, so far as your Committee can discover, to salaries, stationery, printing and engraving, and similar incidental expenses, for which last sum especially your Committee believe the public is receiving no adequate return. It is true there is evidence throughout the report of other work having been done, but this does not conflict with the statement that the large margin is unsatisfactory between the amount paid to the Survey for the years 1881 and 1882, and what the public has, up to this time (1884) received from it. The reports appear, in some instances, as in Mr. Vennor's case, to have been improperly withheld; in others, as in Mr. Fletcher's, to have been suppressed by the Director, with no assigned reason, and in a number of instances to have been so seriously delayed in publication as to render them practically valueless.

In certain minor matters also the Committee find evidence of delay which appears to them unnecessary, and which is certainly very injurious to the success of the Survey. In the report of 1873-74 (page 4) referring to the Museum, we are informed that the work of "re-arranging, re-labelling, numbering and cataloguing the collection, is making satisfactory progress. When it is completed it is proposed to issue a descriptive catalogue, which it is thought will tend materially to enhance the value of the collection, both for educational purposes and for the general information of the public."

In the Report of 1880-81-82 (page 11) it is said:—

"In September, 1881, Mr. A. B. Perry was temporarily appointed for three months as acting Librarian, and during that time he arranged, labelled and numbered nearly all the books in the Library, and made very considerable progress in the preparation of a catalogue."

And at page 28.

"There are now in the Library about 4,500 volumes. The catalogue is being

proceeded with, and will, it is hoped, be ready for printing sometime during the ensuing year."

In one case ten years, and in the other nearly three years have elapsed since the work commenced, and yet no catalogue of either the Museum or Library has appeared.

The Committee must also notice the serious lack of attention to the mining industries of the country in actual operation. Under the administration of Sir William Logan, but little progress had been made in actual mining developments, particularly in the limited sphere of his labours—the present Provinces of Ontario and Quebec. Since his day, not only has the field of practical mining been greatly enlarged by the addition of the Maritime Provinces with their extensive coal and gold mines in actual operation, but in the previous fields we have to note the discovery and development of the iron and gold deposits in Ontario, the phosphates of Kingston and the Ottawa valley, the gold of the Chaudière district, and the copper, iron, and asbestos deposits of the Eastern Townships, yet we look in vain in the present report for any information, either of a statistical nature of their production, or of a descriptive or geological character, as to their progress or peculiarities. Thirteen pages of the last report suffice to narrate the work of the Survey for the last two years, in connection with the mines in actual operation in the whole Dominion. These thirteen pages are devoted exclusively to the mines of the Province of Quebec; two pages embracing the whole account of the copper mines of the Eastern Townships, and it is significant to note that they omit entirely any reference, even by name, to the three mines in most active operation in that district—the Capel, the Oxford, and the Albert—although at the time of the pretended inspection, over 500 men were at work in them, a depth of over 1,000 feet had been reached, upon a continuous vein, the annual output was over 60,000 tons of copper ore, and the cash expenditure exceeded \$250,000 per annum.

The attention of the Survey to the mineral and economic resources of the country—its gold, copper, iron, phosphate, lime, gypsum, manganese, &c.—appears to be much less than it formerly was, even although the importance of the subject, and the means of acquiring and publishing information in reference to it, have largely increased.

An attempt was made, in 1871, to secure the statistics of the product of our mines, by sending blank forms to the different mining companies, with a request to furnish full information as to the gross and net result of their operations. Very few replies were received, and the effort was discontinued. The result demonstrated, as has been proven elsewhere, that an officer of the Department must be specially detailed to procure information of that kind, and must overcome the natural prejudice against inquisitorial demands of this nature by personal interviews and explanations: That such information may be obtained, when judiciously sought, is evident from the results of such efforts in the United States, as shown by the volume recently published under the direction of the Geological Survey there, giving the fullest and evidently most reliable details, not only of the quantity and quality of the different ores produced, but of their values, both at the mines and after transportation to market. Nothing could illustrate more forcibly the importance of the subject of the mineral resources of a country, as compared with its other sources of wealth, than the fact established by the returns in question, that the aggregate value of the metals and minerals, including coal, produced in the United States amounted, in the year 1882 to the enormous sum of \$453,000,000. The collection of these returns, in this complete form, is a new feature in the management of the Geological Survey of the United States, but its result has attracted marked attention there to the importance of the subject, not only as a guide and incentive to proper legislation for encouraging their mining industries, but as throwing light on the question affecting the fiscal policy of the country.

Even if, in the opinion of the Director of the Survey, its functions did not include the collection and preservation of mineral statistics, still it would seem that the great geological and scientific facts demonstrated by the opening and continued prosecution of these mining industries would attract the attention of the Department, and that a

record of them would be preserved for the proof or refutation of existing theories, and more especially for the guidance of future explorers in similar fields. In the development of the mines before referred to, in which a depth of over 1,000 feet has been reached, geological facts, both of a scientific and geological character, must have been developed, of which no record whatever has been preserved, the existence even of the mines themselves, being apparently unknown to the officer of the staff to whom the duty was assigned of recording the mineral progress of that Province.

An equally significant omission in the Reports in reference to the undeveloped or recently discovered deposits of mineral and other economic resources of the Dominion. Minute attention to particular properties in which minerals are believed to exist, would not be desirable, but the communication to the public of general information, as to the probable extent and chemical characteristics of recognized mineral deposits, and their availability and adaptability to the commercial uses of this and other countries, is certainly a legitimate field for the attention of our Geological Survey, and would tend more to the material prosperity of the country, in attracting the application of capital and proving the value of our resources, than the purely scientific researches so much indulged in, which seem devoted rather to upsetting preconceived theories of antecedent or rival scientists, than to the discovery of new principles or the addition of new information in reference to mineral deposits and mining operations. In the opinion of the Committee, the primary object of the Survey should be, to obtain and disseminate, as speedily and extensively as possible, practical information as to the economic mineral resources of this country, and scientific investigations should be treated as of only secondary importance, except where necessary in procuring practical results. A perusal of the Reports leads us to infer, that the attention of the Survey is directed, first, to descriptive representations of the surface of the country; second, to a scientific dissertation upon the existing geological theories, with the object principally of controverting them; and last of all, to a practical study of the useful mineral deposits, with no reference whatever to actual mining operations. The frequent sketches and photographic views of scenery, the long descriptions of the trivial incidents of the journey, anecdotes of the Indians, dissertations even as to their habits and dialects, while all entertaining, should, in the opinion of the Committee, absorb no prominent part of the attention of a field party sent out to study the geology of the country, and certainly should occupy no portion of the published Reports.

The Committee do not wish to be understood as depreciating, in any manner, attention to field work; they realize fully its importance, and would recommend even that the parties engaged in it be increased in number, but they are of opinion that more practical results should be secured, or at least reported by them. They also think that an exaggerated impression prevails as to their relative cost, as compared with the other expenditures in connection with the Survey. In support of this, the following statement is submitted, which is not asserted to be complete or accurate, but it is as perfect, in those respects, as the information derivable from the Reports themselves will warrant, and is sufficiently correct, at all events, as an illustration of the point now under consideration.—

STATEMENT of Field Surveys as shown by the Published Reports, 1879-80-81-82.

Year.	Person in charge of Party.	Locality.	Cost.	Whether Report Published or not.
1880	Dr. Selwyn	Souris District.....	\$1,204	Published.
1880	Dr. Bell	Hudson Bay	1,945	do
1880	Mr. Ellis	New Brunswick.....	926	do
1880	Mr. Fletcher	Cape Breton.....	1,259	do
1880	Mr. Vennor	Argenteuil.....	909	Not published.
1880	Messrs. Ord and McConnell	Berthier.....	728	do
1880	Mr. Broad	New Brunswick.....	517	do
1881	Dr. Dawson	Bow and Belly River.....	3,560	Published.
1881	Dr. Bell	Lake Superior District	2,734	do
1881	Mr. Webster.....	South-Eastern Quebec.....	1,051	Not published.
1881	Mr. Cochrane.....	Hudson Bay	1,226	do
1881	Mr. Ellis	New Brunswick.....	1,068	Published
1881	Mr. Broad	do	626	Not published.
1881	Mr. Fletcher.....	Cape Breton.....	1,500	do
1882	Mr. Bowman.....	British Columbia.....	1,800	do
1882	Mr. M. Connell.....	Rocky Mountains	1,599	do
1882	Dr. Bell	Athabasca District	2,500	do
1882	Mr. Cochrane.....	Moose River	985	do
1882	Mr. Weston	Lake Huron District	272	do
1882	Mr. Broad	New Brunswick	1,071	do
1882	Mr. Fletcher.....	Nova Scotia	1,315	do
1882	Dr. Selwyn.....	.....	1,179	do
1882	Mr. Ellis	Gaspé.....	1,376	Published.

This statement is significant, as showing that the average annual cost of these exploring parties does not exceed \$1,400 each, exclusive of salaries, so that in the year of greatest activity, as in 1882, when there appear to have been nine parties in the field, the aggregate cost of the whole out-door service of the Department did not exceed \$13,000. As the salaries in connection with the Survey are now chargeable to the Consolidated Fund, the appropriation is virtually increased to about \$93,000 or to \$60,000, independent of salaries, so that the field service, if conducted on the same scale as in 1882, will only involve an expenditure of about one-fourth of the present appropriation, exclusive of salaries, and there would still be a balance of the appropriation of over \$47,000 yearly, for additions to the Museum, engraving of maps, publication of reports and incidental expenses. Your Committee are of the opinion that there should be a sufficient margin out of this large balance to secure the service of a first-class Mining Engineer and Inspector, whose special business it should be to keep himself and the public informed as to all mining developments and progress, and to procure and preserve full statistical information as to the product of our mines, and interesting facts of a geological, chemical and economical character, brought to light by actual mining and smelting operations and experiments. The Committee have examined a large number of witnesses, representing the scientific, mining, commercial and other interests in this Dominion, and have procured, by correspondence, the written views of a still larger number of experts and representative men, of all interests, in other countries, and without a single exception, the advisability of procuring and preserving mineral statistics in connection with our Geological Survey is strongly advocated, both from a theoretical point of view, and as demonstrated by the experience and practice of other Governments. Your Committee believe that this opinion is shared by the members of the Government here, but that the plan has not been adopted, solely on the ground that the field operations of the Survey were of the first importance, and that their cost absorbed the greatest portion of the appropriation.

Your Committee believe that that impression as to cost is an erroneous one, and would strongly recommend that immediate action be taken towards the establishment and maintenance of a Bureau of Mining Statistics, in connection with the Survey. In reference to the field operations themselves, your Committee believe that their enquiries have demonstrated that a change should be effected as to the time and manner in which the results of such surveys are communicated to the public. The "Statement" embodied in this report also shows that a large amount of the work done is practically thrown away, in so far as the public are concerned, and that the publication of the more favoured reports is frequently so long delayed as to greatly impair their practical usefulness. In the present Director's Report for 1871-72 (page 14) he says:—

"Mr. R. Barlow, the draughtsman of the Survey, has made considerable progress during the year, towards the completion of the map of the Eastern Townships, which is being engraved in London, in four sheets, on a scale of four miles to one inch. This map embraces a large region extending on both sides of the St. Lawrence, from Montreal to Quebec, and it is hoped it will be ready for publication next year."

The map is not yet published, although it contained the results of Sir William Logan's work during the last years of his life, and after he had resigned his position as Director of the Survey. Of Mr. Vennor's work in the phosphate region, in 1877, 1878, 1879, and 1880, not a page has ever been given to the public. Of Mr. Broad's explorations in New Brunswick, prosecuted at the head of a surveying party during three successive years—1880-81-82—not a line has ever seen the light. The map illustrating Mr. Fletcher's work in Cape Breton, in 1877, has not yet been published, although it was referred to in the Director's report of that year, and promised for the Report of the succeeding year. (See Report, 1877-78, page 6). Of the field work done by him in 1880 and 1881, in Cape Breton, no Report has yet appeared. No publicity has yet been given to the work done by Mr. Webster, in 1881, in south-eastern Quebec, and of the whole field work of the Survey during the season of 1882, with the exception of Mr. Ells' report upon the Gaspé Peninsula, the public will derive no advantage until 1885. The delay in the publication of these reports is unfortunate, and as your Committee believe, unnecessary, while the total absence of information, expected to have been obtained from the work of such men as Messrs. Vennor, Broad, Ord, McConnell, Fletcher, &c., should receive the special attention of the Government. Each of these gentlemen was at the head of a staff and carried on his operations in important fields and at large expense, but it is not the total waste of expenditure which the Committee regard as of the most consequence. There has been in each case a loss of valuable time and of experience gained, which can hardly be estimated. This branch of the subject leads also to a reference to the fact that, from some cause, the Survey and the country have suffered from a series of resignations and dismissals among the staff, extending from that of Dr. T. Sterry Hunt, in 1873, to that of Mr. Torrance, during the last month, and averaging about one skilled man each year, the result of which cannot have had any other result than great loss to the efficiency and progress of the Survey. These resignations of men who had been originally selected for their natural and acquired qualifications, and who must have greatly added to their first qualifications by years of experience and training in the service, and the necessity of replacing them by new and untried aspirants, must be greatly deplored. The still continued frequency of such changes demonstrates that they are attributable to some permanent cause, which certainly requires investigation.

Your Committee also feel obliged to report that the relations between the Director and some of his staff have been, and are, of such an unpleasant character as to have greatly impaired the usefulness of the Survey. By some of the witnesses this difficulty is thought to result from insufficient salaries; by others, to defects in the temper and tact of the Director; and by others still to jealousy and insubordination on the part of the members of the staff. Your Committee have not felt it to be within their province to investigate and decide as to a defect of internal administra-

tion of this kind, but its existence and the unfortunate effects resulting from it are too apparent to be wholly ignored.

Omitting any reference to matters of detail, like those last alluded to, your Committee beg to report, as the result of their enquiry, that the present administration of the Geological Survey is defective in practical results; that a more systematized plan of its operations should be established, either by additional legislation or by departmental regulations; that the field operations should be confined to subjects more closely allied, practically and scientifically, to a Geological Survey; that Reports of such explorations and surveys, with illustrative maps, should be published, not later than the succeeding season, after the work has been performed; that such reports and maps should, as a general rule, be published separately for each district explored, and at a nominal price, not exceeding the actual cost of printing and binding.

Your Committee beg also to recommend that a Mining Engineer be appointed, with the rank of an Assistant Director, whose province it shall be to inspect and report upon the mining and metallurgical developments of the country, and to procure and preserve a record of their progress, and statistical information as to their product; and desire to add that, in their opinion, these changes and improvements may be effected, under judicious management, without additional expense to the country.

The whole respectfully submitted.

ROBT N. HALL, *Chairman.*

7th April, 1884

EVIDENCE

TAKEN BEFORE THE

SELECT COMMITTEE APPOINTED by the HOUSE OF COMMONS

TO OBTAIN INFORMATION

AS TO

GEOLOGICAL SURVEYS,

&c., &c.

HOUSE OF COMMONS, OTTAWA, 6th March, 1884.

The Select Committee, appointed to obtain information as to the methods adopted by the Geological Surveys of this and other countries in the prosecution of their work, with the view of ascertaining if additional technical and statistical records of mining and metallurgical development in the Dominion should not be procured and observed, met this afternoon, Mr. Hall in the Chair.

ALFRED R. C. SELWYN, Esq., F.G.S., F.R.S., LL.D., of Ottawa, Director of the Geological and Natural History Survey of Canada, was called and examined.

By the Chairman :

Q. How long have you been connected with the Geological and Natural History Survey of Canada?—Fourteen years. My first report is dated 1st May, 1870.

Q. Had you any previous connection with the Survey before you were appointed its Director?—No.

Q. And you have continued since to occupy the same position, and you are still occupying it?—Yes.

Q. Please state under what statutory provisions the Geological Survey of Canada is organized and conducted?—Under the Dominion Act of 1877, 40th Victoria, chap. 9, entitled, "An Act to make better provision respecting the Geological and Natural History Survey of Canada, and for the maintenance of the Museum in connection therewith." I was requested to look over that Act and made several amendments and alterations in it, which I considered essential, but which were not adopted.

Q. Are these statutory provisions modified in any respect by Orders in Council or other regulations?—No.

Q. So that the Act of 1877 is the only Act under which the Department is organized and conducted?—Yes; always excepting the details of administration. The Act does not go into the details of administration; that is left to the Director, subject, when considered important, to the approval of the Minister.

Q. Are there any by-laws or published regulations for the internal regulation of the Department?—No, there are no published regulations. Each officer has his duties, which are set forth in the Estimates, which specify the salaries and titles.

Q. Then I understand there is no written designation in the Department of the responsibility and function of each subordinate officer?—Yes, that is specified in the

Estimates. It is well understood, in the organization of any Geological Survey, that the title implies the duties of the officer. Of course, these duties have occasionally to be modified according to circumstances; if one officer has a great deal to do, the others are supposed to help him—that is, mutual assistance is rendered wherever it is possible to do so.

Q. But any modification of the existing relations would be at your own suggestion, and it would not be necessary to refer it to any other?—No; except as specified in previous answer, I am supposed, after having forty years' experience in conducting Geological Surveys, to be able to know what is required, and the best means of doing it.

Q. My enquiry is rather as to whether the gentlemen composing the staff have the means themselves of knowing what their duties are?—Certainly they have.

Q. How do they know?—They are instructed; but they ought to know this without instruction. If I engage a draftsman I suppose him to know how to carry out the work he is asked to perform, and in like manner with a Geologist, Botanist or other officer.

Q. By whom?—By me.

Q. Verbally or in writing?—Verbally, and in writing too, to some extent. It would be impossible to write out the details of what has to be done from day to day. The duties of the Curator and Assistant Curator of the Museum have, of course, to be done from day to day, but the very name of "Curator" implies the duties which that officer has to perform. There is one Curator for the Mineralogical Department and another for the Natural History Department, and so on, and each man is supposed to understand what the duties of his position are and to carry them out. They are under my control, and I suggest to them what should be done. But in all this we have to be guided in a great measure by the means at our disposal, whether we can or can not get anything done, and therefore no hard and fast instructions can be given. There is an Accountant and a Secretary to look after the correspondence, and a Chemist and an Assistant Chemist, and the work of all these different branches should be so thoroughly understood by the gentlemen in charge that it should not require written instructions, but it does want constant consultation as to the best way of illustrating facts, which we have to study, and how best to do this is dependent on a variety of circumstances.

Q. What is the present staff, and what are their relative responsibilities and salaries?—They are fully detailed in the Estimates. I can furnish a list of the permanently appointed officers; I cannot repeat all the names.

Q. But we might at least get at the principal officers of the staff?—There is a Director, which is myself, and there are four gentlemen who are nominated as Assistant Directors, each one with their special duties. Dr. Bell and Dr. Dawson are Assistant Directors for field service; Mr. Whiteaves is Assistant Director for Museum work and Paleontologist and Naturalist, and Mr. Hoffman, Assistant Director for the Mineralogical Branch and Chemist. These are the four principal officers. There are a certain number of field geologists and assistants, and then very often we have to engage assistants as draftsmen, because it is frequently found that the field geologists cannot work out all their observations in the summer and draw the maps, which are very essential, and therefore we have to hire extra assistants for that work. Prof. Macoun is Botanist.

Q. What is the relative rank of these different offices?—They rank according to their salaries. The four Assistant Directors rank equally. They receive the same salary, and the rank, in a great measure, is fixed by the salary.

Q. And they rank equally, so far as responsibility to yourself is concerned?—Yes. Of course they always submit anything they propose to do to me for my approval; that is, when it is possible to do so. When they are in the field, they are personally responsible, and have to act as circumstances necessitate, reporting subsequently to me.

Q. Do you consider the present system under which the Survey is conducted, efficient and successful?—In most respects it is, but in others it is not. A system

obviously depends upon circumstances. For instance, a Geological Survey must be adapted to the peculiar local circumstances. We have to deal with a country 4,000 miles in extent, from east to west, and the character of each section has to be judged by itself. In the remote and unsettled regions we have a different system from that used in the settled regions; and the work is not done in the same detailed manner. It will be quite apparent that a number of systems is required and that no one system suits all the circumstances we have to deal with. The system to be adopted is also greatly dependent upon the information in existence, such as good topographical maps. Where maps are available we do not need to do topographical work, but where they are not, we are absolutely compelled to do so; and inasmuch as over the whole of this Dominion, or by far the larger part of it, at any rate, there are absolutely no correct maps, we have to do topographical before geological work, and by far the larger part of our time is taken up with this work. This should not be the case. The Geological Surveys of European countries have nothing to do with topography. It is an entirely separate department; but in new countries like Canada and Australia, it has to be done. In Australia, where I was for seventeen years, Director of the Geological Survey, I had to do the same thing, and to make similar topographical maps with the greatest minuteness. Here is a map (the witness here submitted a topographical map of the Victoria Survey, Australia, to the inspection of the Committee), which in execution is equal to the maps in Great Britain, it was made by the staff of the Geological Survey. It is about as perfect a geological map as you can have, but it involved an immense amount of time. Millions of pounds sterling of ore have been taken out of the area represented on it. I have a map of New Brunswick here, but there are no hill features on it. A geological map without orographical features is of very inferior value, because geology is so intimately connected, with these that they are explanatory of each other. It is proposed to carry out this system in Canada, wherever circumstances admit of its being done. The location of every known mineral deposit of value is likewise given. Of course we do not tell people that they can make fortune at these places. It is the duty of the miner to find out the quantity of the ore, but it is our duty to show him where it can be found. I propose to issue an edition of these maps, leaving out the geological colours, and showing the location where the various minerals are found, so that any one can go straight to the place.

Q. How many of these maps have been published since your connection with the Survey?—I have some ten or twelve, at any rate, with those now being engraved. They embrace nearly the whole of New Brunswick and the south-eastern part of Quebec, Cape Breton, &c. The north-western part of Quebec has not been published as a geological map yet. It was issued by Sir William Logan, but it was thought better to issue it only as a topographical map. The location of all the valuable minerals is marked on it, so that it is valuable as a mining map.

Q. How does the efficiency and standing of our own Geological Survey compare, in your opinion, with those of corresponding Geological Surveys of other countries?—That is an awkward question for me to answer. The best way perhaps for me to do so, is to refer to letters which I have received from gentlemen in all parts of the continent, such as Mr. Raymond, United States Commissioner of Mines; Mr. Broadhead, Director of the Missouri Survey, and others. Professor George H. Cook, of the State Geological Survey, of New Jersey, writes, under date of 11th February, 1881:—

“DEAR SIR,—It gives me much pleasure to acknowledge the receipt of the ‘Report of Progress of the Survey under your charge, for 1878-79—a gift from the Government of the Dominion of Canada. The work is highly appreciated, and is very useful to us, and I beg you will tender my thanks for it.’ Professor Hitchcock, of the New Hampshire Survey, writing under date, October 5th, 1881, says:—‘Much obliged to you for your scheme of geological nomenclature and maps. You speak of a map of part of the Canadian North-West Territory, as included with the maps. There was no such sheet in the package sent me. I like your ages, except the first, which had a Canadian origin; I shall say eozoic and archean, and there is a strong party of United States geologists who agree with me in this particular.’ Mr.

G. K. Gilbert, of the United States Geological Survey, in a letter to me dated, Washington, October 27th, 1881, says: "I have received your favour of October 24th, and the accompanying index sheet of the Canadian map, which I am very glad to see." After referring at some length to the Bologna Congress, the letter concludes as follows:—"I beg you will excuse me for criticising the Canadian scheme. Further than that the printing of the letters designating the formations and other geological matters, in a colour distinct from the topography of the map, is to my mind, a better device than the one which we employ, and I hope that Major Powell will be led to adopt it when, after the report of the Congress, the question of revising our scheme must come up." Mr. Gilbert, under date October 19th, 1881, also says: "I have the pleasure to acknowledge the receipt of your paper on geological nomenclature, with accompanying maps, and have read it with a great deal of interest." Prof. W. C. Kerr, State Geologist, of North Carolina, under date October 15th, 1881, writes:—"I thank you for the copy of your new geological map. I like your scheme of the grand division of the rocks, and the colouring, as far as I have been able to examine it, and I am fortunate in getting the results of your labour in this line, before attacking the same problem here, as I shall have to do this winter, in making my geological map." Mr. C. E. Dutton, of the United States Geological Survey, writes me under date Washington, January 31st, 1881, and says: "I have the honour to acknowledge the receipt of the Report of Progress for 1878-79, from the Canadian Survey. I have read the work with much interest, and beg leave to express my high appreciation of the ability, candor and intelligence with which the work has been prosecuted. Great credit is due alike for the direction and field operations." Mr. W. R. Smith, of Belleville, whom I do not know, but who writes as Secretary of the Murcheson Club, Belleville, under date January, 1880, says: "I beg to acknowledge the receipt of the Report of Progress for 1878-79. It seems to be a very interesting Report, and the description of the Queen Charlotte Islands and their inhabitants a very important contribution to scientists. We look upon the Report as the best part of our library." Mr. White, Curator of Paleontology in the United States National Museum, under date Washington, January 31st, 1881, writes: "I have the honour to acknowledge the receipt, by mail, of the Report of Progress of the Geological Survey of Canada, for 1878-79. It is a very valuable contribution to the literature of North American geology, and as such, it will receive a cordial welcome from all persons interested in geological investigation. I beg to present my sincere thanks for the donation." Prof. E. W. Claypole, of Antioch College, Yellow Springs, Ohio, writes: "Many thanks for the Report of Progress for 1878-79, for which I am, I suppose, indebted to your kind thoughtfulness. I have as yet only dipped into it here and there, but I feel inclined to write a line to express my satisfaction at the stand you have taken in regard to the nomenclature of the palaeozoic rocks." And then follows a scientific discussion on this question.

Q. You might feel a delicacy in expressing an opinion of the work of the Survey, so far as your own administration is concerned, but you might give us ideas as to its value on other points; for instance, its relative efficiency to the amount of money expended?—I prepared a document on this subject, at the request of Sir John Macdonald, a good many years ago.

Q. But it still expresses your views?—Yes. The document is as follows:—

GEOLOGICAL SURVEY OF CANADA.

SIR,—Adverting to the conversation which I had with you on Friday the 11th inst., and in which you requested me to furnish you with a memorandum, showing what changes, I considered, were required in the organization of the staff of the Geological Survey, with a view to expedite the progress of the Survey, and to render it more complete and effective, I now have the honour to submit the following report for your consideration.

In framing estimates for carrying out geological investigation, they may be based, either upon the wealth and resources of the country which has to be examined, or upon the extent of the area over which the observations have to be made. If

based upon the latter consideration, it is needless to say, that in Canada, the fields in which it is highly desirable and important that geological explorations should be undertaken, either for scientific purposes, or for reasons more directly connected with their immediate practical and economic value, are almost co-extensive with the area of the Dominion, and the estimate of the expenditure which might be deemed to bear some relative proportion to the work to be done, would probably greatly exceed the amount, which, under existing circumstances, could be provided. In making the estimate submitted herewith, for the Dominion Geological Survey, I have, therefore, been guided, rather by the former than by the latter consideration.

In comparing the results, and in considering and providing for the cost of such works, in new and in old countries, it is necessary to bear in mind, the very greatly superior facilities afforded for their prosecution in the latter, and it will then be apparent, that in order to produce results in the former, even approximately equal, a very much larger expenditure is required than in the latter.

In the United Kingdom, and in other European countries, where Geological Surveys are in progress, the geological explorers have no difficulty in procuring reliable and accurate topographical maps, on which to record their observations. Here, on the other hand, their geological investigations have to be preceded by the making measurements for the construction of topographical plans, and the geologists who are supposed to devote their attention to geological and scientific studies, are really carrying on a combined topographical and geological survey, and the work connected with the former is that to which, usually, the larger share of the expenditure is devoted. In settled countries they are not compelled to resort to special, and by no means luxurious, the often costly means of transport and modes of living; they are not subject to severe bodily toil; to exposure in all weathers, and to personal risks; all of which are inseparable from the work here. And almost unaided, they can perform an amount of work, to do which, in this country, they must each be accompanied by a staff of four or five assistants, all of whom have to be paid, transported and fed, at considerable cost.

As in some measure compensating, however, for this increased expense, it may be pointed out that the result may always be made to include valuable information of various kinds, the obtaining of which in older settled countries forms no part of the duties of the geological corps, but is otherwise acquired often at considerable expense to the State.

The Geological Department of the United Kingdom is divided into three sections—the Museum of Economic Geology; the School of Mines; and the Geological Survey, and is carried on at an annual cost of about £31,000.

The work appertaining to each section is performed by a separate staff of well-paid and experienced officers. The organization of the Geological Survey consists of a Director-General, assisted by three local Directors, one for England and Wales, one for Scotland, and one for Ireland, and working under them there are four district geologists and eleven geological explorers, making a working field staff of nineteen geologists.

The lowest salary paid to the geological explorers on the English Survey, is £350 sterling per annum, equal to, say \$1,700 per annum. On the Canadian Survey, men who are supposed to be capable of doing similar work, are paid from \$800 to \$1,400 per annum.

In any scheme for the enlargement of the operations of the Canadian Survey, the securing the services of a certain number of well-trained geological surveyors, is an essential element, but it will be readily seen from the foregoing remarks, that there is no likelihood of being able to do this unless the rate of remuneration for the services required is made at least equal to that which such services command elsewhere. It is also, I think, essential that the Director should be in a position to guarantee the continuance of the appointments during good behaviour, or in other words, that the Survey should be regarded as a permanent Branch of the Service. Without some, such guarantee, well-trained and efficient men would not be induced to join the ranks of the Survey, nor regard it as a field in which they might

hope, by energy and industry, to gain credit and distinction in their profession; and they would rarely take that interest in the progress and success of the work, which they would do if assured of being permitted to carry it to completion.

With the changes above suggested carried out, there would probably not be much difficulty experienced in gradually organizing an excellent and thoroughly efficient corps of geological observers for the Dominion from amongst the students of the mining schools of Europe, the United States and Canada.

I may now proceed to show what, in my opinion, the organization of the Canadian Geological Survey should be, in order to attain a reasonable amount of annual progress in working out the geological structure and in determining, with some degree of precision, the value and extent of the mineral resources of the vast area of country embraced within the limits of the Dominion.

One Director.	
One Assistant Director for New Brunswick and Nova Scotia, with.....	3 field geologists.
One Assistant Director for Quebec and Ontario, with.....	4 “
One Assistant Director for Manitoba and North-West Territory, with.....	4 “
One Assistant Director for British Columbia, with 4	“
Total field staff, 19 geologists, salaries	\$38,000
Contingencies, including labour, provisions, camp equipment, boats, canoes, waggons, horses and travelling charges.....	25,000
The organization of the Paleontological and Chemical branches, and the Museum, library, office and mapping departments, would remain as at present, with such additional assistance as would be requisite to meet the increased work which the enlarged field operations would entail on them, and the total cost of these, including salaries and contingencies, could not be estimated at less than.....	22,000
Total.....	<u>\$85,000</u>

For the reasons already adverted to, and for others equally important, in connection with the systematic conduct and the uninterrupted progress of the work, such measures should be adopted as may be necessary to ensure the annual appropriation for geological purposes being voted for a period of years, and that any unexpended balance in each year should be carried to the credit of the fund, and be made available for the service of future years. Two or three seasons would probably elapse before the field staff could be organized on the scale of efficiency herein recommended.

I have the honour to be, Sir,

Your obedient servant,

ALFRED R. C. SELWYN.

Right Honourabl

Sir J. A. MACDONALD, K.C.B., &c., &c., &c.

Ottawa.

By Mr. Baker :

Q. In what year was that Report made?—I think it was in 1873. No action was, however, taken and at that time the Survey was getting only \$30,000. The vote was increased gradually, year by year, until last year, when a substantial addition was made to the annual vote. Up to 1st of July, 1883, the whole cost of the Survey and Museum, including all salaries and contingencies of every kind, were paid from the annual vote.

By the Chairman :

Q. That was a grant of \$60,000?—Yes; I only had \$45,000 the two years before that; previous to that I had \$30,000 and before that again, \$25,000.

Q. But at present you receive the \$60,000, and the whole of the staff appear on the Civil List?—Yes.

Q. And their salaries appear on the Civil List?—Yes.

Q. Practically, how much does that add to the grant?—This year, 1883-84, \$30,503.

Q. So that the total would be what?—\$90,503. Since this the whole of the expenses have increased. As an instance, the one item of stationery which in Montreal never averaged more than \$300, here in 1881-82 was \$611.89 and last year amounted to \$455.72. In Montreal each officer found his own private stationery; here all receives it at the cost of the Department. The Museum is much larger and the staff greatly increased. We have doorkeepers, messengers, carpenters and night-watchmen; none of whom were on the staff in Montreal.

Q. Can you suggest any changes in our present system which would, in your opinion, improve its efficiency? If so, what changes would you recommend, and how much increased expense would such changes entail?—There are several changes which, I think, would very much increase the efficiency of the Survey. The most important, perhaps, is that the topographical work should be entirely separate from the duties of the geologist. Men who are geologists, such as Dr. Dawson and Dr. Bell, should not have topographical work entailed upon them, but there should be a topographical surveyor attached to each party, whose duty it should be to go in advance of them to make topographical surveys in whatever detail might be suggested to the him by Geologist as being advisable, or necessary, or possible. This is done on the United States Surveys. People are apt to think here that a land surveyor is a topographer, but a man who can simply run lines for land surveys is not a topographer. He may be, but, as a rule, he is not. You will see the salaries in the United States in their report. Here, they get from \$4 to \$2 a day, but in the United States they get \$1,800 a year, as much as the best geologists on our Survey. We get young men with little training and experience, but in the States the very best men are selected, because they find that they can get on better with their work. The Director-General there gets \$6,000 a year, and he has no larger extent of country than I have to superintend; he has no Museum to look after, and has no greater responsibility. Has four assistants—first-class trained men, at \$4,000 a year, while I have four at \$1,850 a year, and my own salary is only \$4,000. It is unreasonable to expect such a staff to carry out work of the same character as the United States Survey does. We cannot do it, and more good and experienced men is one of the greatest improvements required, and the change which would add most to the efficiency of the Survey.

Q. Do you mean that these salaries would command better talent or more work?—Better talent; and better talent means more work, and good work. We get young men who have come from local colleges; they have done very well, and are nice, pleasant, intelligent young men, but they have had no training or experience, and we have practically to train them. That is not done in a day; it takes years. We may have them for two years, and then they become dissatisfied. They are, perhaps, very good men, very good surveyors, but have not the slightest taste for scientific or geological research, and yet, if they do not get paid the same as the best men, they find fault. There are few of them who can write a report, and it requires an immense amount of labour to make such reports even readable.

Q. Then I understand that you think it would be better to have a staff from abroad?—I do not care where they come from, so long as they have had the training. I want to know, when I send a man out into the field, that he is able to do the work, so that I will not have to do the work for him when he comes back.

Q. Do you not think that the greater familiarity which the young man who is born here has with the geography of the country would counterbalance any superiority in those educated abroad?—Most of them know very little about the geography of the country. It is perfectly astonishing how little they know. They are naturally

not as well educated as those coming from abroad. For instance, they go to our local colleges and study there, and they come into competition with only a small number of men, and still they think they are as well educated as a man who comes into competition with perhaps 100 men; they take a standing among half a dozen and they think that equal to a standing among 200 or 300. Only the other day a young Canadian on the staff—a very capable writer and a hard worker—came and told me he wanted a collection of rocks to examine, when I said to him: "Have you never been into the Museum, and are you not aware that there is a collection of rocks all labelled and ticketed there." That man has been on the Survey now for seven or eight years. What can you expect from a man with so little observation as that. Topography should be distinct from the geological work, and there should be a paid topographer attached to each party.

Q. Would you limit your suggestions as to changes in the system to that single one?—The Director should have unlimited power to select his assistants from the very best persons he can find, regardless of where they come from, or who they are, except that they understand thoroughly their duty, and that they can give some previous guarantee of knowledge and work. He should, moreover, have ample power to dismiss them, if he finds them incapable; and, unless such power is granted, he cannot be held responsible.

Q. Have you not that power?—No; I can make complaints, and ask for an investigation; but that is a very long process, and a very unpleasant one.

Q. As a matter of fact, there have been a good many changes in the staff since your connection with it?—Yes; both by death and resignation. Some of the best have resigned to take better positions, and some have resigned for other causes. There is a clause in the regulations of the United States Surveys which, I consider, should be strictly enforced on the Geological Survey of Canada. In the Report of the Committee appointed by the United States Government to enquire into the system of the United States Surveys, which is a very interesting and useful document, the following paragraph appears: "It should be specially provided that the Directors and members of the Geological Survey, charged, as they are, with the investigation of the natural resources of the public domain, shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no service or examinations for private parties or corporations."

Q. Has there been any ground for complaint in this particular?—Yes; one gentleman resigned for that reason—simply that he was speculating in phosphate mines for other people and neglecting his duties entirely, and travelling up and down from Ottawa and charging his travelling expense to the Survey. He was buying phosphate lands himself and speculating in them, and these facts are within the knowledge of many gentlemen in Ottawa. There have been other resignations of that kind. I told another gentleman who resigned, that he was an able man, but he had never had any training in geological work. He was a land surveyor—a strong active man, not specially industrious, but still did that kind of work very well—but when he attempted to write a geological report, it was simply valueless. There is a gentleman on my staff who is just the same—a very neat draughtsman and good topographer, but in no sense a geologist. None of these were men of my selection, but I had to make the best use I could of them. None of them have had any training to fit them for the work, and you cannot expect them to do work for which they have not been trained, any more than you can expect a man to follow either medicine or law as a profession without special training.

Q. There were some more important changes in the early history of the Survey. Who comprised the staff when you took over the Department?—Sir William Logan, who asked me to succeed him as Director, Dr. T. Sterry Hunt, as Chemist; and Mr. Billings, as Paleontologist. Immediately prior to that, Mr. Alexander Murray was the Chief Geologist, so that there were only these four appointed officers. Then there was Mr. Richardson, whom Sir William stated had formerly been a farmer, but who had become a valuable and indefatigable explorer. He was a very honest man, but his

reports were all written either by Sir William Logan or myself. I have had to do that in several cases.

Q. All these gentlemen are not still connected with the Survey?—Mr. Billings is dead, Dr. Hunt has resigned, and Mr. Murray was transferred to Newfoundland and has carried on the work there, until last year, when he resigned on account of old age. Mr. Murray left for Newfoundland before I came here, and the other chief assistants were Mr. Richardson—now dead—and Prof. Bell, who has been working on the Survey with one interval, ever since.

By Mr. Holton :

Why did Dr. Hunt resign?—He resigned, I think, from a feeling of irritation against Sir William Logan for not nominating him as his successor. So far as I know, that was his reason. He certainly did, at that time, having previously entirely concurred with Sir William Logan in all his views, when I came out, begin to change his views, and I asked him to explain these things, and what was the reason of this change, to which he replied: "Well, Mr. Selwyn, the fact is I had to shut my eyes to some things, "and make others appear what they were not." I told this to Sir William Logan, and the result was that he went over all his work again, and when he began to go over it he found that mistakes had occurred, and the result was, he died in the prosecution of this work, and never left any statement about it. Dr. Hunt has accused me of supplanting him. I know nothing about this, except that Sir William Logan—who knew that I had been connected with the British Survey in 1845—asked Sir Roderick Murchison and Prof. Ramsay (now Sir Andrew Ramsay) to recommend some one, and they suggested to him, that I would be the best person. I was very glad to accept it, as it was a much wider field than I was working in in Australia. In answer to Sir William Logan's letter, I asked him whether I would not be considered, more or less, an interloper, and if there was not someone already on his staff who was entitled to the position he was asking me to take. The only man he might probably have recommended was Mr. Murray, and he had gone to Newfoundland. These are the exact facts about my appointment, so far as I know. When Dr. Hunt resigned, I had to look out for another chemist, and I offered the position to Dr. Harrington, who was the chemical lecturer at McGill College. It was a very small salary, but it left him free to carry on his lectures, as well as his work on the Survey; and he accepted. There was another assistant then, Mr. Gordon Broome, and after he left I found Mr. Hoffman, who is the present chemist, and who had been chemist to Baron Von Muller, the Government Botanist in Victoria, Australia. He was there carrying on investigations in organic chemistry, for Dr. Muller, and knowing his experience I recommended him as assistant to Dr. Harrington. When Dr. Harrington, however, was appointed Professor in McGill College, he found that the combined work was too great, so he resigned his position on the Survey, and Mr. Hoffman was appointed in his place.

By Mr. Ferguson :

Q. You say that no first-class talent can be got from other countries without first-class salaries?—Certainly not.

Q. And that all the talent, under the present circumstances, must necessarily be inferior talent?—Certainly, except in certain rare cases, in which pay does not enter into the consideration.

HOUSE OF COMMONS,

OTTAWA, 7th March, 1884.

The Select Committee on Geological Surveys met this afternoon, Mr. Dawson acting as Chairman.

ALFRED R. C. SELWYN, Esq., F.G.S., F.R.S., L.L.D., of Ottawa, Director of the Geological and Natural History Survey of Canada, was again called and his examination continued.

By the Chariman :

Q. At the last meeting of the Committee, Dr. Selwyn, you were asked to make any suggestions which you thought fit, with reference to improvements which might be made in the organization of the Geological Survey of Canada. Have you prepared any suggestions?—I have prepared the following suggestions :

1st. Separation of the Geological and Biological work from that which appertains to topography and mensuration.

2nd. Full authority to the Director to select his assistants and to dismiss those who are found to be inefficient. This would rarely occur if clauses 3 and 4 were attended to.

3rd. Salaries to be made more in accordance with those which similar duties command in other countries. In this connection, the United States and the British Surveys may be cited.

The salaries of the United States officials are given in the report of the United States Survey, and those of the British Survey in Whitaker's Almanack. I may mention that the Director of the Geological Survey of the United Kingdom, who was my junior—he was an assistant on the Survey when I went to Australia—gets £800 sterling a year, which is exactly my salary here, and in addition he gets £300 a year as Director of the Museum, and he also now gets £600 as Director of the Scotch Survey, so that altogether he gets £1,700 sterling a year. The Director of the Geological Survey of the United Kingdom is Professor Archibald Geikie.

By Mr. Holton :

Q. Are his duties not more extensive than yours?—Well, can you imagine the duties that are required to supervise a Survey of the extent of Great Britain, and those which are required to supervise a Survey of the extent of the Dominion, as being so.

Q. I understood you to state yesterday that there were departments connected with the British Survey which we have not here—for instance, the School of Mines?—Yes; no others.

Q. Is he in no sense responsible for it?—I do not know. In his present position as Director-General he gives no lectures. He has, I suppose, the supervision of it, but that is a very light duty. The following are the remaining suggestions which I have prepared :

4th. No students to be placed on the staff or attached to field parties, under pay, who have no intention of making science their profession, and then only on furnishing such guarantees as may be required, of their fitness for the duties required.

5th. Some increase in the Chemical Section would be desirable, so that the Chief Chemist should have more time for original researches. The same remark applies to the Biological Section.

6th. The appropriation for the maintenance of the Survey and Museum, should be made annually on the terms recited in the Act of 1868 and the salaries of the whole of the employees should be paid from it. No useful object is attained by making some of the salaries chargeable to the "Civil List." To do so, neither adds to nor diminishes the total cost of the work, while many of the rules and regulations which are applicable to the other branches of the Civil Service are quite inapplicable to a purely scientific branch—indeed, may be said to often seriously interfere with its efficiency and progress.

7th. In view of the present numerical strength of the staff and the enormous extent of the country, much better results would, in my opinion, be obtained by greater concentration. But the requirements of the several Provinces and territories, all desiring immediate attention, have hitherto prevented this.

8th. No officer of the Survey, should under any circumstances, hold any direct or indirect pecuniary interest in any mine, mineral lands or timber limits in the Dominion, nor receive any remuneration for any report or opinion he may give to persons, individuals or companies who are so interested.

By Mr. Holton :

Q. One of the chief objects of this Committee is to ascertain how the practical utility of this Geological Survey of ours can be extended?—These suggestions are exactly in that direction. I must differ from you in that respect.

Q. These are suggestions for the improvement of the Survey?—That means the greater practical utility.

Q. There is, as everybody knows, a general complaint in the country?—No, Sir, I do not know. I know there are certain persons who make complaints, but they are either persons who have no experience and know nothing about geological surveys, or they are disappointed office-seekers and others who have been found to be incompetent. If they have any complaints, let them formulate them, so that they can be answered. If you enquire of impartial geological scientists there will be no such complaints.

Q. I refer to the feeling which exists in the minds of the people generally. I do not, for example, pretend to be a scientist, and it is not possible for me, therefore, to make such complaints as you hint at, nor is it likely that such complaints would be made to me by others. But, as one of the public generally, there are complaints?—Is there any institution of which there are no complaints made. Let any individual make a definite complaint, so that it can be properly answered.

By the Chairman:

Q. Mr. Holton is speaking of the general expression of opinion throughout the country. To conduct the Survey in a scientific manner, requires a gentleman of high standing, but with regard to the practical work, it is generally supposed that the Survey has made very few discoveries?—A very wrong supposition, and that it is so easily proved.

Q. Well, of course, you have reported on the geological features of the country and of the different sections, but it is generally supposed that you have rather reported on what is already known, to a certain extent. This is, of course, highly interesting and very useful, but it is supposed that, with regard to new discoveries, as to mines, &c., the Survey has not made much progress?—That is, I know, a very general impression, but is it true?

By Mr. Holton:

Q. The sort of complaint which is in the public mind is not a complaint which can be formulated in the way Dr. Selwyn suggests. Who is to formulate it?—Surely the individual who makes the complaint could formulate it.

Q. But it exists very generally throughout the country. For example, I know as a fact, that that there is a pretty general feeling in this country that, from a scientific point of view, the Survey does not occupy the position which it did some time ago. There is also a feeling that the Geological Survey has not accomplished as much for the public good as it should, and that nothing practical is being done. There is a demand for increased practical utility, and this is one of the main objects of this Committee, and on these points I, for one, would like to hear Dr. Selwyn give his views?—There are a certain number of persons in this country who make these complaints, and very industriously spread them. Now, I think that any person who is so ignorant as to spread these complaints, or any number of persons who agree in making them, should certainly point out some facts in support of their allegations.

Q. I am not speaking on behalf of dissatisfied employees of the Survey, but on behalf of the public.—You cannot separate one from the other.

Q. But I do represent them. I should be sorry to represent the malcontents?—It is impossible to answer these allegations; they are not supported by a single fact, except such as can be traced to those persons you just alluded to.

By Mr. Cameron:

Q. I may refer to a complaint which reached me more than once during the last two years from Eastern Nova Scotia. It is, that maps have not been published in connection with the reports of the Geological Survey of that section of the country, and the people say that these reports are practically valueless without these maps accompanying them. Complaints have been made in Parliament many years ago, but since my arrival in Ottawa this Session, my attention has again been called to this state of things from the East, and these complaints do not come from any malcontents?—That cannot be supported by facts. The maps and reports speak for themselves. There are certain delays, but they are insuperable. For instance, the Messrs.

Burland, who do this work, have had maps in their hands, of that very district, since this time last year.

Q. The reports which I refer to were published three or four years ago?—The maps have been published, too.

Q. But no maps connected with the Counties of Inverness and Victoria?—Yes, most distinctly; not the whole of it, it is true, but a very large portion of it.

Q. But the maps connected with the most important parts of the report are not published?—These complaints come from every Province in the Dominion, because each Province wants impossibilities. Now, each Province here is as large as the whole of Great Britain, and I would ask anyone if it is reasonable to suppose that, with such a staff, as there is at present, it is possible to publish maps of the whole Dominion promptly.

By Mr. Mulock:

Q. Yesterday, Dr. Selwyn, you mentioned that in England they had three divisions of Geological Service?—Yes.

Q. One of them you mentioned as being the School of Mines?—Yes.

Q. What is there in Canada corresponding to that school?—Nothing, except the courses of lectures at the Universities.

Q. Nothing in connection with the Geological Survey?—No.

Q. What work is done by that school in England?—They have courses of lectures, similar to those given in the Colleges here.

Q. It is simply theoretical instruction?—Yes, and lectures.

Q. No practical work?—There are a series of mining models, showing the practical mode of working mines, timbering, &c. Three are explained to the students.

Q. I call practical work, taking a man into the mines; and I call theoretical work, work done in colleges and schools?—They do not take their students into the mines.

Q. Then that is theoretical work?—I differ from you in that respect; it is scarcely to be called theoretical work, if you take a man and show him the methods of timbering and of putting up machinery, &c.; that, I consider, to a great extent, practical work. They never take their students into the mines, as far as I am aware.

Q. What are the other two divisions?—The Museum and the Geological Survey.

Q. These two we have here?—Yes.

Q. You spoke about the salaries paid by the Dominion as being insufficient to provide you with proper material?—Yes.

Q. Then, I should infer that, in your opinion, you have not the necessary quality of material?—No.

Q. Of whom do your staff consist?—The chief members of the staff are Dr. Robert Bell, Dr. G. M. Dawson, Mr. J. F. Whiteaves and Mr. G. C. Hoffman.

Q. What does Dr. Dawson do?—He is Chief Geologist and Assistant Director for field work.

Q. What are his qualifications?—There is no man in this Dominion better qualified for the work, and he only gets \$1,800 a year; he should get more like \$3,000.

By Mr. Baker:

Q. Is he the next in seniority to yourself?—He is not next in seniority as regards his time on the Survey. There are many who have been much longer on the Survey, but I certainly hold him to be the senior in qualifications.

By Mr. Mulock:

Q. What duties has he performed since his appointment?—Those of a field geologist.

Q. In what part of the country?—Chiefly in British Columbia and the North-West.

Q. For what period of time?—Since the date of the boundary survey.

Q. Then whatever reports you have published in respect to British Columbia are the result of his investigation?—No; there were reports published of British Columbia before he joined the Survey, both by myself and Mr. Richardson, now deceased.

Q. Then, you and Mr. Richardson and Dr. Dawson made the surveys for all the reports in respect to British Columbia?—Since then, Mr. Amos Bowman, who now works as Dr. Dawson's assistant.

Q. Since when?—Two or three years ago.

Q. But the printed reports show the result of their investigations?—Yes.

Q. There is nothing to their credit that is not disclosed in the reports?—Nothing that I am aware of.

Q. Who appointed Mr. Bowman?—Mr. Dawson selected him as his assistant.

Q. Are you satisfied with him?—Yes, so far as I know. He is not a trained geologist but a very good explorer and topographer.

Q. When did Dr. Bell enter the Service?—On the 1st July, 1884, he will have been twenty-five years and six months in the Service, with a brief interval, when he became a professor at Kingston College.

Q. You have been here seventeen years?—Yes.

Q. Then he was here when you came?—Yes, and long before.

By Mr. Holton :

Q. How long has Dr. Dawson been in the service?—Nine years and six months.

By Mr. Mulock :

Q. What have Dr. Bell's duties been?—Similar to those of Dr. George Dawson—field geologist.

Q. In what part of the country?—Chiefly, since 1869, in the region east of Lake Winnipeg, and north of Lakes Superior and Huron, to the shores of Hudson Bay, On one occasion he went west to Qu'Appelle, in the North-West Territories.

Q. Has he had any assistants?—He has had a number of assistants all the time.

Q. Are the results of his labours disclosed in the printed reports?—Yes; over his own signature, and in his own words.

By Mr. Holton :

Q. Published at length?—Yes.

By Mr. Mulock :

Q. What do you say as to Dr. Bell's qualifications?—There is a great deal to be said about it. I have not been altogether satisfied with his mode of conducting the work.

Q. On what ground?—I have been constantly informed that his statements were not reliable. The most recent is that of Dr. Rae, who writes, signing his own name, that if Dr. Bell's statements about other parts of the Hudson's Bay are as incorrect as that regarding the southern parts of it, they are of little value.

Q. Where does this appear?—In the *Canvian Gazette* of 4th May, 1883.

Q. What other reasons have you for discrediting his reports?—Simply from such statements as Dr. Rae's.

Q. Is that Dr. Rae the Arctic explorer?—Yes. I have had other statements about his work, and I have no objection to name them, but I do not think they should be published.

Q. If men are to make charges reflecting on the efficiency of certain members of your staff, I certainly think the names should be given of the persons making the charge?—I have no objection.

Q. You produced a piece of testimony yesterday which I thought utterly valueless—I mean, a letter from Mr. Smith, of Belleville. If you had not given us the name I would have thought nothing about the matter, but I regard such testimony as utterly valueless?—I know nothing about him. I gave you a number of letters, and said I did not know the persons who wrote them, but they might be taken for what they were worth.

Q. You are not at liberty to mention the names of the other persons, then?—I am at liberty to mention the name of Sir William Logan, who is now dead, but no other person.

Q. What did Sir William Logan tell you?—He told me that Dr. Bell's work was not reliable.

Q. When?—Fourteen years ago.

Q. Did you ever report that matter to the Government?—No.

Q. You have never made known then, to the Government, that Sir William Logan told you that Dr. Bell's work was not wholly reliable?—Yes; I have to the Minister.

Q. But there is no record of it?—No.

Q. To what Minister?—Sir John Macdonald.

Q. When?—I could not tell you the date.

By the Chairman :

Q. I find the following, in a note attached by Dr. Selwyn, to a report of Dr. Bell, on the Basin of Moose River:—

"It may be, however, that Dr. Rae's recollection of it, as it was forty years ago and Dr. Bell's map of it as it is now, are both correct. A comparatively small elevation of the coast, aided by a silting up of the channel, effected by fluvial and tidal currents and wind, would suffice, in the lapse of forty years, to produce even greater changes in a river delta without any occurrence which could be correctly designated as "a convulsion of nature." Dr. Bell has already shown that there are other reasons for assuming that the shores of Hudson's Bay are slowly rising, or, as he states it, that the water is receding.

"ALFRED R. C. SELWYN.

"OTTAWA, 3rd December, 1883."

This exculpates Dr. Bell. It has also been asserted by an eminent man, connected with the Geological Survey at one time, that Sir William Logan has not had justice done him, and Mr. Thomas Macfarlane, in a paper entitled: "Remarks on Canadian Stratigraphy, says:—

"Although he is gone from us, it is surely our duty to take care that justice is done him, and I contend that it would be only an act of simple justice to his memory to give to the world the results of his labours, just in the shape which they attained at his death. Apart altogether from his theoretical conclusions, the correctness of which Mr. Selwyn disputes, the observations of Sir William and his assistants, as to the actual phenomena exhibited by the rocks of south-eastern Quebec, have a practical value to the country and to all future observers, which I conceive it to be the duty of the Survey to put on record. When we consider the very slender foundation of new material upon which Mr. Selwyn's views regarding the Quebec group are built, it would seem that the conclusions he has arrived at are, to a very large extent, theoretical, and therefore just as little entitled to immediate acceptance as those of others who have written upon the subject." Are there really reports of Sir William Logan's later years which have not been published, Dr. Selwyn?—No; not one.

Q. This is written by a very eminent man?—Mr. Macfarlane addressed a letter to the Minister on the subject of the Geological Survey, and the matter was referred to Mr. Lindsay Russel, the Surveyor General, and the latter, in his report to the Minister, said: "I would request that copies of this letter should be given to both Professor Selwyn and Mr. Macfarlane." The letter was handed in.

By Mr. Mulock :

Q. He was discredited by Sir William Logan fourteen years ago, you mentioned. Did he write to you?—No; it was verbally.*

Q. How long ago was that?—I really could not tell the exact date.

Q. Was it fourteen years?—I cannot say exactly.

Q. Was it just after Sir William Logan resigned?—I have no precise recollection of the date. It has been mentioned to the Minister, Sir John A. Macdonald, on many occasions. I really could not tell the precise date.

Q. Where has Mr. Whiteaves been doing work?—He is a Naturalist and Paleontologist. His work is almost entirely in connection with the Museum.

Q. How long has he been in the service?—Since the death of Mr. Billings.

Q. How long ago is that?—Several years.

* I find Sir W. E. Logan wrote me two letters on this subject, which I did not recollect when the above reply was given.

Q. What about his efficiency?—He is thoroughly efficient; he has spent his life in connection with the work in which he is engaged.

Q. What about Mr. Hoffman?—His duties are those of Chemist and Mineralogist.

Q. What about his qualifications?—As a chemist, his qualifications are as good as they can be.

Q. For the duties he has to discharge?—He is very painstaking, industrious and hard-working. He is not a first-class mineralogist, but his chemical knowledge enables him to tell what any mineral is.

Q. What are Mr. John Marshall's duties?—He is Secretary and Accountant.

Q. Have you any fault to find with him?—None, whatever.

Q. What about Mr. H. G. Vennor?—He has resigned.

Q. Is Mr. Hugh Fletcher on the staff?—Yes.

Q. What are his duties?—Those of a field geologist, and his work has been confined to Nova Scotia and Cape Breton.

Q. I see his service on the Survey has extended over a period of eleven years and ten months?—Yes; he has only one fault—that he does not exactly understand discipline, like many young Canadians, and last year he was suspended for corresponding with the newspapers about matters connected with the Survey, contrary to regulations.

Q. Has he been an efficient officer?—He is very industrious and hard working and he works honestly and efficiently.

By the Chairman:

Q. But not amenable to discipline?—I have no other complaint to make of him; he is not what I would call a first-class man, and he does not get a first-class salary.

By Mr. Mulock:

Q. What duties does he perform?—Those of a field geologist.

Q. Do you know where he was trained?—He is a graduate of Toronto University.

Q. And after leaving the University, what has he been doing?—On our Survey; he joined it as assistant to Mr. Robb.

Q. In what department did he graduate?—In Science and Art.

Q. In the Natural Sciences?—I am not quite sure.

Q. Do you know what standing he took?—I do not.

By the Chairman:

Q. How do the salaries at present compare with what they were in Sir William Logan's time?—They are very much larger now than they were then. This, however, only applies to some of the officers, not to all.

Q. Well, with regard to the higher officers, such as immediate assistants?—About the same. For instance, Dr. Hunt got \$2,000 a year, or more than that.

Q. What did Mr. Richardson get?—His salary had been gradually increasing every year. He was getting \$1,600 when he was superannuated?

Q. Then there is a very eminent and distinguished man whose name will live as long as Canadian Geology is spoken of—Mr. Billings. What was his salary?—\$1,800, and I have a memorandum from Sir William Logan, saying that it ought to be increased to \$2,000. But Mr. Whiteaves has a far larger amount of work. He is the Palaeontologist, and has the whole care of the Biological section of Museum. The whole work has been greatly enlarged.

Q. But Mr. Billings was the father of Palaeontology in Canada?—I do not think so.

Q. But he was celebrated as a palaeontologist?—So will Mr. Whiteaves be, when he has had more time and opportunity.

By Mr. Holton:

Q. It seems to me that you have a prejudice against young Canadians. In speaking just now of Mr. Fletcher, you said he was not amenable to discipline, like all young Canadians?—I did not say like "all" young Canadians; I said like "many" young Canadians.

Q. Are there not many young Englishmen who are also not amenable to discipline?—Yes; that is a matter of training, but I am dealing just now with young Canadians. There are some of both classes in every country in the world. I did not intend my remarks to apply specially to young Canadians.

By Mr. Mulock:

You say Mr. Fletcher was engaged in Nova Scotia and Cape Breton. Is that during the whole time he has been in the Service?—Yes.

Q. Has no one else in the Service been in the same district?—Mr. Robb was there, and Mr. Fletcher acted as Mr. Robb's assistant until the latter resigned, and since then Mr. Fletcher has been placed in charge. There have been others, among whom I may mention Mr. McOuat.

Q. During the same period?—Yes, but in different sections. Mr. Fletcher was at work in Cape Breton while Mr. McOuat was at Londonderry.

Q. Do all the reports show the name of the officer who made the investigation on which the reports are based?—Yes.

Q. So that, by an examination of the reports you can tell all that Mr. Fletcher has done?—Yes; there is one report which is not published, but which is now in progress. It was handed to me very late last year.

Q. Then you have the getting out of the reports?—I have.

Q. What is the usual custom? Do the men in the field transmit their report or draft of report to Ottawa?—They make their reports in the winter, in the office, when they return, and afterwards hand them to me.

Q. Who would be chargeable with the delay in the issuing of the reports?—The gentleman who makes the report. If they send them in time to be published, before they have to attend to their field duties again, then they are published, but if they come in late, we cannot get through with the publication of them in time to get away to the field. This has been the practice frequently, and now, during the next three months, they will probably be too late to put in the hands of the printer before we go to the field.

Q. Mr. Vennor, I believe, was charged with leaving without having completed his reports. Is there any truth in that?—Yes.

Q. What are the facts of the case?—Simply, as I related them yesterday; he was occupied with weather prophesying and speculating in apatite lands. There are no entries for days together, in his note books.

Q. He was four years behind?—He never sent in a detailed report since 1876, though, as can be seen in the reports, he worked up to 1880.

Q. Where had he been working?—In the Ottawa region.

Q. Is it not the duty of the men out in the field to make an annual report to you?—Yes.

Q. Did he not do so?—No; he gave me a short summary and promised a detailed report.

Q. The first year elapsed, and he promised to do something better; he went into the field the following years, and with what result?—Just the same report—a short summary.

Q. And the third year?—Just the same.

Q. And the fourth year?—There were not four years, I think.

Q. Did you make a complaint to the Government?—Yes.

Q. Officially?—Yes.

By the Chairman:

Q. He was recognized as a very competent man in tracing up these phosphate lands. Did he not do very valuable services in this direction?—Yes.

By Mr. Mullock:

Q. I see there is a Mr. R. W. Ells on the list. Is he in the service now?—Yes.

Q. What are his duties?—He is a field geologist.

Q. Where is he working?—In New Brunswick and the Province of Quebec.

Q. I see he has been twelve years in the Service. Has he been working there all the time?—No; one year he was in the Saskatchewan District, in the North-West.

Q. What are his qualifications?—Very fair; indeed I may say he is very industrious and efficient.

Q. You have no fault to find with him?—None whatever.

Q. The name of Mr. Scott Barlow is also on the list. What are his duties? He has taken his father's place as Chief Draughtsman.

Q. Is Mr. C. W. Willmot in the Service still?—Yes; and he is a very industrious hard working man.

Q. Is Mr. A. S. Cochrane still in the Service?—Yes.

Q. As Assistant Topographer?—Yes.

Q. He is a minor officer?—As a surveyor and topographer he would do very well, but he knows very little of geology.

Q. The rest are all minor officers, so that any want of skill on the part of the staff is found in the higher classes and not in the lower?—No; pardon me. I have no complaint to make about Dr. Bell's skill. He is competent.

By the Chairman:

Q. You consider Dr. Bell competent. What, then, is the matter?—That has been already stated.

By Mr. Baker:

Q. In the event of you being ill, or being prevented from attending to your duties from other causes, who would be placed in charge?—I should recommend one of the Assistant Directors, and I should not hesitate for a moment to recommend Dr. George Dawson.

By the Chairman:

Q. Is he not theoretical?—No; he is practical.

Q. He published a somewhat voluminous work some years ago in connection with the boundary survey about the age of certain deposits in the plains east of the Rocky Mountains, entering into a long discussion upon the subject, and giving views of certain geologists of the United States?—I think that was very necessary.

Q. But he arrived at no conclusion?—His evidence was not sufficient to enable him to arrive at a conclusion, but he suggested very many problems.

Q. Which have turned out valuable since?—Yes.

By Mr. Mulock:

Q. I see there are a number of persons appointed since 1832—John Macoun, John Thorburn, A. B. Perry, John McMillan, A. P. Low, H. M. Ami, R. Faribairn, R. L. Broadbent, H. P. Brumell, M. O'Farrell and John Meade. All these men appear to have been attached within the last two years, in 1832-33.—Not all. The two last have been many years in the Service; some of them *employed*, though not *appointed*.

Q. So that the Service has not profitted much by their labours?—I have not seen so, neither is the supposition correct.

Q. And these men cannot be responsible for any shortcomings prior to the date of their appointments?—No.

Q. Whose places do they fill, or are they new appointments?—A great many of them are new appointments, and most of them since the increase in the means.

By the Chairman:

Q. You have had a large territory to examine?—An enormous extent of country. The whole Dominion.

By Mr. Mulock:

Q. Will you tell me how any shortcomings in the past can be placed individually? You have said that the results are not what you could have wished, because you have not had proper material. Can you specify in what respect your staff, in the past, has been inefficient?—It was principally the want of funds.

Q. Not in the inefficiency of the men?—Even the men are not first-class. No man is a first-class man until he has had a great deal of experience. These are all young men, with very little experience. It is a matter of education and training.

Q. Scarcely any of the men have been in the Service twelve years. How, as a whole, have your investigations and reports been verified by practical results?—I do not think they have been disproved in any one single instance.

Q. Did you report in regard to hard coal in the North-West?—That was only a matter of last year.

Q. Did you not four years ago?—Certainly not.

Q. What was your previous opinion?—My opinion was that no hard coal would be found on the plains.

Q. That opinion appears in the reports, does it?—I have no doubt it does.

Q. When did you give that opinion?—Some time in 1881.

By the Chairman:

Q. Is it really hard coal—anthracite coal?—It is a semi-anthracite.

By Mr. Mulock:

Q. Have you had occasion to modify your reports in the least?—Not in the least. I said years ago that there was an abundance of coal in the North-West which all subsequent investigation has proved to be true.

Q. Does any of the staff make any examination of mines working under practical men, and drawing inferences and making reports as to what you have found?—Certainly.

Q. Have you any system for doing that, or is it simply an irregular examination?—It is irregular in this sense, that it is the duty of a field geologist within the district which he has to work, to visit any mines that are being worked, and these reports are included in the section devoted to economic minerals. That was always the custom of Sir William Logan.

Q. Do you not think it would be of service to have a systematic examination of all mining development under practical men? In brief, what is your opinion?—Undoubtedly desirable. Dr. Bell stated that I set my face against the collection of mining statistics, and that I never took any trouble to collect mining statistics. This is untrue and the facts prove it to be so.

Q. Your opinion, as a professional man, is in favour of a thorough examination from time to time, of all the mines that are being worked, and to collect information therefrom?—Most certainly.

Q. Why has that not been done?—Because, we had neither means, nor appliances, nor money, and, moreover, it interfered with Provincial action. The larger number of mines in the country were examined and inspected by provincial officers, mainly in Nova Scotia and British Columbia.

Q. If there were no difficulties in the way, then, you would recommend such a course?—Certainly, I would.

By the Chairman:

Q. I think, some two years ago you visited the copper mines at Michipicoten, on Lake Superior?—Yes.

Q. And your report upon that copper mine was rather adverse?—No; it was not adverse. And, moreover, I made no report about it.

Q. At least it read adversely, as I was informed. The people complained that the Director of the Geological Survey, one of the chief officers of the Government, had made an adverse report on the mine, which had prevented their raising the necessary capital in England. They said they had themselves employed scientific and practical men, some of the best miners and mineralogists to be found, and they all encouraged them, saying that it would turn out a profitable and paying mine, and then the Director of the Geological Survey came and threw cold water on the scheme, and the consequence is, that they are now greatly embarrassed in raising capital on account of his report?—The facts of the case are simply these: Mr. Stewart, one of the Directors, came to me, and said he had been up to Michipicoten, and he was interested in a mine there, and would I give him a letter to make use of in London—I was well known in England—as he wished to try and raise capital on the London market. I said to him, “Well, Mr. Stewart, I cannot express any opinion beyond what I know from reading Sir William Logan’s reports, and from seeing the specimens brought from there, but I have no objection to giving you a letter stating exactly these facts, and pointing out that from these facts it appears to be what I would call an exceedingly legitimate mining speculation. But if I give you this letter, I wish to ask you not to

“commit the folly of spending the money you get, on the surface, instead of developing the mine; in putting up great buildings, a great plant of machinery, and all this kind of thing. If you get the money, the first thing you should do, is to thoroughly explore the ground to ascertain how much or how little mineral you can find. You are quite right,” said he, “I will take good care of that,” and he went to England, and on the strength of my letter, he gets this capital, and then came out here and went to work. I heard no more about it until the year before last I happened to be up on Lake Superior, so I visited the mine, when I found a magnificent plant of machinery, fine hotel, wharf, steamboat, houses, stores, &c.—in fact, a regular village—and I found three shafts, I think one of them was about 100 feet deep, and no level nor the ground tested in any way.

Q. Might that not all be necessary?—I do not think so.

By Mr. Mulock :

Q. Where does the discouragement come in?—When I left the place, after going through the works, I met the engineer who put up the machinery, Mr. Williams, whom I knew in connection with the copper and gold mines in North Wales, and had a long talk with him about it, and they were at their wit's end to know what to do. At Sault St. Mary I met Mr. Stewart, and I said to him, “I am sorry, Mr. Stewart, to see that you have done the very thing which I asked you not to do. To which he replied, “Well, I know we have, but we had to make some show.” I then said: “Very well, I can say no more; it is no business of mine.” That is the whole history of my connection with that mine. I certainly think a great deal too much has been spent on the surface, and too little underground, but the whole of my connection with the mine is as above stated.

By Mr. Mulock :

Q. I would like to ask you, Dr. Selwyn, to produce your reports in regard to the coal prospects at or near Medicine Hat. I understand that coal of a certain quality and hard character, has been discovered near that vicinity?—Near Medicine Hat?

Q. No, Calgarry; I mean in the Medicine Hat district. Do you know the place I refer to?—I cannot possibly say without a more definite description, Medicine Hat and Calgarry are 180 miles apart.

Q. You gave an opinion, I am told, in regard to the coal prospects in that vicinity?—I would like to see it.

Q. Did you make such a report?—No.

Q. Does it not appear in the reports?—No; I was at Calgarry last year for the first time.

Q. I do not speak of you personally, but of the survey?—No; the survey never did either.

Q. Then there never was any report of the coal of the character that has been found?—That depends upon the locality. The reports made are printed and published and speak for themselves.

By Mr. Cameron :

Q. I notice that there was a geological report of the counties of Inverness, Richmond, Antigonish, and Guysboro', published in 1879, and yet no maps of these counties have been published?—Some have, and some are in course of publication; they are published separately, here are some of them (witness here handed the maps to Mr. Cameron.)

By the Chairman :

Q. You stated the cost of the survey annually as \$83,000?—It has varied every year.

Q. That was the estimate for the past year?—Last year it was only \$60,000.

Q. Does that include the salaries of the officers?—Last year it did.

Q. And it also includes the expenses of the Museum?—Everything.

HOUSE OF COMMONS, OTTAWA, March 13th, 1884.

The Select Committee on Geological Surveys met this afternoon, Mr. Hall in the Chair.

ALFRED R. C. SELWYN, Esq., F.G.S., F.R.S., LL.D., of Ottawa, Director of the Geological and Natural History Survey of Canada, was called and his examination continued.

By Mr. Holton :

Q. I would ask you, Dr. Selwyn, some questions with reference to those who, since your assumption of the directorate, severed their connection with the Survey, either by resignation or dismissal, so far as you can relate them. I have prepared a list of some eighteen or twenty names, some of whom, however, you have already explained as to the causes of their severing their connection with the Survey. For instance, there is Mr. Henry Brown; what were the reasons for his withdrawal from the Survey?—Before answering the question I may be permitted to say that, while I have no objection to state all the circumstances to the Committee, these statements will involve more or less personal remarks, which, I think, ought not to be made public, as they affect members of the Survey, either beneficially or otherwise, and you can hardly disconnect the beneficial from the injurious. I think this information should be given privately in the office, and not in a public manner. I have not the slightest objection to give the information, but I think that, in view of the manner in which my previous statements have been reported in the public press, that it would be much better to give the information privately.

Q. Of course, referring to public reports, that is one of the misfortunes which we cannot very well control. I do not think we can adjourn to the Museum or to the office of the Survey, and we can only get at the information by investigation here. My object in asking you these questions is to get at some of the causes of complaint. When did Mr. Brown leave?—I cannot remember the exact date, but he left three or four years ago. Mr. Brown joined my survey in Australia, and worked with me for several years. The survey was broken up there, and he and others had nothing to do. He remained in Australia, and some years ago he wrote to me asking me if I could find him a place on the Survey here. Knowing him very well, and knowing that he was industrious and had worked satisfactorily on the Australian Survey, I told him I would do so. He then came here and worked for one or two years, but he found he did not like the climate, and he left again for Australia. Since then the South Australian Government have applied to me for testimonials in regard to him, which I sent them. They have since appointed him Government geologist, at £300 sterling per annum, to make a geological exploration of that colony, and he is now, I believe, doing the work.

Q. Did Mr. Robb resign, or was he dismissed?—He was requested to resign.

Q. Why?—I must object to giving this information publicly.

Q. These gentlemen have been engaged in the public service of the country, and this is a Parliamentary Committee?—Of course, if you compel me, I will have to answer these questions, but I think it is very improper to have them published.

Q. But the public are already aware that Mr. Robb was requested to resign, and there can be no possible harm in knowing the cause?—It becomes a record against these men, I could give the information to the Committee, but if it is to be spread abroad all over the country, I think I must decline to answer unless I am compelled to do so.

By the Chairman :

Q. The Survey has been going on for a great many years, and of course it is publicly known that a large number of the gentlemen connected with the Survey have severed that connection, so that the injury, we may say has been done to them. Of course it is an injury to a man to change his station in life, whatever that position may be. These gentlemen have severed their connection with the Survey and the public has a very proper desire to know what the grounds of complaint are—either for ill-health, incompetency or insubordination. A very brief answer will

serve the purpose of the Committee?—The causes are manifold, and therefore a brief answer does not cover them. Mr. Robb was educated I believe as a mechanical engineer.

Q. What about Mr. Ford?—He is an Englishman.

Q. What was his department?—He was an artist.

Q. Did he resign?—Yes; last year he asked for leave of absence to go home to England, on account of ill-health, and after he arrived there he wrote to me that he did not intend to come back again, but would seek employment in England.

Q. What about Mr. Mackenzie?—I forget the circumstances of his resignation. My first knowledge of him was also in Australia.

Q. And Mr. Molson?—He was only temporarily employed in the field, and I offered him a position on the Survey, but he would not take it.

Q. What about Mr. Matthew?—He is Deputy-Collector of Customs, and he was employed by Sir William Logan and by myself about two weeks in the year, during the holidays in the summer. He takes an interest in geology, but it was found not to work satisfactorily, as it was difficult to serve two masters, and he has not continued work for the survey during the last year or two.

Q. What about Mr. Broad?—He was allowed to resign on account of using insulting language and insubordination, which I reported to the Minister. He came into my office one morning and told me that I was a liar and that he did not believe a word I said.

Q. When was this?—Last year.

Q. How long had he been in the service?—He was first employed as assistant to Professor Bailey in New Brunswick, and the Professor found him so insubordinate that they were having continual disagreements.

Q. Was Professor Bailey attached to the Survey?—No; he is a professor in the University of Fredericton. And still does occasional work for the Survey.

By Mr. Dawson:

Q. What was Mr. Robb's particular duty when in the Survey?—He was a field geologist; he commenced the Survey of Cape Breton, with Mr. Fletcher as assistant.

By Mr. Holton:

Q. Why did Mr. Webster sever his connection with the Survey?—He resigned of his own accord. He was a very hard working and efficient land surveyor.

Q. So that there was no difference of opinion between himself and the heads of the Department?—Not that I am aware of. Mr. Webster was only a land surveyor, which naturally unfitted him for the duties of a geologist.

Q. What about Mr. Ord?—Mr. Ord was exactly in the same position. He had no training as a geologist, but was simply a land surveyor.

Q. And Mr. Tyrell?—He is on the survey, and is both efficient and industrious.

Q. Is Mr. Coste still on the survey?—Yes; he is a graduate of the School of Mines in Paris. He has been on the survey only since last summer, but he is a little hasty in his temper. He has not yet been appointed.

Q. I would like to have you say briefly what, in your opinion, should be considered the necessary qualifications of the Director of this survey and of his immediate assistants. In this I refer to education, training, experience and scientific attainments?—There are a great many degrees and kinds of training. He should certainly have a long experience, especially in conducting similar work.

Q. For instance, early education? Do you consider a University course necessary or essential?—No, not absolutely. A long period of practical training is probably better than a University course. At the University you have simply the theory and not the practice; in fact many of the best men have not had University training. The fact of a man having gone through a University science course, I conceive, would place him in a position in a shorter period than the man who has to attain it by practical work. There are several instances of this on our own survey now. There are those now on the survey who have passed through the science course in the Universities, and who are now getting salaries which they would not have been able otherwise to command for seven or eight years.

Q. People think that the sole qualification necessary in a Director would be a knowledge of geology. Is it not your opinion that a knowledge of other sciences is necessary?—Most certainly it is.

Q. What sciences?—A general knowledge of chemistry, not a special knowledge, and a general knowledge of mineralogy, but geology embraces the whole. Each one of the others is a specialty. The director of the survey should really be a field geologist, because the duties of exploration and the circumstances which a man has to foresee and overcome, necessitate a knowledge of field work, which a mere chemist could not probably do at all. A chemist works in his laboratory, and has nothing to do but office and laboratory work. It is not absolutely necessary that the Director of a geological survey should be a chemist, or a mineralogist, or a naturalist or a palæontologist.

Q. But he should have sufficient knowledge to enable him to direct the specialists?—Yes, but not to interfere with their work any more than they with his. It has been found, however, that the Director of a geological survey should be a field geologist. Sir William Logan was neither a chemist, palæontologist, or naturalist, but he sought to get men on the survey, who had made these branches their special study, and he had to direct them all. The best managers of mines know nothing about mining, but they are business men, and they get specialists to conduct the several branches.

Q. State briefly what is your own scientific training?—My scientific training commenced as an amateur in England in collecting fossils and studying them. I joined the British Survey under Sir Henry De la Beche in 1845. Sir Henry was the best stratigraphist and field geologist that ever lived, and I do not hesitate to say the founder of all accurate geological surveys.

Q. How long were you in the British Service?—I was ten years under him. I did the whole of the maps of North Wales for the British Survey, and I was selected from the British Survey as one of the best men on it to go and take up the work of the geological survey in Australia when gold was discovered there. My work in Great Britain extended over a good many counties, Wales and parts of England.

Q. And then you worked in Australia for 17 years?—Yes.

Q. Your position there was very much the same as it is here?—It was exactly the same as it is here.

Q. Was the work completed when you left Australia?—No, it was not. I am not a universal genius, and those who are ornithologists, botanists, chemists, and mineralogists, &c., &c., are not the best geologists. A shoemaker should stick to his last; my last is stratigraphical geology, and because a man sticks to his last he is not the less qualified to direct others and select others to do their business. All these survey organizations must be made up of specialists.

Q. From Australia you came directly to Canada?—Yes.

Q. And to this day you have been at the head of the survey here?—Yes, and I was requested to come here by Sir William Logan, who was acquainted with my career quite well, and who, as he told me, knew of nobody here whom he considered so fit to take charge of the survey. I accepted the offer, because it was a wider field, and promised to afford a great deal of interesting investigation in the direction in which I have been interested all my life.

Q. What are your duties in connection with the geological survey of Canada?—The duties of directing the survey.

Q. But I would like something specific: For instance, do you do any work in the field?—Yes, every year. I think my reports will show that very clearly. I have travelled over the whole country from Victoria, British Columbia, to Cape Breton doing field work.

Q. Is the whole of your time devoted to the Survey?—Yes, and a great deal more, half the night as well as the day.

Q. What sort of work do you do in Ottawa?—I attend to the direction of the Survey and Museum. I have to read over all the reports, and put many of them into decent English. Here is one, (and the witness here handed a report in manuscript to the

Committee); look at it, and you will see what that involves. I have to revise many of the reports of my subordinates, in that manner.

Q. Is it part of your duty also to arrange work for the different parties going out season after season?—Yes. The gentlemen of the staff are directed by me to go to certain sections, but they have unlimited discretion in engaging assistants. I hold them responsible to carry out the work; they are supposed to know how to do it, and I give them instructions, but I do not bind them specifically, because I know that in this country circumstances arise over which we have no control, and which cannot be foreseen. If they have to depart from the instructions which I give them, they must be guided by circumstances. There may be a certain route designated which is found impracticable, and in that case I must leave it to their discretion to adopt some other route, or other mode of best elucidating the subjects which we wish to investigate, and therefore they are not controlled in that sense in any way.

Q. What instructions do you give them?—Simply to go to a certain district and to investigate the geology and natural resources of that district.

Q. Generally you take one particular section of country?—I have to inspect the work of these gentlemen, and make it correspond in all the different sections. One man will take one view and another a different view, and I have to consult with them and see how far we may make conflicting views correspond. If we cannot arrive at any conclusion, I have to go to the ground and inspect the work myself, and, of course, it is almost impossible for me, in a country such as this, to go everywhere; but so far as I can I devote a certain portion of my time every year to going over the different sections of country, so that I may be enabled to properly direct the subsequent work of my assistants who go to the field.

Q. Is it within your knowledge that any member of the permanent staff of the Survey does outside work and receive fees for it?—It is not within my knowledge. I have suspicions, but I cannot say that it is within my knowledge.

Q. Is there any regulation in the Department prohibiting it?—Most decidedly.

Q. What is the present condition of the Museum?—It is, I believe, getting into a very good condition.

Q. Has it been much improved of late by the addition of specimens?—Yes; but not as much as I could wish. There is no use getting additional specimens until we get additional space for them. I have now a large collection of specimens packed away.

Q. It is the want of additional space, then, which prevents its growth?—Yes; but such as it is, it is in a very efficient condition. The arrangement of it is universally admired, and gentlemen from the United States, Canada and elsewhere, who have visited it have spoken very highly of it. Some have said they intend to adopt my system of labelling, as they never saw anything so good.

Q. Is there any record of mining development kept?—In a small degree only. At the end of every report there is a section devoted to economic minerals specially, and every economic mineral known in the district reported on is mentioned there.

Q. Is there any record in the office to which anyone interested can refer?—None, except what there is in the reports.

Q. Or of the mineral resources of the country?—No; but there should be. I endeavoured to do it fourteen years ago, but I was baffled; and for several reasons, which are not necessary to mention, the attempt was continued only in the manner stated.

Q. I suppose you are well acquainted with the United States survey, and its methods of working?—Yes.

Q. What do you think of its mining statistical department?—I think very well of it, and I have no doubt that it is carried on in such a manner as to be most useful.

Q. What do you think of its value to the public?—I think it is of very great value. I do not know the whole of their system. It has been recently organized—I think about three years ago—by Major Powell.

Q. Do you know of any reason why we should not have such a department as that attached to our survey?—Not the least in the world. I recommended it years ago.

By the Chairman :

Q. Will you please give the reasons why the suggestions which you say you made ten years ago have not been carried out?—From the difficulty of getting persons thoroughly competent to do the work, in the first place, and secondly, and perhaps in a still greater degree, the unwillingness of gentlemen engaged in mining pursuits to give us returns of their operations. We had no power to collect them, whereas in the United States they have an Act which makes it compulsory on these gentlemen to give this information. In Canada it is not compulsory. The third reason is that with the exception of the Provinces of Nova Scotia and British Columbia, there was very little mining being done in Canada at the time, and in those two Provinces the Local Government collected the statistics.

By Mr. Holton :

Q. Could this collecting of mining statistics be done by the present staff?—It could be done by one or more persons appointed to do it on the present staff.

Q. Would it require additional expense?—No; I looked forward to Mr. Coste doing this work. I sent him last summer to make an examination of the mineral development of the Lake of the Woods, and he did it very satisfactorily, as far as I can judge. His first connection with the survey was last summer, and the little work that was entrusted to him was done very satisfactorily.

By Mr. Dawson :

Q. The reports with reference to the Lake of the Woods are not printed yet?—No.

Q. When will it make its appearance?—I am going to get it printed as soon as I get instructions as to who is to print it.

By Mr. Holton :

Q. What is your opinion as to the practical value of what is now being accomplished by this Survey to the people of Canada?—That is a very large question indeed, and I can only say, as the best answer which I can possibly give, is that we are following the experience of all the countries in the world, who have decided that some practical advantage is derived from a Geological Survey of the country.

Q. I estimate that during the last twelve years, this Survey has cost this country between \$600,000 and \$700,000. This is an enormous sum, and what have we to show for it?—You have the Museum, and the rest of the question can only be answered by referring to the practical experience of similar institutions and their cost in other countries.

By Mr. Dawson :

Q. You have shown us a volume representing reports for 1880-81-82. Does that volume represent to the public at large the value of the Survey, and does it contain the information which the Survey has obtained during those years?—No; certainly not, and in any sense the work which has been done by the Survey during those years.

Q. But what else have they to show for it?—There are other reports. That is only a portion of the work. The removal of the museum from Montreal and its re-arrangement here is a great and a very large part of the survey work during those years.

Q. But what is before the public at large is contained in this volume?—No, that is only a part of the result of those years. You should not take a single volume, but the reports and maps for the whole twelve years.

Q. But this volume represents three years' work?—No; you cannot possibly put the result of a single season's work into the year. The investigation of a certain amount of country often requires two or three years.

Q. You say there are 4,000 copies of this work struck off. These are, to a certain extent, put in shops for sale?—They are only in the principal bookstores—Dawson's, in Montreal, and Durie's, in Ottawa.

Q. In Toronto, also?—I do not think so.

By Mr. Holton :

Q. On an average, how many are sold?—I could not tell you.

Q. Is there no account kept?—Certainly there is both the gratuitous distribution and the sales are given in the reports.

By Mr. Dawson:

Q. You distribute a lot of them, do you?—Yes; of course if the Government decide that the Geological Survey is no good. It can of course be abolished.

Q. Do you distribute a very large number?—More than are sold.

Q. Do you keep a record?—Yes; I have already answered that question.

By the Chairman:

Q. Does the aggregate of the reports, since you have been connected with the Survey and the Museum, together, represent all the work of the Survey since your connection with it?—Yes; together with the maps and advice and information verbally or in writing to convey one seeking it. There is a good deal to show. We have done an immense amount of work.

Q. The public has to pay for it, and they want to know what they are getting for it?—We make assays for the public; we direct the public where to spend their money and where not to spend it, and to a great extent the Survey acts in the capacity of a mining adviser.

By Mr. Dawson:

Q. Does not the Survey make mistakes sometimes?—Can you point to any mistake which has been made?

Q. They threw cold water on the Lake Superior gold district?—I think I have sufficiently explained that before. The survey never did anything of the kind.

Q. And also said to have thrown cold water on the Chaudière gold district?—That is equally untrue. What are the facts? The first year I came to Canada I went to the Chaudière gold district and examined it carefully. I found Mr. Lockwood at work there—and I gave him after carefully examining the country and the mining that had then been done the benefit of my seventeen years experience in Australian gold fields. He adopted many of my suggestions and worked the mines on these more or less up to 1878—when he again sought my aid, because he said in a letter to me he had spent all the money he had and could not raise any more. I was then in London in connection with the Paris exhibition, and I took a great deal of trouble in this matter and through representation made by me, Mr. Lockwood was able to arrange with Mr. Gordon to carry on the work. Mr. Gordon found all I had told him correct, and is, I believe still working these mines. Strange to say I am now charged with throwing cold water on the Chaudière gold mines, whereas all the capital spent on them by Mr. Gordon and his friend since 1878 was brought into the county through me, and not only without a single cent of profit to myself but at some personal trifling expense—(important evidence given is omitted here).

By Mr. Holton:

Q. I see this last volume covers three years. Why was there this delay in publishing the reports, and why were they not published year after year, as the work was done?—Because it is often impossible to do so, partly arising from the fact of the gentlemen connected with the Survey in sending in their reports. Sometimes I do not get the reports until the time comes round to go into the field, and we cannot sacrifice our short season of field work.

Q. Are some reports of the staff given in full and others not?—Yes, it is simply because some of them can write reports, while others cannot.

Q. Is it your habit to limit the reports of the members of the staff to a certain number of pages?—Certainly not; if the report is spread out unnecessarily, I call attention to it, and tell them not to use six words where two will do.

Q. With reference to Sir William Logan's work: why has his work in the Eastern Townships not been published?—I have no reports of his that have not been published.

Q. Have you no notes, then?—None whatever.

Q. Are there none in the possession of the Survey?—None. There is a map with some geological lines on it, that has not been published, simply because Sir

William Logan asked me himself not to publish it. He went to work to correct it, and he died in the prosecution of that work.

By the Chairman:

Q. Did he not leave some notes of his work during the last two or three years of his life?—None whatever. I have been over the whole of the work, which in many respects is incorrect, and I have said so in the public reports.

Q. Did not the Department bear a portion of the expense of Sir William Logan, in going over that work before he died?—They simply paid for an assistant to do topographical work—Mr. Webster.

Q. There is no record of that work in existence?—None; except the report that Mr. Webster wrote. I did not publish it *in extenso*; Mr. Webster was not a trained geologist. The plottings of the measurements he made are in the office.

By Mr. Cameron:

Q. In reference to the publication of the reports of Cape Breton, I received a letter from there, dated 19th February, in which the following enquiry is made. "I open my letter to add, with reference to the Geological Survey, for I notice that the promise made that the maps of Cape Breton would be published has not been kept. I see the last Report of Progress, 1880-81-82, has not any reference to Nova Scotia or Cape Breton," and he refers me to a discussion in the Senate in 1882-83, where it was promised that the maps and reports would be published, and they complain not only of one section, but of several sections, that have not been published. I beg to correct the impression, that Mr. Fletcher had anything to do with those complaints, because they came direct from the county?—Last year, Mr. Fletcher actually corresponded with the papers, making complaints to this effect, for which he was reprimanded and temporarily suspended.

Q. But still it is none the less the fact that his report is not included in the volume published for 1880-81-82?—That is quite true.

Q. Nor the maps?—They are in the hands of the engraver.

Q. Is it not natural that the people of eastern Nova Scotia would probably impute the neglect to Mr. Fletcher and find fault with him?—They have no right to do so. It is not Mr. Fletcher's fault but dilatoriness on the part of the engravers that the maps have not been published. The Messrs. Burland got them last year, and I have not had the proofs yet. As regards the report, Mr. Fletcher put it in my hands very late last spring, and as the maps were not done, I thought it better to defer the report until the maps were ready. The report is in the office now waiting to be printed.

Q. You yourself, in a letter to the Minister of Justice, attached so much importance to those maps made by Mr. Fletcher that you attributed the delay to a desire on your part to have them done in the most perfect manner?—I am not aware that I attached any special importance to these, more than to other maps. I wished them to be done well but never stated that as the cause of the delay.

Q. This letter was written by yourself to Sir Alexander Campbell?—As illustrative of the reports, of course the maps are important, but I do not think you will find any special reference to Mr. Fletcher's in my letter.

Q. They were so important that nobody in this country was able to finish them?—I said that there were no good map engravers here, and I could not get maps published in what I considered first-class style. Mr. Burland himself told me that he did not get enough of this work to get first-class engravers. They employ mostly young men. We draw the maps, and Messrs. Burland & Co., of Montreal, engrave them.

Q. There are four mineral counties in eastern Nova Scotia, and there are complaints that they have been neglected?—We cannot do more with the available staff than is done. We have not only Nova Scotia, but the whole Dominion to deal with.

Q. But there is no report for that part of the Survey for four years?—Mr. Fletcher gave me his report of that part of the country early last spring, when it was very nearly time to go to the field.

Q. We can surely expect it in the next report?—Yes.

Q. There is a good deal of fault found with Mr. Fletcher in the East, as they are under the impression that he is to blame?—They have no reason to do so. It is not his fault; he works very industriously, and I have always given him the credit for it.

HOUSE OF COMMONS,
OTTAWA, 14th March, 1884.

The Select Committee on Geological Surveys met this afternoon, Mr. Hall in the Chair.

ALFRED R. C. SELWYN, Esq., F.G.S., F.R.S., LL.D., of Ottawa, Director of the Geological and Natural History Survey of Canada, was called and his examination continued.

By Mr. Dawson:

Q. I see, Dr. Selwyn, that you stated the other day that the cost of the Geological Survey was \$83,000 annually?—No, I stated that this current year the total was about \$83,000, I spoke from memory but said that the estimates shewed what it was.

Q. It is \$92,784, according to the Estimates?—Yes; it has been increasing year after year, and all the members of the Survey that are now put on the civil list get the Statutory increase.

Q. There are four Assistant Directors, three at \$1,900, and one at \$1,850, making a total of \$7,550 for Assistant Directors. Then I see there are five first-class clerks, one at \$1,600 and four at \$1,450, making \$7,400?—They are not first-class clerks; they are field geologists.

Q. Then I see there are five second-class clerks, three at \$1,250 and two at \$1,150, making \$6,050. They are field geologists and not second-class clerks. They are all professional men, and have nothing to do with clerical work.

Q. I see there are eight third-class clerks, one at \$950, one at \$900, two at \$800, two at \$750, one at \$600, and one at \$550, making \$6,100; one Librarian at \$600, and messengers, \$1,084, I suppose these third-class clerks are junior field geologists?—Yes; some of these young men are from the various colleges.

Q. The Chief Assistant Director is Dr. Dawson?—No; he is not. Dr. Bell has had his name published as Senior Assistant Director, but he had no authority to do so, because they are all on the same footing and were appointed at the same time. The only seniority which he has is the number of years' service.

Q. They do not seem to work very smoothly together, in the Department?—I have no knowledge of anything of the kind, except from these outside letters and reports. I am not aware of anything, except this, that there is intense jealousy on Dr. Bell's part, of Dr. George Dawson. That, I have no hesitation in saying.

Q. Has Dr. Bell been insubordinate?—No; not at all. Dr. Bell accused me of, what he called, sitting on him, when I never did anything of the kind.

Q. As to the value of the Geological Survey to the country; are there not some instances where the opinions of the geologists might have done harm—opinions expressed, which the facts did not bring out. For instance, with reference to the Chaudière gold district, there was an opinion expressed, that the gold there was all derived from a certain class of rocks, which had their limit somewhere about the Plante, and that to the south of true formation; it was all drift or alluvial gold, derived from the destruction or grinding of these older rocks during the glacial period, and as to the rock south of that, it would be useless to look for gold in it?—I doubt whether you can show me any such opinion. I do not remember it, and I have already answered this question.

Q. Opinions of that kind might be very detrimental to the development of the country?—I do not think so at all, if they are correct.

Q. But, if they were not correct?—Then they were simply opinions, and probably given by some person without knowledge of the subject.

Q. These opinions were not correct, I believe?—Well then, why are we asked to give opinions at all. I think correct opinions are very desirable, and I do not

think they are calculated to do harm, if expressed in a proper manner. A great deal depends upon how they are expressed, and by whom.

Q. Last year, I think, an opinion was expressed about the mines of the Lake of the Woods, that the lodes there were rather pinched up?—I never expressed such an opinion. A great many of my opinions have been misrepresented.

Q. What actual mines have been discovered by the Survey?—I do not know if any actual mines have been discovered. It is not the function of a Geological Survey to discover mines, but rather to point out the localities where they may be discovered, and where economic minerals exist. The Survey has pointed out many such, which have led to the opening up of mines, such as apatite, iron, &c. There is scarcely a single mine, except, perhaps, the Jack Fish Lake Mine, the locality of which has not been pointed out before the mine was opened up.

Q. But these mines, with the exception probably of apatite, were all discovered before there was any Geological Survey?—Pardon me.

Q. Was not the coal of the North-West so discovered?—Not until Dr. Hector, of Captain Pallisers expedition mentioned it in his report.

Q. Long before, in Sir John Richardson's time, the great explorer?—You can go back further than Sir John Richardson—by Sir Alexander Mackenzie, long before Sir John Richardson's time.

Q. At that time geologists would not admit that it was true coal?—I have never heard anything of the kind by any geologist of any repute.

Q. Was it not formerly a generally accepted opinion that true coal could not be found in any except in formations of the carboniferous period?—Most certainly.

Q. These coals were of a different geological horizon, are they not?—Certainly.

Q. But do they not sometimes occur where they have no business to be?—No. I find no such theory, after forty years study of geology and of the works of the best geologists in the world.

Q. The lignites belong to the upper Tertiary period, do they not?—Yes, they belong to both the Tertiary period and to other periods.

Q. Coal may then occur in any geological horizon?—So far as our experience goes, it points to the fact that it does not appear below the Devonian formations, but then experience is not always infallible; we can only express an opinion according to our experience.

Q. You stated the total issue of the last volume of reports of the Geological Survey at 4,000. Does that include the French?—I think it does.

Q. How many in French?—Five hundred. The issue varies every year: the last one was 500 French and 3,500 English.

Q. I think you stated that these volumes were sold in some of the book-stores?—Yes at Dawson's, in Montreal, and Durie's, in Ottawa.

Q. There are none sold in Toronto?—Not that I am aware of.

Q. How can they get them in British Columbia?—Simply by applying to the publishers.

Q. Are they not advertised?—No; not in the local press. The volume bears the publishers name and imprint, which I think is the usual way.

Q. Many people might not know that. I did not know it until the other day?—A book is always supposed to be on sale by the publisher.

Q. A great many do not know that, with a book like this, costing \$92,000 annually—and here are three years' work together—I think it is highly desirable that they should be advertised. There are 4,000 of these published every year, and are only put on sale at Dawson's, in Montreal, and Durie's, in Ottawa?—Mr. Dawson's name appears on the book as the publisher.

By Mr. Holton:

Q. Is any account kept by the Survey of the sales of these books?—Most certainly. Besides those for gratuitous distribution, they are sent to Dawson's and Durie's, and they sell them.

Q. Do they report the number of sold volumes to you?—Yes.

Q. And they pay for them?—Most certainly.

By Mr. Lister :

Q. And supposing they are not all sold?—They return them to me.

Q. Is there any year in which they were not all sold?—I do not remember. A periodical Dr. and Cr. account is rendered.

By Mr. Holton :

Q. Have you no remembrance of any returned books?—I think there was one year. Every book that goes out of the office is entered, so far as I have been able to have it done. No such system was adopted before I came here, but they were given out promiscuously.

Q. Does the Survey fix the price?—We calculate the price according to the cost of paper and printing; in fact, the printer's bill determines the value of each volume, and the return to the Government is that amount, less the bookseller's commission for any he sells.

By Mr. Dawson :

Q. Do you not think it desirable that there should be a larger edition published in a cheaper form, so that the public at large would have the advantage of the information?—I think it is exceedingly desirable. I tried myself to get a larger distribution of both maps and reports. The larger the edition the less the cost per copy.

Q. You do not know the present selling price of these volumes?—I do not.

Q. This volume, the one for 1880-81-82, represents three years, and I think the price is \$1.75, is it not?—I cannot remember these figures off-hand. A priced catalogue is published.

By the Chairman :

Q. Here is a large volume of over 800 pages, published by the United States Survey, at 50 cents a volume. Do you not think that something in that form, and made interesting as that is, so that the public could get it at as low a price as that, would be extremely desirable?—Yes; but that is a volume relating to a mineral yield of \$450,000,000 value. The total mineral yield of Canada is not much more than as many thousands perhaps.

Q. Is that not a question which we should know?—I have tried to do it, but there are certain difficulties connected with it.

Q. Do you mean to say that, as Director of the Survey, you have not the authority to detail one of your subordinates to take charge of the work of collecting the mineral statistics of the country?—It has been tried and proven for various reasons a failure, and it is a question whether I have the power to do it, and, therefore, I did not attempt it until I got more power and more means. The experiment has not been repeated for want of means and the proper persons to do it. You will find that the gentlemen employed for that work in the United States are experts, not boys from college.

By Mr. Dawson :

Q. Are your present staff composed of boys from college?—Many of them are, and recently appointed.

By Mr. Lister :

Q. The only places where this Report can be got is Ottawa and Montreal. There are none to be sold in British Columbia, New Brunswick, Prince Edward Island, Nova Scotia or Manitoba, or in other parts of Ontario?—None, except at these two places; but I think that it would be desirable that they should be kept in other places. In the meantime, it is sent to every Mechanics' Institute, public library, college or school, and everybody sees the publisher's name, and they can write to the publisher for it.

By Mr. Ferguson :

Q. Would it not be desirable to have agencies established for the sale of these books in the different Provinces?—Yes; I think it would. I have mentioned the matter to the Government.

By Mr. Lister :

Q. How long ago?—I could not say, but it was thought, at the time, not to be expedient.

Q. Nineteen out of every twenty people do not know that there is such a book as this?—I quite agree with you that it would be desirable to publish it more extensively.

By the Chairman:

Q. Do you not think the usefulness of the Survey could be very much enhanced if its attention were turned more strictly to the economic minerals of the country, and to the record of the mining districts, rather than to the strictly scientific work, which the attention of the Survey has been drawn to? Would not that make the volume more interesting?—You start with the assumption that the economic minerals have not been attended to. Such is not the case.

Q. I mean the relative importance that is given to it?—They are studied, and described, and located, and they are collected and placed on exhibition in the Museum. We have actually published a volume, which, I think, it would be desirable to reprint, in connection with the Philandephia and the Paris Expositions; but we cannot do this annually. We have a country 4,000 miles in extent, and our first object is always the economic part of geology; the purely scientific part is incidental. It is of the first importance to trace out the geological formations, and, when we have done that, we know where to go to look for certain minerals, which we know to be characteristic of those formations. All I can say is, that the system of this Survey is that of every Survey in the world, but it is not so expensive as many others less than one quarter its size.

Q. But take a practical test. We have before us the volume of the work of the Survey for the last three years?—I think it is not fair to take a single volume.

Q. But this is for three years?—It does not represent the whole work of three years.

Q. It so represents itself?—No.

Q. What does the title page say?—It says it is the report of 1830-31 and 1832, but you must not judge by the reports in any one single volume.

Q. Is it possible in that volume for anyone to discover what is the product of Canada in any one of these minerals?—Certainly not. It is not a volume of mining statistics.

Q. Will you state how many pages are devoted, in that volume, representing, as it professes, the work of three years, to the subject of copper, for instance?—I could not say without referring to it. The subject of copper, so far, is within the limits in which copper is found.

Q. Then the general subject of the copper of the country has received no attention?—Pardon me. It may not have in this volume, perhaps, but it has in other volumes. This is not a volume of mining statistics. I have contemplated such a work but not yet been able to do it. You can see that one year it was attempted. Your whole reference is made to this volume, which happens to be the thinnest of any one year. The object of the date, 1830-31-32, is to try and bring the dates, which have always been behind hand, up, so that they will really represent the date of the work. If you go back to my predecessor's time—he has been held up so very much as an example of useful and zealous work which I might follow—we find that in 1863 a thick volume was published, a special grant being made for doing it, which was the *resumé* of the previous years, from 1844 to 1863. Between 1863 and 1866 not a single report appeared, and in 1866 a volume was published, no thicker than the present one, without illustrations and without maps. From 1866 to 1869 not a single volume was published, and in 1869 a report appeared, in which I took part in getting out and editing it, and since that a report has been published every succeeding year up to the present time.

Q. Were there any great vacancies?—I can only say that that is the true state of the case, and the volume published in 1869 represented the work done in 1866, 1867 and part of 1868.

By Mr. Dawson:

Q. Were not the funds in those years very limited?—Yes; and the area was in proportion to the sum.

By Mr. Ferguson :

Q. There has been a very large sum of money spent in this Survey?—I stated all along that this volume does not represent the expenditure.

Q. Is there no other volume proceeding from the Survey that is available to the public than this, for their information within the last three years?—There are volumes on botany and on palaeontology, and a great number of maps.

By Mr. Dawson :

Q. Are they published?—Some are.

Q. What one?—A catalogue of the plants.

Q. That is Prof. Macoun's work?—Yes; the work of Prof. Macoun.

By Mr. Ferguson :

Q. The object of the Survey is to give information to the public; not only the public of this country, but the public who are invited to this country, which means immigration, and if there is any more information which is not published, is there not a dereliction of duty somewhere, because these volumes should be published at the earliest possible moment?—There are instances of considerable delay. The summer before last, I requested Dr. Bell to examine the Athabaska region, where it is known that salt and petroleum exist, from Sir Alexander Mackenzie's reports of very many years ago, and Sir John Richardson's, too, and more recently, Mr. John Macoun's report, when he was with me examining the Peace River country. I asked Dr. Bell to go there that year, and I expected him to start about the beginning of June, or the end of May, but he did not start until July, and up to this moment I have not got his report.

Q. Could not an epitome of the reports be given in the shape of a small volume for the public use, instead of a large volume of this kind?—I hardly call that a condensation; that is a detailed report.

Q. Something of this kind, and at about the same price (holding up the volume of 800 pages issued by the United States Survey, at 50 cents per copy)?—You are dealing with two different things altogether. I have already stated that a volume of mining statistics is valuable, and should be properly collected, and under a proper law. There is no such law, and no such organization here at present. In the meantime we have done the best that we could, and I can only say that there has not been one single mineral, except the mineral referred to previously, that has not been mentioned by the Survey before it has been discovered, and what we can do more than that, I do not know. Of course, if I have control of the Survey, and I am authorized to pay the members of the staff such salaries as they receive in other countries for doing the work, I can do it, but I cannot do it with young men of no training and no experience.

By the Chairman :

Q. I understand you to say that the collection of mining statistics requires a very competent person?—Certainly. If a man who is not an expert, goes to collect the information, they tell him all sorts of yarns, and he is not capable of judging whether the information is correct or not.

By Mr. Ferguson :

Q. Would it not be advisable to have a practical miner?—No; a practical miner is not an expert.

Q. One may be a theorist and the other practical. He must depend upon the practical miner for knowledge?—There may be such a thing as a theorist, but because a man is a geologist, and an educated man, it does not follow that he is not a practical man. I have seen a great deal of money spent on the reports of the practical miner which was completely thrown away.

By the Chairman :

Q. Have you not seen more reports from the theoretical miner which have proved delusive?—I have never seen money spent on the report of the practical geologist that was thrown away, but I have seen hundreds and thousands of dollars spent on the reports of theoretical geologists, or practical miners, that was thrown away.

By Mr. Dawson :

Q. The reason why you are unable to do such work is the inefficiency of the staff?—I have not an expert in this particular business on the staff; but it is not fair to say that the staff is inefficient. It requires a specialist to do special things, and I have not had the means nor the power to engage them. The best answer I can give to the question is my own report of 1870, because there seems to be an impression that I have no appreciation of mining statistics and economic minerals. I have always attended to it.

By the Chairman :

Q. What attention has your Survey given to studying and publishing the facts regarding the following great mineral industries of the country—coal, salt, petroleum, apatite, copper and iron?—Statistics of all these have been published, although not in the reports of any one year. As regards apatite, I have stated fully the circumstances of my endeavours to get proper reports and maps shewing its distribution. Mr. Vennor was entrusted with that work, and he failed to complete it through causes that were notorious. Last year I commenced the work again, and entrusted it to a gentleman whom I had every reason to suppose was competent to do it successfully. He went out in June or July—and he is well-known in the country as a mining engineer—and I gave him general instructions, telling him that I held him responsible for the work. Wishing to do to others as I would be done by. I told him to select his assistants himself and to take care that he selected good men. Well, he was in the field from July until the 10th of October. He sent me a kind of preliminary report—I might call it a letter—containing, however, very little information, I asked him to fix the position where apatite was to be found on the map correctly, so that any one would with the aid of the map know where to look for it. In this report he mentioned a line he had run, and it had taken him six weeks to run this line. I asked him how many miles this was, and he said it was four miles. Any one of the members of the Committee will easily see that it was getting along very slowly to only run a line of four miles in six weeks. I said to him: "If you cannot do better work than this, it is no use your beginning it, because you will only be spending money and will not succeed." He replied that they had to cut the line out and go all over the work again. "Were you not there to superintend the work?" I asked, to which he answered that he had to go away about something. Now that gentleman has promised me a report, but I have never received it. He has been working at it since he came in on the 10th of October. That is another case where I suppose I have been accused of treating a member of the staff unfairly, but I will ask Mr. Dawson, who understands this work, if he could not run a line of a great deal more than four miles in six weeks.

Mr. DAWSON—It is certainly very little work for that length of time.

By Mr. Holton :

Q. At one of the early Committee meetings you charged, by implication, at least, a prominent member of your staff (Dr. Bell) with inaccuracy in his work and reports, and further declared that, as a consequence of this, he was unreliable and his work unsatisfactory, and this assertion you based upon information and a corrected map of the neighbourhood of Moose Factory, which you said you had received from Dr. Rae, of England. You also stated that you had so informed the Minister, and that you had further, in a note placed opposite this map in your last official report of the Survey, made a similar statement. I, therefore, have to request that you place in the hands of this Committee the whole of the correspondence which you have had with Dr. Rae or others upon this subject, and also the corrected map furnished you by him, and also to state what other steps have been taken by you to make out a case of inaccuracy against Dr. Bell?—I have taken no steps to make out a case of inaccuracy against Dr. Bell. I never stated that he was inaccurate; I simply called attention to the fact, as I consider it my bounden duty to do, but I never asserted to anyone that Dr. Bell was inaccurate. There is a great difference between charging a man with inaccuracy, of your own knowledge, and calling attention to others having so charged him, and the two should certainly not be confounded. The one I did,

but the other I never did, and not only that, but I have tried to point out how Dr. Bell might be right and Dr. Rae mistaken.

QUESTIONS submitted to Thomas Macfarlane, Chemist, 16 Inspector Street, Montreal, and replies thereto—submitted to the Select Committee appointed to ascertain the methods adopted by the Geological Departments of this and other countries, &c :—

Have you had any opportunity of noticing the organization of the Geological Survey of Canada and its methods of working?—Yes; in 1865-66 I was employed on the Survey under Sir W. E. Logan, exploring and reporting on the shores of Lake Superior, and the County of Hasting, Ontario, and both then and since have been much interested in the geology of the country.

Have you any knowledge as to the manner in which geological surveys are carried on in other countries?—Yes; while engaged professionally in Norway, Saxony, and the United States, I have had occasion to observe the work done by the Geological Surveys of those countries.

In what capacity were you engaged professionally in these countries?—As Chemist at the Modum Cobalt Works and Kuterna Mines in Norway, in 1855 and 1856; as manager of the same from autumn 1857 till autumn 1859; as manager of the Amandal Copper Mines, Hielemarken, Norway, till autumn 1861; as manager of the Wyandotte Silver Smelting Works in Michigan, in 1871, 1877 and 1878; as metallurgist in Leadville, Colorado, in 1880, and as expert in reporting on mines in Colorado, Utah, Nevada and South America.

Have you had any experience in mining or smelting in the Dominion?—Yes; at the Acton Copper Mine, from 1861 to 1864; at the Albert Copper Mine, Ascot Township, P. Q., from 1866 till 1868; at the copper mines of Capelton, P. Q., from 1873 till 1876, and in the Marmora gold district in 1879.

Have you had any experience in exploring, beyond that gained while on the Geological Survey of Canada?—Yes; in 1863, 1869 and 1870 I was employed exploring the mineral lands of the Montreal Mining Company on Lakes Huron and Superior, when the Silver Islet Mine was discovered.

What do you conceive to have been the object of the Government in establishing the Geological Survey of Canada?—When I came to Canada in 1860, and conversed with Sir W. E. Logan on the subject, his opinion seemed to be that the chief work of the Survey was to assist in discovering and developing the mineral resources of the country, by all the scientific means at its command, and in a subsidiary manner only collecting and studying scientific data. In 1877 an Act was passed by the Dominion Parliament "to make better provision regarding the Geological and National History Survey of Canada, and for the maintenance of the Museum in connection therewith." Section 2 of this Act says: "The objects and purposes of the Survey and Museum shall be to elucidate the geology and mineralogy of the Dominion and to make a full and scientific examination of the various strata, soils, ores, coals, oils and mineral waters, and of its recent fauna and flora, so as to afford to the mining metallurgical and other interests of the country correct and full information as to its character and resources." This definition of the object of the Survey does not differ materially from that entertained by Sir W. E. Logan nor from those prevailing among the public generally.

How long has the Survey been in existence?—Since 1842, I believe; consequently, forty-two years.

How long was it under the directorship of Sir W. E. Logan?—From 1842 until 1869, when Dr. Selwyn succeeded him.

Have you any idea of its cost to the country, from 1842 till now?—I do not suppose that that could have been less than \$1,500,000.

Do you think that the results have been worth the cost to the country?—I very much doubt it.

Do you think that the Survey has been useful in fulfilling the object of its existence?—There is no doubt that it has been of great service to the country, but I do not think that of late it has been quite as useful as formerly, or as it is capable of being.

In what respect has it been defective latterly?—In spreading its energies over too much ground, and failing to work out any district thoroughly; in discussing matters of theoretical geology rather than in collecting reliable facts, and in quite neglecting those to be obtained by a close inspection of our mines and a recording of the work done in them.

Was there more attention paid to mining by the Survey when it was under the direction of Sir W. E. Logan?—I think so. The reports of the Survey, previous to and including the General Report of 1863, show that no inconsiderable amount of work was devoted to the mining interests of the country.

What results has the Survey to show for the money expended upon it during the last forty years?—The maps and reports which it has published, and the various collections now exhibited in the Museum.

Do you not think that it has had some influence in encouraging sound mining enterprise, and in discouraging useless searching for economic minerals, or speculation in mines and mining lands?—I do not think that it has had much influence in any of these directions, unless, perhaps, in preventing boring for coal in Quebec and Ontario.

What maps have been published by the Survey?—The only one published separately from the Reports is that of 1864, which embraces Newfoundland, the Dominion (exclusive of the North-West) and a large part of the United States.

Is not this map, in your opinion, valuable and instructive?—It is quite valuable, as showing the views entertained by the late Sir W. E. Logan regarding the geological structure of the country; but it can scarcely be regarded as useful or instructive, even to the better educated part of our population.

Why should not people of good education be able to make use of it?—Because its colours indicate formations and not the rocks, or the groups of rocks, actually found at the different localities shown on the map. There can be no doubt as to the rocks which actually crop out at the various points, but the opinions of different scientific men vary immensely as regards the formations to which they belong. The map, therefore, only shows Sir William Logan's views as regards the distribution and constitution of these formations.

Do you not believe his views on such points to have been correct?—Not always. For instance, as far back as 1862, I maintained that the rocks of the Quebec group were more ancient than the Potsdam sandstone, which view has since been adopted by Drs. Hunt and Selwyn, although it is not yet admitted by Professor Dana, Principal Dawson, and many of the Survey officers.

Is it always possible to show on a map the actual distribution of the rocks or rock groups?—Not always; and it is, of course, most difficult with maps on such a small scale as that of 1864. Sir William's declared intention was, however, to cause it to be followed by other maps of greater minuteness.

Where do you find any intimation of such an intention?—In the Atlas published in 1863, where we find the following statement (p. 23).: "It is now the intention of the Geological Survey to publish in successive portions a geological map of the Province of Canada on a scale of 4 miles to an inch. Such a map of the Canadian territory south of the St. Lawrence, from a meridian somewhat east of Quebec to another a little west of Montreal, is now prepared and already partly engraved. Another similar map including the region to the west of the last, as far as the meridian of Bowmanville, and extending northward nearly to the 48th parallel of latitude, is in preparation, and it is proposed that these shall, in due time, be followed by similar maps of other portions of the Province."

Have any of the maps thus promised been published?—No. Two private editions of the Eastern Townships map have been published, and these are justly valued for their correct topography, but the geological edition, with the colours indicating the characters of the rock exposures, has been published by the present Direc-

tor of the Survey. As for the map of Eastern Ontario, no work seems to have been done on it since Sir W. E. Logan's death, in 1875.

What reasons has Dr. Selwyn given for not publishing the geological map of the Eastern Townships?—Dr. Selwyn maintains that Sir William's views on the age and structure of the Quebec group of rocks are incorrect. He came to this conclusion very shortly after Sir William's death, but nine years have since passed and still the map is unpublished.

Do you think its publication would be of public advantage?—Yes; provided it were not caused to represent mere theories regarding formations, but only the facts ascertained by the officers of the Survey as regards the nature and position of the various rocks, or groups of rocks, to be observed in the townships.

Are we to understand that the Survey has published no maps since Sir W. E. Logan's death?—No general or separate maps have been published, but many smaller maps, illustrating special explorations by officers of the Survey, are contained in the Reports.

Do you consider these to be valuable?—Some of them certainly are; for instance, I have found Mr. Vennor's map of the townships in Hastings County very useful.

Have you not found the reports themselves to contain valuable information?—Twelve volumes of reports have been published since 1863, containing a great deal of varied information, some of it quite valuable, but comparatively little of it referring to our mineral resources.

State some of the defects in these Reports?—I will only mention the last one for 1880, 1881 and 1882. It is only half the usual size, and contains the work of only a small portion of the staff. The page of errata shows great carelessness in the line of reading. Mr. Vennor's work of four seasons, from 1877 to 1880 inclusive, is not furnished, although it would be of great interest to all who are engaged in developing the phosphate industry. The notes on Quebec mines make no mention whatever of those of Capelton, which have been supplying several chemical and copper works near New York, with large quantities of ore. The statement that the bulk of the ore of the Suffield mine resembles that described by Dr. Harrington as tetrahedvite, is surely incorrect and misleading. The description of the Jackson Rae apatite mine is quite inaccurate. The chemical contributions from the Laboratory of the Survey seem very trifling, when it is considered that they are the results of the labours of the chemist and his assistant for three years.

Are you aware of any reason for this neglect of the mines of the country by the authorities of the Survey?—I believe it is because the present director is of opinion that we have no mines which are not sufficiently cared for by the Provincial Governments, and that with regard to economic minerals the Survey has chiefly to do with those occurring on the Crown lands of the Dominion.

Do you think this opinion is well founded?—No; for after a mining location or claim has been granted, the Provincial Government exercises little or no control over the resulting mines, and makes not the slightest attempt to recover any facts of technical or scientific interest in connection with them. Nova Scotia is, perhaps, an exception, for there the payment of a royalty on gold to the Local Government makes it necessary to have a Department of Mines.

Do you think it would be advisable for each of the Provincial Governments to establish a Mining Bureau for recording mining statistics, obtaining plans of underground workings and elucidating scientific facts observed in the exploration of mines?—No; for a staff of officials containing all the practical and scientific talent necessary for doing this, and the necessary accommodation and apparatus for them would be too expensive for each Province, and it is doubtful whether they could find continuous employment on the mines of each individual Province.

Do you consider that the present staff of the Geological Survey is sufficiently numerous to watch the development of the mines of the whole Dominion?—I do.

Do you think that the Survey has heretofore given judicious advice to the public as regards mining?—I think most people who have had dealings with the Survey

have noticed an extreme cautiousness and indefiniteness on its part in giving advice, which amounted to a general discouragement of all mining enterprise. Reasonable cautiousness and circumspection are of course highly commendable, but indiscriminating advice to have nothing to do with mining, simply has the effect of making that industry disreputable. On the other hand, the Survey has occasionally thrown aside all caution and become entangled in schemes which have brought discredit upon mining and the country. If, instead of thus oscillating between two extremes, the Survey had settled down to its proper work, giving careful and minute descriptions of the mineral occurrences and mines, accompanied by plans and sections, with estimates of cost, &c., and judiciously distinguished between these schemes which could not by any possibility pay and those which gave reasonable promise of doing so, there would not now prevail so much want of confidence in it on the part of those interested in mining.

Has the failure of the Survey to do such work had any bad results?—The want of minute and reliable information regarding mines which have been worked and abandoned has occasioned much loss of capital. Representations on the part of interested parties have caused worthless mines to be repeatedly unwatered and manned, only to result in repeated failure. If, in such cases, the archives of the Survey had contained plans and dates concerning the previous working of these mines, such disastrous losses might very likely have been avoided.

Do you think that the records of the Survey are defective as regards mines now in operation?—Yes; for instance, in the cases of the Silver Islet Mine, Lake Superior. This mine was discovered by an exploring party, under my direction, in 1868, and in February, 1870, I published a description of it, directing attention to its extremely rich ore, and to an apparently new mineral occurring in it. Although the mine has since been worked to a depth of 1,000 feet, and ore to the value of over \$3,000,000 produced, no study of its phenomena has been undertaken by the Survey, consequently, nothing has been ascertained of such a nature as to guide the labours of the explorers in the same region. Neither has any survey been made of the underground workings by geological authorities, nor was any chemical examination made as regards the nature of the supposed new minerals, until Professor Henry Wurtz communicated to the New York Academy of Sciences, in 1870, a description of two new mineral species found at Silver Islet, which he termed huntelite and anmitite. The honour of discovering these new minerals might easily have been earned by Canadians, had the Geological Survey properly performed its duties. There is also a great deal of mining now being done for gold and silver in the County of Hastings, of which no notice is taken or record kept by the Survey.

Do you consider it part of the work of the Survey to employ a staff in making discoveries of useful minerals?—No; that properly belongs to private enterprise, but the Survey authorities ought to be able to indicate the districts throughout the country in which remunerative mines might reasonably be sought for.

Has this not been done?—I think not; for instance, the most wonderful copper mine in the world, the Heckla and Calumet, producing 15,000 tons of ingot copper annually, is worked on the south side of Lake Superior, but our Survey does not point out with sufficient accuracy where such mines may reasonably be expected, on the north shore of the Lake. The same remark applies to the iron mines of Marquette. Nor has the Survey ever indicated in advance the districts which were likely to become productive in phosphate, gold or silver.

Has not the Survey been useful in advising and guiding individual explorers?—Not to any great extent. The Survey has never even undertaken to do assays or analyses for explorers or the owners of mines, who are thus left in uncertainty as regards the value of their ores. This is especially felt by the proprietors of phosphate mines. There is no good reason why such work should not be done for the public, and paid for at reasonable rates.

Does this indicate to you a want of proper management?—Yes; and of proper system and organization. With the exception of the Director, Palæontologist and Chemist, none of the officers of the Survey have any very definite positions or work

assigned to them. Even the position of the Chemist and Mineralogist is singular, seeing that he is, nominally, at least, Inspector of Mines. The Palæontologist is also styled Assistant Director, an honor which he shares with two other gentlemen on the staff. None of the officers are charged with doing the underground surveying of mines, or the collection of statistics, although several of them are quite competent to do so. No practical metallurgist, or ore-dresser is employed on the staff, although under Sir W. E. Logan this was differently arranged.

How does the work of our Survey compare with that of other countries?—No other country in the world has been at so much expense in supporting a Geological Survey as Canada, and carried it on for such a long time. Nevertheless, the results cannot compare with those gained in other countries in much shorter periods. As models of excellence the work and publications may be mentioned of the United States geological exploration of the 40th parallel.

Are you aware as to what has been done in other countries for the encouraging of mining and the collection of mining statistics?—With regard to England, I understand that in 1843 Robert Hunt originated the system of collecting returns of the produce of collieries and metalliferous mines, the returns to be purely voluntary. In 1848 the first volume of statistics was published, and they were regularly continued each year until 1881. Under the Mines Regulation Act, it became compulsory for the colliers and mine owners to furnish annual returns to the Inspectors of Mines, which were published in aggregate in the Inspectors reports. They have not represented the total production of the United Kingdom, since the Inspectors had no power to obtain returns from any other workings. Consequently, the production of tin and iron (as given by the Inspectors) and some other minerals, fell far short of the truth. Two years ago the Treasury awakened to the fact that two Departments were doing the same work, and that mineral statistics were published in duplicate. After long consideration it was determined that the Mining Record Office, established by Mr. Hunt, should be abolished, and the business of obtaining returns from the mines should become part of the duty of the Inspectors of Mines, under the direction of the Home Office. This arrangement has been carried out, and the work which has been hitherto done by Mr. Hunt, under a strictly voluntary system, is now to be carried out with the power of an Act of Parliament, and twenty-six Mine Inspectors. The statistics for 1882 are not published yet, but they have been compiled and are in the hands of the printers. The volumes from 1843 to 1881 are probably to be found in the Parliamentary Library. Mr. Hunt had his office at the Museum of Practical Geology in Jermyn Street, London, and it appears to have had some connection with the Geological Survey of Great Britain.

In France, the collection of mining statistics is entirely in the hands of the inspectors of mines, and, indeed, those officers also form the staff of the Geological Survey.

I can give full particulars regarding the system pursued in Saxony and Norway, but the circumstances of these countries are so different from Canada, that it appears useless to go into details.

In the United States, the Geological Survey, now under the directorship of the Hon. J. W. Powell, has a special "Division of Mining Statistics and Technology," under the charge of Albert Williams, jun. This gentleman has recently published a report, called "The Mineral Resources of the United States," for the year 1882 and first six months of 1883, a work exceedingly valuable, not only for its statistics, but for its technology. As in Canada, the United States Geological Survey is placed under the Department of the Interior, which is also charged with the work of the Census. It has published a report on the production of the precious metals in the United States, during the tenth Census year, between the 1st of June, 1879, and 31st May, 1880, which shows the large amount of work done in collecting statistics, principally by the staff of the United States Geological Survey. Compilation of statistics is, however, far from being the principal work of the Survey members. They are very largely occupied in exploring and studying the geological relations of important mining districts, mapping out the areas of productive rock, ascertaining

the conditions which regulate the distribution of the economic minerals, examining the processes for the most economical and satisfactory treatment of the ores, and pointing out the possibility of improvement. As an example of the excellent way in which this is done, I refer to Emerson's Report on the Geology and Mining Industry of Leadville, Colorado. Having been myself engaged smelting ores in Leadville, I happen to know the great value of this Report. From this it will be seen that the United States Geological Survey gives the fullest details as to statistical, scientific, and technical matters connected with the different mining districts, not only in the Territories, but also in the individual States.

In what way do you think the Canadian Survey could be rendered more useful?—By being reorganized and more efficiently directed towards both practical and scientific work; by giving each member of the staff a well defined sphere of labour, and encouraging him at the same time to co-operate harmoniously with his colleagues?

What number of officers do you consider necessary, and what would be their respective positions?—1 Director; 2 to 5 Field Geologists; 6 Palaeontologists; 7 Botanists; 8 Chemists and Assayers; 9 Mineralogists and Lithologists; 10 Surveyors of Mines and Records of mining statistics; 11 Metallurgists and Technologists; 12 Lapidaries. The names sufficiently indicate the duties, but the distribution of these might be modified according to the qualifications of the several officers.

Do you not think that some Surveyors would also be necessary?—The field geologists are of course surveyors, but a large amount of work of this description might be dispensed with if advantages were taken of the work of the numerous and efficient Provincial and Dominion Surveyors, and of the maps on record in the various Crown Lands Departments.

In the event of its being impossible to carry on an elaborate Geological Survey, what would you suggest in its place?—The establishment of a Mining Record Office similar to that organized by Mr. Robert Hunt in 1843. It should not, however, be purely statistical, but be in charge of men capable of surveying each mining district of importance, and minutely describing its characteristic mines. In this way lithological maps might be prepared, and descriptions published of the following more important mining districts of the Dominion:—

- I.—Township of Ascot and its copper mines.
- II.—Megantic County and its asbestos workings.
- III.—County of Ottawa and its phosphate workings.
- IV.—County of Hastings and its gold and iron mines.
- V.—Western Algoma and its silver mines.
- VI.—The coal regions of the North-West.

Should no reform of the survey be possible, what course would you advise?—Its entire abolition, because at present it is almost useless to the country.

What would then be done with the various collections now in the Museum?—They might be placed under the care of the Royal Society of Canada, and the Survey building used as its head quarters.

If it were decided thoroughly to reorganise and reform the survey, do you think that it could then be made of service to the country?—I think that it would be useful in the highest degree for developing the mineral resources of Canada, and causing these to be better appreciated in foreign countries, besides, as in former times, procuring a high reputation for Canada from the scientific work incidentally performed by the Survey officers.

THOMAS MACFARLANE.

HOUSE OF COMMONS, OTTAWA, 15th March, 1884.

The Select Committee on Geological Surveys met this morning, Mr. Hall in the Chair.

George M. Dawson, Esq., D.S., A.R.S.M., F.G.S., of Ottawa, Assistant Director of the Geological and Natural History Survey of Canada, was called and examined.

By the Chairman :

Q. How long have you been connected with the Survey?—Since the spring of 1875. Before that time I was connected with the British North American Boundary Commission from the spring of 1873, which was the first connection I had with Government work. Half the expenses of that Commission were paid by the Canadian and half by the Imperial Governments, and it was appointed for the purpose of determining the boundary from the north-west angle of the Lake of the Woods to the Rocky Mountains. Capt. Cameron was the Commissioner in charge on the British side, and in that work I was engaged two whole seasons as geologist and naturalist to the Commission.

Q. How long have you held your present position as Assistant Director?—I fear I cannot tell the exact date from memory. Four assistant directors, of whom I was one, were appointed simultaneously.

Q. Will you please explain to the Committee what you understand to be the functions of the Director, as distinguished from that of the Assistant Directors or other members of the staff?—The functions of the Director, I think, might be classed under two heads: First, those that are of a purely routine and official character in connection with the management of the Department as a whole, the control of its expenditure and the distribution between the various fields of work, of the grant, and second, the strictly scientific duties of supervising the work done in the various departments, judging of its character and seeing that it is put in proper shape and properly published. I may also state that the duties of the Director of a staff like ours are onerous, considering what he has to do, both in occasionally assisting in field work (particularly in elucidating points about which there is a difference of opinion among those engaged in the work), and also having charge of the expenditure and looking after the publication of reports and duties of that kind.

Q. What are his authority and responsibility in relation to the Assistant Directors and other members of the staff? Has he the entire control with reference to the nominations to those positions and to the direction of the Assistant Directors in their positions?—Not quite. Of course, since we have been included in the inside branch of the Civil Service, appointments to the staff are made by Order in Council, and though the Director naturally nominates them, the appointment can only be made by Order in Council.

Q. Is that limited to the assistants, or does it also extend to the other officers of the Survey?—It extends to all those on the permanent staff.

Q. So that the Director has really no appointment in his own power? I suppose that would carry with it the conclusion that he has no power to discharge either?—As I understand it that is quite correct, except in the case of temporary appointments, and I think the general regulation is that a temporary appointment cannot continue longer than three months. If an incompetent man is once attached to the staff by Order in Council it may be a difficult thing to get rid of him.

Q. What would be his duties, responsibilities and authorities in so far as directing the work of the Assistant Directors? Has he entire control over that?—Practically entire control, although I know it has been the practice to submit a scheme of work for each, for the year, to the Minister for his approval, and in any case where it has been desirable to explore particular tracts, the Director is requested to take immediate control himself or some of his assistants. For instance, with regard to the Peace River, in 1879. At that time it was thought that a railway route would be chosen by the Peace River, and Dr. Selwyn was requested to send a party in connection with the surveys there, and I was sent on that duty to work in connection with the engineering parties for one summer.

Q. The Assistant Directors, I suppose, do not work conjointly in carrying out any field work, but a separate section of country is assigned to each for his summer's work?—Yes; I should explain perhaps, that there are now four Assistant Directors, but only two of those, Dr. Bell and myself, have been engaged continually in field work, Mr. Whiteaves and Mr. Hoffman are almost permanently attached to the Museum—Mr. Whiteaves as Paleontologist and Mr. Hoffman as Chemist—and they have only visited localities interesting from chemical and palaeontological points of view.

Q. Your work and that of Dr. Bell, then, consists of field work during the summer, and to return to Ottawa to complete your report during the winter?—Exactly. I may also state, perhaps, that, as a rule, the winter is scarcely long enough to get the summer's field work into proper shape, because, what between writing the report, and getting the maps constructed and engraved, and the report printed, it very often happens that the work cannot be got through the press under the supervision of the writer of the report, until the second winter.

Q. To what are these delays attributable?—Of course it takes some time to prepare a report in proper shape, and to elaborate sufficiently the different features of the work. In the printing of the report and maps, the supervision of the writer is necessary, as very often little questions come up which cannot be decided without him, and if the writer has gone into the field, the report will have to stand over until the ensuing autumn.

Q. Is there no record of the work of the summer accessible to the public in any form, until it is actually published in the Report?—There is a short outline of the season's work sent in by the Director to the Minister of the Interior, and incorporated in his Departmental Report every year, being sent in just in time to form part of the Report presented to Parliament. There is no detailed account of the work printed until the Official Report is issued. But, as a rule, if gentlemen interested in any mine or other subject in any part of the country, ask for information, we can give it, and of course we do so very freely, by letter or otherwise.

Q. Can members of the Geological Survey give information to the public, by correspondence or otherwise, separate from the reports, and in advance of them?—Yes, so far as not to interfere with any individual rights. It would not be right, as a rule, to give a report of a given mine, which might be favourable or adverse to it, but in regard to general questions, such as the number of seams and their depth at a given point, we are very happy to give all the information we can.

Q. As a matter of fact, is there much enquiry?—In my own field there has been a good deal of enquiry.

Q. That is the coal fields of the North-West?—Yes; the coal fields of the North-West and the mines and minerals generally of British Columbia.

Q. Although you had no direct personal connection with the Survey under Sir William Logan, yet of course, you are familiar with its history under his charge?—Yes.

Q. Would you state to the Committee your impressions as to the efficiency of the Survey under the present system and administration, as compared with its corresponding efficiency under that of Sir William Logan?—As far as I know the system of administration is very much the same at present as under Sir William Logan, only more expanded in connection with the larger scope of territory and the larger amount of money that is at its disposal. There is one point, however, which perhaps I may be excused for touching on. I think that the Survey should as far as possible be removed from all political influence, and that is one thing which was perhaps better in Sir William Logan's time. We were in Montreal, and under charge of Sir William Logan, and the very fact that he assisted the Survey with his own means gave him such a feeling of independence that he was very determined in preventing any aggression. I think in a department of this kind, of which the public cannot properly understand the work, work which requires a great deal of original thought and even enthusiasm to carry it out, the responsible head should be made independent of any outside influence, I think the members of the Committee will

understand that in any other case the tendency will be among the least useful members of the staff to work other methods of interest than those of doing their work. It seems to me that in a department of this kind, if the Government has confidence in its head, they should give him the utmost possible power, if not then they should not have confided the management to him. It should be the same with every scientific department. I saw that a gentleman giving evidence in the Agricultural Committee the other day, said an agricultural station would be a success, if it were altogether put apart from political influence, which might be detrimental to it.

Q. You feel then that for the efficiency of the Department, increased authority should be given to the Director. I suppose it would be a conclusion from that, that the selection of the Director would then be a matter of much more importance; that is, his personal fitness for the place would become a matter of much more importance if his responsibilities were increased?—Certainly.

Q. You have given your views generally in comparing the Survey and its administration now with that of Sir William Logan. I would be glad to have your views, so far as you are able and willing to give them, as to its reputation for efficiency and ability throughout the world, through Great Britain, the European countries and the United States. How does it compare at present, so far as its reputation goes with its administration under Sir William Logan. Does it occupy the same relative position as regards efficiency?—I think so. I have no knowledge of anything to the contrary. I have a pretty extensive acquaintance with the scientific men of the United States and Europe, and I have always heard the Survey spoken of in the highest terms. Of course, in Sir William Logan's time, the country was geologically quite unknown, and there were striking geological facts to be discovered, which were likely to attract the attention of scientific men abroad at the time. Afterwards the work assumed more of a routine character. Apart from that, I do not know any difference; in fact, I have only heard it spoken of abroad in the highest terms. In Canada, unfortunately, we can only point to two scientific branches—the geological and the meteorological—supported by the Government. In almost every other country, you find botanical gardens, &c. One case in which its utility was particularly established, was the display of the products of Canada at the various exhibitions in London, in Paris, and in Philadelphia, and in all those cases, I may say it received the highest commendation for the manner in which the products of the country were displayed and the prominence given to them. Some of these were under Sir William Logan's care, and the two last were under the care of the present Director.

Q. You dropped the remark that the present system was very nearly identical with that of Sir William Logan. Is it not a fact that the condition of the country in its mineral development has very much changed during the last thirty years? At that time they were not developing mines, only superficially in some cases, but now to a very great extent, and now there is a large mineral output throughout the Dominion. There was nothing to correspond with it at that time. I would be glad to get your opinion as to whether the change with the country in that respect ought not to have made a change correspondingly in the Department?—I meant rather that the method of administration was the same, as a whole, than that the mode of character and extent of the researches were the same. Of course, the mining industry, as you remarked, has very much developed since then, and the operations of the Survey have been extended over a much larger tract of North America, and these surveys of an exploratory and preliminary character which have been superseded in the Eastern Provinces are now going on in the west, while in the portion of the east in which something like decent maps can be got, and which owing to its settled condition is important, there is a detailed system of investigation which there was not in Sir William Logan's time. We have very nearly completed a geological map of New Brunswick on a scale of four miles to the inch, and those of Nova Scotia and Quebec, on the same plan, are in progress. In the west, of course, a system of running surveys has to be adopted of a more or less fragmentary character, because

of the necessity of knowing, in a general way, its resources in coal and other minerals upon which the settlers must depend immediately.

Q. I would be glad of a little more definite answer, expressing your views upon that subject, with reference to the mineral development of the country. The impression of the Committee is, that the work of the Survey, as indicated by the reports, does not show very much attention to mineral observations. We would like to know whether the Survey are attempting to collect these statistics or whether that is left entirely to private enterprise?—I may refer to this little report of mine in the last volume which has been issued and which, on account of its small size, might be thought to represent very little work. The report covers twenty-three pages, and represents one year's work of myself and assistant, and a second year's work by my assistant alone, besides additional observations by myself, in the Bow and Belly River District, covering an area of 24,000 square miles, and involving measurements of 3,000 or 4,000 miles. This report which, although it contains only twenty pages, includes much valuable information in regard to coal deposits. It is not fair to judge by the mere size of the report as to its value. It was issued in this condensed form, because there was great interest taken, in connection with the railway, in the coal deposits of that particular district. There is now in preparation a very detailed report, which cannot appear immediately on account of the delay in the maps. With regard to the collection of mineral statistics, I think much could be done by a properly paid officer under the Geological Survey. The difficulty in the way is, that the mines of the various Provinces are under the control of the Provinces themselves, and consequently, in some Provinces there are departments of mines, Nova Scotia and British Columbia, I think, are the only two—and those departments collect for their own Provinces all the mineral statistics, probably as fully as necessary, and they have the authority to do so. In the other Provinces there is no authority to collect statistics, and if they are collected by the Geological Survey, they must be collected as a matter of favour from the owners of mines, and that takes a good deal of trouble, and in some cases actual personal visits, as it is not possible to accept a report without some supervision. However, I think it could be arranged. I think that the Provinces which have not got any mining departments should be asked to legislate in some way, to enable the Dominion officers, or anyone who is authorized to do so, to receive reports of the mines directly. In the Provinces which have mining departments, I think, with the permission of the Governments of those Provinces, that the information could be obtained from their Mining Inspectors in advance of its publication, probably by giving the Mining Inspector a small fee for his extra trouble in preparing a duplicate return and sending it on in advance. The information thus obtained could be published in a tabulated form for the Dominion. Of course, with regard to the Geological Survey, there is probably no one on the staff now to do such work. It would take at least one man's whole time, and it would be necessary every two or three years, at least, to visit these mines to keep *en rapport* with what is going on. I think that the matter might be temporarily arranged through the Professors of the Universities in the various Provinces, who teach practical mineralogy, who might undertake the collection of the statistics of each Province for a small fee; probably occupying two or three months of their holidays in the summer time with their collection, and the information could then be published with very little labour as a mass of statistics for the whole Dominion.

Q. Do you think there would be any objection on the part of the people interested in the mines, to furnish such information?—In some cases there would be no objection and in other cases there would be objections. Some mines are held for speculative purposes, and it is not the interest of the people holding the mines to give the information asked for. If you asked them the number of tons of phosphates or coal turned out, and it happened to be a bad year, they would not tell you, because the amount would be so small. Unless there was some regular system, therefore, one would not be able to get the information accurately. I think plans of the mines should also be sent in each year showing the new work that had been carried out. In connection with the Geological Survey of Great Britain,

there is not only a collection of statistics, which is, of course, done under Act of Parliament, but there is what is called a Mining Record Office, in which duplicates of the plans of all the mines, whether working or abandoned, in all parts of the country are kept, and it is obligatory on the part of those in charge of the mines to furnish these.

Q. Is that a branch of the Geological Survey of Great Britain, or is it independent?—It is under the control of the Geological Survey.

Q. Is that also the case with reference to the statistical information that is obtained under the authority and care of the Geological Survey?—Yes.

Q. And published as a branch of their Report?—Yes.

By Mr. Wood:

Q. How is it in the United States?—Since the organization of the United States Geological Department, which took place in 1879. They are situated as we are; that is to say, the mines are under the control of the various States.

By the Chairman:

Q. But there is a general supervision as well?—A volume was published not long ago in the United States, and I have heard it stated that many of the figures are not at all trustworthy for that very reason. There is no legislation upon which the Survey can act, and they have consequently been obliged to make a sort of general estimate which is very unsatisfactory; because, if the figures are wrong they are apt to do far more harm than good.

Q. There must be a great difficulty at present, in many mines, of ascertaining what the mineral product of this country is. It is increasing of course, but we are unable each year to find out, beyond the fact that it is increasing. There are various classes of people in the country interested in the products of the different mines, such as copper and iron, not only with reference to the fiscal policy of the Government, but also with reference to the trades themselves. The only way we have of obtaining that information at present is through the Trade and Navigation Returns, and they only refer, evidently, to what is either imported or exported. They do not touch at all upon the metals that are obtained from our own mines and used in our own country, so that there is really no way of getting at our own resources in this respect?—Yes; there is another difficulty. For instance, part of the phosphate mining is carried on in the Province of Quebec and partly in the Province of Ontario as well, and there are no details given for each Province. All that we can get are the total shipments from Montreal, part of which comes from each Province, and of course, in cases like that, it would be extremely desirable to get more information. I hardly see how it is possibly to get the information complete unless the Provinces can be induced to legislate in favour of either furnishing statistics from their mining departments or allowing the Dominion officers to collect them.

Q. Do you think the attention of the Government has ever been called to the advisability of such a course?—I do not know. Dr. Selwyn some time ago prepared a circular which, was issued to the owners or those in charge of mines, but it did not work satisfactorily as they may not give the information.

Q. Do you know whether he communicated that result to the Government and endeavoured to obtain the necessary power to make it compulsory?—I cannot say.

Q. Has there been any reference to it in the Reports, as far as you know?—I do not remember. The whole thing occurred before I was connected with the Survey.

Q. I suppose the work of the Department might be called superficial. I suppose it has reference to explorations upon the surface, rather than for the existence of mines; that is not carried on in any sense. The Department neither seeks for mines, nor do they take any special pains to ascertain what mining developments there is when it is in the hands of private parties. That is the case, is it not?—No, not strictly so. The duty of the geologist, when working in the country, is to examine all the mines also as well as he can. I have always made it part of my duty to do so, although there are not many mines in operation where I have worked. Of course we do not take mining surveys and levels, because that must be done by the engineer in charge of the mine, and it might certainly be looked upon by him as an intrusion.

if any person was to go into his mine to estimate its extent and value. I might also state that in three cases the Geological Survey has undertaken borings where it appeared to be necessary, and the results would be of interest. In the North-West borings were undertaken a few years ago, partly with the object of ascertaining the depth of coal seams, and partly for the purpose of ascertaining whether water could be obtained from artesian wells. Then, several years after that, in 1880, Dr. Selwyn, himself, superintended a series of borings on the Souris River, for the purpose of finding how far east towards Manitoba these lignites could be found, and, therefore, how near Manitoba a supply of fuel could be obtained. Borings were also carried on in New Brunswick. I do not know the exact circumstances, but it was under the superintendence of the Geological Survey. As a rule, borings for developing mineral deposits are more of a private character. They have only been undertaken by Government where they had appeared important in regard to a large tract of country, or where circumstances were such that private individuals did not care to spend money in proving probably difficult questions.

Q. How long ago were those explorations in the Souris District made?—1880. The results are in the Report for 1879-80.

Q. They were made under the personal supervision of the Director?—Yes.

Q. Was it by the employment of an ordinary drill or a diamond drill?—By an ordinary drill. It was done by contract, a bargain being made for so many holes of such a depth and such a distance apart. A gentleman from the oil district of Ontario undertook the borings.

Q. Do you know what was the depth?—It is stated exactly in the Report. One bore was over 300 feet.

Q. Was the result a practical success?—So far as the Souris District was concerned, the depth was considered too great to go for coal in that region, as there was so much coal readily accessible on the river banks. It appeared that this coal sunk to the east, and was too deeply covered to be worth exploring, and thus it fixed the eastern limit of the Souris coal fields for practical purposes.

Q. The Report of the Department then, based upon that exploration, was adverse to the probability of coal existing there?—Yes; at a depth at which it would pay the explorer, and consequently, the operations were not continued.

Q. Were similar explorations made in any of the districts of the North-West?—I mean, independent of your exploration of the Bow and Belly River District?—No borings or sinkings in the Bow and Belly River District occurred until the railway was run through the country. Those above mentioned were the pioneer operations, and as there were no means of transport, except by waggons, the difficulties were considerable; but it was looked upon as important, because the scheme for the railway largely depended upon the distance from Winnipeg at which they could obtain their supply of coal.

Q. Has the subsequent supply of coal been due to the operations of the survey or to private explorations?—Partly to each. Of course, many localities have been known from time immemorial, by Indians and half-breeds, who have seen it cropping out along the banks of the rivers. Others were discovered first by the Geological Survey, but the mere discovery of an outcrop of coal has no special merit in it in this country, as you can see it as you go down the river in a boat. What I consider important is to outline this coal between the points at which it is visible, on the maps, not only the outcrops, but the probable continuation and the depth of the seams and their probable course from where the outcrop is seen, may all be given. This particular seam which occurs on the Belly River (the witness here exhibited the map of the Bow and Belly River district) has been traced by us onward to the Little Bow and the Bow, and on to the Red Deer River, and southward was traced to the Milk River Ridge.

By Mr. Dawson:

Q. And where is the coal that is claimed to be anthracite?—On the Cascade River, Bow River Pass.

By Mr. Wood:

Q. What is the character of that anthracite?—It is, perhaps, more strictly speak

ing, a semi-anthracite than an anthracite. It is very nearly the same character as that which is called anthracite in Wales. It contains a little more volatile matter than the best Pennsylvania anthracite. It has about 86 per cent. of fixed carbon.

Q. Is there not a similarity to the mineral called albertite?—None whatever, except in external appearance; its composition is not the same.

By the Chairman:

Q. Referring again to the character of the work of the Survey, of course, during the time of Sir William Logan there had been no mineral development by private enterprise throughout that section of country over which he had control—the old Provinces of Ontario and Quebec—but the position has very much changed since then, not only in the prosecution of the enterprise in these Provinces, but in the Lower Provinces, in which the development had previously been going on. What strikes me is that so great a change in the country in that respect has seemed to have brought about no corresponding change in the Department. In his time he had no alternative to look after the mineral development, but had to inform the world as to the strata of the rocks and things of that kind, but its previous development certainly seems to me to have been entitled to some recognition by the Department?—I think I explained that. In these eastern Provinces, where a beginning has been made, a new system of mapping has been carried out under the Geological Survey. But what I meant was that the system of administration was the same. The system of mapping and field work has been changed. For instance, Nova Scotia and New Brunswick are divided into sheets, and these sheets are published in regular order, so as to make a complete map of these Provinces on a scheme of four miles to the inch. That kind of work was not done in Sir William Logan's time. His time was spent in making surveys of a broader character; but even in his time, the explorations were of use in developing the mineral resources of the country, and the attention of the Survey was not confined to metalliferous ores, but its researches have been valuable in the development of other minerals, such as building stones, limestones, cements, brick clays, &c.

Q. There is a general impression that the Survey, as conducted at present, does not correspond with the expenditure. I do not mean any reflection on the members of the Survey, but with the conviction that some change should be made, and we are endeavouring to get at the views of experts as to what change is necessary. I am not reflecting upon those who are in charge, but there is an idea that the expenditure of the money which is made does not produce any practical result that is correspondingly useful to the country. Now, can you point to any instance in which the explorations of the Survey have ever called the attention of the public to a single mineral deposit, which has been followed up with a beneficial result. Take, for instance, the Chaudière gold fields, the Acton copper mine, the copper mines of the Eastern Townships and also of Lake Superior; in every instance, if the matter had been left to the information of the Geological Survey, the prosecution of the work would never have been started, whereas they are now going on successfully, and if they had been governed by the opinions of the Geological Survey they would never have operated them. Therefore, I am asking you if, in your knowledge, you can point to a single instance in which the investigations of the department have led to a profitable mining industry?—In regard to one of those, the Acton mine, I am not very familiar, but the Chaudière gold fields have been mentioned in one of the Reports by Dr. Selwyn himself, and I know that in conversation he has expressed opinions extremely favourable to those gold fields, and his opinion has weight, on account of his being in Australia, where gold mines are more numerous. With regard to the general functions of the Survey, I think there is a little mistake, not only here, but in other countries. It should be generally understood that the work of a Geological Survey is not to discover minerals. If the geological surveyor were to go into the Rocky Mountains, for instance, and spend the whole summer in hunting up mines, he might have nothing to show for his work. Such work is for those who hope to make a profit out of the mine. In the same way good agricultural or timber lands may be pointed out in a general way by Government

Surveys, but the actual mode of farming or lumbering is a matter for the individual to determine for himself. The duties of a Geological Survey, I think, are often as useful in showing where not to explore as where to explore for mines. To go back to Sir William Logan's time; one of the first things he did was to examine the rocks around the Gaspé and Baie des Chaleurs regions, and report adversely as to the occurrence of coal there, and the result of that, no doubt, was to save a great deal of money which might have been spent in useless exploration. In the same way Sir Roderick Murchison states that in his opinion the money spent in useless exploration in England alone would have been sufficient to pay for a Geological Survey for the whole world. Besides that, there are other instances where the work of the Survey has been directly beneficial. There are certain belts of country in which minerals occur, and the belts in which they do not occur in a sufficient quantity to justify mining operations, and in preparing maps of these, a beginning has been made. We have given every assistance to those engaged in searching for phosphates, in pointing out the belts which were likely to hold large quantities of phosphates. The same is true with regard to the coal fields. As a rule, it is only in a general way that the Survey would be justified in undertaking borings or actual excavations in search of coal, because that would only be increasing the value of some private individuals property, or perhaps spending a large quantity of public money for a negative result, at the same time, a general and complete survey of a coal district can be made. This map of the Nanaimo and Comox coal fields is an example, and supplies information upon which miners can go to work. As for the value of the information supplied, in some cases, it is difficult of course to bring out instances of that. I know, however, that this little report of mine on the coals of the North-West has been thought of value by some gentlemen connected with the Canadian Pacific Railway; and I was told the other day that they had published 10,000 copies of it and sent it to England, for the purpose of inducing immigration.

Q. So that, according to your view, the efforts of the Survey should not be devoted to special localities for minerals. It would be expected that the Survey should ascertain and determine the general characteristics of the various sections of country, so as to indicate the presence or non-presence of metallic substances. Has that been the case with the salt and petroleum in Ontario? Was their presence indicated by the work of the Geological Survey, or was it mostly by accident, or by private exploration or enterprise?—To some extent it has been the case that the Geological Survey has been able to give assistance in that direction by defining the particular folds of the rocks which are most likely to be the best places to bore for petroleum in a district where it is known to exist. Petroleum exists in porous sandstones and fissures in the rocks, and it is irregular in the mode of its occurrence; in fact, it might be described as occurring in almost lake-like areas. Petroleum is one instance where geological investigation, except in a general way cannot be of particular service to the actual miner. It is very different with reference to coal. Petroleum, in that respect, is very much like water; one can indicate, but very generally, the strata which would be apt to produce flowing springs, artesian wells and so on, but that is very different to telling where there is a sufficient supply of water. It requires experiment to determine that point.

Q. You have stated why the result of the work of the Department did not lead the attention of the public to deposits in these regions. But I think you have not answered categorically if that was the fact in either of those cases, whether the Survey indicated the presence of either petroleum or salt?—I am afraid I am not in a position to answer that, because the reports, if any, would be of a date previous to my connection with the Survey.

By Mr. Dawson:

Q. What explorations have there been chiefly in the West?—Chiefly west of Lake Superior and the Lake of the Woods.

By the Chairman:

Q. The information that is embodied in the Report for 1880-81-82 represents the useful result of the work of the Department during these three years?—No; I should

hardly say that it represented it altogether, because, in the first place, it is necessary to boil down the work very considerably, to publish it. There are maps and reports giving every detail in the office, which can be consulted by any one wishing to obtain further information. And then, this Report covers a sort of interim period, when we were in somewhat disorganized state, on account of moving from Montreal to Ottawa. It is dated over three years, in order to bring us abreast of the present time.

Q. At least, it embraces the principal part of the work?—A man might be working for two or three years, and in one particular year he gets his report ready and hands it in. In this way, several years may be ready at once, so that the volume for that particular year will be very bulky, whereas in other years it will be much less.

Q. I was aware of that, and I thought that taking a period of three years would be a fair illustration. If that Report does not represent the useful work of the Department for these three years, what else is there of importance that has been done, which is not included in that Report?—No doubt it gives an abstract of the work. This little report of my own is the result of two or three years' work of myself and assistant. In regard to the other portions of the work, sometimes a few pages may cover no less than six months' work. The palæontological work has, as a rule, been published separately, occasionally as an appendix; moreover, the re-arrangement of the Museum, necessitated by the removal from Montreal to Ottawa, has occupied considerable time. Although that Report shows all that is ready to go to the public for the time being, it cannot be considered as even representing the whole work of the Survey. A great deal of information is often given by letter, and otherwise, which is valuable, but which does not appear in the Report.

Q. Assuming that it is not the whole of it, it is the principle part of it, is it not?—It represents the principal part of it. I would like to state, in this connection, that I think the Canadian Survey in some respects, in regard to the reports for instance, is in advance of many others. Instead of producing, as in the United States, the largest of volumes, with the broadest of margins, and the thickest of covers, so that if you wish to consult the Report for instance, on the Comstock lead, it is so large as to be unwieldy, our principle has been to publish the Reports in the cheapest possible form consistent with utility, and as concise as possible. In regard to the English Geological Survey, they have perhaps even a more systematic method than ours, but the price charged for their reports has been objected to.

Q. While I quite agree with you that the bulk of the volume should not be accepted as any test of the work, still I have no hesitation in saying that the public and this Committee have the impression that the Report itself, as indicating the work of the Department for three years, and an expenditure \$1,250,000, shows that there is a very little practical result for so large an expenditure of money, and the object of this Committee is to correct the impression that this money was not being properly used, or else to get any changes which may be desirable. I would like to know whether you consider the administration of the Geological Survey at present efficient and satisfactory?—Well, I suppose no two gentlemen who were to organize any service such as this would be quite of the same opinion in regard to its organization. But, on the whole, I think there is no reason to be dissatisfied with the organization of the Survey or with its work. Of course, the matter is quite open to criticism, but I think that if the Public Accounts are looked over, it will be found that the money has not been wasted.

Q. That may be true, but could the money be spent more judiciously? There is no impression that any member of the Department does not do the work his salary represents, but I want to know whether the general administration is efficient, and practically efficient, as giving a result with which the public should be satisfied? The question is, whether the impression is an incorrect one or not?—I am speaking of the part of the work that I am familiar with. As far as I know, I think the administration and the work of the Geological Survey is very satisfactory, and the results obtained are as great as can be expected from the expenditure, when the character and extent of the country in which we have to work is taken into consideration. Of course, some minor improvements might be made, but that would be a matter of

opinion, and people might differ as to the mode in which it should be accomplished.

Q. But in your opinion the system is generally satisfactory?—I think so. However, I would certainly admit of the value of the collection of statistics bearing on the mines of the country as a very important addition to the work of the Survey.

Q. Would that add much to the expense of the Department?—Not if it were conducted in the way I have already suggested. Of course if you engage a gentleman specially he would have to devote his whole time to the work, and it would involve his salary and travelling expenses. It is very difficult to get the right kind of man for the work.

Q. There is an impression that there is a lack of harmony among the subordinates. Is that correct?—I fear there are some gentlemen on the staff with whom it would be very difficult to be harmonious, and that they might object to something, whatever was done, but I may say that I think that if there is any dissatisfaction or friction on the part of any members of the staff, it largely arises from the fact that salaries of many are not sufficient, and when a man finds himself pinched, from a pecuniary point of view, he is apt to be irritable on other questions, and the gentlemen who are in the lower ranks are in that position. I think it would be very important that some of the salaries should be fixed at such a figure that the members of the staff could see that by diligence and in course of years, at any rate, they would arrive at something like a competence or fair remuneration for their services. The members of this Survey are different in many respects from those of other branches of the Civil Service. They require a prolonged course of training and education, and may be considered as professional men, and should be remunerated and treated accordingly. As I stated before, unless you get a man who is enthusiastic it is very difficult to know whether he is doing his work satisfactory or not. A report must not be judged by the number of sheets of foolscap or its size. When a gentleman is out in the field for perhaps six months, with the supervision of his party, he has a position of great responsibility, and this should be taken into account.

By Mr. Baker :

Q. Are the officers on the staff of the Geological Surveys generally satisfied with being on the Civil Service list, and under the Civil Service Act?—I think there is a general dissatisfaction among the officers, owing to the fact that they rank as clerks of various standings. They think, and quite rightly too, that they should go into the list of professional men and experts, rather than rank as clerks. Personally, I have no objection as to what they designate me, but I think there was a feeling of dissatisfaction on that point last winter.

Q. There is no distinct understanding in the Department as to the order in which you rank, is there?—The Department is divided into certain branches, there being four Assistant Directors, and if the Director were absent, the charge of the Department would devolve upon one of them, very often devolving upon the one that is left in the office. Two of us are very often in the field. In 1876, when Dr. Selwyn was in Paris, he left me in charge, but it is a matter to be arranged for convenience, of course. In regard to the subordinate officers, they are, as a rule, classified under their various heads.

Q. From a Civil Service point of view, what is the corresponding rank to that of your own, for instance?—I think I am classed as a Chief Clerk. I do not care what they call me. It is a matter of classification according to salary.

Q. Is the Director of the Geological Survey considered in the light of a Deputy Head, as in the other departments, or is he considered the head of a special branch?—I think he is considered the head of a special branch, with a rank equivalent to that of a Deputy Head, except that he has not the franking privilege.

Q. Do you not think that if the Geological Survey were divided into Provincial Departments more systematic and beneficial results would ensue? For instance, in regard to British Columbia, if you were left to complete that work, instead of proceeding in a desultory manner, would it not be done more expeditiously and more satisfactorily?—On the whole, I think that is the case. I was continuously occupied how-

ever in British Columbia during the summers of 1875, 1876, 1877, 1878 and part of 1879, but had not been there since until last summer, when I was working in part of the Rocky Mountains, which included the western slope to some extent. Before I went out to British Columbia, Mr. James Richardson was working there, I think, from 1871 to 1875, both years inclusive. I think it would not be advisable to establish separate offices in the several Provinces.

Q. But if you, yourself, for instance, were to go into a certain field and continue the work there until it was completed, would not the work of the Survey be much more satisfactory, and would not the thread of the report be much more connected?—That is quite true, and that is why I spoke before of two classes of Surveys—one in the Eastern Provinces and another made in the West. Almost every year I was requested to go into particular districts through which railway explorations were being carried on, to give an idea of the practical value of the railway. In British Columbia, owing to the size of the Province and the distance apart of the localities, our attention has been confined largely to the regions which were considered as probable routes of the railway, and attention specially given to the coal fields and the mines. For instance, Mr. Richardson examined the Nanaimo and Comox coal fields. Other coal fields were known on Vancouver Island, but as it was considered impossible for them at present to compete with these two, it appeared unnecessary to make detailed examinations of them at present. In the meantime, it was thought proper to go on with the work more immediately useful. Sometimes a district is found rich in economic minerals, and intervening districts are left for the time being for subsequent investigation.

Q. Are there no some portions of Vancouver Island of which you have no precise information, from a geological standpoint?—The only precise information we have is with regard to the Nanaimo and Comox coal fields. We do not know the west coast at all.

Q. Have you any knowledge of the coal deposits in Quatsino Sound?—Yes; I visited that place in 1878 and made a preliminary examination, but as it was not complete and it was not likely to compete with the known coal fields, a report was never published, but I have the results at the office.

Q. Taking into consideration what has been done in Vancouver Island, what quantity of work still remains to be done, and what, in your opinion, would it cost to finish up the work, and how long would it take?—We have two classes of maps in the Geological Survey—a preliminary map, which gives the main features, and a finished map, which it would be impossible to make for some time. I think a preliminary map could be completed with about two years more work.

Q. What would that probably cost?—Roughly speaking, I think two good men, working together or apart, as the case might be, and a small staff, would be sufficient to complete the work in the way I have indicated. With regard to the west coast, one would really require some kind of steam launch; you cannot trust sailing vessels, as they are so often becalmed. I experienced that before, when I went in a schooner to the Queen Charlotte Islands.

Q. And a steam launch would not cost more than \$4,000 or \$5,000, and would give you a sort of floating house?—Yes; we could sleep on board, which would be a great advantage. And then we should have a small boat to make excursions along the shores. The cost of the expedition, besides the two gentlemen in charge, should not exceed \$2,500 a year for the summer's provisions and all other expenses on a survey of the kind I have referred to.

Q. The reason I ask is, that if the funds are not provided by the Government they may be by private enterprise. We have arrived at a stage when this information, with regard to the coal regions, is required. You mentioned that in Nova Scotia and British Columbia there were certain systems of collecting statistics?—I think there are reliable statistics in Nova Scotia, but with regard to the gold of British Columbia, there are great difficulties in the way of getting them, because there is no way of telling how much is carried away privately by individuals. A few years ago Mr. Charles Good, Deputy Minister of Mines in British Columbia, worked with

me in revising the statistics of the gold export of that Province, and after we had ascertained the amount of what had been actually shipped, we put down one-third more as having been carried away privately.

Q. Is it not a fact that a much larger quantity of gold has been taken from British Columbia than the amount mentioned in the Trade and Navigation Returns—\$18,000,000, during the last fifteen years?—It is more than \$40,000,000.

Q. In addition to that amount, is it not a fact that sums varying from \$500 to \$5,000 are carried away by Chinamen without the knowledge of the authorities?—I think that is not improbable. I have no doubt they do carry away a great deal, and many of the white miners also carry their earnings to San Francisco.

Q. Are you of the opinion that if the Director of the Geological Survey were free and unencumbered by any outside influence, that the business of the Survey would be much more satisfactorily and successfully conducted?—I think that the greater freedom which he is allowed the better; because the men will come to understand that they have got to please him, and will work accordingly. So long as there is a division of the responsibility in the appointment of the men on the staff, there will always be friction.

Q. And the same remarks would apply to the principal positions under the Director. As regards the appointments, I suppose they should be free from political patronage?—Certainly.

Q. Do you think it will be necessary in the immediate future to have a larger staff?—That is a matter for Parliament to decide. With a larger staff we could certainly get on faster with the work: Just at present the vote has been largely increased, and I do not think we will spend the whole of it this year, as it is impossible to increase the staff all at once. I think the Director should have the power to take on good men whenever he can get them. I think it desirable to increase the staff still more, but it should be a gradual process, each want being filled as it occurs, and the Director should be allowed to select men with the proper training.

Q. Could gentlemen of such calibre be secured readily, if proper salaries were paid to them?—I would not say readily, but there are opportunities for getting them occurring at all times. For instance, the Geological Survey of Great Britain have just finished a map for the whole of England, on the scale of a mile to the inch, and I think it quite possible that the men who have been engaged at that work might be free to engage elsewhere, as the staff of the Survey is very likely to be reduced. There are occasions of that kind when geologists can be secured by paying them proper salaries.

Q. Do you think that the amount of money voted annually is, from your point of view, what it should be?—I could not give a definite answer to that. I think we are scarcely likely to expend our whole vote for this year, but it is quite probable that it might be expanded from year to year. I do not wish to speak with authority, as I do not keep any account of it. Dr. Selwyn has control. I receive for my own work a general grant—usually what I estimate for the work—to spend in carrying on my portion of the work as I think best.

Q. Do you not think that if the geological department were relieved from topographical work, that greater satisfaction would be given to the work of the Survey?—I think it would, on general principles, and in countries where there are good topographical maps, such as the Ordnance maps of England; no one would think of doing topographical work on the Geological Survey. However, it is the case that in a new country, especially, the maps are not reliable, except quite locally, for the geological work, and that necessitates corrections in places where topographical maps are made; and then it is very often necessary to supplement the work by the land surveyors, because they are often not alive to the features of the country, from a geological point of view. In other cases it is often necessary in following the land surveyor to make a map *de novo*. Although I quite agree that it is better to relieve the Geological Survey of topographical work as far as possible, yet there is no doubt that there are cases where the topographical and geological work must both be done, and the United States Survey have found this to be the case, especially in

mountain districts, in which case a small party might be attached to each survey for topographical work, which would give more time for the geological part of it.

Q. In that case, I suppose the topographical party should go in advance of the actual geological party?—In some cases it should, and in other cases I think the two might go together very well. For instances, when the survey was made in the Rocky Mountains, we occupied a large part of the time in making topographical route surveys, and if I had had a topographer with me I could have devoted more time to the geological structure. I would not recommend topographical work which would imply sending a topographical surveyor into the field in advance of the geological corps; that would devolve upon the Department of Dominion Lands and should be undertaken by them, if necessary.

Q. But should there not be maps from the Dominion land surveys which should be sufficient guides?—In that part of the country where the land is divided into sections or quarter-sections, but unfortunately the gentlemen connected with the surveying of these blocks, do not pay sufficient attention to the topography, which is very necessary.

Q. Would you please state what you consider the boundaries of British Columbia?—I think the eastern boundary must have been fixed by the Imperial Government about 1858 or 1859 (when it was made a Crown colony) at the watershed or main divide between the waters of the Hudson's Bay and the Pacific. In fact, I know it was assumed to be such by the British Columbia Boundary Commission, in 1863, who erected their terminal post, at the intersection of the watershed with the 49th parallel. I have always understood that it runs on the watershed of the Rocky Mountains up to the 120th meridian, thence north to the 60th parallel and thence west to the western boundary, where it joins Alaska. The western boundary again is fixed by Treaty with Russia, and the same Treaty rights govern the United States in regard to it.

Q. If the southern boundary were carried on along the 49th parallel it would cut off a part of Vancouver Island?—The 49th parallel was defined as the boundary line merely to the coast. The western boundary, with regard to Alaska, is very indefinite. In the Treaty, it is described as the coast range of mountains, and where this range does not lie more than 30 miles from the sea. If the coast range is further inland than 30 miles, then it follows parallel to the coast, but 30 miles distant. The latter has been assumed, but I think if it were properly defined it would be found to be only 1 or 2 miles from the coast.

By Mr. Cameron :

Q. Is it not important in mining districts to have the reports of the Geological Survey published as soon as possible after the surveys are made?—Certainly; as soon as it is possible to publish something like a complete and definite report of the district.

Q. Complaints have been made from Cape Breton and from eastern Nova Scotia that surveys made five or six years ago have not been published—neither the reports nor maps in connection with them. Is it not rather an unusually long time to delay the publishing of such reports?—I am not aware of the special circumstances, because I have had nothing to do with the work there. But I suppose if the reports had been ready they would have been published, unless delayed by the slow progress of the maps.

Q. Does the responsibility for the publication rest with the Director of the Survey?—The gentleman who makes the survey hands in his report, together with a map of the district, when it is finished, and if the report and map are in a state to be published, they are sent to the printer and the map engraver as soon as possible, to form part of the next annual Report. I think there is something to be said in favour of pursuing another plan: that is, of publishing a short synoptical report annually, and to publish afterwards a separate report of each district with a map; and if desirable, these could be arranged so as afterwards to be bound up in a volume.

By Mr. Dawson :

Q. I have read your report on the country along the boundary, and a very inter

esting report it is. I think you also made explorations in the vicinity of the Lake of the Woods?—Yes, in 1873.

Q. You discovered some granite there, which is likely to be valuable?—There is a large quantity of granite and other building stones in that vicinity. At the time I was there none of the metalliferous deposits had been discovered. I saw a few veins, but nothing worth reporting on. But while I was at the Lake of the Woods my time was mostly spent in determining a moot question, as to whether the limestones occurred on the south shore. They do not occur in place there. There are fragments of limestone found south of a certain line across the lake, but north of that you will find no fragments of limestone. These fragments become more and more abundant as you go south.

Q. Where are these fragments likely to be derived from?—It is very difficult to tell. I think it is very likely that they come from the direction of Winnipeg and the Manitoba Lakes, along the edge of the Laurentian range. Most of the glacial striation on the Lake of the Woods was from north to south, but besides that, in a few places I had noticed striæ is at right angles, indicating the movement of ice in the direction that I have already spoken of, which followed along the Laurentian range.

Q. I believe the line of division between the older rocks and the newer extends northward along the chain of lakes?—Yes; they extend along these lakes, the older rocks on the one side and the recent formations on the other.

By Mr. Mulock:

Q. How many parties had you in the field last summer?—I think there were eight or ten altogether.

Q. The progress of the work, I suppose, depends largely on the number of parties?—Yes, each party taking a district.

Q. Have you any idea of the cost of each party?—It varies very much. A few hundred dollars may be all that will be required to meet all the necessary expenses in the older Provinces, such as hiring canoes, &c., for transport; while in the western regions it is often necessary, for means of transport, to buy waggons, horses, &c., as being the cheapest in the end, and then the arrangements which have to be made for a complete camp outfit, and the wintering of the animals, involves a large expenditure. Where \$1,000 would be sufficient for the expenses of a season's work in the east, it would require, for a party of the same size in the west, perhaps from \$2,000 to \$3,000.

Q. Do you think it would be well to increase the number of parties?—Of course by increasing the number of parties as fast as you can get men to conduct them, the Surveys of the country would be more rapidly advanced, but that is a question for Parliament to decide.

Q. Taking your present strength, can you form any idea how many generations or centuries it would take to do what ought to be done in this direction for the Dominion?—It all depends on what class of work you go into. England has been undergoing a Geological Survey since 1832, and just the other day a map of England has been finished on a scale of one mile to the inch.

Q. How many parties were there?—A very small number at first, and they gradually increased,

Q. Have you any idea as to the exact number of parties which they had?—I suppose they probably had ten or a dozen parties, but I am afraid I cannot give you any reliable information on that point, although I was working there for one summer.

Q. They had many more parties than we have here?—Yes, relatively to the area of the country.

Q. And still it took them half a century?—I do not think that mapping on so liberal a scale would be necessary here. Our map of Nova Scotia and New Brunswick is on a scale of four miles to the inch.

Q. Taking the Province of Ontario, are there not supposed mineral districts wholly unexplored as yet?—I do not know of any. There may be. As regards the Peninsula, it has been pretty thoroughly gone over; but with regard to that portion north of Lake Superior, only a beginning has been made, and it had been confined to the lake shores and along the course of the various rivers. The geology of the Penin-

sula of Ontario is a succession of outcrops of formations of varying width, in accordance with the steepness of the dip and the shape of the surface.

Q. I think you were in charge of the party that examined the supposed coal or lignite districts of the North-West?—Yes.

Q. There has been, I understand, a discovery of anthracite coal there?—Yes, at Cascade, on the Bow River.

Q. It is hard coal, is it not?—I explained that it was more nearly a semi-anthracite than an anthracite.

Q. I understand that the persons who are interested in this mine or who made the discovery say that the Survey reported against the probability of any such find, and that subsequently the coal was found or discovered against the best opinions of the Survey. Do you know how that is?—I am perfectly confident that no report was ever published of that district, and has not been, on this side of the mountains, except Dr. Hector's report, in 1859, under Capt. Palliser. I am sure that no such official statement has been made; I think not even as a verbal statement or a letter. I am quite free to admit, however, that from a general knowledge of that country one would have been justified in designating the discovery of coal as improbable, because most of the mountains are of limestone, and this coal lies in a small trough, which might be called a geological accident.

Q. So that it does not follow at all that coal will not be found to any large extent?—I speak now from the facts, and the facts are that this trough of coal has a certain width, about two miles between the mountains. It runs north and south, but we do not know exactly how far. I was there late in the fall, and there was snow on the mountains, so that it was difficult to tell; but we will be able to ascertain the length of it next summer. But I have only seen anthracite coal there in one place, the rest of the coal which I have seen in the mountains being bituminous. It was a surprise to me, but one is always liable to be surprised. If all these things could be theoretically determined, it would not be worth while exploring.

Q. Do you think that it would be advisable to have more parties put into the field than the present appropriations admit of?—I think a gradual increase would be very desirable, indeed. I do not think it would have a very beneficial effect to suddenly increase the men, as you might get a lot of incongruous results and get things generally mixed up. But a gradual increase might be made from year to year.

Q. It should be a matter of policy, then, in the Department, to increase the number of parties in the field as speedily as that work can be efficiently done?—Yes.

Q. That has not been the aim of the Department up to the present?—There is scarcely any year that there has not been an increase.

Q. How many parties were there last year?—Eight or ten.

Q. In the report up to the end of 1880, it appears that there were six districts reported upon. It took at least six parties, or perhaps more, to make this report?—Yes.

Q. Has there been an increase in the number of parties in the field in the last four years?—Yes; I think so, although I could not say how much. There has been a general tendency to increase, and also to allow gentlemen to go into the field, in charge of parties, with one or two assistants.

HOUSE OF COMMONS,
OTTAWA, 18th March, 1884.

The Select Committee on Geological Surveys met this afternoon, Mr. HALL in the Chair.

ROBERT BELL, Esq., C.E., M.D., L.L.D., Assistant Director of the Geological and Natural History Survey of Canada, was called and examined.

By the Chairman:

Q. What is your age?—Approaching 42.

Q. How long have you been connected with the Survey?—Since the beginning of 1857, with the exception of some slight interruptions.

Q. What previous experience or study had you to qualify you for a position connected with the Geological Survey?—I was very young at that time, only a boy in fact, but my father was the principal amateur geologist in the Province of Ontario and had the best cabinet of fossils, rocks and minerals, and before the commencement of the Geological Survey of Canada had mapped out the geological formations, so that from my earliest recollections I had the benefit of his constant teaching on the subject, and I had read all I could. My father had the best library of geological books up to that time, so that when he died, Sir William Logan, knowing these things, took me in hand, and from that time he took great pains with me, and I have heard him remark to leading geologists what he had done with me, and they have said that if he taught me all these things I must be a good geologist. That was up to the commencement of my career with Sir William Logan.

Q. Would you also state what your educational advantages have been?—I enjoyed a good common and high school education, and afterwards I studied land surveying in Upper Canada, and passed the preliminary examination and then civil engineering and surveying, with the natural sciences, at McGill University, where I took the degree of C.E. with first-class honors in natural science and mathematics, prizes and so on. After that I went to Edinburgh, where I studied zoology and geology under Prof. Allman, botany under Prof. Balfour, and chemistry under Prof. Lyon Playfair and his assistants, Professors Dittmar and Fairley, who are now both leading professors of chemistry, and also under Prof. Alexander Crum Brown, who succeeded Prof. Lyon Playfair.

Did you take a degree at Edinburgh?—No; I took Prof. Playfair's certificate for practical chemistry, and also those of Professors Dittmar and Fairley, as well as that of Prof. Crum Brown. Afterwards I became a professor of chemistry and the natural sciences generally, at Queen's University, Kingston; held that Chair for about five years, and gave it up with a view of perfecting myself in subjects bearing on geology. I also studied medicine in McGill University, and graduated as a physician and surgeon in 1878, and last year, in recognition of my services to sciences, &c., Queen's University granted me the degree of L.L.D. I might also mention that I have been a fellow of the Chemical Society of London, and am a fellow of the Geological Society of London, and of the Royal Society of Canada, besides belonging to numerous minor societies.

Q. What was the *personnel* of the Geological Society at the time you joined it?—It consisted principally of Sir William Logan, as Director; Mr. Murray, Assistant Director; Dr. Hunt, Chemist and Mineralogist; Mr. Billings, Paleontologist; Mr. Richardson, Field Geologist; Mr. Richard Oatey, Practical Miner, and Mr. Barlow, as Topographer. There was also a Mr. D'Urban, Naturalist and Botanist.

Q. What position was assigned to you when you first became connected with the Survey?—I was first Assistant Geologist; I assisted Mr. Richardson, and afterwards Mr. Murray, but as we had very few men, Sir William thought fit to send me on independent expeditions after about three years probation, though I was only in my teens then.

Q. So far as you recollect then, would you state briefly the changes which occurred just after Sir William Logan's resignation?—The first great change which

took place after Sir William Logan's resignation, was the resignation of Dr. Hunt, I think, from two to two and a-half year's afterwards.

Q. What was his position?—Dr. Hunt was officially chemist and mineralogist, but he was also the real adviser in chief in matters relating to the literature of geology and geology generally.

Q. Had he been connected for some time with the Survey?—Yes, for a long time. At the time of his resignation, I suppose, he had been about twenty-five years connected with the Survey, his services in connection with it having commenced shortly after the establishment of the Survey. Dr. Harrington succeeded Dr. Hunt, and remained on the Survey for several years, I think from 1873 to 1879. Dr. Harrington left, and Mr. Hoffmann, who had been assistant, was appointed in his place. Mr. Billings became connected with the Survey about 1855, and acted as paleontologist for a good many years; being connected with the Survey after Dr. Selwyn came. When he died Mr. Whiteaves, who had acted as assistant paleontologist for some two years, at a nominal salary—he worked for the love of the subject and lived on his own means—was eventually appointed; but they had great difficulty in getting the appointment confirmed. It was finally confirmed, however, principally on the recommendation of the medical men of Montreal, who appreciated his devotion to science, and were aware of his fitness for the position.

By Mr. Holton:

Q. What were the difficulties connected with his appointment?—Another person wanted to get the position and wished to have Mr. Whiteaves deprived of it. No one, for a moment, disputed Mr. Whiteaves' capacity and claims for the place.

By the Chairman:

Q. Was it political or personal influence?—Personal, with as much political influence as could be brought to bear. Mr. Murray was connected with the Survey from the beginning until he went to Newfoundland; he was invited to undertake the Geological Survey of Newfoundland by the Government there, and he was still to be, in a manner, connected with the Geological Survey of Canada. Sir William Logan had, with the consent of the Government, promised to allow the principal officers to give him all the assistance they could. The Government of Newfoundland could not afford to pay the expenses of a whole staff, so we were to help him with his work, in the interest of science generally, and to assist in elucidating the geology of the eastern part of Canada. Some time after Mr. Murray left, it became evident that he was going to stay there altogether, so the Government of the day agreed to fill his position by appointing myself as assistant director. There was considerable delay in getting this brought about. I do not exactly understand it, but there was some difficulty in recognizing my position, on the part of the Director, and instead of appointing one assistant director he caused four to be appointed, which gave me no improvement at all, because it raised the other three to the same rank as myself.

Q. Did Mr. Murray occupy the position of assistant director exclusively?—Yes; he was called Assistant Provincial Geologist, Sir William being Provincial Geologist.

Q. And he was the only one?—Yes; they could not afford to make them all assistant directors, and only one is competent to work in harmony with the rest of the staff. If you have half a dozen heads there will be trouble in the camp; Sir William recognized this, and was not likely to make a mistake. Mr. Richardson was on the Survey from nearly its commencement, and remained on till about three years ago, when he was superannuated, although still able to work.

Q. Was he superannuated at his own request?—I am not quite sure about that, but it was not according to his own wishes; he might have requested it as the least of two evils. Mr. Richardson died last autumn. Mr. Barlow was working for the Survey, though not appointed on the permanent staff, before my time, and he was superannuated a few years ago, although still able to work. He was probably the best topographical draughtsman in the Dominion, so far as we are aware. He was succeeded by his son, Mr. Scott Barlow, who, I should mention, has been on the Survey for a long time, and is now in the position which his father occupied. Mr. Vennor was at first my assistant. Sir William Logan, writing from London, in 1865, requested

me to take him as my assistant, and I did so, and he remained on the staff until 1881. Mr. Vennor served from 1865 to about 1881. Mr. Robb was employed on the Survey many years ago, I think from about 1863, as mining engineer and field geologist. His profession was that of a mining engineer, but he was also a good geologist, and had written a book on the Metals in Canada, and was regarded as a good geologist and mining engineer. He was a brother of the well-known Professor Robb, the great geologist, of New Brunswick. Mr. Robb resigned; I think he served about eight years. Mr. Weston, joined the Survey few years after myself, and is still connected with it; he came as a lapidary and librarian, and is now collector of fossils and curator of the paleontological department. Mr. Fletcher joined the Survey about fourteen years ago; he is one of the field geologists, and still remains. Mr. Fletcher was taken, probably, on account of his knowledge of geology and mining, at the time he was appointed; he was a son of a practical miner, Mr. Hugh R. Fletcher, who for many years was in charge of the Bruce Mines, and afterwards in charge of mines in the Lower Provinces. Mr. Fletcher is a practical miner and a distinguished geologist, and was also a distinguished graduate of Toronto University; he took the first prizes and first-class honors in every year during the four years of his course in that University, and I think all his brothers have done the same; one of his brothers is Professor Fletcher, of Queen's University. Mr. Ellis was appointed about the same time as Mr. Fletcher. Mr. Ellis had studied in McGill College, graduated in Arts, and had a natural taste for geology and is now a field geologist; he is still on the Survey. Mr. Webster was on the Survey about fourteen years as a field geologist, as one of Sir William Logan's assistants, and afterwards as an independent field geologist, working in the Eastern Townships; he had about fourteen years connection with the Survey and left about two years ago. Mr. Ord was another field geologist who had been on the staff some nine or ten years; he left about three years ago. Mr. H. Y. L. Brown was another member of the Survey; I understand he was a geologist in Australia, and came here at the request of Mr. Selwyn, from Australia, and with the promise of a good position, similar to that which he occupied in Australia and at a good salary. Mr. Brown only served about three years and left about eight years ago, going, I believe, to England; he was a mining engineer and geologist, a man of great ability and capacity, and a very gentlemanly and courteous man. Mr. Broad was on the Survey for about six years, up to the present year, and I believe was virtually dismissed. Mr. Broad was a field geologist, and first assisted Prof. Bailey or Mr. Ellis, and was then entrusted with independent work, which he continued for five or six years. He was six years altogether on the Survey, and I understand was virtually dismissed. I might also mention Professor Bailey, of the University of New Brunswick; he was connected with the Survey twice. Professor Bailey was connected with the Survey for some years, doing work in the summer holidays, and reported at his leisure in the winter, without coming here. This had been quite allowable in other cases, and he was in reality an officer of the Survey, although writing his reports in New Brunswick. Well, he left the Survey for a while, and after Mr. Broad's dismissal, he was asked to come on again and take up the work Mr. Broad had had in hand. Mr. Matthew had also worked during his summer holidays in connection with Professor Bailey, and is regarded as a very good geologist; he was offered a position as geologist on the International Boundary Commission, but he could not accept it and another was appointed in his place. I am referring to the United States Boundary Commission that commenced operations in 1872 and continued until 1875. Mr. Matthew refused that appointment, but worked for some years on the Geological Survey; he is not now employed. Dr. Geo. Dawson has been on the Survey since he completed his work as geologist on the Boundary Commission just referred to; I think he has served about seven years out of nine, having only worked one year out of the three preceding the last. The next gentleman whom I will speak of is Dr. Spencer, now Professor of Natural Sciences in the University of Missouri. He was a born naturalist and geologist, and his natural leanings induced him to study these sciences at the University, where he graduated as a mining engineer and

natural scientist—I refer to McGill University—and afterwards received the degree of M.A., and Ph. D. from one of the German Universities. He was a very pushing and clever man; he assisted me one year in the North-West, and was employed in the office for one year. He only served me one year in the field, and then left. Another gentleman who worked with me for some time was Mr. Peter McKellar, who was an excellent expert in mining matters; he worked with me for two years, but did not care for any permanent appointment on the Survey. Mr. Alexander MacKenzie was on the Survey, I think, for nearly five years; he came as a miner, and had been a practical miner in Nova Scotia and elsewhere; he also left. I might also speak of Mr. Foord; he came as artist to the Survey, in succession to Mr. Smith, who had died before Dr. Selwyn's time. Mr. Foord was afterwards appointed as assistant palaeontologist to the Survey, but left last year. Mr. Molson is the next to whom I might refer; he was with me for two years, and had the promise of a permanent appointment, but finally declined to take it. Mr. Molson, I might mention, was a distinguished graduate in science, and a gold medalist of McGill University. Mr. Grignard worked for a year or two on the Survey as artist, after Mr. Foord became more of a palaeontologist. Mr. Joseph Tyrrell is a gentleman who joined the Survey about three years ago, and his name was temporarily left off last spring, but he was put on again and is still connected with it. Mr. Fraser Torrance is another gentleman who has been connected with the Survey. He was a mining engineer and was employed to work in the phosphate regions in the County of Ottawa last summer, but he was discharged during last month. Mr. Coste is another who has been connected with the Survey for about one year. He was dismissed temporarily a short time ago, but has been reinstated. He is a mining engineer and a graduate of the Ecole des Mines, of Paris, and is a gentleman of much learning and at the proper age promises to be a highly valuable member of the staff. Mr. A. S. Cochrane is still on the Survey, and has been for about seven years; he was temporarily dismissed once or twice, but is still at his place, at small pay. His position is rather undefined; he has been considered assistant field geologist, but has really been doing draughting in the office, principally in connection with my work. He has been trusted with independent surveys for at least three years, and is really a junior field geologist and topographer. There is on the list Mr. Low, who is now a field geologist; he is still on the Survey, being quite recently appointed. Mr. R. G. McConnell, assistant field geologist, is still on the Survey. On the list are also the names of Mr. McMillan, assistant field geologist, who is still on the Survey, and Messrs. Faribault and Giroux, assistant field geologists. Then, in the house staff there is Mr. Frank Adams, assistant chemist and mineralogist, and formerly an assistant of my own in the field. He is a good geologist, and still does field work in the summer, working in the laboratory in the winter. Mr. Willmott, is assistant curator of the mineralogical department and also a collector of minerals. Mr. Brumell is Mr. Willmott's assistant. There is also Mr. Broadbent, assistant in the Museum, and Mr. Ami, assistant palaeontologist. Dr. Thorburn is librarian. He is not on the Civil Service list, but he is acting as librarian of the Survey. There are also a caretaker, messenger, door-keeper, yardman, &c.

Q. Has any change been adopted in the system under which the Survey was organized since your first connection with it? Is it still conducted under the same system as it was when you first joined it?—Not exactly. When I first joined it the main idea was to make our work have special reference to the mineral development of the country and the discovery of economic minerals.

Q. In what respect has that been changed?—Well, very little attention has been paid to mines latterly, and a great deal of attention to other matters. The proportion of the indoor staff has greatly increased, but still the work done is somewhat different, on account of the greater area and the pioneer sort of work we have to do, instead of being confined to more exact work in limited areas. It has been changed from a Geological Survey of Canada and now bears the name of the Geological and Natural History Survey of Canada, and we have endeavoured to pay some attention

to natural history. Latterly a botanist has been appointed and a great deal of attention appears to have been devoted to Indians, and also to journals of travel.

Q. Have these changes, with reference to the attention paid to mineral subjects, come about by reason of the change effected by Confederation, and on account of the larger area, or by changes suggested by the Director himself?—Partly both to the greater area and the small staff, it being necessary to do more preliminary work, and also to a great extent to the present Director's views as to the object of the Survey being different from those of Sir William Logan. The history of Sir William Logan's career, as recorded in the Reports, shows clearly what he conceived the Survey to have been instituted for.

Q. Would you mention that in brief?—Sir Wm. Logan was distinguished as a practical geologist in regard to coal mines, having been the first to trace out the coal fields of South Wales, in such a way that his plans were adopted by the official survey of Great Britain, and consequently when he came here he had a good idea of coal mining, which, in this country, was of great importance, and one of the first problems solved by the Survey was the existence or non-existence of coal. Sir William thought it might be found in the Gaspé Peninsula, his first two years being spent there, and he was accompanied by Mr. Murry and also the chemist and mineralogist of the Survey, with the view of discovering the existence or non-existence of coal in that region. He had great hopes of finding it there, but of course the whole country was unknown, geologically, at that time. It was known that copper and silver were to be found on Lake Superior, and the Bruce Mines were found on Lake Huron, and therefore Sir William paid particular attention to the Lake Superior and Lake Huron districts. In all the work that was afterwards done, the economic minerals had the most prominent place, the search for them forming a most conspicuous portion of the Survey. Sir Wm. Logan employed, about the time when I first came to the Survey, a Mr. Oatey, a practical miner, whom he sent to examine mines, and to give his practical advice to assist the miners, this being a young country and very little being known about practical mining. Mr. Oatey was sent to collect specimens under Sir Wm. Logan's directions. Sir William had done all he could, up to that time, and kept in advance of any mining development which was going on. He also devoted himself to structural geology, although the materials he had to work upon were not nearly so inviting as now. The geology of Ontario and Quebec is very meagre, as compared with the Dominion as a whole. Well, Sir William and his assistants were such men as to make the Survey interesting, and one of the foremost in the estimation of scientists in Europe, notwithstanding the meagre field they had to work in. Sir William elucidated the structure of the most ancient rocks, the Laurentian, and gave them their true character and the name, which has been recognized all over the world, and Mr. Murray the Huronian rocks. And then, Sir William solved some problems puzzling to the geologists of the world at that time, as to the true geological position of the rocks of the Eastern Townships, which are a prolongation of the rocks of the Appalachian chain. At the same time he superintended the geological work in all other parts of the country, assisted by Mr. Murray and myself, including the geological work in connection with Ontario and Gaspé and all the country north of the St. Lawrence; indeed, the whole Provinces of Ontario and Quebec had been covered, with the exception of the more remote and less interesting and important regions.

Q. What changes are observable in the present direction of the Survey in these respects?—When Mr. Selwyn first came he did not make any very radical change. I was engaged in collecting mining statistics, as a volunteer sort of work, for a few years previous, and Dr. Selwyn agreed to continue this for the Provinces of Ontario and Quebec, under my direction, and for the Provinces of Nova Scotia and New Brunswick, under the direction of Mr. Hartley. I submitted to Dr. Selwyn a copy of the questions which I had been sending out, requesting information with reference to mining statistics. The circular which accompanied these questions was as follows:—

DOMINION OF CANADA,

RECORDS OF MINES AND MINERAL STATISTICS.

It has been decided to institute, in connection with the Geological Survey, a systematic collection of records of mines and of statistics of the production and consumption of minerals in the Dominion. As it will be impossible to effect this, so as to secure reliable and valuable results, without the cordial co-operation of all persons interested in mining pursuits, owners, directors, managers and agents of mineral properties, and iron masters, smelters, and metal merchants, are invited and respectfully urged to lend their hearty assistance towards promoting the object in view.

The great and permanent value to the mining interests of the country, of such records and statistical information, when carefully collected and compiled, is so well recognized and established that it does not need to be dwelt upon.

To facilitate the work, the annexed form has been prepared for circulation; and it is hoped no difficulty will be experienced in getting it promptly returned to this office, with as much information, under the respective headings, as can be conveniently given.

As the mineral statistics are intended for publication with the annual reports of the Survey, it is desirable that all returns for the year should be sent in as early as possible, and in no case later than the 31st January.

Statements given in confidence will be used only to aid in the compilation of totals; and it is hoped that inability to reply fully, or even in part, to all the queries, will in no case be considered a reason for altogether withholding information, however scanty, which can be given without inconvenience.

Prof. R. Bell, and Mr. Edward Hartley, have been requested to undertake the collection and arrangement of the returns; Prof. Bell, in Ontario and Quebec; and Mr. Hartley, in Nova Scotia and New Brunswick.

ALFRED R. C. SELWYN,
Director Geological Survey.

GEOLOGICAL SURVEY OFFICE,
MONTREAL, January, 1870.

A blank schedule was sent along with the above, containing the following questions:—

Name in full. Mine or other description of property worked. Name of and distance from nearest town, railway station, or port. Cost and mode of conveyance.

Names of owners, or of company and manager.

Nature of tenure and particulars of terms (rent, royalty, &c.)

Total depth of mine. Names, average thickness, depth and number of seams, beds or veins.

Number, dimensions and depths, of shafts and stopes, and total length and dimensions of galleries, levels, drives or other excavations.

Total area worked, in acres, cubic yards or feet.

Dates when discovered, first worked, suspended and cause, and re-opened.

Number of hands employed, men and boys; total number of days work. Miners or quarrymen, mechanics, bankmen, labourers; whether by contract, day-work or tribute.

Average rate of wages, or earnings of each class.

Number of horses employed in the mine, and on the surface.

Number, H.P., and kind of engines in the mine, and on the surface; also, whips, whips, cranes, stamp mills, crushing rollers and pumps; whether worked by steam, water, wind or otherwise.

Total cost or estimated value of fixed machinery; also, of rolling stock or plant.

Total quantity sold. Total value, and price per at the works or delivered.

Quantity used on the works. Quantity on hand on 1st January, 18 , and quantity on hand 31st December, 18 , from previous years.

Total quantity crushed, reduced or otherwise treated. Produce, per and process used.

Destination of produce. Provinces, neighbouring States and foreign countries.

It is very desirable that plans and sections of the Mine, accurately drawn to scale, and showing surface and underground works, should, if possible, accompany the returns. After the first year the annual additions only would need to be given.

This was entirely my own suggestion, except one question from Mr. Hartley. This document frightened people; it had the look of prospective taxation, and as if a royalty was to be exacted from the miners. It had too much of the authoritative style about it, and it was not successful; but after about three years working of it, Mr. Robb was instructed to take the information collected—I suppose I got about nine-tenths of the information myself—and compile a statement from it. These statistics appear on page 146 of the Report for 1871-72. In Great Britain, experience had taught gentlemen in charge of mining surveys, to make the questions as simple and as brief as possible, and I have some circulars here, accompanied by questions, which were sent out by Mr. Hunt, Keeper of Mining Records. There were only a few questions attached to each circular. The following are samples of the questions asked:

Circular No. 1

- (1.) Name and situation of iron works.
- (2.) Owners of iron works.
- (3.) Number of blast furnaces.
- (4.) Number of furnaces in blast during the year 187 .
- (5.) Quantity of statute tons of pig iron, made in 187 .
- (6.) Quantities and descriptions of iron ore used in 187 .
- (7.) Number of puddling furnaces.
- (8.) Number of rolling mills.
- (9.) Number and capacity of Bessemer converters, if any.
- (10.) Particulars relating to the character of iron ore used, and whether raised or purchased, will be valuable.

Circular No. 2.

- (1.) Name of mine.
- (2.) Situation of mine.
- (3.) Name of company or individual working the mine.
- (4.) Name of secretary and purser.
- (5.) Name of manager or chief agent.
- (6.) The description of ore or ores raised.
- (7.) The quantity of each description of ore raised in the year 187 .
- (8.) General remarks on the character of the mine and minerals raised.

Circular No. 3.

- (1.) Name and situation of the colliery or collieries.
- (2.) Name of the owner, or of the firm working the same.
- (3.) Quantities of coal raised and sold or used in 187 .
- (4.) Quantity of slack raised and sold or used in 187 .
- (5.) Description of coal produced.
- (6.) Prices at which the coal and slack were sold at the pit bank.
- (7.) Any information as to the distribution of the coal will be valuable.

Circular No. 4.

- (1.) Name of the works.
- (2.) Name of firm, and postal address.
- (3.) Number of boxes of tin and of tin plates made in 187 .
- (4.) Number of black plate made and sold ready for tinning in 187 .
- (5.) What was the actual weight of the whole.
- (6.) General remarks on the manufacture.

These answers were filled up, and a general compilation of mining statistics collected in this way. Since the Survey has stopped collecting these statistics, I have carried on the work privately, and have the returns up to the present year, which are ready for publication if they are considered of value.

Q. You say you have collected these statistics privately?—Yes.

Q. Have they been furnished to the Department?—No; as I had no encouragement to furnish them. I requested Dr. Selwyn to allow me to go to the mines, but he refused his consent, and I therefore collected these statistics privately.

Q. And are you still doing it?—Yes; I have them up to date. I thought it was a pity to let the record be lost, because we could never have got it again; I have spent some time in compiling these statistics, and they are now pretty much in shape to be published as a book to be called "The Mineral Resources of Canada; an Account of the Economic Geology of the Dominion, and of the Progress of Mining during the last Twenty Years."

Q. Did you find any trouble in getting from the owners and managers of mines the information necessary for such work?—Not at all. There is no difficulty in getting such information from them when they are properly approached. Sometimes there is some delay in getting the returns, but on visiting the mines you can always get the fullest particulars, and in case of any negligence to fill them up, you can do it yourself, on the spot. In fact, the only way to collect them properly is to do so yourself.

Q. Did you have any difficulty, on visiting the mines, in obtaining the necessary information and data of our mineral produce?—Mining men are like others in this country; they are generally obliging and civil in giving information. I do not consider it necessary to employ highly-paid experts to do this work; nor do I think school-boys in their holidays could collect these statistics. I should think, therefore, that the gentlemen already on the staff are fully competent to do so. Many of the geologists on the staff could not only collect those statistics, but could give valuable advice to the miners.

Q. Do you think that attention to mining statistics would entail much additional expense on the Survey?—A very slight addition; perhaps travelling expenses, and it might require the time of one man during the winter to compile them. It might also take a little of the time of those amongst us who are best qualified to give advice to mining men, which would be valuable, as being disinterested.

Q. An impression prevails that the work of the Survey is not commensurate with its expense, and that these defects result principally from the system under which the Survey is conducted, or from its administration under that system, or both; and the Committee would be glad of your views on this subject?—I am not at all responsible for the administration of the Survey in any respect, because I am never consulted and, therefore, if any blame is supposed to be attached to me personally, I repudiate it, but I will say that the results are not what might be expected in proportion to the expenditure.

Q. Is the defect in the system, or is it the administration under that system?—The only way, perhaps, to bear out what I say, would be to compare our results with those of other Surveys. For instance, in the State of Pennsylvania, a survey was begun in 1874 and nearly completed in 1880, but is still going on in a small way. Most of the results of the investigation, however, came within that period, and up to the present time no fewer than fifty-three volumes of reports and seven atlases, embracing about 10,000 pages of reports, in which are found 1,000 plates, cuts, and other illustrations, and 100 maps have been published. The expense was about \$50,000 a year, not much more than one-half of what we are spending, and the Director considers it ample; he did not wish any more, and said, although he was offered more money, that it was sufficient to carry on the work as fast as he could superintend it. In comparison, I might cite the results of other Surveys, such as the Survey of the United States, and those of France, Italy, Spain, Germany, Norway and Sweden, and also of India. Our own reports vary from 200 or 300, to about 500 pages, and one such volume a year. In Pennsylvania they have had fifty-three reports in ten years.

while we have had about six reports, each containing pretty nearly the same amount of matter, but ours are different from theirs. Their reports are of practical utility, while ours are not so, to a great extent. Some of our reports are no doubt useful, but a great part of some of them is taken up with journals of camp occurrences, and would not be read or sold at all if published as private books. I might mention that the Director's own reports since he came to the Survey, about fourteen years ago, consist of 146 pages of summary business reports, stating what others have done, changes in the staff, &c.; 293 pages of journals of travel, and the last five reports contain only thirty-two pages in all relating to geological work proper, part of these, however, being quotations from the reports of other gentlemen which had been suppressed.

Q. Does the responsibility rest solely on the Director? Does he determine what is to be published? Does he lay out the field of labor and assign the different sections to the various members of the staff?—Yes, I understand that latterly he has been asked to lay before the Government a statement of what he proposes to do, and this, as a matter of course, is approved of and carried out. He never consults with me, but I suppose he consults with somebody. I do not know anything about that.

Q. Supposing he wished to divert the attention of the staff under him to the collection of mineral statistics, and to report on actual mining operations that are going on, is it quite in his province to do so?—Yes; I have heard him say that the interference of the Government is merely nominal. The Government are not supposed to do what should be done, without advice; if they employ an expert to do this, they probably allow him to have his own way.

Q. Without referring to the *personnel* of the staff, or to the selections of the subordinates and their treatment by the head of the Survey, what is your opinion as to its efficiency?—The members of the staff are, as a rule, I believe, capable men, and with fair opportunities would do much better work than they are doing. Opportunity is everything; for instance, if a man has an appropriate field to go to and is given the proper means of carrying out his work, he may accomplish much, but if he is systematically discouraged and deprived of the means of carrying out his work, he will accomplish very little, and then if his reports are suppressed or unduly curtailed, the public are in utter ignorance of his work, his name not even being mentioned in the report.

By Mr. Cameron:

Q. Is the Director of the Survey responsible for the suppression of names?—Yes; he has suppressed the names of many who have sent in reports.

By Mr. Baker.

Q. Is the systematic discouragement active or passive?—It is active, amounting, I may say, almost to persecution; I know it amounts to such in my own case.

By Mr. Wood.

Q. Can you give us any idea of the nature of those reports which are suppressed?—I can give you an idea of reports, such as my own, of experienced geologists in the Eastern Townships and elsewhere, which were duly sent in each year, but which have never seen the light.

Q. What sort of information did these reports contain?—Information in regard to the work done with reference to the geology of the country, and perhaps what is proposed to be done, and also, in some cases, interesting information with reference to the economic minerals.

By Mr. Cameron:

Q. I believe there has been no report of Cape Breton published since 1881?—I am aware that Mr. Fletcher, who is, I may say, one of the best geologists we have, certainly one of the most painstaking and capable geologists, and a man of experience and systematic training, made a very valuable report on one of his recent surveys, which was accompanied by a map, giving a very detailed account of the geology of Cape Breton. The Director said the report could not be published as the map was not engraved; the map was all ready, and still the report is not published.

Q. How long is it since the map was ready?—I think about two years; it was got ready as quickly as possible.

Q. Have you any idea of the importance of that district?—Yes; I believe that it is very important. Mr. Fletcher himself has said so repeatedly. But, I may say, that I am not thoroughly aware of what is being done, as I am never consulted.

Q. You are quite sure that the report and maps could have been published?—Yes.

Q. Do you know anything about the suppression of Sir William Logan's report with reference to the work of the last years of his life?—I am aware that all the reports of the Survey, from 1858 to 1863, have disappeared. I have seen them myself in the old office in Montreal, the manuscripts which were piled up being nearly a foot high.

By Mr. Dawson:

Q. Were these all reports of Sir William Logan?—Some of them were my own.

Q. When did you last see these manuscripts?—They were on Sir William Logan's shelves and, as they wanted to make a partition across the room, this material was all cleared out, and since then there is no trace of them to be found.

Q. Who was the custodian of these documents?—They were in Sir William Logan's custody until he gave them to Dr. Selwyn. I dare say Sir William handed him all the reports and maps.

Q. You are sure you saw those reports there?—Yes.

Q. Did you ever notice these remarks of Mr. Thomas McFarlane, which he has published about Sir William Logan:—"If laborious and painstaking study of the actual stratigraphy in the field is to count for anything, it is no discredit to Mr. Selwyn to say that his work in this respect is far outweighed by that performed by Sir William. Further, we all know that the closing years of his life, even after his official connection with the Survey ceased, were devoted to a re-examination of the Eastern Township rocks, and to the completion of his map. Surely all this ought not to be thrown aside as useless work. Surely Sir William, had he lived, would have had something to say in these days in defence of his opinions. Although he is gone from us, it is surely our duty to take care that justice is done him, and I contend that it would only be an act of simple justice to his memory to give to the world the results of his labours, just in the shape which they attained at his death. Apart altogether from his theoretical conclusions, the correctness of which Mr. Selwyn disputes, the observations of Sir William and his assistants, as to the actual phenomena exhibited by the rocks of south-eastern Quebec, have a practical value to the country and to all future observers, which I conceive it to be the duty of the Survey to put on record. When we consider the very slender foundation of new material upon which Mr. Selwyn's views regarding the Quebec groups are built, it would seem that the conclusions which he has arrived at are, to a very large extent, theoretical, and therefore just as little entitled to immediate acceptance as those of others who have written on the subject." There, you see, it is distinctly stated that some of Sir William Logan's writings have been suppressed?—Yes; I think the work of Sir William Logan's last years, which was a volunteer sort of work, at his own expense, in the Eastern Townships and the adjoining States, has been suppressed; it took the form rather of maps, which have been suppressed up to this time. Mr. Selwyn has said that there was not a line on them correct, but Sir William was a good draughtsman and surveyor, and very painstaking in everything he did. I know, for instance, when he was working in the Eastern Townships, that he spent two years in one township, namely Danville.

Q. And is the result of these two years' work now in the office of the Geological Survey?—Yes; at the time Sir William retired, he left maps of probably ten or fifteen years of his own work, and also of that of Mr. Richardson and of part of that time of Dr. Hunt, Mr. Murray and myself. This was subsequently supplemented by the work of Messrs. Webster and Weston, under the direction of Sir William Logan.

Q. Can you imagine any reason why these reports and maps should have been suppressed?—Well, Mr. Selwyn likes to put his own name on every piece of

paper. At the Philadelphia Exhibition he pasted a piece of paper over Sir William Logan's name on the map exhibited by the Survey.

Q. I would infer that it was jealousy of his great predecessor?—It would appear to be so; at any rate, the officers of the Survey are strongly of opinion that it is only fair and just that this map should be published. By all means let us have the benefit of what we have done, and if any fault is to be found with it, Mr. Selwyn would then have an opportunity of expressing his views upon the subject. I might say, with regard to the map, that Dr. Selwyn has reduced the number of the lines, and claims he has simplified the map; but he has not simplified it, in my opinion, any more than he would simplify a fine portrait by whitewashing it. But, I suppose, he thought it would give him an excuse to put his own name on the map, instead of that of Sir William Logan, and it is thus published by two publishers—Dawson Bros., in Montreal, and Walker & Miles, of Toronto. These maps show nothing but the divisions and sub-divisions of the land into the townships, seigniories and lots.

Q. Then he has taken credit for the work of the Crown Lands Department?—The map is simply a topographical map. I see it says it is the work of the Geological corps, which is not true.

Q. So that he exhibits the map as being the work of the Geological Survey, while it is, in reality, the work of other Departments?—Yes, the work of the Crown Lands Department.

Q. Did not the Geological Survey contribute part of the expense of the re-examination of the Eastern Townships by Sir William Logan?—Yes; Mr. Webster was paid by the Department, and acted as Sir William's assistant.

Q. So that the Survey had a pecuniary interest in the work?—Yes, Sir William Logan intended it as part of the report.

By Mr. Baker :

Q. Amongst scientific men, what is the usual name for an act of misrepresentation by putting your name to other persons' documents?—I think it is called literary piracy. If the same disposition to give credit to everybody, which was exhibited by Sir William Logan, prevailed, there would be more encouragement to members of the staff to do their work efficiently. With reference to a former question, I may say, that my own reports on the Eastern Townships, and those of Messrs. Webster, Richardson, Ord, Weston, Brow and others, have all been suppressed.

Q. Have any of the reports of Dr. Dawson on British Columbia ever been suppressed or curtailed?—No. I may mention that I have been asked to get my reports into a dozen pages, and certainly not to exceed twenty.

Q. Simply to put you in the back ground I suppose, or on the score of economy?—To put me in the back ground, I believe; I was told that the cost of printing was too great to allow of their being published at length. I may say that Dr. Dawson presented a report of 239 pages, representing two and a-half months' work, mostly on Indians, and illustrated by fourteen plates and thirty-six figures, principally Indian gim-cracks, and the report itself was a disquisition on Indian dolls, potlatches, Indian dances, &c., which were not necessary. I admit that this may be valuable information, but it is inappropriate for publication in the report of a Geological Survey.

HOUSE OF COMMONS, 19th March, 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the Chair.

ROBERT BELL, Esq., C.E., M.D., LL.D., Assistant Director of the Geological and Natural History Survey of Canada, was again called and examined.

By the Chairman :

Q. Do you mean that those reports which have been entirely ignored have been embodied in the report of the Director without any reference as to who did the work?—They have not been printed at all.

Q. Was there no reference made to them?—Scarcely any; the work may have been alluded to, in the small report published by Mr. Selwyn, the reports themselves not being printed at all. One of Mr. Webster's suppressed reports was largely devoted to the Chaudière gold fields. In speaking of the mines, I might say that Sir William Logan devoted a great deal of attention to the Chaudière gold fields and purchased specimens of the gold to illustrate the subject, at his own expense. He bought some £500 worth of gold, which he kept for some twenty years for the benefit of the public, to show the style of the gold and the abundance in which it had been found.

Q. Did he leave it with the Museum after his resignation?—No; his executors sold it as not authorized to be given to the Museum. I mention this, as the subject of these gold fields came up yesterday, and I forgot to mention it in speaking of the great attention which Sir William Logan paid to mines.

Q. You have referred to the suppression of the report made by Sir William Logan upon the mining regions of the Eastern Townships. I would like all the information on that subject which is possible. I know there is a great deal of enquiry about these reports in that section of the country; it is known that Sir William spent some time after he resigned his connection with the Survey working in the Eastern Townships and he was aided by an officer of the Survey, showing that the Survey intended to be interested in that work, and yet there has never been anything to show for those years of labor?—I think I mentioned yesterday that it took the form of maps rather than reports. I am aware that Sir William Logan maintained his views to the end, and that he worked as long as he was able to. Mr. Webster assisted him both at his own house and in the field. Dr. Selwyn says that at the last moment Sir William Logan told him that he had no faith in his map and did not wish to have it published, but this is at direct variance with what he told everybody else. I do not know why he should have made such a request, because he spoke to everybody freely about his views.

Q. There is no printed evidence of Sir William Logan having been dissatisfied or having at all doubted his conclusions as to his geology of the Eastern Townships?—None, whatever. Dr. Selwyn was strongly of the same opinion as Sir William Logan up to the time of the latter's death, and disputed Dr. Hunt's views. After Sir William's death, he wrote to Dr. Hunt that he would have no objection to be converted, but he would have first to go to the field to have the foundation for his change of views, which he did the next summer.

Q. His views were completely changed?—They were as completely changed as he had anticipated they would be.

Q. I understand that he adopted the view of Dr. Hunt, in contradiction to that of Sir William Logan?—Yes; he opposed everything that Sir William Logan had said and done, and adopted those of Dr. Hunt; there was nothing new, therefore, in his views, but he simply adopted Dr. Hunt's views as being correct. This was with regard to the age of one of the divisions of the Quebec group; Sir William Logan considered certain rocks to be altered Quebec group, which Dr. Hunt said were older; that is, Dr. Hunt was of the opinion that the portion of the altered Quebec group was of an older geological date, but Sir William Logan thought it was an altered portion of the same formation.

By Mr. Wood:

Q. Are there no printed records, in any of the reports of the Survey, with reference to these different views?—Yes; there is abundant evidence on these points.

Q. Can you refer to the reports where we can find them?—Yes. Dr. Hunt's views were first given at the American Association for the Advancement of Science, at Springfield, Illinois, and the question has been very much debated by geologists since, and there are numerous essays printed, and papers have been read before Societies on the subject.

By the Chairman:

Q. Is there any reference, in the published report, to this work which Sir William Logan was doing during the last years of his life, and to the fact that he did

prepare a map?—I do not remember anything at all satisfactory and giving an honest account of the true state of that matter.

Q. Is there any reference to it, at all, since Sir William's death?—Yes; there is some slight reference in the report of the second year succeeding his death.

By Mr. Dawson:

Q. I think Dr. Selwyn refers to his views, with a view of combatting them?—Yes; and he has written several papers on the same question; the last one was published in the transactions of the Royal Society of Canada, having been read at the meeting in 1882.

Q. In effect to depreciate the work of his predecessor and advance his own?—He states, as a reason for showing why he should be taken as an authority on this subject, in preference to Sir William Logan, as follows:—"As I already stated, I commenced to investigate the structure of the Quebec group. I did so with the thirty-one years' experience in stratigraphical geology, chiefly among the ancient formations in Europe, Australia and America, and an amount of experience of palaeozoic and archaean geology, in time and space, which, probably, no other geologist on the continent could claim, Sir William Logan himself, not excepted."

Q. Sir William Logan continued to explore these rocks of the Quebec group for a long time after his connection with the Survey had ceased, did he not?—Yes; working in the Eastern Townships, and also in the States of Vermont and New Hampshire, and, I think, in Massachusetts, Connecticut and Maine.

Q. And these views have not been published, although quite accessible?—No; they may not have been prepared in proper shape for publication, but I think his views could be found on record and should be published.

Q. Dr. Selwyn, I believe, has published some of Sir William Logan's maps and taken credit for the whole work?—He has had copies colored and hung up about the office, but I think he hesitates to publish it. Sir William's geological map was quite complete and the lines were actually engraved on copper plate, and Sir William had colored a copy or two with his own hand. Sir William Logan's name was on the title of this map, which was dated 1868.

Q. Is that map printed and circulated?—The copper plates are in the hands of Stanford, the map engraver, of London.

By Mr. Wood:

Q. Could they not be brought here?—Yes; they might be sent for.

By the Chariman:

Q. There has never been any publicity given to that map?—No.

By Mr. Wood:

Q. Could we get all those reports of yours which were referred to yesterday, and which you say were suppressed?—My own reports have seldom been suppressed, but I have been instructed to make them short. The reports of several other gentlemen have, however, been suppressed. Mr. Fletcher's reports have been held back, and also those of Messrs. Webster, Ord, Weston, Vennor, Brown, Broad, Richardson, Dr. Honeyman, &c. I think the report of Mr. Fletcher, on Cape Breton of 1881, has been suppressed. Sometimes the title is a little misleading; for instance, my report for 1880 is represented as being for 1879-80, although my previous report was for 1879.

By Mr. Dawson:

Q. I see that we had a gentleman before the Hudson's Bay Committee yesterday who had been stationed there in the service of the Hudson's Bay Company within the last few years, and he said that the only really accurate map which we had of the country about the Moose River was the one published by Prof. Bell, in his report; that it was really a very good map and very accurate, so far as he could judge. Now, Dr. Selwyn criticizes the accuracy of Dr. Bell's map, giving as a reason for doing so, that he had received a letter from Dr. Rae who lived there some forty years ago, and Rae, in his letter, says:

"There are, or were in my day, two islands to the north-west of 'Inner Ship Hole' called the Ship Sands, and these islands were separated from the north-west

shore of the river by a deep and swift stream, which occupied about twenty minutes to paddle across in a canoe. Spring tides, aided by a gale, sometimes covered these islands with several feet of water. If the Moose River is as your map shows it to be, the islands where we camped must have been well inland, off the main shore of the left bank."

On November 20th, 1883, Dr. Rae again says:

"In reply to your enquiry, I must say that it is possible by some convulsion of nature, that the north branch of the river may have ceased to exist, but in the usual course of things such an event was not at all likely. You may make this north branch even wider than I showed it in the rough sketch I sent you, unless the Ship Sands have greatly increased in width."

Dr. Selwyn then says:—"In the map now published it will be observed that there is no north branch, and that the main shore of the left bank comes close out to the 'Inner Ship Hole' and includes the islands mentioned by Dr. Rae," and then adds, "It may be, however, that Dr. Rae's recollection of it, as it was forty years ago, and Dr. Bell's map of it, as it is now, are both correct."

Now, Dr. Selwyn qualified what he said by saying that, and Dr. Bell could probably give us some information about the manner of his surveys there. As I said before, this gentleman (Dr. Haydon) from Moose Factory, found his map the most accurate he had seen?—You might suppose that Dr. Rae had sent him these letters, unasked, but, on the contrary, he was asked to give these letters, and Dr. Selwyn immediately seized the opportunity to make that statement of inaccuracy against me. When he is ready to admit that my map was accurate, it was unnecessary to say it was inaccurate. It was not done in the public interest. Mr. Dawson has requested me to give the history of it. The survey was made in the autumn of 1877, on my return from a long, successful and arduous expedition up the East-main coast. I was not called upon to make the survey at all, and it had no reference to the work of the season. Whilst my canoe was being prepared for the journey to Michipicoten I occupied my time in making this survey; I wished to do so, because it would utilize every hour of my time, as there was a good deal of expense attending the expeditions to these distant parts, and I expected that it might be useful in some way hereafter. It had no geological significance whatever. This map, I may say, remained in the office unnoticed for years and years, and it had been traced by anyone who wished to copy it; any of our maps might be had in the same way. In the autumn of 1882, Dr. Rae, who is a very old man, and who appears to be foolishly jealous of anyone who has anything to say in regard to arctic matters generally and in regard to Hudson's Bay in particular—he has been there, I may say, and therefore no one else has a right to speak of the subject—and as I presumed to say something upon it, he thought fit to put me down, in a lecture given in Winnipeg, in the autumn of 1882, and stated that this map was inaccurate. He stated in regard to the channel referred to in Dr. Selwyn's note, that it was two miles wide and very deep; this was published in his letter to the *Canadian Gazette* of London, of the 3rd May, 1883, but he has now reduced it to one mile. Dr. Selwyn's first duty was to ascertain whether the map was correct or not, but he would stop at nothing to injure me, so long as he kept within the law. Dr. Selwyn wrote to Dr. Rae for particulars about this map; he was aware of the existence of it for years, but he came to me one day, after having made a note of what Dr. Rae said, and asked to look at the map, and then suggested that it should be published. I said that it had no connection whatever with the report, and we had no excuse for dragging it into the next report. The map, however, was produced, and Dr. Selwyn had it reduced to half the scale. The original title of the map was "Plan of the Moose River, in the neighbourhood of Moose Factory, surveyed by Robt. Bell." Dr. Selwyn changed the title to "Plan of Moose River, from the neighbourhood of Moose Factory to James Bay." He could not see the necessity of changing the last line, thus making the map appear as a plan of James Bay, that not having been from actual survey like the rest. Great expedition was shown in engraving this map, and some 5,000 copies were struck off and piled up in the office, where they waited for many months until the rest of the report was ready. I had

been away all summer, and on my return Dr. Selwyn told me of his proposal to make a note about the inaccuracy of the map. I said it was his duty to find out whether it was correct or not, and not to accept the statement of a jealous old man like Dr. Rae, who was between 80 and 90 years of age, and could only speak from recollection for upwards of 40 years. I told him that my survey was certainly a good survey for the time spent upon it, and if there was a slight error he might suppress it, or if he thought that I had made a slight geographical mistake, it would be far better for him to accept my proof, if he wished to say anything about it. I wrote to two gentlemen who were quite well acquainted with the neighbourhood in question. One of them was Mr. E. B. Borron, a Stipendiary Magistrate, who had lived at Moose Factory for some years. Mr. Borron writes back to me, in a letter dated Collingwood, 20th December, 1883, as follows:—"As regards your map it has always been a surprise to me how carefully and accurately you have made your surveys and maps, considering the short time that it is possible for you to devote personally to that work. I never supposed that it was any part of your duty or that of any other geologist on the staff of the Geological Survey to make surveys and charts of such minute accuracy as would enable a ship to enter Moose River and drop anchor in the 'Inner Ship Hole.'" Further on he says: "There is no channel any further west than that you have laid down, that I know anything of," and still further: "Parson should know about the island, as well as any man, having been in the habit of sailing about in his Rob Roy canoe." I wrote to Mr. Parson, who was chief factor of the Hudson's Bay Company in charge of Moose Factory while I was there, he having been there some years before and also afterwards, and was quite competent to judge of its accuracy. He is now in charge of the Hudson's Bay house in Montreal. He returned the map, saying it was all right, and I asked him to write again, with particular reference to the point in question, to which he replied, under date of Montreal, 7th November, 1883, "I did not make any alteration or suggestion about the geographical features of your map, because I did not see any to make." Then I wrote to him again, asking him to find fault with it if he could, saying that I was much concerned about this charge of general inaccuracy, because it was calculated to do as much harm to a surveyor as it would be to a business man if he was called a thief, and if I could not disprove that statement I would be condemned as a surveyor. I was therefore anxious to show that even in this slight matter I was not inaccurate, and although it was a voluntary piece of work, which I need not have done at all. I had just crossed the sea from Fort George, 350 miles, sailing night and day in disagreeable weather, a voyage which had never been attempted before in a small open boat. I was entitled to a little rest, but immediately on my arrival I went to work. This last letter from Mr. Parson, which is dated Montreal, 11th March, 1884, reads as follows: "In reply to your letter in regard to your survey of the neighborhood of Moose Factory and the topographical features of that locality, as represented on the map in the last report of the Geological Survey, I beg to say that I was in charge of Moose Factory when you made the survey in the autumn of 1877. Having accompanied you during part of the time you were engaged in this work, I am aware that you made use of certain surveying instruments, stopping at numerous stations to do so, and taking great pains to make your observations. Your map gives a better idea of the mouth of Moose River and the neighborhood of Moose Factory than any other I have seen. I may add that I have also found your map of the route from Moose Factory to Michipicoten accurate, both as to distances and courses on the rivers and lakes, and also in regard to details as to rapids, portages, &c., &c., and have heard several people remark how useful they found it on their journeys." I also asked Dr. Haydon about it; he was physician and surgeon to the Hudson's Bay Company at Moose Factory for five years. He returned from Moose Factory and was up there until last autumn, going home by the last ship in October of last year, and of course while at Moose he had leisure to explore the neighborhood for miles around. He writes, on the subject, as follows:--

"OTTAWA, 17th March, 1884.

DEAR SIR,—Having seen in the papers that the accuracy of your map of the mouth of Moose River has been doubted, I take this opportunity of letting you know that it seems to me to be perfectly correct, and after a residence of five years at Moose Factory, I should have some right to judge.

"I am, Sir, yours truly,

"WALTON HAYDON, F.R.G.S."

I may also mention that Dr. Selwyn sent a man secretly up to the late Mr. Nason's friends, at Weston, to compare my map with any map which he might have left of his surveys in the neighborhood of Moose Factory. I happen to know that Mr. Nason's map confirms the accuracy of my own, and it was so reported to Dr. Selwyn, who has never seen fit to mention this circumstance to me, and probably does not know that I am aware of it.

Q. And has not given publicity to the information he has received?—No. I asked him to publish the letters of Mr. Borron and Mr. Parson, along with his statement of inaccuracy, but he pushed them away from him, and they would have gone into the scrap basket if I had not saved them. You can infer from these circumstances how far he desired to act fairly in this matter. At the second meeting of this Committee, the newspaper reports stated that Dr. Selwyn had said that I was very inaccurate and unreliable. I asked him the next morning if these reports conveyed a correct idea of what he had said, and he admitted they did, whereupon I immediately went into my room and wrote him the following letter:—

"GEOLOGICAL SURVEY OFFICE, "OTTAWA, 8th March, 1884.

"Alfred R. C. Selwyn, &c., &c., Director Geological Survey :

"SIR,—Having admitted to me this morning that you yesterday charged me before the Committee of the House of Commons on the Geological Survey, with inaccuracy in my reports and maps, I would now ask you, as I have the right to do, to point out in writing, specifically, where, from your own knowledge such inaccuracy is to be found.

"I have the honor to be, Sir, "Your obedient servant,

"ROBERT BELL."

Dr Selwyn also stated that he had mentioned the matter to the Minister. I told him that I had made surveys for twenty-five years, averaging probably 1,000 to 3,000 a year, amounting, in all, to 40,000 or 50,000 miles. Dr. Selwyn, in the letter which he wrote in reply to my note, said : "Sir,—In acknowledging your letter dated 7th March, which you have just handed me, I have to inform you, in reply, that the first sentence in it is wholly untrue. I never admitted having charged you with inaccuracy in your reports or maps, nor indeed have I ever done so. I have always treated your reports as accurate and reliable."

By Mr. Dawson :

Q. With reference to the report which was published for 1880-81-82, the result of three years' work, do you not think a larger issue could have been struck off of this volume?—Yes.

Q. We were informed that only 4,000 were struck off, and were only for sale in Montreal and Ottawa?—Yes; I believe that is the case.

Q. Should not the people of the several Provinces have an opportunity of becoming possessed of this valuable work?—Yes; I think a report which costs no more than that, if it is of any value to the country, should be distributed more largely. The great difficulty in getting them is that you have to buy them. Of course, having travelled a good deal in the various parts of the country, I am asked for these reports. On one occasion a gentleman asked me for a report, and I told Dr. Selwyn that this gentleman wanted to have a copy of my report, at the same time showing him a letter which the gentleman had written to me. Dr. Selwyn's reply was, that he could

not have it, and that he should write to him, as Director, for the report. The result was, as I am only allowed six copies of the report, that I had to buy one at \$2.50 and send it to him, which I think I should not be called upon to do, out of my slender salary.

Q. Do you not think some evil may arise when officers of the Survey go about and make hasty reports on mines, their opinions being sure to carry weight, on account of their high position, and are these reports not calculated to do a great deal of harm?—Yes; most certainly. A man who occupies a responsible position, and whose work is taken as an authority, should be exceedingly cautious about making his statements.

Q. We had a mining company established at Michipicoten Island, on Lake Superior, and they had laid out about \$250,000, but the Director of the Survey happened to go up there, and he said there was nothing in the appearance of the mine to justify the extensive buildings which had been put up, the machinery which had been put in, etc., and the effect of this was to destroy their credit in England, so that they could not get the necessary capital. They had practical men there, too, quite as likely to be able to speak of the quality of the ore as the members of the Geological Survey?—I am aware that Dr. Selwyn so reported in the summer of 1882, in regard to copper. I had also heard him say that he did not believe that there were any silver deposits in the neighborhood of Thunder Bay, with the exception of Silver Islet, which appeared to be worked out.

Q. Sir William Logan, in reporting upon the rocks of the Lake Superior region, described two groups of rocks, one the lower copper-bearing series and the other the upper copper-bearing series, did he not?—Yes.

Q. Now, in the reports which are published, I see that these rocks, the upper copper-bearing series, are sneeringly referred to by Dr. Selwyn as the so-called upper copper-bearing rocks?—Yes.

Q. I should fancy that Sir William Logan had paid a good deal of attention to the question before he gave out his opinion upon it, and I think he should be treated with a certain amount of respect?—Their place in the geological scale has not been determined yet, and at that time Sir William labored under great disadvantages, not having anything to compare them with.

Q. They have found no better name for them since?—None; we call them sometimes the Nipigon series for short, and to save repeating such a long name as the upper and lower divisions of the upper copper-bearing rocks.

Q. With regard to the coal of the North-West, according to the old theories of geologists and according to all the works published on geology, it was supposed that true coal belonged to the carboniferous period, and that it was immediately over the Devonian series?—Yes.

Q. This coal was of an entirely different series, in a horizon much higher than the carboniferous period?—Yes. The name carboniferous was given to this system of rocks, because it was pre-eminently a coal-bearing one, and notwithstanding that true coal is found in newer rocks, it is not generally found in any but the carboniferous; in fact, true coal in any formation but the carboniferous is somewhat exceptional.

Q. Until the discoveries in the North-West?—With regard to the coal of the North-West, most of it is not true bituminous coal. The border line between coal and lignite is not sharply defined.

Q. Is the Nanaimo coal lignite?—It approaches nearer to the true coal, although not quite identical. It may be more properly called true coal than lignite.

Q. According to the theory of geologists, formerly, true coal was not known to exist except in the carboniferous period?—Scarcely that; it was stated by geologists that true coal seldom existed elsewhere than in the carboniferous period, but the majority of coals newer than the carboniferous were of the nature of lignite.

By Mr. Holton:

Q. In your examination yesterday, you mentioned the names of several members of the staff who were discharged. I would now like you to state to the Committee

why it was that they were discharged?—The first on the list is Dr. Hunt, but as he is to be here himself, I will say nothing about him. Mr. Richardson was spoken of as having left the Survey; he was superannuated, but I think he would have been quite willing to remain, if matters had been a little more pleasant. Of course, in giving the reasons, I simply state my own recollection and what I have heard the gentlemen themselves say. Well, Mr. Richardson's willingness to leave, was the disagreeable treatment to which he had been subjected during the greater part of Dr. Selwyn's administration. He found that his own work, and also that of his great benefactor, was not only depreciated but sneered at, and he naturally did not like that. His reports were suppressed, the reason for it being, as Dr. Selwyn says, that they were unfit for publication, unless he had time to take the trouble of revising them. Sir William Logan, however, in his report of the geology of Canada, speaks of Mr. Richardson's reports as being really very valuable. Mr. Richardson did not pretend to be a man of great literary attainments, but still he could write a very good report. Sir William says: "He requires aid in working up his materials in a report." Sir William always helped him with these reports, and they were published. Dr. Selwyn says it takes too much of his time to revise these reports, but Sir William took the pains to supervise them, and Mr. Richardson's reports were accordingly published. Mr. Richardson prepared a pamphlet, setting forth his wrongs. Mr. Webster's reports were also suppressed, although it was admitted he had done a great deal of excellent work.

Q. He was discharged from the Survey, I understand?—Not exactly; he was allowed to resign. Matters were made so disagreeable for him that he got leave of absence for some months, and during this leave of absence a general wish was expressed that he would come back, but he said that so long as Dr. Selwyn remained, if other means of living failed, he would not come back if he had a cartridge left to shoot himself with. Mr. Ord left, but as he is going to be before the Committee, he can give his own reasons. Mr. Broad was one of the best men the Survey ever had, but he received no assistance; he was, of course, at first a beginner, but a very promising young man. He, however, received no assistance from Dr. Selwyn to perfect him in his profession. His work was admittedly good, but, still after six years of hard labor, Dr. Selwyn knew scarcely anything of what he had done. Mr. Brown left because faith was not kept with him; he came here under certain promises as to pay and position, but shortly after his arrival a new man was placed over his head. He did very good service, but was not allowed to report, his work being scarcely mentioned. Mr. Brown left quietly, and was half way across the Atlantic Ocean before Dr. Selwyn knew he was gone. Mr. Vennor appears to have left because he had no prospect of getting on under Dr. Selwyn, and as his pay was small, he thought it would be better to leave. The Survey was about to remove from Montreal to Ottawa, and as his friends were in Montreal, and he saw no prospect of bettering himself on the Survey, he left. Dr. Spencer got no encouragement in pay, or prospect of promotion which he might earn, and was treated with no consideration at all, being continually nagged at, and so he left. He published the work which he did in Canada at his own expense, and it was afterwards published in connection with the Geological Survey of Pennsylvania, and also by the American Philosophical Society, and by the American Association for the Advancement of Science. Mr. Charles Molson, the gold medallist I spoke of, left on account of broken faith; he had no confidence in Dr. Selwyn, and did not approve of the rule or understanding at that time that every man who should not happen to be a gold medallist, or something of that kind, should not get promotion, and he did not think it fair that he should be promoted before other members of the staff without medals.

Q. Mr. Molson, you say, was a very clever and hard-working, pushing man?—Yes; he is occupied in mining.

Q. Is he still pursuing it?—Yes; in Colorado. Mr. Foord left because he got little credit for his labours, and his scientific productions, although published at the expense of the Survey, were represented in the introduction as not having the authority of the Survey. Dr. Harrington left, and although he did not say much

about his reasons, it was well known that he did not like the Director; his leaving had nothing to do with the removal of the Survey to Ottawa, as he left a considerable time before that took place. Mr. Alexander MacKenzie left because he had no confidence in the Director; he was denied any credit for the length of time he had served, and then, he was a mining man, and was not considered to be required on the Geological Survey. Mr. Robb's position was made very unpleasant for him; he was also very much nagged at; he had no confidence in the Director, and being a mining man, was not wanted. Mr. Grignard left because promises made to him had been broken, I believe principally with regard to his pay; when he left, he stated that the Director was no gentleman at all, and he would not stay with him. Mr. Matthew's reports, I believe, were not considered satisfactory; he could only give his vacation to the work, but there is no reason, that I know of, why he should not have continued to give it, the same as in the past. Prof. Bailey left, or was not asked to continue his work, on account of some disagreement with the Director, who did not consider him competent in some important particulars. He has been employed again during the past year, to go over Mr. Broad's work. Mr. Tyrrell was only temporarily left off the list of the Survey, owing to some misunderstanding on the part of Dr Selwyn, but his name was restored to the list. Mr. Scott Barlow once offered his resignation on account of broken promises and unpleasantness, but the matter was afterwards remedied, which admitted of his staying. Mr. Robert Barlow was superannuated, but would have stayed, I believe, willingly, had his skill been appreciated. He did not enjoy a very pleasant life in connection with his official position, and he could get no adequate increase in his pay, receiving about \$50 as an increase, after some fifteen or twenty years' service. He was superannuated, but left dissatisfied. Mr. Coste is another whose leaving arose from broken promises; he was summarily suspended one day by the Director, and asked to write a letter of resignation, which he did, setting forth his reasons. He appears to have been employed without any understanding as to what his work would be, but was promised a definite salary, which he has never received. At the time he was induced to resign, he had no prospect of his qualifications as mining engineer being required, so that he might receive the position which he considered he was entitled to. Dr. Selwyn told him repeatedly that we had nothing to do with mines, and he was employed as junior draughtsman, his pay not being what his talents deserved. He was, however, taken back again. I might mention that some of these resignations took place before the staff of the Survey was properly on the Civil Service list, and it may be denied that these were members of the staff, but that is a very trivial technicality, as none of us were on the Civil Service list until a few years ago.

Q. What, in your opinion, are the scientific attainments which should be possessed by the Director of such a Survey as ours, in order to qualify him for the proper discharge of his duties?—I think the qualifications should be of a two-fold nature, professional and personal. With regard to the professional training, I should say, in these enlightened times, when educated men are abundant, that the Director should be a well educated man, especially in all departments of natural science, these being subservient to geology. Of course, geology requires a knowledge of some of them more than others. He should be a naturalist to some extent, a botanist, a palæontologist, and he should be a good chemist and mineralogist, and also have knowledge of physics or natural philosophy. In a Survey such as ours, where there is so much pioneering work to be directed, he should have a knowledge of surveying, of mapping, and the use of instruments, some knowledge of astronomy being involved in all this. Personally, he should be a man of good common sense and gentlemanly bearing, with a good temper and disposition; and he should be industrious, giving all his time for the benefit of the Survey; in fact, to have all the ordinary qualifications necessary to deal with men and business matters.

Q. In your opinion, is the present Director possessed of all these qualifications?—I should hesitate very much to answer that question. I might be supposed to be actuated by feelings of retaliation, perhaps, for the events which have transpired about the question of my inaccuracy, but I am not at all vindictive or hot tempered,

and I should not be influenced very much about that particular circumstance. I think, however, from what I have said, you may infer that I have no very high opinion of the Director, with regard to either his professional or personal qualifications. I have had a good deal of intercourse with him, both in the field and in the office, and I have been subjected to a good deal of persecution.

Q. What are supposed to be the special work and duties of the Director?—He is supposed to superintend the work of all the officers of the Survey; to know what every man is doing, and to be able to guide, advise and assist him. These officers include not only the field geologists, but topographers, draughtsmen, chemists, mineralogists, paleontologists, and botanist and field naturalist. Prof. Macoun was understood to have the latter title, but it appears to have been taken away from him.

Q. Does the Director devote the whole of his time to the work of the Survey?—Well he attends the office pretty regularly, but I do not know what he is doing. He does not seem to know what the men are doing, or to know them even personally. He does not know some of those who have been there many years, when he meets them.

Q. Does he spend most of his time in Ottawa?—More than half of the whole year, I suppose, is spent in the office. He accompanied me once in the field, going with me from Lake Superior to the Red River; I think it was a great waste of time, as it was scarcely necessary for two officers of the Survey to try to do the same thing. His company was also excessively disagreeable, I might say intensely so. It kept my assistants and men always in hot water; some of them wanted to go back, and some of them did leave; but we came to an understanding with the others. My men did not understand his position, and his right to give contradictory orders; they were supposed to only obey the orders of the man who employed them and paid them. The trouble was his foolish interference with little affairs of the camp, and his nagging at the assistants and men. He did no geological work, that I am aware of. When he came home, he would not allow me to know what he was reporting on; he had the advantage of me, as he could know what I was doing. His report stated, that on his expedition to Red River, he was accompanied part of the way by Mr. Bell, and then went on to make some stupid remarks on my geological report.

By the Chairman:

Q. Is that report published?—Yes.

Q. Are his remarks on your report also published?—Yes.

Q. Which report is it?—It is the report for 1872.

By Mr Holton.

Q. Is it within your knowledge, that members of the staff undertake outside work, for private parties, receiving remuneration therefor?—Not that I am aware of. For my own part, I know that Sir William Logan, at the very first, instructed all the officers to avoid any outside work, and especially in regard to mines. Of course, they might be allowed to invest their money if they had any in any way they liked, but, it was understood, that they were to have nothing to do with mines, except in their official capacity, and, as far as I know, I believe they adhered to that rule; I did, except, during a short period that I was entirely disconnected with the Survey, and when I returned, Sir William made the stipulation, that I should never have anything to do with any mining property. I undertook to make such an engagement, and I have kept it up to this moment.

Q. I do not refer to that so much as to members of the staff being employed by private parties to report on mines, for instance, and receive remuneration for it. Is there no regulation prohibiting it?—I am not aware of any direct regulation, but I should think it should be forbidden, and should not be done.

Q. You cannot say whether it is done or not?—I am not aware of any instance just now. There have been rumors, of course, of parties having a certain interest in performing this sort of work, but I have no personal knowledge of it.

Q. Is it part of the work of the Survey, as at present conducted, to preserve records of the mineral resources of the country, or of the mining development of the country, or statistics of any kind?—No such records are kept officially.

Q. What is your opinion of the value of mineral statistics? Could such be gathered, preserved and published, as is done by the United States Geological Survey, by the present staff, and without any great additional expense?—I consider that the collection of mining statistics and records of all sorts should form a very important part of the duties of the Geological Survey.

Q. You are acquainted, I presume, with the methods pursued by the United States Geological Survey, in connection with this?—Yes, and also with the methods pursued in Great Britain, both from published accounts and from personal interviews with the Keeper of the Records, Mr. Robert Hunt.

Q. Could such a work be undertaken by the staff of the Survey, as at present constituted, or would a heavy additional expense be necessary to obtain mining statistics?—They might be collected by the present staff, with very little, if any, additional expenditure. It might be an expenditure of time in a different way from what we spend it now, but with, perhaps, no additional expense. The present staff is quite competent to collect these statistics. We have, of course, a number of men better qualified in regard to mines than others. We have one mining engineer connected with the Survey and another lately left, and some of the field geologists have a special knowledge of mines as well. It has been part of Mr. Fletcher's duty to examine coal mines, and before he came to the Survey he had been engaged in mining; he was well acquainted with copper and gold mining. I have also some knowledge of mining.

Q. What is the present condition of the Museum? Is it as extensive or as rich in valuable specimens as it ought to be after forty-two years of labor and expenditure? Has its growth been in proportion to the increased annual expenditure upon the Survey?—The condition of the Museum is very good, as far as the labelling and general arrangement goes. As to its value, I think it is not as valuable a Museum as might be obtained by the same expenditure of money. It has not grown at all in proportion to the increased expenditure and the number of officers connected with the Survey. A large proportion of the valuable specimens have been distributed after having been shown at the large exhibitions, and those which are left do not equal those which have been taken away. We have had great collections made for International Exhibitions, which should have been retained. I quite agree with the plan of giving away cumbersome duplicates, but a large number of those which have been given away should have been retained. Very little is added annually to the Museum, and its intrinsic value is not very great, after such a length of time and such a large expenditure in connection with the Survey. You will understand that the formation of a Museum is not our principal object; it is incidental, but in some cases we might increase it much more rapidly than has been done.

Q. I understood that Sir William Logan bequeathed to the Survey books and instruments to the value of \$17,000. Have they been received by the Survey, and where are they now?—We have a few books and instruments, but not many, in the possession of the Survey. The instruments were valued by Mr. Ross, an instrument maker in Montreal, and those of any value to the Survey were bought, but not all.

Q. I understand they were bequeathed to the Survey?—No; Sir William, in his lifetime, allowed them to be used, but there was no bequest of any books or instruments that I know of.

Q. Is the Survey, on the whole, economically managed? Is there any sign of waste?—I think, upon the whole, the expenditure is about as economical as in Government Departments generally, that is to say, when a man is promised so much and gets it, you cannot give him less, and certain supplies have to be paid for, but in some respects I think there has been a waste of money.

Q. In what respect? To what do you refer?—One point which occurs to me is the boring operations, which have been carried on in the North-West Territories.

Q. When was that?—They commenced in 1873, and have been continued until two or three years ago, at intervals.

Q. Briefly, what are the circumstances?—Well, it was pretty well understood about that time (1873) that lignite or coal was to be found in the plain of the North-

West, among the clayey and marly sub-strata of the Cretaceous and Tertiary periods, and it was considered desirable to penetrate these, and find out where coal or lignite existed. It was first decided to make the borings with diamond drills; when I heard of this proposal I asked Dr. Selwyn not to adopt it, as diamond drills were not suited to that class of work. I had had some knowledge of them in boring petroleum wells. He was evidently struck by my arguments, and promised to refer the matter to a gentleman in town. I do not know whether he intended to be guided by the advice or not; at all events, he went to New York and bought a diamond drill, with steam engine and also horse-power, which were forwarded in great haste by express to Winnipeg, at so much a pound. It was found that they would not fit together, and the horse-power which had been sent up was found to be of no use; in fact, it was left, and I suppose remains to the present day just where it was unloaded from the steamboat, at the mouth of the Assiniboine River. The gentleman who was placed in charge of this boring seemed to have no knowledge of it; at any rate, with an unsuitable machine, and with no special knowledge of the work, the drilling was an expensive failure. These operations were continued by two parties the following year, and were again expensive failures. In 1875 another boring party was sent up, and was intended for the Battle River, but ended by boring a hole in the back yard of the enclosure of the Hudson's Bay Post at Fort Carlton, and finally there was some borings by contract, but not with the diamond drill, I think. Then there were some borings about the Souris country, two or three years ago, but although that was successful, as far as boring the holes were concerned, it resulted in nothing of any practical value. Four holes were bored, and in one case a seam of lignite was struck, but it was within a mile of the natural outcrop of the seam, and would be of no more value than boring through a pile of planks to ascertain the existence of a plank at the bottom, instead of looking at the edge.

Q. Can you estimate the loss to the country by these failures?—If the carrying out of these operations was supposed to be of any practical value, we have lost the benefit by their not being carried out, and then the direct loss of money was pretty serious. These operations were begun ten years ago, and we have no result yet, and if any result was desirable, we have lost the opportunity.

Q. Were these experiments, in your opinion, necessary?—Not necessary, but if they had been successfully carried out, they would have added valuable information about the geology of the country.

Q. What, in your opinion, is the present status of the Survey in the scientific world? Is it as high as formerly? If not, how do you account for its decline?—I scarcely think it is as high. Of course, we live on the traditions of the past, and our good name has not gone altogether I hope, but I believe the Survey has rather gone back. We have not retained the reputation which we certainly ought to have, in proportion to the expenditure. When I was last in England, in conversation with Prof. Huxley, for example, I found out that he did not know who the present Director was. The names of Logan, Billings and Hunt were household words, but he did not know who the present Director was.

Q. In your opinion, is the Survey at present accomplishing any practical good for the country? If not, why not?—I think it is. The value of our surveys, if the public can consider them accurate, alone, amounts to something. These topographical surveys are valuable, supposing no geological work had been done at all. If our own officers cry them down, I do not think they will be considered of much value hereafter. The geological work also, as far as it goes, is valuable. The general information we obtain in regard to the country, in the more distant expeditions, gives us an insight into the resources of these distant regions, which is always valuable to the men in charge of the country in planning our destinies, and also valuable to those who go in advance of the others to settle the country. The more minute work, such as that done by Messrs. Fletcher and Ells, the chemical and palæontological work done at headquarters, and the botanical work, are all valuable.

Q. Is it your opinion that the usefulness of the Survey could be increased, and if so, in what way?—I think its usefulness could be increased, by giving a more

practical character to the observations of the Survey; by having it devoted, mainly, to the mineral resources of the Dominion. I should also say, that an increase in the relative strength of the field officers, as compared with those in the house, would be advantageous. The field staff, I think, has increased little or nothing, during the last ten years. I should think that general explorations of our great unknown territories might be made, which would embrace a variety of subjects besides geology. Geology should be one of the primary points, but we should also get a knowledge of the topography, the soil, the timber, &c.; such information, for instance, as that procured by Prof. Macoun, before he joined the Survey. Another class of field operations should be more thorough geological work, in the old and more settled portions of the Dominion especially such as give promise of mineral wealth. I consider that a new Geology of Canada should be prepared similar, in its scope, to that prepared by Sir William Logan in 1863. I think more satisfactory information could be secured, by selecting men for positions on the staff, according to their qualifications and experience, because, in geology, the value of the information depends on the experience of the man who furnishes it. If the Geological Survey is also to be a Natural History Survey, it might be as well to have a qualified entomologist and ichthyologist. These would, perhaps, be most useful departments. We have a botanist, as you are no doubt aware. He is a master in the subject, and a very competent man in every way. Then, it is found impossible for one chemist and one palæontologist to do all the work of this vast country; and part of the work of these departments might be given out to specialists abroad. It is impossible for a palæontologist to change from one subject to another, and we could get quicker results, and probably others would have more confidence in them, if we were to give some of the work to specialists in these departments. The reports should also be published, as soon as ready, and these should be very widely circulated. Separate reports on the different subjects should also be distributed to those who require them; a man should not have to take a whole volume in order to get the subject he wants. Then a number of these should be bound together, in cloth covers, instead of paper, for presentation to the several public libraries, colleges and other similar institutions, in various parts of the country. One other improvement is this—as the troubles in the Survey have arisen from certain defects on the part of the Director, I think, some means of correcting them should be found. The Director of the Survey should be a man of some dignity, and one whose word could be relied upon by the subordinates, in all cases. I have found no difficulty in managing men myself, by simply making no promises but those I intended to fulfil, and fulfilling them to the letter. White men, such as geologists, are very easily dealt with indeed, my experience has been, among Indians and others that I have employed in the field, that by keeping my word they have been very amenable to discipline. Indians, as you are doubtless aware, are, perhaps, the most difficult to manage, in the field and out of it, and yet, out of the hundreds of Indians that I have employed, I do not know of one who would not be willing to go with me again. I have had one Indian with me for nine years in succession, and others for five or six years, and not by any particular favours either; I made them work hard and do their duty, but I kept my promises to them.

Q. Am I to assume that you would like to recommend the appointment of a more efficient Director?—I should very much prefer not to make a recommendation on that point. Of course, the Committee, after getting all the evidence, will be in as good a position as myself, and I think it would be unbecoming in me to make any recommendation on that head.

Q. I would like to ask you if, as a rule, competent men can be found in Canada and amongst the Canadians for the various positions on the staff of the Survey?—I should say pre-eminently more so in Canada than anywhere else could we find the proper men. I have a good reason for saying so. A Canadian who is employed even as a mapper or draughtsman is worth much more than a new-comer from a foreign country, as they have a clearer understanding of the geography of the country, and are more versatile than the ordinary class of immigrants that we get from the old country, mechanically, as well as in other respects. For my own part, I am not

ashamed of being a Canadian, and I think we have no reason to be ashamed of our record when coming into competition with other people. We have given an inspector of mines to the south of England—Mr. Frechville. We have given lessons in geology and in coal mining, in regard to tracing out coal districts, to English geologists, and Sir William Logan was a Canadian. Sir William mapped out the coal fields of Wales in a way that could not be improved upon by any Geological Survey. Mr. Billings was a Canadian, and he was considered a master in his subject, his opinions commanding the greatest respect as an original thinker, palæontologist and naturalist throughout the world; he taught many lessons to English people on these subjects.

Q. Is it your opinion that Canadians are less amenable to discipline than Englishmen?—Not at all. I have seen no case where they were not amenable to discipline; certainly, the gentlemen in the Geological Survey have not shown the slightest disposition to resist discipline, even those who are complained of, such as Mr. Fletcher and myself. I do not think the slightest want of discipline can be charged against us; neither Mr. Fletcher nor I have ever refused to go anywhere we have been ordered, nor offered the slightest insubordination, and this, in spite of a good deal of persecution. I believe the Director thinks any of the members of the staff have no more right to speak to him than the privates to the general in the army. I know, in my own case, when I have attempted to remonstrate with him, I have been told that he would not discuss matters with me.

Q. Are there not several scientific schools in Canada?—Yes; I might mention the School of Practical Science in connection with the University of Toronto, the Ecole Polytechnique, in Montreal, and the School of Applied Science in connection with McGill University. The Geological Survey itself should be a pretty good school for specialists in our own line. There is a School of Mines in connection with the Geological Survey of Great Britain, but what I have seen of the men who have come from it, I do not think are superior to the men produced in Canada. On an average, I have seen very few as competent men as we can turn out.

Q. It is your opinion then, that young men can be and are being sufficiently trained in these schools for scientific work?—Yes, I think so. The great ultimate training is entirely a matter of practice, but to give them the necessary training to start this work is well done in these schools in Canada.

Q. You are perhaps aware that during the past year or two there have been, from time to time, very severe reflections upon the Survey published in the press. Did you in any way inspire these articles, or are you in any way responsible for them?—I have neither written nor inspired any of them. I knew nothing about them, with the exception of one that came out in the *Mail*, and for which an officer of the Survey was suspended. I was not aware that such a letter was going to be written or had been written until it was published, and I did not know who wrote it until the author was made public.

Q. It is within my knowledge that these editorials or letters have been attributed to members of the staff, and I asked this question, as I shall do to others, to give them an opportunity of exonerating themselves?—For my own part, I have never written nor inspired any of them, either last year or this, and I am not aware of any one being inspired, except the one I referred to, and the gentleman who wrote it did not suppose that he was transgressing any rules; he was simply defending himself against statements which had been published concerning him and other geologists, and he thought he was doing his duty in informing the editor of the paper of his views upon the matter. That is the true state of affairs in regard to that case. But when he was told that he should not have done so, he bowed to the will of the Minister; he was severely reprimanded, and when he read near the end he trembled for his fate; he did not know whether he was to be hanged, exiled or imprisoned for life; and it ended by saying that the pleasure of the Minister was that he should be suspended for a fortnight. He was rather relieved that the sentence was no worse than that, although he thought it was severe enough. In connection with the question of my general accuracy, I merely submitted the opinions of certain gentlemen on the particular point that had been raised. I had intended, also, to submit a number

of testimonials, which I received from ten to twenty years ago, from the highest authorities, such as Sir William Logan, Prof. Chapman, of Toronto; Prof. Geikie, of the Geological Survey of Great Britain; Prof. Baird, of the Smithsonian Institution; Prof. Allan Nicholson, late of the Toronto University, and perhaps twenty others, all referring to the great care and general accuracy with which I was accustomed to make my reports.

By Mr. Baker:

Q. It has been stated in the evidence already given that the Survey is conducted under the Dominion Act of 1877. Is that so?—As far as I am aware, it is. It is the last Act in regard to the Survey constituting it the Geological and Natural History Survey of Canada, instead of the Geological Survey, as it formerly was.

Q. Previous to your going into the field to work in any of the Provinces, are you furnished with any specific instructions in writing by the Director?—For my own part I only remember receiving written instructions on two occasions. Sir William Logan never gave written instructions to me or to any other member of the Survey.

Q. Are written instructions given to other assistant Directors, or are they merely verbal?—I am not aware, but there may be. There are certain rules and instructions in regard to the method of keeping the note books and labelling specimens, which are standing rules. These have been submitted in writing; every officer going into the field gets a copy of the same rules.

Q. Would not much time be saved if topographical surveys were made, irrespective of the geological, and previous to the geological survey being made?—A rule which would apply to one country might not apply to another. We have to consider the special conditions, and no general rule will apply. I do not think, as a rule, that it would be practical to make topographical surveys independent of the geological, and if it were it would be cumbersome and expensive.

Q. Are the general outlines of the topographical maps made by the Department of Dominion Lands a good and sufficient guide for the purposes of a geological survey?—Where they are based on any kind of survey they may be so considered; we could improve them here and there, but any maps that exist of distant parts of the country that have not been surveyed are not sufficient for geological purposes.

Q. Would not much time be saved by the previous existence of maps that would be a sufficient guide?—Yes; much time would be saved, but it would, as a rule, cost more than it was worth, to send a topographical party ahead of the geological one, for that purpose. Well qualified men, such as many of those who have left the Survey, are capable of making surveys simultaneously, without any loss of time. For my own part, I have made the surveys, and done the geological work as quickly as two men separately would do it. When you arrive at a station, you may also take a few minutes for taking a topographical observation, sufficient for our purpose.

Q. Do you hold the opinion that Canadians know less about geographical matters than do the Irish, Scotch, English or American?—I think, as a rule, Canadians are better geographers, with regard to, not only their own country, but of other countries. The reason is, that maps are very common in this country; you see them hung up in railway stations, offices, hotels and most houses; in fact, everywhere; and we read in the papers of the geographical development of the country, and know more about the counties and natural divisions than most people.

Q. Then, you are of the opinion, that young Canadians are better adapted, provided they are properly trained, than those of any other country, for work on the Geological Survey?—Yes; infinitely better.

Q. If you had the exclusive right of selecting your assistants, you would select them from Canadians in preference?—Yes; but if I had the responsibility of performing a certain amount of work, I would not select a man solely because he was a Canadian, but I would give him the preference over a man of equal training; for people of other countries never give us any advantage over themselves, and I do not see why we should do so for them.

Q. You believe in Canada for the Canadians?—Yes.

Q. Do you think it would be advisable for the Director of the Geological Survey, be he who he may, to have absolute power in the selection of his staff?—Certainly not; that would be a dangerous power in any man's hands.

Q. Do you not think that political influence, or the mere fact of its being a branch of the Civil Service, is detrimental to the work and to the welfare of the Department?—Any interference might, or might not, be detrimental; but I think it is essential that the gentleman managing the Survey should be responsible to the people of the country, rather than to have an autocrat, who would discharge according to his likes and dislikes. A man should be promoted according to his skill and seniority.

Q. You are of opinion, then, that the position and status of the assistant directors should be properly defined?—Yes.

Q. And that promotion should be made according to seniority?—Not exclusively on that ground; but seniority should be considered, other things being equal. It should be no disqualification to a man that he has been a long time in office, if he is not lazy, or too old, or otherwise incapacitated. It is no encouragement to a man, after he has spent many years in the service, to have a young man put over his head. Even if the latter had some little advantage, I think that seniority should be an important factor in the promotion.

Q. In the event of any important geological question, is it the custom, or do you think it should be the custom, for the Director to summon his assistants to a conference, to hold a Board meeting, as it were?—I think such a step would be advisable.

Q. But that is not done?—For my own part, I have never been consulted in anything by the present Director.

Q. Not in regard to your assistants?—We are generally allowed the final decision. Sometimes I have taken men when urged to do so, and in all cases they have turned out very well, but Sir William Logan allowed us to choose our own assistants, as he held us responsible for the work done.

Q. You stated just now that an impression prevailed among the powers that be that the juniors had no more right to approach the Director directly than privates to approach a general in the army. Do you think it would be advisable, for instance, for the junior of your staff to make a complaint without sending it through you?—I think he should let me know what the complaint was, and then request me to forward it to the Director. I would not, however, be a stickler for rules; he might go directly to the Director, if he chose.

Q. Do you unhesitatingly assert that you have never aided, abetted, assisted or concocted any of those articles which have been published in the papers?—I wish to state emphatically that I have never had anything to do with them.

Q. There has been a good deal of talk about your map of 1877. I suppose those letters which you read are all of recent date?—Yes; the question never came up before. I believe the whole thing is a plot to injure me; I was not aware of it until I returned, and then I obtained the letters which I have read to the Committee. They are not eulogistic, but simply assertions that my map was correct.

Q. Do you claim that that map is a complete survey, or is it simply a running survey, or whatever you choose to term it, and do you hold that, in proportion to the time you devoted to it, it is as accurate as anybody, under similar circumstances, could make it?—It may not be absolutely correct, but many particulars might be added. It is as good a map as could be made by anyone in the same time, but it was merely an incidental piece of work, to utilize the spare time, and has no geological significance whatever. It never would have been missed if it had not been published. I requested that it should not be published, not that I had any doubt of its accuracy, but because it had no connection with the subject of the report, and was not a geological map, in any sense. It is merely published, I believe, as a target to be fired at, not in the public interest, but to do me injury.

Q. Is it geographically correct?—As far as it was possible to make it so, in the time devoted to it.

Q. Then it appears to me that an excessive amount of zeal on your part has dropped you into a hornet's nest?—I do not call it excessive zeal. It costs a good

deal to go to these distant parts of the country, and I think it my duty to devote every hour to the work of the Survey, in some shape or another. It is a small side issue, of no importance, and of the most insignificant, paltry, trifling, minute and microscopic character. I may mention that Dr. Selwyn was aware that I had averaged about 2,000 miles of surveying each year during the twenty-five years I had been on the Survey, or about 40,000 or 50,000 miles altogether, and I challenged him to put his finger on one single error.

Q. Is it part of the work of your profession to do the work of nautical surveying? This appears to be such a trigonometrical survey as I would send into the Admiralty?—It is a survey of the shores. Dr. Selwyn asked me to put the soundings on it also, but there are no two years in which the channel is in the same place, and I said that it would not be advisable to do that.

Q. I see here Bushy Island, Sawpit Island and Moose Island. Are the indentations in the trend of coast-line geographically correct?—Yes; on the whole, I think they could scarcely be improved.

Q. Have the terminal points in these sandbanks been determined by parallel lines of soundings, and by means of forward and back angles, taken to verify the possible extremities of the sandbanks?—In two or three days it would have been impossible to do so much work, in a distance of 15 miles.

Q. Then this was simply an incidental piece of work, and no part of your profession, really?—A very insignificant part of my work.

Q. If you were called upon, by the Director, to make a nautical survey of that particular locality, is it part of your profession to do so?—No; but I could use the never necessary instruments. I have been familiar with them all these years, but I have attempted to make such a survey. It is no part of my duty to make a nautical survey; a chart is one thing, and a geological survey another. This survey was only a slight addition to our knowledge of geography, and was better than any map which had preceded it.

Q. How many maps have preceded it?—Only one; that of Samuel Hearne, published in 1795. Dr. Selwyn triumphantly spread out the tracing of this map before me, supposing I had never seen it before, and said: "It is remarkable that this agrees with what Dr. Rae says." I replied, "It is not remarkable at all, but somewhat interesting, that it should do so. Dr. Rae has evidently forgotten all about the geography of this region, and has refreshed his memory by means of Hearne's map." This map shows the breadth of Moose River, at 12 miles above the Factory, to be 16 miles, while everybody knows that it is less than 1 mile. The course of the river above is also shown to be at right to that below, whereas it is all in the same general bearing.

Q. What is the rise and fall to the tide there?—About 10 feet, at spring tides.

Q. How many days did you say you were making the survey?—I suppose two or three days doing the whole thing.

By the Chairman :

Q. Is the time of the chemist entirely occupied?—Yes; very fully occupied; he is a very industrious man, and works, generally, from early in the morning until late at night.

Q. Would it be possible, in your opinion, to utilize the time and skill of the chemist, for the analysis of the different soils of the country, to ascertain their value, for agricultural purposes?—We would require more than one chemist, but we might send the soils to specialists, say in England. A complete analysis of the soils is not made now-a-days, it not being found necessary in order to determine their fertility, but only an approximate analysis, showing the proportion of organic matter, etc.

Q. You hardly think, then, that it would be in the public interest for the Geological Survey to superintend that?—It would be in the public interest.

By Mr. Baker :

Q. Do you not think that, putting the comparison between Canadians, and Englishmen, Irishmen, Scotchmen or Americans out of the question, there is a tendency in the rising generation to kick over the traces and not be subject to discipline

and not to recognize the difference between seniors and juniors?—As education increases, and people come to be governed more by reason than brute force, less of the so-called discipline is necessary.

Q. But deference to seniors is a different thing from what it used to be?—Now a-days we respect a man for his education and good character more than on account of his position in society. I think there is also a certain amount of respect due from superiors to inferiors, and when a man is nagged at, tyrannized over, and called a liar continually, it is hard for him to be amenable to that kind of discipline.

Q. For instance, suppose a young man in your party were to slap you on the shoulder and say, "Bell, old fellow?"—Such a thing would not be possible. I am not in the habit of allowing my assistants to suppose that they might take such liberties, and none of them would dream of doing so. My experience in the matter of discipline, both as to white men and Indians, has been easy. I have had no difficulty, whatever, with assistants, either white men or Indians.

Q. With proper tact and study of human nature, in keeping with times, a good deal of trouble might be avoided?—Yes; there need be no trouble at all.

By Mr. Wood:

Q. I think I understood you to say that you had been allowed to appoint your own subordinates?—Yes.

Q. And you had a better result than if they had been selected for you for field work?—Yes.

Q. With regard to the Director, you think the same rule should not apply?—I think if he were considered a fair man, and competent to make a good selection, that although it should not be absolute, he should have the authority to recommend, almost to the power of appointing, but the Government should have the power of vetoing any proposed action, if not in the public interest.

Q. If you had the right man, you think he should have this power?—Yes, of nominating his assistants.

By Mr. Baker:

Q. Is it not a fact that, politically many young fellows are placed on the staff irrespective of the Director, or assistant directors?—I think not; during Sir William Logan's time the worse recommendation a man could bring was that of a member of the Government or Parliament; it would destroy his chances, if anything would.

Q. But have not appointments been made irrespective of the Director?—I think not; perhaps a little political pressure has been used in one or two cases, but not generally.

Q. Has it increased, or is it tending in that direction?—Perhaps it is, but still it has not reached alarming proportions. I, myself have been obliged to refuse one request by a Minister of the Interior.

HOUSE OF COMMONS, OTTAWA, 19th March, 1884.

The Select Committee on Geological Surveys met this afternoon, Mr. HALL in the Chair.

Dr. T. STERRY HUNT, of Montreal, was called and examined.

By the Chairman:

Q. You were formerly connected with the Geological Survey of Canada?—I was, from 1847 to 1872.

Q. What were your previous studies and qualifications for geological work?—I had, from my boyhood, almost, been trained up for chemical and mineralogical work, and had been for two or three years a special student at New Haven under the late Prof. Silliman, and Prof. Dana.

Q. Your first connection with the Geological Survey was, of course, under Sir William Logan?—Yes.

Q. And continued under him until his resignation?—It was continuous from February, 1847, to June, 1872, when my resignation took effect. I resigned my position after the appointment of the present Director.

Q. You have since continued your devotions to chemical science, and to the study of geology and mineralogy?—I was for six years a Professor of Geology in the Institute of Technology at Boston, Mass., from 1872 to 1878, and I might say during this time and since I have been constantly employed in a private capacity in geological studies over most of the United States, east to west, and from north to south, and more or less in Great Britain and on the continent.

Q. What titles do you hold as a recognition of your devotion to science and your experience in them?—Perhaps the title I should first mention is that I am Fellow of the Royal Society of London, a rank which I have held for twenty-five years, and a Fellow of the Geological Societies in France, in Belgium, in Austria and in Ireland. I might say that I have also been President of the Institute of Mining Engineers of the United States, and also President of the Chemical Society of the United States. In 1881, avowedly in recognition of eminent services in geology, the University of Cambridge, in England, conferred on me the honorary degree of Doctor of Laws. I have received special recognition from the French Government, having been made an officer of the Legion of Honor, and last year I also received special recognition from the King of Italy, being made an officer of St. Mauritius and St. Lazarus, that was avowedly in recognition of my geological services. I am also a member of the National Academy of Science of the United States.

Q. Will you explain to the Committee what was your position in connection with the Geological Survey of Canada?—I was appointed chemist and mineralogist to the Geological Survey. It was considered that, as we had especially to deal with the mineral wealth of the country, a chemist and mineralogist was very necessary, and I was appointed to that position on the Survey. I might say that I had previously been appointed to that position in the State of Vermont, where a survey was then going on, but which I resigned to accept the position here.

Q. That was your position when you first connected yourself with the service. Did your position change relatively to the Survey or to the Director of it in time?—No, not nominally; I still retained the name of chemist and mineralogist, but with the growth of the Survey my salary was increased, and I had an assistant, and I occupied myself with a great many cognate questions, applying chemistry and mineralogy to the geological questions raised, and also doing a great deal of field work. I may say that during the last two or three years of Sir William Logan's administration, he was absent from the country a great deal, and practically the whole duty of directing the Survey devolved upon me. I had power of attorney to receive and pay all moneys for two years, and also organized all the parties and employed the assistants.

Q. What was your relative position, in so far as Sir William Logan himself was concerned? You might be considered as his chief assistant?—Yes; I may mention, as an index of it, that in 1867, on the organization of the Dominion, Sir William stated to me that the salary which I had been receiving for my services was too small, and that I must get an increase. "I would make your salary the same as my own," he said, "but there must be a distinction, and I will make it \$200 less than my own." I was really his assistant, and did a great part of the work.

Q. What were your salaries then?—\$2,800 and \$3,000. Sir William's was £750 sterling, and my own was £700 currency. It was not until I was leaving the Survey that I told the Minister that, as I was no longer interested in the matter, I would say to him that all the salaries were too small, and that I would recommend him to raise the salary of the Director to \$4,000 and the others in proportion. I have reason to believe that it was mainly on my recommendation that it was raised.

Q. In what year did Sir William Logan resign?—Sir William resigned, so far as I can remember, some time in 1869.

Q. Had the present Director any previous connection with the Survey, previous to Sir William's resignation?—None. He was brought out from England to take a position on the Survey, by Sir William himself.

Q. What had been his previous position?—He had been an assistant for several years on the Geological Survey in England, and was then sent out to Australia, where he had charge of a Survey in the Province of Victoria. That Survey was abolished in 1867 or 1868, as I am informed.

Q. Was he a man with a University education, and holding a University degree?—Not that I am aware of; I think I may safely say that he was not. He did not use an Academic degree, at any rate, and I think he is not a University man.

Q. When he was brought out here, at the time of Sir William Logan's resignation, did he hold any titles from the societies in Great Britain, in recognition of his services?—Not that I am aware of. I know he sought after the title of F.R.S., after coming here, and obtained it.

Q. Would you please state to the Committee, as fully as you choose, what were the functions of the Geological Survey, as you understood them, at that time?—When I came on the Survey, they were two-fold; in the first place, there was the exploration of new regions; more or less of topographical work had to be done for foundations for geological delineations. The whole western country was new at that time; we knew nothing of the relations of the great groups of rocks to one another. One of the first things we had to find out was the relations of the coal formations to Upper and Lower Canada; great outlines had to be sketched and a great deal of topographical work had to be done, and the question of the economic minerals of the country next claimed attention. The copper of Lake Superior was just coming into note, the iron deposits were just being found in various parts of the country, and also the copper of Lake Huron and of the Eastern Townships. Of course, with all that had to be done, work of general geology, in order to determine the relations of the ore deposit of certain rocks, so that in future we might, from the rocks of the country, be able to say where the ores were to be found. This was indispensable. It was a new country, and the whole relation of the ore deposits had to be made out; nothing in that way had been done even on the other side of the line. We were the pioneers in the work of defining the geological relations of our mineral wealth for North America. Sir William Logan, I should say, was first and foremost a practical miner and mining engineer, and it was as such that he was selected for his position. He had acquired his reputation as a careful explorer and mapper of the Welsh coal fields, and had also a practical experience in smelting, copper mining and the buying of copper ores. It was for these reasons that he was selected, and that is the basis of his usefulness, from a practical point of view. Thus, you will see, that the early work of the Survey was, in the first place, to determine the geological relations of coal, iron and copper deposits, and around them the stratigraphical geology of the country grew up. A careful chemical analysis of all materials were made, and also a preliminary study of the soils of the country and their relations to agriculture, and of the mineral waters of the country and their economical and medicinal values. There were special memoirs prepared on the questions relating to the metallurgy of iron and steel, and these were published in the reports of the Survey; these were of value to Canada in utilizing the iron of the country.

Q. Was there any attention paid to building material?—Yes; the whole question of our granites, marbles, roofing, slates, bricks, clays, cements, sandstones, &c.; from every available quarry we procured marbles, which were cut and polished, and considerable sums of money were spent in order to display these materials. We are just beginning to reap the advantage of it. Careful explorations were made upon the porosity of building stones, and the method which I adopted of determining the absorptive character of these building stones has since been adopted in the United States and Great Britain. Then the question of fertilizers was taken up, as well as the question of manures for the soil. I first called attention to the mineral phosphates of the country, and the mode of utilizing them; there was also the question of fish manure and the wastes of the fisheries of the Gulf. I considered these questions as important, as they did upon the agriculture of the country, and were just such methods as we required. I studied, also, in that connection, all the facts with regard to petroleum—its discovery and its distribution—and from its discovery in 1861, followed

it up for some eight or nine years, furnishing all the information that could be gathered on the subject, and determining essentially the facts with regard to the distribution of oil in the country; in fact, I prepared a special memoir on the subject, at the special request of the Government, as well as the information which was published in the report. The whole question of the gold of the country was early made a subject of investigation; Sir William Logan spent over two years in succession, and devoted a good deal of time on several other occasions, and I have spent as much or more time, in collecting as far as possible, facts with regard to the distribution of gold in the Eastern Townships. In that connection I have studied the question of the hydraulic washing of gold as first practiced in California, more than twenty years ago, and which is now adopted in the Chaudière district. Later, the whole question of the gold of Nova Scotia and also of the Madoc region, engaged the attention of the Survey, and a fresh examination of the gold of the Chaudière District and the Eastern Townships, was undertaken in 1868. I engaged for making the surveys, a Mr. Michel, an able French engineer of great experience, and prepared, with him, a report on the gold of Nova Scotia, and also in parts of Ontario and Quebec. That is the kind of work we were doing, and all these things were left by Sir William Logan to me. Then the question of salt demanded our attention; when salt was first discovered by accident in a boring at Goderich, I commenced a careful examination of the brines at repeated intervals, and went to the United States and studied the question of making salt by solar evaporation, as well as by boiling, and published an extended paper, with tables on the strength of brines, and all the economic information that I could collect with regard to it. All this information was embodied in the report of the Geological Survey. In the same way the early facts with regard to the discovery of the mineral phosphate of lime, apatite, which I first made known, were represented in special discussions of the matter in 1863, and again as late as 1869. Questions with regard to the distillation of shales and the extraction of mineral oils were also investigated in the laboratory of the Survey, the results of these investigations being published. I mention this to show how many of these questions arose, and what I considered were the duties of the chemist of the Geological Survey.

Q. Will you also mention if, during Sir William Logan's administration and your own, there were not important geological discoveries made which attracted the attention of the whole world?—Most undoubtedly. As for the Laurentide hills, we first recognized the fact that they constituted a great group of vast antiquity, to which Sir William Logan and myself first gave the name of the Laurentian Series, and then identified them with similar rocks in England, and in Norway, and in Sweden. This name of "Laurentian Series" is now written all over the geological map of Europe.

Q. The correctness of your discoveries in reference to these rocks has been recognized by other scientists and geologists throughout the world?—Most certainly. There have been some geologists in England who have doubted them, but the great teachers of geology in England and elsewhere admit of the correctness of our discoveries with regard to the Laurentian Series. Afterwards, the name of Huronian was given by me, in 1855, to the rocks of the district of Lake Huron. The Director of the Geological Survey of Austria assures me that he recognized them in the Alps, and that our three great groups—the Laurentian, Huronian and Mont Alban—are the key to the rocks of the eastern Alps, and these discoveries, first made known by the Geological Survey of Canada, are recognized by Italians, by Germans, by Frenchmen, and by Austrians. In the last volume of the Royal Society of Canada, just published, I brought out some of these facts, showing that this, especially the great groups of pre-Cambrian rocks, was a question of great importance. These are great facts which have been acquired to science by the work of the Geological Survey of Canada, and their value has been recognized by the first geologists of Europe.

Q. Sir William was very much devoted, personally, to science, was he not?—Yes; he was a very single-hearted, simple-minded, and industrious man in his study: his practical work as a mining engineer and mapper, and a worker of coal; and also his practical work in connection with copper, was of great service to the country. He turned his attention to these studies and pursued them with a great deal of zeal and

practical earnestness. He was a man who had not previously had a scientific education, but he availed himself of every opportunity to learn; he was never above learning from any man, and that was why he tried to get around him men who could aid him in every department.

Q. Of whom did the staff consist at the time you joined the Survey?—Of Sir William Logan, Mr. Alexander Murray (subsequently Director of the Geological Survey of Newfoundland), and myself. Then Mr. Richardson was employed as a field hand and explorer, and was not an officer of the Survey, except in later years. Later, more explorers were attached, Mr. Bell, who was then quite a young man, being taken on. Mr. Murray resigned, to accept the position of Director of the Geological Survey of Newfoundland. Mr. Billings was appointed palaeontologist about 1855 or 1856. At the time of Sir William's resignation, there were on the staff Mr. Billings, Dr. Bell and myself, and Mr. Barlow was attached as mapper. Mr. Thomas Macfarlane was on the staff for about two years; he may have been a member at the time of Sir William's resignation, but my impression is that he had already resigned. In fact, in 1869, Sir William, anticipating his own resignation, said he wanted to find somebody as a colleague for me, and Dr. Selwyn was proposed; I wished to have Mr. Murray brought back, but he declined to come, as he had the Directorship of the Survey in Newfoundland. Well, Mr. Selwyn was brought out, as I supposed, to be a colleague for me, but he was afterwards placed over me as my superior. At that time the means of the Survey were not nearly so large as now.

Q. What was the appropriation during those years?—My impression is that for many years it was only \$20,000 per annum, which included everything. Sir William Logan's salary was \$2,000, Mr. Murray's \$1,600 and my own \$1,200; subsequently, my salary was raised to \$1,600, and in 1867 it was further raised to \$2,800, so that all this work was done with very small salary. There might have been high thinking in those days, but very plain living, and very hard work.

Q. What had the cost increased to at the time of Sir William Logan's resignation?—My impression is that it went up to \$40,000, or perhaps \$50,000. There were also, in addition to those I have mentioned, one or two young men employed in subordinate positions; I am inclined to think that Mr. Webster was connected with the Survey, but he held a subordinate position. I believe Mr. Webster was born in Canada, and received his education here. Mr. D'Urban, who was also on the Survey at that time, as well as being nominally librarian, did a great deal of work in the field; he was afterwards a successful teacher of science in England, and is now in charge of the Science Museum at Exeter, England, and occupies a high social position there; he has done some good work in botany.

Q. Was Sir William Logan's attention devoted to the interests of the Survey indirectly, even after he severed his connection with it?—Yes; he worked for a long time, even while his health was failing, and when he has told me that he had never passed a night without severe pain and sleeplessness, but still he carried on his work, principally in the Eastern Townships.

Q. Are you aware that he was studying some geological questions of importance and interest, and that he had some assistance from the Geological Survey in conducting those?—I would not say much about that, because he was endeavouring to establish a theory in which he was undoubtedly in error. There was no reason, however, that I know of, why his honest work should not have been published, unless he wished the contrary.

HOUSE OF COMMONS, OTTAWA, 20th March, 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the Chair.

Dr. T. STERRY HUNT, of Montreal, was again called and examined.

By the Chairman:

Q. You mentioned the name of Mr. Thos. Macfarlane among those formerly connected with the Survey. Mr. Macfarlane is temporarily absent in Europe, but his

views have been obtained in writing and submitted to the Committee, and I would like you to give us your opinion as to his experience and qualifications for giving such evidence, so that it may be properly appreciated by the Committee?—He is a graduate of the School of Mines, at Freiberg, the oldest and most important School of Mines probably in the world, and whose pupils take the highest rank everywhere. While pursuing his studies there he was sent, on the recommendation of his Professors, to conduct metallurgical operations in Norway, where he made some very important and elaborate studies on the older rocks of Norway, which he has published, and which are highly appreciated by scientists both in the old and new world. He then came out to Canada to take charge of copper smelting works and continued operations of that kind in the Eastern Townships, becoming afterwards attached to the Geological Survey of Canada. It was through my own recommendation, seeing his high qualifications, that he was employed. He remained for some two or three years, and his reports are of the greatest value; in fact, they are models of what reports should be. He reported upon mining deposits in various parts of Hastings County and around Lake Superior. I might also say that he made comparative studies of the north and south shores of the Lake in order to establish the similarity between the two, and subsequent writers quote his work extensively; in fact, Mr. Macfarlane's work is a standard authority. He resigned his position on the Survey, and then went up, in the employ of the Montreal Mining Company, to explore their mineral lands on the shore of Lake Superior, and was the discoverer of the famous Silver Islet Mine. Afterwards, on behalf of the American Company, who purchased it, he built smelting works in Detroit.

By Mr. Dawson:

Q. The only disagreement, I believe, between Mr. Macfarlane, and Sir William Logan was with relation to the age of some rocks?—Yes; and I may say that the late results have justified Mr. Macfarlane's view, and have also shown how Sir William's view might also be reconciled with it. Mr. Macfarlane then made explorations of the Rocky Mountains and visited South America also for metallurgical researches for American capitalists. I know his status, not only from his publications but from the fact of his being a student at Freiberg under such eminent scientists as Messrs. Hague and Pumpelly. He has published papers not only upon questions of geology, but on questions of lithology, of iron smelting, and of the treatment of copper ores, and many others which are extremely valuable to science.

By the Chairman:

Q. How long did you retain your connection with the Survey after the appointment of the present Director?—About two and a-half years. I tried to find some way of getting along, as I was unwilling to leave and I remained the second year, but the petty annoyances which I had to put up with increased and I sent in my resignation about the end of 1871 or the beginning of 1872. Dr. Selwyn was sworn in, I think, at the close of 1869. It was a determined attempt on his part, as he found that I had a status in the country and that I was looked upon as an authority, which he was not; he was very unwilling that any one should appeal to me and wanted to cut off my power by curtailing certain work; I had been in the habit of being alternately in the field and laboratory but I was now kept more in the laboratory.

Q. I suppose since you severed your connection with the Survey you have kept yourself informed as to its progress and management, and the system under which it has been conducted, to a certain extent?—Yes; of course I have always received the reports and read them over more or less, and have been in the habit of seeing the Museum once or twice a year, and have always kept up friendly relations with Dr. Selwyn.

Q. Do you see any indications of any change in the system under which it was managed in Sir William Logan's time, and in what direction do those changes tend?—They tend, in the first place, to diminish the usefulness of the Survey, by taking its attention from practical work in economic geology and mining. It was a constant object with myself and Sir William Logan, who understood and appreciated perfectly my motives, and also assisted me by every means in his power, that the great

work of the Survey was to look into every chemical, mineralogical or metallurgical question, that could apply to the mineral resources of the country as, I have already explained. Then there was the question of fish manure and soils; all these subjects engaged my time and attention, and the investigation of them attracted the attention of the public generally.

Q. Why are these subjects now neglected?—Because the Director is not practically familiar with these subjects, and does not know their importance. He was not very long on the Survey before I discovered that he knew less of the importance of these subjects than an intelligent University student might be expected to know. This is one of the directions in which the work of the Survey has been changed, and in the second place, much attention has been paid to explorations and to field work, to mapping and topography, and also to general natural history. The study of the plants, the cataloguing and distribution of them, and of insects and birds, &c., all have a considerable value; and if we had sufficient means we might do these things, but should not leave others undone. The great thing which the country requires is a knowledge of the natural history, that will have its immediate practical application; for instance, so far as the insects are injurious or beneficial to the agriculture, and the United States have an entomologist for that purpose. So far as botany is concerned, the distribution of our forests, the capabilities of acclimatization of useful plants and their adaptability to different soils, may all be valuable, and a mere dry catalogue of these things is of no immediate or practical interest. If I had a quarter of a million of dollars to spend on a Survey of this kind, I might have some attention paid to general botany and general zoology, but I would not have it done if I am obliged to curtail this immediately practical work. These are like the elegancies of science that come after the necessities.

Q. The attention of the Committee has been called to the very numerous changes that have occurred in the *personnel* of the staff since the present Director's connection with it. You are familiar, I suppose, with many of those changes?—Yes, to a certain extent. First, there is my own case, and I cannot say whether Mr. Webster resigned before Dr. Selwyn came or not. Mr. Webster was on the Survey, and a very valuable man he was; he left and went to the North-West. As to the minor changes, I know of them only by hearsay. When I left the Survey I recommended Dr. Harrington as chemist and mineralogist, which position he held for three or four years, and then resigned; he is now a professor in McGill University, and a well educated and trained chemist and mineralogist. As for these later changes, I only know of them by hearsay. Mr. Ford I knew very well, as an excellent paleontologist; he left last year because he was dissatisfied.

Q. How do you think the status and position of the Survey, as at present conducted, compare with its position and reputation under the administration of Sir William Logan? I refer to its estimation by the outside world?—I should say it is falling off very considerably. In Sir William Logan's time the Survey was doing work that was attracting the attention of the outer world, the work of mapping out the old Laurentian and Huronian rocks, the work of Mr. Billings in paleontology and the work I was doing in chemistry and mineralogy. I do not know whether in the last ten or twelve years there has been anything of note done to attract attention; I would be glad to mention it if I could, but on looking back it is a blank as far as my observation goes. I do not mean to say that there have not been valuable observations in the North-West; Dr. Dawson has given us excellent observations of the western coast, and Dr. Bell has given us some useful information with reference to the Hudson Bay, with regard to the rock distribution of this region; the continuation of the rocks south of the boundary line has been traced northward, and while I wish to say that the work which Dr. Dawson and Dr. Bell have been sent to do, they have done well. I will also say that they might have been better employed at more immediately profitable work. In the same way Messrs. Ellis, Fletcher and Bailey have done some good work in the Eastern Provinces, and I would also say that much of Mr. Vennor's work in noting the distribution of the rocks between the Ottawa and the St. Lawrence deserves respectful mention. The work of the survey during

the last few years has not had the dignity nor *eclat* which it should have, because the energies of the staff have not been properly directed. I notice that Dr. Selwyn says that it would be impossible to prepare such reports as are published in the United States on the mineral resources, because it would require highly paid mining engineers and metallurgists. Dr. George Dawson was educated in the Royal School of Mines, one of the best mining schools in the world, and when he came out to this country was fully prepared for just such work. Mr. Macfarlane was also just the man for such work, and Mr. Fraser Torrance, who was also educated at the great School of Mines, at Freiberg, and a native Canadian. Then there was Mr. Coste, also a native Canadian, and a distinguished graduate of the School of Mines, at Paris, and Mr. Frank Adams, assistant to Mr. Hoffmann, himself a very good chemist, was educated at McGill University, and afterwards at Yale, and had the advantage of studies in modern chemistry and mineralogy, and in German and other foreign literature of these sciences. And yet we are told that there are not competent mining engineers and metallurgists to be had. Mr. Coste was discharged, and I believe taken back again and placed in a very inferior position, not at all in the position his talents deserve; Mr. Torrance, Mr. Adams, and Mr. Macfarlane left, and Dr. George Dawson, who might have done this work, has been employed in other directions. I should not know where to look for better men than those who had graduated in these schools.

Q. And do you not think that, other things being equal, young Canadians who are familiar with their country and climate, are better adapted for honest work on the Survey than persons from abroad?—Most decidedly; and besides they have a patriotic interest in their country, and have a right to be employed, rather than strangers.

Q. Comparing the progress of the Geological Survey of Canada with the progress of Geological Surveys in other countries, it becomes necessary to ask you what progress has been made during the last ten or fifteen years in other countries?—The conditions, of course, of the old world are not so well adapted to bear directly on our case as those nearer home. Still, you might like to hear what is being done in England. The question of mining statistics has been brought up. In this connection the Geological Survey of England should not be taken at all as a standard here, because it professes to occupy itself chiefly with topographical and geological work, and questions of mining and metallurgy do not engage its attention; they had a Keeper of Mining Records attached to the Geological Survey, Mr. Hunt, who undertook to get mining statistics as volunteer contributions; he prepared and published these and was in some way attached to the Geological Survey, but a few years ago there was a mining inspection Act passed, primarily for the protection of miners and those employed in the mining industry, which had power to enquire into all the mines in the country and to make reports on the labour employed, and the production and value; but open workings, however, such as alluvial mines, were not included, and in 1881-82, about two years ago, the Treasury Department, seeing that this work was being duplicated in this way, passed a new Act, and the work is directed by mining inspectors, whose business it is to collect all these materials and report to the Home Office. The report of last year is only just out, but I have seen an abstract of it; it publishes simply statistics which are of value only to the financier and economist.

Q. When you state that the Geological Survey of Great Britain has paid no attention to mineral statistics, I take it that it was not because they had no value, but because they assumed their collection belonged to a subordinate or separate department?—I mean that it paid no attention to mineral resources, and did not investigate the question of metallurgy and the economic use of minerals. In France all these economic questions come in the first rank. France has a regular corps of mining engineers, part of the Civil Service, whose primary work is to inspect all mining districts and to give information to the public at frequent intervals. An official journal is published regularly. The work of the Geological Survey is detailed to men selected from the corps of mining engineers. These same mining engineers are sent all over

the world to make studies of the mineral resources of other countries; they have published valuable memoirs on the resources of this country.

Q. Are you aware that the Geological Survey of France has a Department connected with the Government? Is it a subordinate branch of the Department, as it is here, or is it an independent Department, with a Minister at its head?—Not independent; I think it is under the Department of the Minister of the Interior; that is, the corps of mining engineers; I cannot say positively under what Department the geological maps are published, but I think it is under the Department of the Interior also. But it is in the United States that we have to look for circumstances more nearly like our own, and there have been many State Surveys which have done admirable work, especially those of Ohio, Alabama, Kentucky, Pennsylvania and New Jersey. Pennsylvania, in many respects, is a model, and has within the last few years, been expending about \$50,000 annually, in a careful survey of all the points relating to the distribution of its rocks, and the geological relation of its iron deposits, of its salt and petroleum, and of the bituminous and anthracite coal, the results of which have been published in small volumes, at the cost of paper and printing. Each mineral is dealt with in a separate volume, so that anyone wishing the information on any particular subject, has only to get that particular volume, and does not have to buy a volume containing information on all the questions. The great work of the mining industries of the Territories, the regions west of the Mississippi, were formerly, during many years, in charge of the Commissioner of Mines, who, himself, and through his subordinates, carefully collected all the facts, from each mining district, and published it in a volume.

Q. That was under the charge of the Federal Government, I suppose?—Yes; and at the same time, important work in these regions, was also being done by the surveys of Hayden, of Wheeler, and of Clarence King; it was called the survey of the 40th parallel. Impressed with the importance of consolidating this work, and also of extending the Geological Survey to the older States, where the work had been partially done years ago, they have, within the last few years, organized a General Geological Survey, under the direction of the Federal Government, a survey which covers the whole field, from ocean to ocean, and is employing specialists to take charge of the different regions, and also, to a certain extent, the different subjects within these regions. They have published special monographs of the great mining regions of the West; for instance, the great Comstock lode, which has yielded 350 millions of bullion, and which is the second memoir the United States Government have published on that region. In the survey of the 40th parallel is given a complete description of the mining, as it was ten or twelve years ago, and the machinery and the best metallurgical methods used. The same thing has been done with the Eureka District, in Southern Nevada. The United States Geological Survey has also published, as a general guide and handbook, within the last year, a little volume on the mineral resources of the United States, covering 800 pages; the price of it being fifty cents. Any person who will take the trouble to look over it will find that it embraces a discussion of all the economic minerals, coal, iron, petroleum, structural material, building stones, bricks, tiles, cements, abrasive materials, precious stones, salt, borax, sulphur, &c., &c. Besides these, it gives an excellent description of metallurgical methods. There is also a complete review of the minerals of the United States, arranged by States, and the materials classified; a little over one hundred pages are devoted to this catalogue. Besides this compendium, there are special monographs published on a great many geological, mineralogical and paleontological questions, both practical and theoretical, with valuable maps and illustrations, all published for the cost of publication. Then there is the question of mining statistics, giving particulars, not only of the statistics, but the history and growth of every mining industry, and the cost of material in every place. This is the way in which the work is being conducted in the United States; while considerable attention is being devoted to purely theoretical geology, they are putting in the foremost branch all the questions with regard to coal, and the possible uses of the mineral wealth of the country. Any one interested in the question of phosphates as fertilizers will find here a

memoir of about twenty pages, written by specialists on the ground, and giving a history of the mine and the industry connected with the phosphates, and the whole of the statistics relating thereto. They are not purely statistics, but are combined with mineralogical and geological information. I have just received a volume from the State of Alabama, containing a report of the work of the Geological Survey in connection with the Census Commission of 1880, which includes a most valuable report on the relations of geology to that region. This report is published as the work of the State Geological Survey, and contains the complete exposition of the relations between the rocks and the soil drainage, and adaptability to various crops, as well as accounts of the rainfall in summer and winter, the temperatures and forest distribution, all of which are considered with reference to the physical geography and geology. I will read you a paragraph from a report written by Prof. Eugene Shith, which is as follows: "Whence have the material of these soils come; by what agencies have they been prepared and distributed; how have the products of rock disintegration come to assume the peculiar mechanical condition which characterizes soils; how have soils acquired these chemical qualities which distinguish them from the solid parts of the earth's crust; upon what constituents do their remarkable property of absorption depend; and by what means are they affected? These are questions which must interest every one who cares to look beyond the mere surface of things, and to answer them in some measure has been my aim in the first part of the report." The basis of intelligent and scientific agriculture has been prominently placed in his report.

Q. Do you know the appropriation for the State of Alabama?—I do not think it is more than \$5,000 or \$6,000 a year; I know it is very small, for he gives, as one of the reasons why he was not able to report fuller, and with more maps and illustrations, is that it would have required the whole appropriation allowed by the State for many years. The report discusses the variety of soils in the State, their composition, and their origin and fertility, and then takes up the question of the different crops, and shows the temperature, the rainfall and the distribution of the forests, and their relations to the cotton culture. In fact, I do not hesitate to say that the facts published in such a volume would be of more immediate practical value to Canada than the volumes of the Geological Survey for the last ten years, which have cost so much money. I might also call your attention briefly to the work that has been done lately in California; they had a Geological Survey in California, and to tell the history of it would be almost to repeat the history of the Geological Survey of Canada, except that it was put an end to by the Legislature three years ago, and since then, in a humble way, a State Mining Bureau has been established. The Bill appointing it was passed in 1830, and the State Mineralogist, in a short report, presented on the 30th of June, says: "The California State Mining Bureau was created by an Act of the twenty-third Legislature, approved April 16th, 1880. The first section of the Act provides for a principal office in the City of San Francisco, 'in which there shall be collected and preserved for study and reference, all the geological and mineralogical substances—including mineral waters found in the State.' The same section further provides for a collection of mineral rocks and fossils of other States, Territories and countries, to be at all reasonable hours open for inspection and examination and study. A Section provides for a library of works on mineralogy, geology, and mining, and a collection of models and drawings, of mining and modelling machinery used in the reduction of ores, and directs the opening of correspondence to obtain information respecting improvements in mining machinery of practical value to the people in the State. The State mineralogist is instructed to visit the several mining districts to ascertain and record their history, and to describe their geology and the ores they produce. At the close of the year he is directed to report in detail to the Governor. By section four, the State mineralogist is allowed to appoint assistants when the condition of the funds will permit. All other provisions are secondary and subservient to the Museum, which is made the principal feature of the institution." When speaking of the importance of Museums, he says: "What applies to other countries applies equally to California, for if there is any State that needs to show her natural re-

sources, it is California, which has so long invited capital from abroad, and begins to wonder why the population is so small when her natural resources are so great." And then he goes on to say: "There have been so many mistakes regarding the character of our mining districts, and so many misstatements to those who have been asked to invest their capital in California, that there is need of an official source of information relating to the varied resources of the State. This can be best accomplished by granting to the institution a liberal support. While this institution is called a Mining Bureau, its usefulness has been general, and the merchant, manufacturer and agriculturist are, and should be, deeply interested in its success." It is unnecessary to say that these remarks are quite applicable to Canada. This report contains a special memoir on the borax deposits of California, the greatest producing borax region in the world. Other memoirs and papers have already been published by this Bureau, on hydraulic mining of salt, diamonds, &c., since the establishment of the Bureau. Take the example, again, of the Geological Survey of the State of New Jersey, which has not only lately published special memoirs on its iron ores, but a volume upon its clays used for pottery and other purposes, the mining of which is a great source of wealth to the State.

Q. Can you suggest any changes in our present system which would, in your opinion, improve its efficiency? If so, what changes would you recommend, and how much increased expense, if any, would such changes entail?—That is a very large question, and one would have to weigh many considerations before coming to a conclusion. My great point would be, as I said, to imitate in some respects the Mining Bureau just described, and to have men charged with the business of looking after the mining regions, either taking it up in regions, or in special subjects; for instance, one might take up the mining industries, a second the salt, and a third the copper, the report showing the exact state of these industries at the present time, their past history so far as we know, and suggestions for their future development which may be considered necessary. Great ignorance exists among the people as to what constitutes a mine, and what are the conditions that warrant the expenditure of money in opening them. Many a time money has been spent in the following up of little leads, which are of no economic value at all, and at other times valuable deposits are passed by because the persons having them are really ignorant of the true way to work them. There should be a Bureau in which instructions might be given with regard to the best modes of opening mines and utilizing their material, whether smelting should be undertaken, and whether iron manufacture should be undertaken, and what methods are best adapted for the region, and for the ore. Large sums of money have been spent uselessly in this direction, in the last few years, and it is not only the waste of capital which should be considered, but it also produced discouragement and want of confidence in the metallurgical industries throughout the country. Therefore, I think we want skilled and trained mining engineers and metallurgists to give information upon almost every point throughout the country. There should also be a library, not merely of scientific and theoretical books, but a library where any person could go and consult the works which would give them the information which they required, and where they might see models of mines, machinery, furnaces, &c., which would give them an idea of how underground work is done. The history of the apatite mining in Canada shows what mischief is done when such mines are left in the hands of persons ignorant of mining. Therefore we want practical instruction available to every one in the best methods of mining and of abstracting the materials. Then I think the subjects of the soil and their relation to agriculture ought to be put in the hands of persons specially competent to deal with it. I am not prepared to say, as I know so little of the work that has been done in the great North-West in the past few years, how far the Geological Survey has undertaken work which might be left to another department, because I am not aware of the amount of work of that kind which has been done, though I have reason to believe that large sums of money have been expended in that direction. I think the construction of the detailed geological maps of these regions is subordinate to the great economic question, and should grow up slowly with the

advancement of economics. I should want to look more carefully into the whole question of the administration of late years, and of the extent of the topographical work done, before I would say that too much of the energies of the staff had been devoted to it, but I am inclined to think that the attention paid to topographical and general geographical exploration might be expended to greater advantage on this mining question. We want thorough information on the great coal question of the North-West, and we do not know where to find it. I think the Survey might be made very much more efficient than it is now with the present expenditure of money; I also think that the members of the staff might be employed in better work, or in other words, with the same expenditure of labor and money, under the judicious direction of somebody who knew what was wanted, the Survey might be made of vastly more service to the country. I make no charges against the men of the staff, but I do not think the head of the staff is either competent or efficient. He has no method of working, and changes his moods from one day to another, as I have occasion to know.

By Mr. Dawson:

Q. Of course the Geological Survey had attained a very high position under the direction of Sir William Logan and Dr. Hunt and Mr. Billings, whose names are known all over the civilized world, and I believe they will be historical, and that it would be difficult to find such a staff now. The Survey was very popular then, but it is very unpopular now?—I would say one reason why the Survey was popular then, was that Sir William Logan and myself were always ready to give our time and our knowledge to all those who came to seek for information three and four hours being frequently spent in explaining elementary facts to them.

Q. Do you not think that there is the material in this country for the formation of a very efficient staff without sending to England or to foreign countries?—Most undoubtedly, and if I were charged with a work of this kind, even with twice the money now expended, I think I should be able to find in the country all the material I should want. I would not ask for better men than Mr. Macfarlane, Mr. Coste, Dr. Harrington, Dr. George Dawson, Dr. Bell, Mr. Hoffman, Mr. Torrance, Mr. Adams, to say nothing of the other gentlemen I have mentioned, some of whom, such as Mr. Torrance and Mr. Coste, have returned to Canada with advantages of education in the European Schools of Mines. I might also mention Abbé Laflamme, of the University of Laval, who has rendered much valuable service. I think we have all the material in the country for an efficient staff.

Q. It has been given in evidence before the Committee that the work of Sir William Logan's later years, which might possibly be of very great value, has been suppressed, and not only that, but that some notes of his had been taken credit for by the present Director of the Survey?—As regards the latter charge, with reference to the publication of the map of part of south-eastern Quebec, by Mr. Selwyn, it is certainly a very remarkable thing. I see it is stated that the map was prepared by the "Geological corps, Alfred R. C. Selwyn, Director." The work was almost entirely done under the direction of Sir William, and was engraved in 1868 with Sir William Logan's name. Subsequently Dr. Selwyn allowed this to be printed as a topographical map and omitting Sir William Logan's name and substituting his own. This work was compiled under Sir William Logan's direction by the late Mr. Barlow, cartographer to the Geological Survey, and could not be called the work of the geological corps. It should have been stated that it was done under the direction of Sir William Logan, and then Mr. Selwyn might modestly have put his name below as the present Director, if he chose to do so. As to the geological coloring adopted by Sir William Logan for his map of that region, it involved certain serious errors, which I was the first to point out, in 1870—errors in the interpretation of the rocks and with regard to their distribution. Sir William Logan, who was also assisted by Dr. Bell, Mr. Murray, Mr. Webster, and myself, worked a great many years in collecting the geological material for this map. Sir William's interpretation of these results was vitiated by his theory, and Dr. Selwyn subsequently adopted my interpretation of this distribution, and colored the map in accordance therewith. I think it might be pub-

lished as a map prepared under the direction of Sir William Logan, with subsequent corrections, and giving Sir William and his staff credit for the twenty years' work which they had done.

Q. It was a great wrong to Sir William Logan?—Yes. I understand that Dr. Selwyn says that Sir William Logan wished the map suppressed. Of course I can not tell as to that. I say it with all respect, that Sir William was wrong in the position which he took in regard to these rocks, and that I was right, and subsequent investigations, not only in North America, but in the Alps and other parts of the world, have shown that Sir William was wrong in his views; but Sir William had a right to have the map published if he chose.

Q. Do you not consider that this volume, representing the work of 1880-81-82, is rather meagre, for the immense amount which the Survey has cost, and supposing that it were valuable as a report itself, should it not be more widely distributed? We are told that 4,000 copies of it have been printed, 2,000 of which are put in a book store at Montreal, and also at another book store in Ottawa, for sale. Should not the public have the benefit of this report?—Yes, provided it is worth distributing. I cannot suggest any better mode than that prevailing in Pennsylvania; they stereotype the forms so that an additional edition can be struck off without much trouble. They also publish forty or fifty of these volumes, one on each different subject, and they are bound together in cloth, and sold from 30 to 50 cents each. A limited number are sent to libraries and public institutions free, and also distributed by way of exchange. These separate reports on the different subjects, sometimes embrace only one county, and sometimes several counties, or in other words, small mining and geological districts, extending over one or more counties.

Q. Speaking generally, I should infer from what you have said, that what is most needed at present, is a good head to the Survey?—Yes; the Director, I think, should have some clear and well-defined notions upon the great leading questions of geology, mineralogy, natural history, lithology, stratigraphy and palæontology, which must form the basis of all intelligent work.

By Mr. Wood:

Q. I think I understood you to say, that the United States Survey dealt largely with the character of the soils, and the extent of the cultivation of corn and cotton? I think they have a Bureau of Agriculture?—What I referred to was, the work which has been lately done by the State of Alabama, and what has been done by the State of Alabama might, with advantage, be done by every State. The general Geological Survey of the United States was only recently organized, and is just getting into working order, and is bringing under its general system all that had been done by the independent State Surveys, in the different regions, and to connect it with the Territorial Survey, which has always been under the charge of the Federal Government. A proper study of the great coal and iron fields, of the great Appalachian coal and iron regions, requires a Survey extending over many States, and hence the desirability of making it the work of the Federal, rather than of the State Survey.

Q. The point that occurred to me was, that they would be to the same extent doing the same work?—I have consulted with the Director of the United States Geological Survey on many of these points. Whether the Federal Survey will attempt to discuss the agricultural questions, as has been done in Alabama, or leave them to the Bureau of Agriculture, is a question for the future.

Q. Can you state where, in your opinion, the line should be drawn? How far should the Geological Survey go in these matters and what would more properly belong to the Department of Agriculture?—The Geological Survey should occupy itself with all matters touching physical geography, the nature and origin of the soil, their relation to the rocks below and their relation to drainage and water supplies, as to whether the soils are stratified clay or sands, &c., and as to the question of the waters which may be got by sinking wells or boring. Since, in some regions like the North-West, where water supplies could be got by sinking wells or boring, it would be important to know whether fresh or salt waters fit for irrigation or domestic use could be obtained. Then there is also the question of the selection and

rotation of crops, the adaptation of particular soils to particular crops, manures and experiments in cultivation, which should be left to an Agricultural Bureau.

By Mr. Baker :

Q. Is it generally known that the geological or mineralogical works of the United States, such as has been exhibited here to-day, are bound in cloth and procured for the small sum of 50 cents?—They send out circulars to everybody who they think will be interested in knowing this fact. They also advertize it in the *Engineering and Mining Journal* of New York; I saw the advertisement in several places, and then every copy that goes out has a fly leaf, upon which is advertised the price of the work.

Q. How do you think the mineral statistics of the United States compare with the immigration statistics, as regards reliability?—I cannot tell as regards that. I know there has been some dispute about the correctness of their immigration, but I know that these mineral statistics are prepared with a great deal of care in the different parts of the country, and I know a great many of the men who are employed in the work. There is a report on the phosphates of South Carolina, by Mr. Moses, who is on the spot and has collected all his figures with care and skill. I know also that the iron and steel statistics for Pennsylvania were carefully collected by Mr. Swank, the Secretary of the Iron and Steel Association, who has for years made it his great work to become informed upon everything relating to the industry, with reference to the production for the iron masters, so that these statistics will be most trustworthy.

Q. You stated that the work performed by the Geological Department of Great Britain takes more of the nature of topographical work?—Yes.

Q. Are not the mineral resources taken charge of by some other department?—No; except so far as collecting the statistics. There is now a Mining Inspector under the Home Office. I have received a letter from Mr. Robert Hunt, late of the Mining Record Office, dated 20th October last, in which he says: "The Treasury last year awakened to the fact that two departments were doing the same work, and that mineral statistics were published in duplicate. After some long considerations it was determined that my office (the Mining Record Office) should be abolished and the business of obtaining returns from the mines should become a part of the duty of the Inspector of Mines, under the direction of the Home Office. This arrangement has been carried out; my two assistants have been transferred to the Home Office, and I am retired on a special pension. The work which has hitherto been done by me, and under a strictly voluntarily system, is now to be carried out with the power of an Act of Parliament with the twenty-six inspectors and my two clerks." This Act of Parliament was only passed last year.

Q. You made reference to the Geological Survey of California, and that it had been preceded by the Mineralogical Bureau. How much was expended in the old Geological Survey of California and how long did it continue?—I cannot tell you; it continued for seven or eight years. It was not satisfactory, however; the Director spent large sums of money on topographical and general preliminary surveys, while little or no attention was paid to the economies, such as gold, coal and quick-silver, and the mineral wealth of the country generally.

Q. But the expenditure of the Survey was paid by the Federal Government at Washington?—No; by the State of California. It is only within the last two years that the Federal Government have attempted to interfere with State Surveys. They had previously to do with the geological work and the mining resources of the Territories west of the Mississippi. But the State of California was for many years the only organized State west of the mountains, and the Geological Survey was entirely independent of the Government at Washington, just as much as the State of Alabama was.

Q. With regard to our own Geological Surveys, I understand that you are of opinion that the functions performed by it are not as practical as they might be, and that the greater part of the work is lost sight of by topographical or superficial work?—I suspect that to be the case; I do not know to what extent topographical work has

been done, but I conclude that considerable money is being expended in work of that kind.

Q. But you are of opinion that the geology, of a topographical nature, and the geographical explorations, should be dispensed with, and the attention of the department more directed to mineralogy and metallurgy?—The former should be, in my mind. For instance, along the lines of railways, or where branch railways are projected, or settlers are to go, exploring parties should make careful geological investigation, and with larger means and facilities, I would recommend an extension of that work. With reference to the Canadian Pacific Railway, for example, it would be very desirable to get accurate geological information along that line, and help to work out the geological structure of the country and give immediate information to the settlers who are going to settle along the line. But I am not prepared to speak with authority, because I do not know accurately the extent or the nature of the work being done there.

Q. Then you are of opinion that greater attention should be paid to mineralogy, metallurgy and economic geology than heretofore?—Yes; to mines, building materials and the raw materials of the soil, of economic value, and the best modes of utilizing them, and the relations of that soil to agriculture.

Q. You have said that inasmuch as the head of the Survey had not sufficient knowledge of the different questions which must come before him in his capacity as Director, that he could not carry out an intelligent scheme of geological work?—That is my opinion.

Q. Then you are of opinion that the head of the Geological Survey should be possessed with all the qualifications necessary to enable him to form an opinion on every particular subject that comes under him?—Yes; in everything except special questions, which should be referred to some specialists; but when any question comes before him relating to rocks, ores or minerals, he should have sufficient knowledge of the subject to give an intelligent opinion.

Q. Do you not think that much unpleasantness in departmental matters would not have arisen, and could not possibly yet arise, if the Director were to call his assistants together and take them into his confidence and consult them upon matters relating to the work of the department; for instance, they might have Board meetings?—I think he should most undoubtedly consult his subordinates, but I do not think there is any necessity for Board meetings. There are special questions with regard to paleontology, lithology and chemistry, in which the Director must consult his chemist, his paleontologist, or his lithologist, but he should have some general knowledge of all these sciences.

Q. Do you not think that greater satisfaction would exist and more work be obtained, and more zeal displayed in the Geological Survey, if not only the chief officer, but even his subordinates, were better paid? Do not scientific men command a higher rate of remuneration than the present staff are receiving?—Most undoubtedly they do. When I left the Survey I was consulted in the matter, and I said that I might perhaps be able to give an unprejudiced opinion on the subject, as I was no longer connected with the Survey. I said that Dr. Selwyn's salary (which was then \$3,000) should be raised to \$4,000, and the others proportionately; his salary was raised, but I think that the salaries of his subordinates were not.

By Mr. Lesage:

Q. I understand that you think it important that more attention should be paid by the Geological Survey to our mineral prospects?—Yes; they have devoted all their attention to mere geological detail; of course, I would not neglect the collection of data bearing upon the geological structure of the country, but I would do as much of it as I could, not leaving the other undone.

By Mr. Baker:

Q. With reference to mining investigations is it your opinion that they should be made either according to sections or according to subjects, and that when a man once commences the work of a particular section he should be allowed to carry it on until it is completed?—Most certainly; in taking up a new subject or new field, much time would

be devoted to mastering the details of it and preparing men for usefulness in that particular line, advantages which would be lost if he were taken to another field. Dr. George Dawson went over to Europe recently to look into the question of the brown coal in Germany and Bohemia, and if he had followed that up it would have given us results which would have been of immense practical value to the country. By sending a man into one field one season and into another the next, even though he may be most zealous in working up the material, the work gets disconnected and he loses the thread of it, and the great part of the skill and knowledge acquired in one region is lost.

Q. That must be attributable to a defect in the directorate?—Certainly it is.

By the Chairman:

Q. I would be glad to get your views upon the sub-division of Dominion and Provincial attention to geological subjects and mineral resources and statistics, as illustrated by similar sub-divisions between the Federal and State authorities of the United States?—This centralizing system now adopted for the actual Geological Surveys of the United States will eventually efficiently supplant the work of the State Surveys. You cannot discuss the economic value of a coal field without you take in the whole of that coal region. Some coal fields extend through Pennsylvania, Ohio, West Virginia, Tennessee and Alabama, and therefore the discussions on these coal fields are of value just as they go into the question, irrespective of States. The old State Surveys have done a great deal of excellent work, and I have pointed out what has been done in Alabama and California, to show what single States might do for themselves. More might be said of the work of New York, Pennsylvania, and New Jersey. They have stations of the United States Geological Survey at Washington, Newport (Rhode Island), Denver (Col.), and within the last few months another in San Francisco, which might perhaps unite with and take the place of the State Mining Bureau. I have referred to these merely to show the way in which the question presents itself to the people of Alabama and California, and to show how this local work, so excellently conceived and so well carried out, will not be done away with, but simply carried out on a larger scale by the Federal Authorities.

Q. I suppose the present State Survey will become subsidiary to the Federal Surveys?—Yes; to the greater advantage of geological science. The consolidation of the State Surveys with the Federal Survey now going on in the United States is going to contribute very much to the progress of geological science and to the development of the resources of the country, and the efficiency of the State Surveys are undoubtedly enhanced by it. Here we have one Survey extending from ocean to ocean and splendid conditions for carrying it out, following in the way that is being so successfully carried on in the United States.

HOUSE OF COMMONS, OTTAWA, 20th March, 1884.

The select Committee on Geological Surveys met this afternoon, Mr. HALL in the Chair.

J. FRASER TORRANCE, Esq, of Ottawa, was called and examined.

By the Chairman:

Q. You have been connected with the Geological and Natural History Survey of Canada?—Yes; from May until the end of February of this year.

Q. What were your previous qualifications and experience to fit you for work on the Survey?—I was educated at McGill University, where I took the degree of B.A., and B.A.Sc., and I have studied for two years in the Royal School of Mines in Freiberg, Germany. While I was there I was engaged by the Borneo Company to undertake the management of their mines. A fortnight completed my term of work there. I was struck with jungle fever and was some two years recovering from the effects of it. Since then I have been engaged in professional work in many parts of Canada—in the Chaudière gold fields, and in the Nova Scotia gold fields where I

was in the mines for two and a-half years. I also visited British Columbia, professionally, on two occasions.

Q. These engagements were for private Companies?—Yes. I may also say that I am a member of the American Institute of Mining Engineers.

Q. What position was assigned to you in connection with the Geological Survey?—Last spring I came here specially to see Dr. Geo. Dawson, about further work in British Columbia, and to get some information about the regions there, and while here Dr. Selwyn enquired if I was engaged, and proposed that I should join the staff of the Survey, to examine the phosphate fields of Ottawa County. I was inclined to refuse this offer, because I was aware that it was the most difficult geological field in the whole Dominion, but I finally consented, and so, although I warned Dr. Selwyn that I did not think a season's work there would do any good, he told me that some one must go, and he did not know anyone else in Canada who was prepared or qualified to fill the position, and he was very anxious that I should do so, and promised that he would not find fault if it took four or five years instead of one or two, to arrive at any satisfactory result. On that understanding I undertook the task and proceeded to Montreal, by Dr. Selwyn's directions, to see Mr. Vennor, who was previously engaged in the same field of work, to obtain maps and any information which I could get about the field. Mr. Vennor's last four years of work had not been reported upon officially. When I returned to Ottawa to obtain instruments for my work, Dr. Selwyn armed me with an old broken-down compass, not even a prismatic compass, which he said was quite as good an instrument as was required for the geological work of Canada; but it had lost its magnetism. I protested, but went into the field. Later in the season I was furnished with a suitable theodolite. I was in the field until the middle of October; I had a Mr. Howard with me, and two axmen, most of the season. Mr. Howard is a graduate of the McGill School of Science. Dr. Selwyn now complains that my expenses in the field were too heavy, but he does not state that my salary and those of my assistants were all charged in the field explorations. My expenses were \$300 less than the limit allowed me by Dr. Selwyn before I began.

Q. You returned to Ottawa about the middle of October?—Yes. Dr. Selwyn had not yet returned, and there was a little uncertainty as to what office I was to use during the winter, or where I was to prepare my plans, and nothing was done until Dr. Selwyn returned, at the end of that month or the beginning of November.

Q. Upon going into the field in the spring were you furnished with detailed instructions from the Director?—My instructions were merely verbal, and on my return he denied having issued many instructions which I had received from him. He said, for instance, he had no idea as to why I had gone to Montreal or what my object was, and when my accounts for the season's work were made up, he accused me of defrauding the Government, by charging \$7 for my ten days' stay in Montreal. He said I was living at home, and I told him that he knew more about my domestic arrangements than I did myself; it was many years since I had had a home in Montreal. Of course, that was not calculated to promote harmony.

Q. Upon his return, on the 1st of November, were you assigned an office, and did you commence the preparation of your maps and report?—Yes; as soon as his return, an office was assigned me and I began my work. The specimens were unpacked and relabelled, and the plotting of the plans and surveys were commenced.

Q. What progress had you made with your plans when you severed your connection with the Survey?—My plans were far advanced and my report was partly written when Dr. Selwyn gave me to understand that my work was of no use and that he had not attached any importance to it and he did not wish me to continue my connection with the Survey, and that as soon as my report was submitted he wished me to seek other fields.

Q. At that time he had not seen your report?—No. When I learned that he wished me to seek for other employment I thought it was very important for me—as my pay had not been sufficient to accumulate any reserve fund for a season of idleness—that I should at once get another position. As for the report, I thought it

should be submitted to him when I had my plans prepared, and that report is to be submitted before I leave Ottawa. I have been working at it since. My official connection with the Survey continued up to the end of February. Dr. Selwyn wished me to leave sooner, but as it was the end of January I required a month's notice, and I retired at the end of February. I have the correspondence here. The first letter in this correspondence was submitted to me on the 27th December, 1883. At that time I was credibly informed that Dr. Selwyn wished me to retire, to make room for an English engineer, who had just arrived, and that if I wished to secure an appointment under the Government I had better make an official application. The first letter is as follows:—

“ OTTAWA, 27th December, 1883.

“ DR. A. R. C. SELWYN, F.R.S., L.L.D., &c.,
“ Director of the Survey.

SIR,—I beg leave herewith to submit proposals for reviewing the collections of mining statistics, under your authority; which subject has already been briefly discussed with you by Mr. Hoffman and myself.

“ Perhaps the best plan to pursue would be to divide our economic minerals into several groups, for instance;

“ (1.) Apatite, gypsum, salt, and asbestos.

“ (2.) Iron, and manganese.

“ (3.) Lead, copper, zinc, and antimony.

“ (4.) The precious metals.

„ And report as fully as may be possible on one of these groups each year, with a general synopsis of all available information about the other groups. Thus, each branch of our mining industries would be reported upon with more or less fullness, once in every four years, and an approximately correct record would thus be kept of the development of our mineral resources.

“ I have purposely omitted coal from this arrangement, as Nova Scotia and British Columbia both undertake the publication of the statistics of their respective coal fields; and the members of the staff in our North-West Territories will be engaged chiefly in work connected with the coal fields of that area. Therefore, no special report by me upon the coal mines would be of much advantage.

“ In order to obtain reliable information, it would be highly advisable for me to personally visit, each season, the chief centres of the industries that are to be specially reported upon that year. In doing so, I would have opportunities to pay flying visits to other mines *en route*, and collect necessary statistics for my—(rest of copy is illegible, but I think the termination is simply)—annual synopsis.

“ I have the honor to be, your obedient servant,

“ J. FRASER TORRANCE.”

Finally, Dr. Selwyn, writing to me on another subject, informed me that the time for considering the question of mining statistics had not yet arrived. This letter was dated 28th January, 1884, and in the course of it Dr. Selwyn said: “ As regards your letter of the 27th December, which was duly received, it refers to a subject which requires consideration, when the time arrives for doing so.” I wrote to him again in reference to that subject, on the 30th January, 1884, as follows:—

“ OTTAWA, 30th January, 1884.

„ DR. A. R. C. SELWYN, L.L.D., &c.,
“ Director of the Survey.

“ SIR,—Although I am reluctant to allow personal considerations to enter into an official correspondence, I cannot help regretting that the time has not yet arrived for considering my letter of the 27th ult.; as the arrangements of quite a number of people, besides myself, depend to a large extent upon the decision finally arrived at.

If you would give me an idea when the time for decision is likely to arrive, I would be very grateful for the information.

"Yours obediently,

"J. FRASER TORRANCE."

Dr. Selwyn replied as follows:—

"GEOLOGICAL SURVEY OFFICE, OTTAWA, 30th January, 1884.

"DEAR SIR,—In reply to your letter of this date, I may say that the matter referred to in your letter of the 27th ult. will certainly not be considered till the Estimates are passed.

"Of course, your employment during the past summer was only of a temporary nature, and the result has not been such as to induce me to think your services could be continued with advantage to the Survey. I should, therefore, advise you to seek other employment so soon as the work you are now engaged on is completed.

"Yours truly,

"(Signed,)

ALFRED R. C. SELWYN.

"J. FRASER TORRANCE, Esq., Ottawa."

When I received that notice to retire I personally sought Dr. Selwyn to remonstrate with him on the subject, and asked him if he discharged me for incompetency, to which he replied that I was the last person in the world to charge with incompetency, and the only reason for my discharge was that the temporary work for which I had been engaged was finished. "Oh," I said, "it appears evident that you are engaging extra men," to which he replied that he had spoken to me about draughting plans and that I told him I was no draughtsman. I never did so, and it would have been an absurdity for me to have done so after the training I had received. I replied to his letter on the 1st of February, as follows:—

"OTTAWA, 1st February, 1884.

"DR. A. R. C. SELWYN, LL.D., F.R.S., &c.,

"Director Geological Survey.

"SIR,—It puzzles me to understand how you received the impression that you had spoken to me repeatedly about draughting plans, and that I had informed you that I was no draughtsman. It is my firm belief that no such question was ever discussed between us, but I have talked to Dr. Bell about the draughting, and he may have spoken about me to you. He once asked me if I was a good draughtsman. I replied that I had not had much practice since leaving college, but that when my report was finished I would try my hand at it for him. I must beg leave to assure you most positively that I never refused to undertake draughting; on the contrary, I have always held myself ready to undertake any work that you chose to assign to me.

"It is satisfactory to learn from you this morning that your letter of the 30th ult. was written simply because the temporary work for which I was engaged is nearly finished. I am applying to the Local Government of British Columbia for a professional engagement, and I hope to find congenial work in that Province. If the impression got abroad that I had been discharged for incompetency it would do me very grave professional injury. But I am very glad to be able to refer to you for evidence to the contrary.

"I am, yours obediently,

"J. FRASER TORRANCE."

That letter remains still unanswered, though I suppose he has found no fault with the contents of it. This question of collecting mining statistics has been submitted to Dr. Selwyn, and before it was submitted I had a conversation with Mr. Hoffman, who holds the position of Inspector of Mines, and who assured me that my usefulness would be greater in professional work of this sort, than in this field work

that I had been engaged upon during the past season. I spoke to Dr. Selwyn about it, who even went so far as to nominate the assistant who should carry out the scheme, who was to be Mr. Coste. Dr. Geo. Dawson was also present at the conversation and seemed to agree with the scheme. This correspondence shows that the views of some people have changed considerably. I told Dr. Selwyn, at that time, that I did not think I was well qualified for work as a field geologist, that I had not the necessary training, and that it was not very congenial to me. He said that he did not want me to work as a field geologist, but for me to go into the field and collect the facts, and he would attend to the field geology in the office.

Q. An impression prevails that there is a meagre result from the large expenditure of over \$90,000 per annum, in connection with the Geological Survey, and the object of this Committee is to ascertain if that impression is correct, and if it be correct, whether or not the defects in the Survey result from the system under which it is managed or its administration under that system?—The expenditure is certainly very large for the results accomplished, if they are shown by the published volume of the last few years, but a great deal of very valuable work has been done on the Survey which does not appear in the volume at all. There has been a great deal of work done by Mr. Webster in the Eastern Townships, and there are maps in the office showing the careful way in which he has made his surveys. Dr. Selwyn, in the preface to the report of 1880-81-82, devotes a considerable amount of space, which he reserved in quoting from Mr. Webster's report. From the quotations he furnishes, it is very evident that the whole of the report has been of great value. In the notice of the geology of the south-eastern portion of the Province of Quebec (A and following pages), he refers to some remarks of Mr. Webster's, and he goes on with that quotation of Mr. Webster's for two or three pages, as to the gold of that region. The economic portion of it was entirely furnished by Mr. Webster. The work of Mr. Fletcher has been entirely overlooked in Nova Scotia and Cape Breton, although that region is rapidly growing in importance, as to its mining resources. Large quantities of American capital, I am informed, are constantly going into that country.

Q. When was the work done there by Mr. Fletcher?—He has been engaged in that region for a number of years. Of course, all this work has been paid for out of that appropriation, and if it were known to the public, they might consider that the appropriation was not wasted. Mr. Vennor's work, for four years, has never been published; in fact, I do not think the report was handed in to the Director.

Q. Was that the fault of the system, or of Mr. Vennor himself?—I am not aware. I merely refer to the fact that no report is available for four years.

Q. So that it is actually lost to the public?—Yes.

Q. Are there defects in the system under which the Survey is managed?—I cannot speak on that point, because I am not aware of any system. No rules are laid down by Dr. Selwyn for his own guidance, or for that of his assistants.

Q. Lack of system, rather than anything else?—Yes. I know that the instructions he has issued to me and others, have been absolutely contradictory to instructions given previously, so that it does not seem to me that there is any system in the matter. It is a government of caprice.

Q. Is the administration satisfactory. By that, of course, I refer to the personal supervision by the Director; the instructions that he gives, and his personal relations with the staff?—The administration appears to me to be very unsatisfactory. Dr. Selwyn will, for a week, appear to devote his entire energies to watching the work of one particular member of the staff, and then perhaps let months pass without saying a word to him, and concentrate his attention upon somebody else. The results are very unfortunate. I am aware that Dr. Selwyn has a difficulty in distinguishing between the junior members of the staff, although they have been there for several years. He does not know whether they are working with Dr. Bell, Dr. Dawson, Mr. Ellis or Mr. Fletcher, so that it is not easy to supervise the work, when he is not aware of the work they are supposed to be doing.

Q. Speaking generally, are the relations between the Director and his staff friendly or otherwise?—At the present time they are decidedly otherwise than friendly; in fact, bitter feeling exists between him and almost every member of the staff.

By Mr. Baker :

Q. When were you first appointed?—My appointment dates from the 21st of May, 1883.

Q. And at that time were you given to understand that your employment was distinctly of a temporary nature?—Not at all. Dr. Selwyn spoke, at that time, of continuing my explorations four or five years, before any definite results could be expected.

Q. Did you receive from the Government or from the Department your regular appointment?—Not at all; I was paid out of the general field exploration fund.

Q. Did you receive your instructions in writing, previous to going on this exploration?—No; everything has been verbal and also contradictory.

Q. Were you paid the same rate of remuneration as gentlemen of your training and position usually demand, or in keeping, at all events, with what other officers received when doing similar work?—Yes, Sir; not quite to be compared with the American pay, but it was the same as the others on the Survey.

Q. Were you regularly dismissed by Dr. Selwyn by letter?—Oh, no; the season was getting too much broken, and I came to report myself at the office.

Q. Was it at that time that Dr. Selwyn led you to believe that your usefulness was gone?—Oh, no; it was not until the middle of December. On my return from the field he received me very friendly, but before many months it was a sort of chaff with those around me that I was to be the next victim, but it was some time before it dawned upon me that he wanted me to leave.

Q. You were, so to speak, his pet aversion for a time?—Yes; when I first joined the staff I was looked upon as a favourite of his, and much to be envied by every gentleman who had been on the staff for a long term of years, but when I came back they did not envy me so much.

Q. At the present moment, are you supposed to be receiving pay?—No; my pay ceased at the end of February.

Q. Then you had a formal notice?—At the end of January. I accepted the notice and proceeded to look for work elsewhere, and on the 31st January I wrote the following letter:—

“OTTAWA, 31st January, 1884.

“DR. A. R. C. SELWYN, LL.D., F.R.S.,

“Director of the Survey.

“Sir,—Your letter of yesterday's date only reached me this afternoon. Its contents are duly noted. Accept my thanks for leaving me no longer in uncertainty as to your intentions towards me. As I am engaged by the month, I must leave the service by the end of February, but perhaps you will kindly grant me leave of absence after my report is finished, to enable me the better to seek for other employment.

“I am grateful to you for the friendly intentions, with which you invited me to join your staff last spring. As events have transpired, I am sorry I did not absolutely decline your kind offer. The results have realized my worst anticipations.

“I went into the field without much experience and no suitable assistant. Since my return, the worst construction has been put upon my every action. Whenever I write a letter it is supposed (without enquiry) to be on private business, &c., &c., but I am not going to try to justify myself.

“And I would be very sorry to write anything to still farther embitter our relationship. It really pains me to think that we cannot, when our official relations are abandoned, resume the former friendly relations, which I value very much.

“Again thanking you for your prompt reply,

“I am, yours obediently,

“J. FRASER TORRANCE.”

Q. Then this letter of the 30th January gave you your dismissal?—I understood it so.

Q. And you accepted it?—Yes.

Q. Then how can the Department expect you to make up reports?—I think I am in duty bound to do so, because part of my time was spent in looking for work instead of finishing up the report.

Q. In fact, your work is not complete until your report is in?—No. I may say that this notice of my dismissal took Dr. Geo. Dawson, who, to a certain extent, was interested in my appointment of the previous spring, completely aback, and Dr. Dawson said the result would be that a green hand would have to be sent into the field and have to serve his apprenticeship there, at a loss to the Government.

Q. So, that as far as the geological work which you did there during that season is concerned, it is simply thrown away?—Yes; to a large extent. A great deal of the information which the geologist gets in a region the first season is a general knowledge, and cannot be embodied in the report. It shows him how best to guide his men the next season. That is the reason why the usefulness of a man is valued, to a great extent, by the length of his service. In speaking to Mr. Frank Adams about the Laurentian country, he remarked that it was very unfair to ask any man to make a report after one season's work in a new field, because of there being no fossils there and the strata being disturbed. It is difficult to obtain sufficient data in one season on which to base a report. In fact, men going into the Laurentian field now-a-days, as they cannot depend upon fossils in regard to the structure, they ought to be accustomed to the microscope, and be assisted by chemical analysis and microscopical work as they go on. Otherwise, the work is apt to be misleading and erroneous.

Q. Have you ever made any reports to the Geological Department concerning British Columbia?—No.

Q. So that all the information you obtained out there is your private and personal property?—Quite so, and the same in Nova Scotia and the Province of Quebec.

Q. To what reason do you yourself mainly attribute your so-called dismissal?—I cannot give any definite reason for it. I would like to submit to the Committee a very interesting article by Mr. S F Emmons, of the United States Geological Survey, which has been published in the tenth volume of the transactions of the American Institute of Mining Engineers. The title of it is "The Mining Work of the United States Geological Survey." It speaks of the division of the country into areas, with local centres, under the charge of assistant geologists, and then he speaks of the Survey work now in two branches—one general geology, and the other mining geology—which will independently and mutually assist each other and that in each division there should be a distinct corps in each of these branches. Mr. Emmons, in the course of this article speaks as follows: 'In earlier Government surveys, which were topographical reconnaissances in a practically unknown region, geology occupied a secondary and unimportant position. With the Fortieth Parallel Survey, inaugurated in 1867, and its successors, the Hayden Powell, and Wheeler Surveys, geology became an essential object of the work but owing to the want of already existing maps, topography necessarily absorbed a large portion of their labour and funds. Even these, however, were rather of the nature of geological reconnaissances than of surveys properly so called—the conditions of the work demanding that a given superficial area should be covered each year, without allowing time for complete and thorough investigation of any particular class of phenomena, or series of deposits. Their labours had, nevertheless, furnished an adequate knowledge of the general geology of the great Cordilleran system in the United States, as well as general topographical maps of an area sufficient to serve as a basis for more accurate and detailed studies, which might occupy, for a number of years to come, all the force which could be employed with the funds Congress would probably be willing to appropriate. Therefore, instead of continuing the reconnaissance work over the remaining unexplored area, it was decided to make detailed monographs of particular districts in the region thus partially known, for the purpose of illustrating geological phenomena of special interest, and thus giving time for

topography to precede geology, as it properly should, in the, as yet, unmapped regions. An important change in the manner of carrying on the geological work, introduced by Mr. King, was that of dividing the country into departments, or divisions, over each of which should be placed a geologist in charge, with an office at some central point, to whom, under the general supervision of the Director, was intrusted the entire responsibility of planning and carrying out the work in his division, and the choice and general direction of his assistants. This change was favourable both to efficiency and economy, since by it the annual expense of transferring large parties from Washington to the field was avoided; and the employees, becoming more and more familiar with the character of their particular district, could work up their material in the immediate vicinity of their field of labour, and would be enabled to do more rapid, and at the same time more accurate work. In pursuance of the idea that more attention should be given to the practical application of geology, to the development of mining industry, the work of the Survey was distributed under two main heads—general geology and mining geology—which, while independent, should mutually assist each other. In time, it was intended that in each division a distinct corps should be occupied in each of these branches, whose combined labours would result in giving us not only a geological map of the whole country, but an intimate acquaintance with its mineral resources, and some definite knowledge in regard to the vexed question of the origin of ore deposits. In the two field-seasons that have elapsed since the adoption of this programme, with the limited funds appropriated for the use of the Survey, necessarily but a small proportion of the work contemplated has been accomplished. Nevertheless, a number of monographs are now in process of publication, which will, it is hoped, prove the wisdom of the programme above sketched. Their possible field of usefulness will certainly be enlarged by the fact that they will be procurable by all who desire them, at the cost of publication. The work of the mining geologists of the Survey is that in which the members of the Institute will naturally feel the most direct interest. As a brother mining engineer, I feel that it may not be inappropriate for me at this time to give some account of the manner on which that portion of the work intrusted to me has been carried out, in accordance with the above general programme, and to offer to your consideration and criticism my idea of the principles and aims which should govern such work. The mining geologists of the Government should, it seems to me, bear to the mining engineers of the country a somewhat similar relation to that which the latter held to individual owners and the mining public at large. The duty of the mining engineer towards his employer, the actual or prospective owner of a mining property, is to place before him, in an intelligible manner, the character, mode of occurrence, and probable quantity and value of the mineral deposits which his property may contain, and the best method of utilizing them. The duty of the Government mining geologist, whose field of observation is wider, and whose facilities for carrying on work are greater, differs only in this, that his views should be more comprehensive and his study should take in the general interests of a group of mines or of a whole mining region, rather than of a single mine. In neither case, however, can trustworthy results be obtained, except they be founded on a sound and accurate knowledge of the geological structure of the region in which the deposits are found. In coal deposits, it is true, the necessity of a geological basis for reports has long been generally recognized, but in respect to metallic deposits, how many of the hundreds of mining reports that are made every year in this country have any foundation of actual geological data? But few indeed. I have been forcibly struck by this fact, in the course of my investigations, when I have endeavoured, by the study of reports on regions I had not yet visited, to obtain some definite idea of their geology. Nor is this true only of this country; it applies, also, though perhaps in a less degree, to older countries. Look even at the classical work on ore deposits of our respected Von Cotta, which is a compilation made by a man whom we all acknowledge to be thoroughly competent of the best scientific data obtainable at the time he wrote. How little satisfactory information can be gathered from it, of the actual geological relations of the deposits described. Why is this? And in what way should it be remedied? If we ask the mining engineer

why he has not given more geology in his report, his answer will probably be: first, that nothing has been published on the geology of that region; second, that the persons by whom he was employed desired practical results, not theories. Of the two reasons thus given, the first is certainly a valid one, and the want of published data is one which it should be the first duty of the Geological Survey to supply. The second is the expression of a prejudice, unfortunately too common in the public mind, in favour of practical as opposed to scientific mining—a prejudice for which mining engineers as a class are partly responsible. Fortunately, this prejudice is gradually disappearing. Ten or fifteen years since it was so strong that the fact that a man was a graduate of Freiberg or other European mining academy, was almost sufficient to bar him from employment in a western mine; while to-day, in Leadville, among the most successful miners and metallurgists, are found prominent names of graduates of Freiberg and other European schools, such as Eilers, Meyer, Grant and others. Nor is this prejudice confined to untechnical men. Many mining engineers, while freely admitting the necessity of a geological basis for determining the value of coal, iron, petroleum, and allied deposits, consider it at best, in the nature of an ornamental or decorative addition to a report upon metallic mines. In my opinion, however, there is no inherent reason why, with sufficient study and investigation, the geological relations of metallic deposits should not be determined as accurately as those of coal and iron. The subject, it is true, presents greater difficulties, and in the rapid advances of geology at the present day, the geologist and the mining engineer have been pursuing somewhat divergent paths—the former confining himself more and more to special branches of theoretical study, and the latter to the technical and mechanical side of his profession. In Prosepy's excellent work, *Archiv der Geologie*, a chapter is given (*Geologie und Bergbau in ihren gegenseitigen Beziehungen*), deprecating this tendency, and outlining in some detail the official work done at present, in both branches by civilized nations. It behooves us, then, it seems to me, not only as geologists, but as mining engineers, to give greater importance to geological structure in our reports and papers on metallic mines; and this, not only for the purpose of removing the above named prejudice, but for the sake of accumulating matter which shall, in time, afford us the means of rendering to ourselves as satisfactory and definite an idea of the manner of the formation of metallic deposits, as we have at present in the case of coal." It is one of the most important things that our Geological Survey could devote their attention to; the origin of the ore deposits, the relation of the metals of the country, the laws of deposits, whether they are richer or within certain zones of rocks or poorer, and so on. Such investigations are considered now, by foreign geologists, as likely, in a very short time, to lead to great practical results.

By Mr. Wood:

Q. I think you stated that your report would be submitted in a few days?—

Yes.

Q. And that you have done work in British Columbia?—Yes.

Q. How were you engaged there?—In 1878 I was sent out there by some gentlemen in Montreal, under the instructions of Sir Alexander Galt, and associated with him were Mr. Geo. Stephen, Mr. R. B. Angus, Hon. D. A. Smith, and some fifteen or twenty other gentlemen, with instructions to go out and report on a precious metal mine there. They intended to organize a company and engage in work there.

Had you any interest in the speculation?—Oh, yes; I was to receive a percentage on the products, in addition to my salary as manager.

Q. You have no such connection at present?—No. While I was connected with the Survey I had no financial connection with any mining enterprise.

Q. In regard to your plans for the future: are you looking forward to following mineralogy as a profession, or with the view of speculating?—Recently I have secured patents for improved methods of protecting boilers from the loss of heat by the use of infusorial earth, and the manufacture of fire bricks out of the same material, and I intend to give my attention to these patents.

Q. This work would appear to belong to one who followed geology as a profession?—I think so.

Q. There was nothing of that kind which could have influenced Dr. Selwyn while you were engaged in the Geological Survey. I mean your connection with anything of that kind?—Not that I am aware of. There is no regulation in existence in regard to gentlemen securing patents for such inventions. I may say that the staff of the Geological Survey of the United States is bound by the laws of the country to have no interest at all in any mines or minerals, which, I think, is a good regulation. At any rate, a gentleman's sense of honour would suggest it to him. I am not aware of any person connected with the Survey having any interest in any minerals, and if they had had such, I would have been very apt to have heard of it while outside of the Survey, because many of them I have known for several years.

Q. You are not open to any charge of that kind?—No.

By Mr. Baker :

Q. Was not your predecessor, Mr. Vennor, discharged from the service for having something to do in connection with a phosphate company?—I am not aware of any such connection.

Q. But was that not the belief?—I am not aware.

Q. Those gentlemen to whom you referred to in Montreal did not treat you any more handsomely than the Geological Department?—They treated me well; it was on this last trip, but none of these gentlemen had anything to do with it. In 1878 every obligation that was undertaken was fully discharged, although the work that I did did not lead to the permanent employment that I had hoped for, although I do not blame any of them for that. With reference to the reports, I would suggest that the method should be followed of making these reports sectional. A man interested in Cape Breton does not want to hear what is going on in the North-West or British Columbia, and they ought to be reported on separately and the volumes sold at a nominal price. I think also that the gentlemen in charge of the different Provinces ought to be promoted to the position of assistant directors, which their long service and training qualifies them for, and which would place them on the same footing in every part of the Dominion, and that gentleman should be held responsible for the work, and that the credit for that work should belong to him instead of to the Director. If this were done, there would be more *esprit de corps*, and a greater sense of responsibility in the department than there is at the present time.

HOUSE OF COMMONS, OTTAWA, 22nd March, 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the Chair.

DR. T. STERRY HUNT, of Montreal, was again called and examined.

By the Chairman :

Q. A question was asked Dr. Hunt by Mr. Wood, the other day, as to what he would suggest with regard to the analysis of soils, and what division he would suggest between the functions of the two departments—the agricultural and the geological—in that respect; and, as Dr. Hunt has given some attention to the matter since, I think it would be as well for him to give the Committee his views upon the subject?—I would say that the work of the analyses of soils and sub-soils is one which should especially belong to the Geological Survey, because questions raised with regard to the origin and nature of soils and their classification in geographical areas can only be done by one familiar with the physical geography and geology of the country, inasmuch as it is this that determines the character and the distribution of the soils. There is also the question of the subterranean waters, as to their composition and their fitness for economic and for agricultural purposes, especially in some of the dryer regions of the North-West, where supplies of good water for domestic purposes and perhaps for irrigation are scarce. I think there are regions where irriga-

tion would be advantageous. Such questions ought to be chemically investigated by the Geological Survey, and these investigations should be done, therefore, by somebody having a knowledge of the physical geology of the regions to be studied. In that way, I think the Geological Survey could render important services to the agricultural interests of the country, and doing a work for which it is much better fitted than any special Agricultural Bureau that could be organized for the purpose. At the same time, the functions of such an Agricultural Bureau are very important in relation to the chemistry of fertilizers and their adaptation to special crops and to the questions of economic botany regarding forests and cultivating plants, and these should, in my opinion, be separate from a Geological Survey, and could, with advantage be transferred to an Agricultural Bureau, which, in my opinion, could best take up the work of practical natural history, which is now supposed to be included in the work of a Geological Survey, especially the very valuable work which Prof. Macoun is now doing, and which is of much importance to the forestry and agriculture of the country, and which might properly belong to an Agricultural Bureau rather than to the Geological Survey.

By Mr. Ferguson :

Q. You would separate the analysis of the fertilizers from that of the soils? You would attach one to the Agricultural Bureau while the other would be attached to the Geological Survey? Would it not be in the interest of the country, from a financial standpoint, that both of these should be under one Department?—It would require a special chemist, perhaps, to look after that. A man who undertakes a systematic investigation of the soils of the country cannot, without loss of time, be called aside to make an assay of fertilizers, because the analyses require the different methods, and there should be no interruption of the regular course of investigation.

Q. Still, could not other officers be attached to this part of the Survey, so as to save expense?—It could be done, but yet I would say that in the organization of the Geological Department there are other chemical questions which come up, in regard to milk, butter, cheese, the examination of the disease of live stock, &c., and there would have to be a sort of laboratory to work in, which could scarcely be connected with the Geological Survey. The examination of mineral fertilizers ought to belong to the Geological Survey, except when it comes to the question of commercial analysis, which must be the work of local analysts. For instance, the commercial articles imported by way of Halifax, Montreal, &c., should be examined by local analyses, who should have control of that work, but so far as the general question of mineral fertilizers, which are likely to be important to agriculture, and the analyses of soils and waters, that might fairly be done by the Geological Survey.

Q. For instance, a man might exhibit a specimen of a fertilizer which might be approved of, but when he came to manufacture it, it might be a much inferior article. The question of producing a fraudulent article thereafter would have to come under the criminal law and be summarily dealt with, I suppose?—You could not expect the Geological Survey to do that.

By the Chairman :

Q. Since your examination before the Committee you have devoted some time to an examination of the maps which were produced here by the Director, notably those in connection with the Eastern Townships. Would you give the Committee the benefit of your investigation?—I would say, with regard to the map of south-eastern Quebec, of which divers copies are distributed here, that the geology of this region, as it had been worked out in the previous twenty years by all the members of the Geological Survey, up to 1866, was delineated on the great geological map published by Sir William Logan in 1866. He then set to work to prepare for the publication of a map, on a larger scale, of this same region, which includes the Eastern Townships, and this was prepared in the office of the Geological Survey, and was engraved by Stanford, of London. A copy of this map, upon which Sir William had placed the geology of the Townships, copied from the map of 1866, was placed by me in the Paris Exposition in the spring of 1867. Subsequently, upon this map was made the basis of some further minor changes in that region by Sir William, but it

was never published. In 1870, I pointed out that there was some reason to doubt the geological interpretation of a part of this map. This led Sir William to make investigations to endeavor to satisfy himself whether he or I was right, which were continued nearly to the time of his death, but were never published. Dr. Selwyn tells us that Sir William wished to suppress this map and, from my point of view, I think that resolution was a wise one, more especially as Sir William's views on this subject had already been set forth in his map of 1866. So much with regard to the suppression, for which Dr. Selwyn was probably justified, and in which view I concur. Sir William had a perfect right to have it published if he wished, but it had already been published in available form, and the only question was, whether this was to be repeated. If he did not satisfy himself, as there is some reason to believe, it was better that the work should remain unpublished, and Dr. Selwyn says Sir William wished it to be suppressed. Another charge with regard to the map is, Dr. Selwyn having published as his own the work of others. Now, this map, as I say, was exhibited publicly by Sir William, after engraving, but was not published on account of these delays. In 1875, Dr. Selwyn allowed the firm of Walker & Miles to reproduce and publish it in this country as a topographical map, and to put thereon his name, stating "Prepared by the Geological Corps; Alfred R. C. Selwyn, Director." Had it been a geological map it would have been correct to say that it was the work of the Geological corps, as it was, it was only a map compiled in the office of the Geological Survey for geological purposes, and subsequently published without geological lines as a topographical map. This map, as thus published, had some unimportant additions only made to it after Dr. Selwyn's arrival in the country. The whole of the Eastern Townships, the more important part of the map, had been engraved two and a-half years before he came into the country. There were added to it undoubtedly a few outlines along the main boundary, and there were additions on the north shore of the St. Lawrence, but so far as regards the great tract of the Eastern Townships, which was the only important and difficult part of the map, it was engraved and publicly exhibited, though not published, two and a-half years previous, and therefore the charge made by some one before this Committee, that Dr. Selwyn published as his own a map which was not his work, nor yet the work of the Geological Survey, except in so far as the few outlines which were put upon it by the Geological Survey.

By Mr. Dawson :

Q. Then it was not his own map?—No, with the exception of some of the minor fillings up. All the important parts are the same as those on the map dated 1867, which I received with my own hand from Sir William Logan.

Q. And he took credit for work which he did not do himself?—I may say that Dr. Selwyn spoke to me about this the other day, and he said: "I am not answerable for that. The map was wanted for topographical and general purposes, and I allowed sheets from the original map to be taken and transferred, in the ordinary way, to be re-produced for that purpose. I gave no instructions and no orders as to what was to be put on the map; in fact, I was ignorant of what was put on the map, until after it was published, and am, therefore, not responsible for it."

Q. But he has seen it since?—He has never effaced it, which would have been very easy to do, with another piece of paper.

Q. This is not the same map that is being re-produced in England, is it?—It is the same, only another publication of it. The sheets were taken from the original map.

Q. The reason was, that Sir William had probably changed his views or was not certain as to the proper position of the rocks in the Quebec group?—Yes. Dr. Selwyn says that Sir William expressed a wish before his death that it should not be published, and in justice to Dr. Selwyn, I will say that I do not think he is to be blamed for keeping back the map as a geological map.

Q. Mr. Macfarlane expresses himself very strongly upon that subject?—I said to Dr. Selwyn that he should have had a written record of what Sir William told him, but he said: "I know I should, but I have not." I am therefore willing to take his

word, and I have reason to believe that Sir William was in great preplexity in this matter.

By Mr. Baker :

Q. Do I understand that you consider it was showing his wisdom, from a geological point of view?—Not his wisdom, but his respect for the wishes of Sir William Logan.

Q. You have every reason to believe that that wish was expressed?—I have no reason to doubt Dr. Selwyn's word, from any other source.

Q. But during Sir William's life-time you had opportunities of conversing with him. Did he express such a view to you?—Not in those last years during which Sir William was at work, because I was absent from the country.

By Mr. Dawson :

Q. But you never understood before that Sir William wished to have his map suppressed?—No, I did not; but Dr. Selwyn says it was so.

Q. So the suppression of Sir William's great work rests upon Dr. Selwyn's assertion as to his wishes?—Yes. There is also another reason. Dr. Selwyn, in speaking to me about this map, the other day, said: "I have satisfied myself, Dr. Hunt, that you were right, and Sir William Logan was wrong;" and therefore, Dr. Selwyn, of his own motive, might think it proper to suppress the map, but he would have no right to, except Sir William Logan told him to do so. Therefore, I am willing to believe that Sir William did tell him that, as it would show his wisdom, if he did.

Q. Sir William was in doubt himself as to the correctness of his map?—Sir William said: "I do not know whether I can go over the work of forty years; I am too old for that, I am afraid;" and then afterwards undertook to do it.

Q. Do you know what work is being done in the department at present in the way of maps?—I do not; I saw Mr. Ellis plotting down his work in the Shickshock Mountains in the Gaspé region, where he seems to be doing very excellent work. I also saw a proof of a large map of the county, from the Plains to the Pacific, now being printed in Montreal and, as I judge, devoted to the distribution of the Indian tribes of the West, from the foot hills to the ocean, which could not be called a geological map.

Q. Of what use would that be to geology?—I cannot say; it shows the limits of their hunting grounds, and nothing else.

By Mr. Baker :

Q. Previous to your leaving the Geological Survey had you any conversation with Dr. Selwyn upon this map? Did he indicate to you that it was his intention to suppress it?—No, he never did. I might say Sir William Logan took exception to the views which I put forward in 1870 and 1871, and showed great displeasure thereat, with regard to the geological map of the Eastern Townships, Dr. Selwyn espoused strongly the views of Sir William, as opposed to mine. After fully examining, however, at my request, the evidence which I had laid before Sir William, as well as himself, he came to the conclusion that I was right and that Sir William was wrong. Sir William meanwhile examined this question and, as I am informed by Dr. Selwyn, recommended the suppression of the map.

By Mr. Wood :

Q. With regard to this map that has been referred to, and which Dr. Selwyn published, if I understand you rightly, as a topographical map, is it correct?—It is an excellent topographical map of the region in question.

Q. Was there anything improper in Dr. Selwyn taking the work of Sir William Logan, as he found it to be correct, and giving it to the public in that shape?—I will simply say that he published it as "the work of the Geological Corps, Alfred R. C. Selwyn, Director," and it was not correct to say that it was the work of the Geological Survey, except as the work of the map-maker.

Q. It was not then Sir William Logan's map?—Mr. Barlow was the chief map-maker for the Survey, and he was at work on it for ten years.

Q. It would not be right then to publish it as Sir William Logan's map?—Except that Sir William Logan, in one or two places, might have made some little suggestions, as he had a keen eye to topography, it was to all intents and purposes a Crown Lands survey, and prepared by Mr. Barlow, under Sir William Logan.

Q. What would have been proper to put on it?—“As a map of the Townships, compiled for the use of the Survey, by Mr. Robert Barlow, from such and such sources, and with geological lines by the Geological Survey, Sir William Logan, Director,” because his position as Director could not be ignored. And then Dr. Selwyn might, if he wished, have put at the foot of the map, “Alfred R. C. Selwyn, Director, from such and such a date.”

L. R. ORD, Esq., twenty-seven years of age, was next called examined.

By the Chairman :

Q. Have you been connected with the Geological and Natural History Survey of Canada?—I have been connected with the Geological Survey of Canada for five years, from 1876 to 1881.

Q. What position did you occupy when you were first connected with the Survey?—Surveyor and explorer. There was no stated position; I was employed temporarily at first, and then I was placed on the permanent staff, as surveyor and explorer.

Q. What were your previous experience and attainments to qualify you for service on the Geological Survey? I refer to your academic training, &c.?—I had no academic training, but an ordinary school education. I was employed by Dr. Selwyn, in 1873, on his expedition to the North-West, and also on a special survey of the North-West Territories, in 1874 and 1875. In 1876 and 1877 I was Mr. Vennor's assistant in the phosphate regions of Ottawa and Pontiac Counties; in 1878 I was sent out as Mr. Richardson's assistant in the Shickshock region, and in 1879-80 I was given a district of my own to explore, in the Counties of Argenteuil and Berthier, north of the St. Lawrence.

Q. What force of assistants had you when you had a district of your own?—In 1880, I had Mr. McConnell. That was the last work I did for the Survey.

Q. Did you prepare a report of the work you did?—Yes; in both years.

Q. Does it appear in the published reports?—No; only a notice of it by Dr. Selwyn, in his summaries.

Q. Was your work apparently satisfactory to the Director of the Survey?—I think so; he never gave me any reason to suppose that it was otherwise.

Q. On what account did you sever your connection with the Survey?—Well, I had applied for an increase of pay, and it was general disagreement with Dr. Selwyn. I thought there was no chance of getting on, and that as he had given me charge of a district, I thought I should get an increase of salary as well. It was rather a question of salary; I applied to the Department, and received an answer that everything was left to Dr. Selwyn, and I thought that as long as Dr. Selwyn was Director there was no chance for me, and I left, the first opportunity I got.

Q. What occupation are you following at present?—That of Dominion Land Surveyor.

Q. Have you been connected with the Government since then?—Yes; I have been employed by the Department of Dominion Lands for the last two years.

Q. How does your remuneration, in your present position, compare with that, while you were on the staff of the Geological Survey?—Very much better. Of course, when I left the Survey, it was not so much the question of remuneration at that time, as the prospect. There seemed to be no prospect of any advance in any way.

Q. Can you give to the Committee any views or suggestions as to defects in the administration of the Geological Survey, and, if so, in what would you suggest that it might be improved?—It is rather a lack of system than a system, as far as I have seen. A gentleman of the Survey has his particular field to work out, and although

the Director invariably interferes and dictates to him, saying that he should work out that field in a particular way, he does not go any further than that. Dr. Selwyn is not sufficiently conversant with the way of working up the country, to give directions that are worth being listened to by the members of the Survey.

Q. Do you know anything about the suppression of reports of the members of the staff of the Survey?—I have heard frequent complaints from nearly all the members, particularly those on the part of Mr. Webster. I have heard him complain frequently that the Director quoted such and such facts from him, and published them himself. This report for 1880-81-82 is an instance of that.

HUGE FLETCHER, Esq., thirty-five years of age, was also called and examined.

By the Chairman:

Q. Are you connected with the Geological and Natural History Survey of Canada?—I have been connected with the Geological Survey of Canada since the fall of 1872, and have been continuously connected with it since that time.

Q. What were your previous qualifications for the work of the Survey?—I am a graduate in Arts, a B. A. of Toronto University, and before joining the Survey I had lived for some years in the copper mining region of Lake Huron, and was pretty well acquainted with the mining and smelting of copper. After I graduated I spent some months in the office of a civil engineer, studying draughting, and then paid a visit to the Lake Superior silver region in a professional capacity, to report on some properties there. I was then for about a year connected with some gold mines at Tangier, N.S., of which my father was the manager. I joined the Survey about the end of August, or the beginning of September, 1872, as assistant to Mr. Robb, who was engaged to survey the Sydney (Cape Breton) coal fields. Mr. Robb resigned in 1875, and I was appointed his successor to carry on the work in Cape Breton. Since then I have been engaged in Cape Breton and Eastern Nova Scotia (in Guysboro' County principally). We began in the eastern part of Nova Scotia, and continued westward.

Q. Have you gone there each season?—Every season since 1872.

Q. What assistance have you had?—The first year I was only allowed \$200 for field expenses, and I had only one assistant; now I am allowed anything up to \$1,600 and have five or six assistants.

Q. How long are you in the field each season?—From five to seven months. We generally get away about May and come back in November or December; it depends on the season.

Q. What is the nature of your work? Is it following up surface indications or examining the general appearance in the stratification of the country, or is it explorations of actual working operations?—It includes all these. In Cape Breton we have one of the most important coal mining sections in the Dominion, and in working up that we had to report on the working mines, the outcrop of all the seams, the area of the coal-bearing rocks, &c. We have to report on the condition, prospect and working of the collieries; that was Mr. Robb's work principally, before I took charge. Then it means making a general map, to show by geological coloring the extent of the various groups of rocks containing minerals of economic importance. In order to accomplish that object in Cape Breton, it was necessary for us to make the maps of the country, because there were no maps of the country, not even county maps in any county of Cape Breton at the time we went there, and therefore a great deal of our time had necessarily to be spent in this topographical work, because, as every geologist knows, correct topography is at the basis of actual geology, and therefore of scientific practical mining. Then, in the course of that, all the streams and roads, and lakes and shores, had to be surveyed; in fact, a topographical map of the country had to be made. In the course of these explorations one of the first objects was, of course, to keep a look-out for minerals of economic value. In most cases they were well known before, but in some cases we indicated minerals which have since been worked.

Q. Have you, each season you have been there, prepared a detailed report of your work?—In some cases the work of two seasons was published in one report; that is, one season's work was allowed to run on into the next. In every year I have prepared a summary report, at any rate, and the map, which is the principal part of the work, has been carried continuously forward. The maps, I might say, were always ahead of the reports; in fact, I never write my reports until I have all the information on the maps, and in those cases one has to make maps of the country. There is an Admiralty map of the country, showing the shores and the general shape of the country, and then there is the map of Messrs. Gisborne and Hill, showing the shores and some of the roads and lakes, just such information as could be made out from the Crown Lands and other general sources of information.

By Mr. Cameron :

Q. Do you consider the maps of eastern Nova Scotia and Cape Breton important?—I consider them of more importance than the reports. I think almost everything of value could be put on the maps, and accompanied by a short report would be all that was necessary for a geological description of the country, and it is what miners really look at when they come into the country.

Q. Were maps of the island of Cape Breton published up to this time?—There was the map of Mr. Mackenzie, of Sydney, published in 1883, from information supplied to a great extent by the Geological Survey.

Q. Is there a geological map of the Island?—No; not published.

Q. Nor of any county in the Island?—Yes; of Cape Breton County, finished in 1877.

Q. What are the most important minerals of economic value on the Island?—Coal, iron, gypsum, limestone, copper, lead in small quantities, and silver. There is also gold, but it has not been worked to any great extent, although in several places there is good promise of the gold mines proving of importance. The coal mines were pretty fully reported on in the report for 1872-3 and 1874-5 by Mr. Robb.

Q. Did you notice any coal in Victoria County?—There is coal at New Campbellton, on the Great Bras D'Or.

Q. And in Richmond County also?—There is a coal field of some size bordering on the Strait of Canso, at the eastern end, including the Middle River and Cariboo Cove mines.

Q. Are there not also extensive coal fields in Inverness County?—Yes; large exposures of coal occur at Chimney Corner and from Broad Cove Marsh to the Broad Cove Mines, at Mabou and Port Hood.

Q. Any further south?—Yes; in a small basin on the River Inhabitants, near Glendale.

Q. Did you see any gold along the Middle River?—No; but I have seen gold that came from there. I never washed it out myself, because I had perfect confidence in the statement of Mr. John Campbell, one of the first explorers, who also says that it is found in the North-east East Margaree River.

Q. I suppose that gold must be washed from the mountains?—It is washed from the mountains into the adjoining brooks.

Q. There is a large extent of country there not explored?—Yes; we surveyed all the brooks in the neighbourhood, and to a certain extent indicated the rocks in which this gold may be sought for.

Q. Are not the coal fields of Inverness County very extensive?—They are not as extensive as those of Cape Breton County, which are most important; but they are very extensive, and would be very extensively worked were it not that there are no shipping harbours on that shore.

Q. There is also plaster there, is there not?—Yes; and plaster is also found in other parts of Cape Breton. One of the prominent features of the scenery of Bras D'Or Lake is its white cliffs of plaster.

Q. Did you ever notice the plaster deposits at Mabou?—Yes; they were largely worked at one time, and if there had been a good harbour they would have been worked to this day. There is an enormous deposit of plaster there.

Q. Is there not marble in Inverness County also?—Yes; in the west bay of Bras D'Or Lake. There is marble also, of the same geological formation, at a place called Turk, and also on George's River and at French Vale and Eskasoni. The limestones are largely exported from the Strait of Canso to Prince Edward Island and elsewhere. The gypsum was also largely exported at one time from the Strait of Canso, and is now largely exported from the neighbourhood of Baddeck and the Strait of Canso.

Q. Is the Island well timbered?—It was, I believe; but I think nearly all the pine and hemlock have been cut out. There is a good deal of hardwood, and in some places hemlock is still found.

Q. Would you consider, then, that the publication of a geological map of the Island was important? If it had not been considered important I do not think the work would have been undertaken.

Q. I may here quote a letter that Dr. Selwyn placed in the hands of the Minister of Justice last year, which shows the importance of a geological map of the Island, and which I think ought to be published. Dr. Selwyn says:—"The map of Cape Breton County has been published, and accompanies the reports for 1876-77 and 1877-78. Those of Richmond, Inverness and Victoria Counties are ready for the engraver. Apart from geology, they are valuable maps (scale one inch to a mile) for all purposes for which maps are required, and I think they ought to be engraved on copper plates, and thus be permanently available, as no better or more accurate maps will probably be made of Cape Breton during this century. The lithographic work done by the Burland Company is not satisfactory, and there is no certainty when it will be completed. If the map is engraved, as it ought to be, it must be done either in the United States or in England. Next year—i. e., after the 1st of July, the necessary funds will be available. If put in hand at once, a good many months would be required before it could be ready to print. I should like to have it ready to accompany Mr. Fletcher's final report on the geology of Cape Breton, now being prepared. The MS. of the map can be inspected at the office by any one who wishes to do so." As people complained that the reports and the maps were not published, I have taken some active part in securing their publication. The other day I wrote to the Burland Company, and they referred to the map in these terms:—

"MONTREAL, March 20th, 1884.

"HUGH CAMERON, Esq., M.P., Ottawa.

"DEAR SIR,—In reply to your favour of the 19th, we have in hand a large geological map of Cape Breton, which, I think, includes the Counties you mention. It has been in our hands (or a part of it), for some months, and we are now pushing it with all possible despatch. It is a very fine map, and is being nicely done, which necessarily takes time.

"Yours truly,

"G. B. BURLAND,

"Manager."

These are evidences of the importance of those maps, which I desire to have made public. Now, when were those maps ready for publication?—The work was done from the south towards the north, in 1873 and 1879. Maps were ready to accompany my report for 1879-80, which report had been kept over a year at the request of the Director, until a few additional particulars could be added to complete the map, as, in his opinion, as well as my own, the report was of comparatively little value without the map. When I was speaking of the mineral resources of Cape Breton, I should also have mentioned the copper deposits. There is one mine in Cape Breton County, the Coxheath mine, where American capitalists have spent upwards of \$200,000, I think, in developing it. Other deposits have been worked at Gabarus and at Cheticamp, Inverness County. There is also a little copper at Whyecomagah. With respect to iron, valuable deposits of red hematite have been found at East Bay, Big Pond, Boisdale, Whyecomagah and Middle River.

Q. Have you any idea when the map was sent to the lithographer?—Yes; it was sent in April last. I should state that the whole of the map was not ready in 1879; it was only the map including Richmond and the southern part of Inverness and Victoria, which should have gone in the report of 1879-80. It was then kept back—I cannot understand why—and the report might have been issued in the form in which it now appears in the volume of the year previous, that for 1878-79, but at that time the Director had a long report of Dr. Dawson's, and this report of Cape Breton being a long one, he thought it would be as well to keep it over; at the same time he had also requested Dr. Bell and Mr. Ells to cut down their reports and make them as short as possible. In the subsequent year, as I have before stated, this report on Cape Breton was published, but without the maps, no reason being given for withholding the maps, and then no more was said of them until the remainder of Cape Breton had been surveyed and all the maps were ready for publication. Then this, to which Dr. Cameron has just referred, took place, and about a year ago, on Dr. Cameron bringing it before the attention of the House, the maps were given to Mr. Burland, first in several large sheets. These large sheets were prepared by Mr. Fairbault and myself for the lithographer, and sent down to Montreal. I have no knowledge of the subsequent correspondence between the Director and Mr. Burland, except that Dr. Selwyn afterwards told me to get them made in sheets 24 inches by 18 inches. Then a third change was made, this time into little sheet 18 by 12 inches. What influence that may have had on the time necessary to prepare them, Mr. Burland could tell better than I can.

By Mr. Baker:

Q. What effect would that have upon the delay which has been caused in the production of these maps? How much would these frequent changes throw the lithographer back?—I do not know; but one thing is certain, and that is, that this delay can only apply to the work done since 1879; the maps relating to the work done in 1878-79 were ready for publication in the report for 1879-80.

Q. I have heard the frequent complaints which have been made about these maps not being completed as quickly as they should be. Now, it appears that the reason was these numerous alterations?—I do not know how they would affect the delay.

Q. But what is your opinion? Suppose you were the lithographer?—I think, if I could afford to do it, I would throw up the job.

By Mr. Cameron:

Q. These changes were not made at your suggestion?—Certainly not; my idea would have been to carry out the original plan.

Q. Do you consider these changes any improvement?—I consider them the reverse of an improvement. It would increase the expense to have them published in little sheets.

Q. Several complaints were sent to me from more than one county in Cape Breton, and I was anxious to know where the fault lay, and from what you say I would infer that it was not your fault, as they were got ready some time ago?—My connection with the survey for Cape Breton finished two years ago, and, of course, the longer the publication of the map is delayed, the less I am fitted to supervise the work, a great deal depending on the immediate filling up of the maps.

By Mr. Baker:

Q. What is the ordinary time within which a report should be sent in to the Department, after the completion of the work?—I think that wherever practicable the reports should be sent in without fail during the following winter. Instances of the folly of delaying reports have often occurred in the Department; one man after another has left the Survey, leaving his maps and field notes in the crudest condition.

Q. In fact, I suppose you have no sooner got through with work of that nature, with your report in that crude state, than you will be sent off to another section of country?—Yes; though not in my case.

Q. Then I am to infer that if you were to carry on the work continuously in one section of the country you could better follow out your researches?—Most decidedly.

Every year that a man of ordinary intelligence spends in the same section makes him better fitted to work in that district.

Q. And the first year of a survey of that nature may be considered initiatory?—
Yes.

By Mr. Cameron :

Q. How long is it since any of your reports were published?—My last published report appeared in the volume for 1879-80, and related to the work of 1878-79.

By Mr. Baker :

Q. Is it customary for the officers in charge of a particular section of the Survey to keep duplicates of the reports sent in to the office?—I do not know whether it is customary or not, but it is not often done. I begin to write it out roughly, and in re-writing it, where there are pages that do not need to be re-written, I let them go into the report. I do not think that in my case I have re-written any report.

Q. Suppose that in the transmission of these valuable reports they should miscarry, would you have duplicates of them?—If I were to lose the last report, which has now been in the hands of the Director for some time, I would have to re-write it.

Q. But you have the material?—Yes; the field notes.

Q. Do you not consider that it would be wiser to keep duplicates of these reports?—Most certainly; but I do not think it is quite fair to ask an officer to re-write his report with his own hand; he has more important work to do.

Q. Is it a matter of frequent occurrence that the matter appertaining to a section of the Geological Survey is sent in to the Director in a crude form, by the officers for him to put in shape?—The Director should do so, if they were not able to write them themselves. In Sir William Logan's time, some of his best men, like Mr. Richardson and Mr. Lowe, who were competent explorers and geologists, but were not sufficiently educated to write their own reports, had their reports written for them by Sir William. Mr. Richardson used to complain, when Dr. Selwyn succeeded to the directorate, that he could not get his reports out, because Dr. Selwyn would not take the same pains as Sir William did.

Q. But still the precedent has been established in Sir William Logan's time, that these reports were sent in for him to revise and to see that they were published in proper shape?—That is one of the most important functions of the Director of the Survey, and now, with so much money to expend, I should think it would be the chief work.

Q. The editing, so to speak, of these reports, has been done in Sir William Logan's time, and consequently it is not a new departure for Dr. Selwyn to pursue the same course?—No; if he does pursue it, but I do not think he does. The material was given by Mr. Richardson into Sir William Logan's hands, who "licked it into shape," as he himself expressed it, correcting any inaccuracies of grammar and spelling, and perhaps of statement, which might occur.

Q. Do you consider that when you send in a report to the Director he should alter it in any shape or form beyond that of correcting grammatical or spelling errors, &c.?—No statements should be altered. I think a man who works in a district, if he is competent to work there, is more competent to judge of the correctness of his work than the Director, who has not been there, however efficient that Director may be. For instance, a report of Dr. Hunt's is published in the proceedings of the Pennsylvania Geological Survey, and Prof. Leslie, in a note, states that he does not agree with the conclusions arrived at by Dr. Hunt, still he publishes the report in the form in which it is given by Dr. Hunt. He says there are differences of opinion; these are not my opinions, but they are Dr. Hunt's.

Q. You would be equally satisfied, with regard to your report, if that course were pursued in your case? You would not like to see your opinions eliminated from the report, but would rather have your report sent in as it was, and allow the Director to make any additions to it he pleased? That would be the correct thing to do?—Yes; I think so. In some points, a man of great ability and knowledge, perhaps superior knowledge of them to the man who has been working in a certain district,

might see at once that you were wrong, and might correct them, but I do not think he should override the opinions expressed or the deductions arrived at by the subordinates.

Q. Then, it is not so much a matter of what is done as the way in which it is done—I mean, as regards these alterations?—None whatever; that is the point I wish to make.

Q. It is really a matter of fact?—I do not think that reports should relate very much to matters of theory.

By Mr. Dawson :

Q. They have run too much in theory hitherto?—Yes; I think so.

Q. With regard to Mr. Richardson, is it not just possible that a man, although he is not very much of a literary man, might he not, at the same time, be a thorough and good geologist?—Mr. Richardson was such; as Sir William Logan states, in his report on the geology of Canada, in 1863, he required assistance to put his observations into proper shape.

By the Chairman :

Q. I notice in the reports a few years ago, some reference to the intention of the Director to have a catalogue published of the Library and Museum. Will you state if any such catalogue has been published?—None; year after year the same statement is made that the catalogue is being prepared, of the Library in particular, and the latest reference to it, I think, is in the last report. On page 11 of this report the Director states: In September, Mr. A. B. Perry, graduate of Kingston Military College, was temporarily appointed for three months as acting Librarian, and during that time he arranged, labelled and numbered nearly all the books in the Library, and made very considerable progress in the preparation of the catalogue." A statement, almost precisely the same, is contained in the report of 1873-74, page 5, and ten years elapse and still no catalogue. The same remark applies to the catalogue of the fossils and minerals of the Museum, which is a much more important matter. I think a catalogue has been begun, but I do not know how far it is advanced.

Q. It has not been published?—No; there are a great many complaints; the Library contains 4,500 volumes, and it is very difficult, for even the men in the office, to tell what books are there.

By Mr. Dawson :

Q. And do you take the books out of the Library?—Yes; we can take them out, by giving a receipt for them.

By Mr. Baker :

Q. Members of the staff?—Yes.

Q. But not outsiders?—I think not.

By the Chairman :

Q. I notice a somewhat similar promise, made as long ago as 1870-71, that it was the intention to report upon the mineral statistics of the country. Has that promise been kept?—No; no mineral statistics have been prepared since 1872-73. I assisted Mr. Robb in tabulating them. Of course, in the course of these reports, there are statistics to be found with reference to the industries in certain regions to which the reports of the officers refer; for instance, about the coal mines of Cape Breton, in 1874-75.

Q. I would like to ask you a few questions with reference to the administration of the Department, and first, in reference to the vacillation in management or direction; there has been some complaint on that score, that is, of contradictory instructions given, not only to the same man, but to different persons, in reference the same field of work?—When we go out to the field every year, we receive from the Accountant a copy of instructions, printed off by a lithogram—I suppose the same copy of general instructions would be given to every man—but they do not carry much weight, because, I think, they are seldom followed. Instructions this year may differ from those next year, perhaps.

Q. But do they differ in the spirit of being contradictory?—I can give you an instance of that. In Sir William Logan's time, the members of the staff were

instructed to ink their field notes as soon as possible. I do not think it is necessary, but such an instruction was issued, by the present Director, to the members of the staff. It was pointed out to him, however, that different instructions had been issued on the Canadian Pacific Railway, to the effect that the field notes should not be touched, as it might lead to mistakes. Accordingly, Dr. Selwyn issued an order directly the opposite to the one he had previously issued.

Q. I do not think you understand me. I mean, with regard to the nomenclature, for instance?—I might state in that connection, that the British Association are to be brought out this year, to be told that Sir William Logan's Laurentian rocks are not Laurentian at all, but are Huronian, (Report for 1877-8, page 14A) and here in the report of 1880-81-82, there is a new classification given by Dr. Selwyn which differs from everything else which has been published in regard to the geological formations. It is headed "Stratigraphical Nomenclature," and is found on page 48 of this report. It differs from every classification known; it differs from that of the Bologne Congress, at which Dr. Hunt was present, and it differs from the well-known one of the British Survey, which had always been followed by Sir William Logan. But there is a far more important discrepancy; Dr. Selwyn also gives a new scheme of colors, which, as everybody knows who has looked at the report, differs even from the colors on the maps of the very same report, and also from those used by Sir William Logan, and the British Survey, and which had been followed up until this scheme was inaugurated. Now, this would lead to great confusion. As an instance that it does not agree with the classification in the reports, I may say that on the chart of colors the Quebec group is classified as Upper Cambrian, while in one of the reports (p. 16 DD.) it is described as Cambro-Silurian.

By Mr. Dawson :

Q. I was told the other day that in the Department there were immense piles of the former reports of the Survey which have never been used? Is that the case?—There is a whole room full of these reports which have never been distributed. They are being distributed from day to day.

Q: But there are also reports there, are there not?—I do not think it would be judicious to distribute every report that the Survey owned in one year.

By Mr. Baker :

Q. You stated just now that previous to going into the field you went to the Accountant and received instructions written by a lithogram, but those instructions were not always followed out; in fact, more frequently not. I want to ask you if you consider that the correct thing? Do you not think that the instructions of a superior officer should be carried out?—Yes; as far as possible, but I know that in a great many cases no care is taken to have them carried out. He, himself, does not care to have them carried out; they are too unimportant and contradictory.

Q. That is an assumption. If you receive instructions from the head of the Department to do certain things, I think they should be carried out, except for certain specific reasons?—So do I; but you cannot depend upon the subordinates carrying them out on account of laxity of discipline. It is the duty of the Director to see that they are carried out.

By Mr. Dawson :

Q. But if they have instructions that are not at all applicable to the duty they have to perform, they have to rely upon their own judgment?—Yes, very freely.

By the Chairman :

Q. Supposing that you were going to a certain field, and that you were attempting to elucidate a certain geological problem, does he give you written instructions?—No; every gentleman is given his field, and is told, verbally, to do the best he can with it.

By Mr. Baker :

Q. The instructions you referred to as having been received from the Accountant previous to going into the field, were devoted to Departmental matters, were they not?—Yes; how to keep our note books, &c.

Q. But do you receive any specific instructions as to the work upon which you are going, signed by the Director?—No.

Q. Do you not receive any instructions from the Director himself?—No.

Q. Do you receive them signed by the Accountant?—No; these are signed by the Director, and relate to departmental matters.

Q. But nothing about scientific matters?—No.

Q. Do you mean to say that you never receive any general instructions as to the nature of the work you are going upon, from the Director?—Only verbal instructions.

Q. Did you ever receive any instructions like this: "To leave Ottawa on such and such a date and investigate a certain locality." Do you receive any instructions of that nature?—No.

Q. So that you start out to paddle your own canoe, as it were?—Yes.

By the Chairman :

Q. You are practically a Director yourself the moment you leave Ottawa?—Yes; the Director should have an intelligent understanding as to what sort of information you were to get in the field.

By Mr. Baker :

Q. Am I to infer that the absence of these instructions is any detriment to the work? In my opinion it is a detriment to the work. I think that most of the men feel the want of some instructions. It is not a case of having too many instructions and not obeying them, but of not having any to obey.

Q. Then, if you had the instructions and were to disobey them, the onus would rest on you?—Yes.

Q. At present the onus cannot be placed anywhere?—No.

"GEOLOGICAL AND NATURAL HISTORY SURVEY,

"OTTAWA, 20th March 1881.

"DEAR SIR,—A question having been put to me while giving evidence before the Geological Survey Committee, as to whether the Survey had reported against the probability of the occurrence of coal in the Rocky Mountains west of Calgary, where the Cascade River anthracite basin has lately been discovered, I replied that I believed no such statement or report had been made.

"The district particularly referred to, was actually examined for the first time last autumn, and no report on it has yet been printed. Any allusion to the occurrence or otherwise, of coal, must therefore, have been incidental merely. I have, however, searched the published reports of the Survey and can find no mention whatever of the district in question, except one of a general character, in my preliminary report on the Bow and Belly Rivers districts, published in May, 1882, where the following observation occurs:—

"The most interesting feature of these explorations was the discovery that in the region of the Crows' Nest Pass, wide valleys based on cretaceous rocks occur west of the first range, formed of palæozoic limestones, and that, in these cretaceous rocks, an important intercalation of volcanic material appears. *It is possible that in some of these now isolated troughs of cretaceous rocks coal beds may yet be found, in the heart of the range.* The existence of a seam was indeed reported about twenty miles west of the summit of the Crows' Nest Pass, but I was unable to read the locality." (p. 2).

The words italicised in the above quotation have since been found out by the discovery on Cascade River and by other discoveries of a similar kind in the southern part of the range.

"I have the honour to be, Sir, your obedient servant,

"GEORGE M. DAWSON.

"ROBERT N. HALL, Esq., M.P.,

"Chairman Select Committee on Geological Surveys."

HOUSE OF COMMONS, OTTAWA, 26th March, 1884.

The select Committee on Geological Surveys met this morning, Mr. HALL in the Chair. FRANCIS BENNETTS, Esq, Mining Engineer, of Ascot, P. Q. was called and examined

By the Chairman:

Q. How long have you been connected with the mining industries of Canada?
—About thirty years altogether.

Q. Before coming to Canada had you any experience in mines in Great Britain, and if so, what?—I have gone through every department of mining, and had about eleven years of practical experience in Great Britain.

Q. Will you state briefly your experience in this country? I believe you have had some experience in the Lake Superior region?—I have examined some of the mines there—the Bruce and Silver Islet Mines.

Q. What has been your principal occupation here in Canada?—I have been twenty years in the Ascot Mines, in the Eastern Townships. I am the representative in this country, of the Canadian Copper and Sulphur Company, (Limited), whose headquarters are in Glasgow, but their affairs are managed by John Taylor & Sons, the eminent mining agents, of Queen street, London.

Q. Will you state to the Committee, briefly, what actual mining operations are now being conducted in the Eastern Townships?—There is the Canadian Copper and Sulphur Company (Limited), the Orford Copper and Sulphur Company, the Union Company and Messrs. G. H. Nicholls & Co.

Q. These operations are all carried on very near each other, are they not?—Yes, within a radius of ten miles, in the neighborhood of Ascot.

Q. How many men are employed in these mining industries there?—About 500 hands, boys and men.

Q. What population would that represent?—The population immediately supported by mining there, is about 2,000.

Q. What is the output of the mines there?—From 4,500 to 5,000 tons. It has increased from a few hundred tons to about 5,000 tons a month.

Q. What depth have you reached in your own mine?—The Orford mine is below ours, on the continuation of the same vein. They are down about 1,000 feet.

Q. For the last ten or fifteen years, are you aware that that section of country has ever been visited by any one from the Geological Survey of Canada?—I have no knowledge of any of them being there. I have looked over the reports of the Survey and see no reference to these mines having been examined by the Geological Survey. There is, in the last volume of reports for 1880-81-82, two pages devoted to the copper mines of the Province of Quebec, but they contain no reference whatever to the three principal mines to which I have referred.

Q. How much cash do you think is expended in connection with those mines in the Ascot district?—In the mines that I am immediately connected with and in the vicinity, I should think there was an expenditure of about \$250,000 a year for all purposes, or from \$20,000 to \$25,000 a month.

Q. Please give to the Committee some general idea as to the value and extent of the mineral deposits in the Eastern Townships?—They are simply immense. They are connected with the lower grade ores. The deposits include iron and copper, and there is also what I call sulphur pyrites.

Q. The iron deposits are of vast extent, are they not?—Yes.

Q. And of great richness?—Yes; a very high per cent. of iron ore.

Q. These immense iron deposits have not, thus far, been practically utilized, owing to the difficulty of smelting, and to the expense of getting fuel, but there is no question as to their richness and ultimate value?—No; I should think not.

Q. As to the copper interests, is it equally true that there is a vast amount of copper ore?—Yes; the copper ore is associated with sulphur. What we use is the 3 to 3½ per cent. of copper, but it also contains a large amount of sulphur, from 35 to 42 per cent.

Q. The low percentage of copper has made it difficult to realize a benefit, so far as devoted to copper alone?—Yes; the sulphur was wasted for a good many years and is still wasted. The great value of the sulphur has only been appreciated since the value of the sulphur deposit in the Tarsis mines of Spain has been established. It is admitted now, in the United States, that the sulphuric acid manufactured from it is as good as that produced from any sulphur mine.

Q. What use is now being made of the sulphur in these mines, and how is it being utilized?—The sulphur of the Orford mine and of the Messrs. Nicholls is sent immediately to New York, where it is utilized in making sulphuric acid.

Q. Why?—Because there is greater encouragement there for its manufacture. It is taken from the mine in its raw state and taken to the United States to be utilized there in the manufacture of sulphuric acid.

Q. Has there been an enormous expenditure of money in Ascot that is now perfectly idle on account of these ores being sent out in their raw state?—Yes; the works of the Orford company are now lying idle.

Q. If the manufacture of sulphuric acid and of agricultural fertilizers were encouraged in this country, would it have the effect of keeping all that manufacture in this country?—Yes.

By Mr. Ferguson :

Q. What proportion of that ore is refused when they get it in New York?—The constituent parts are sulphur, copper and iron. They take out about 3 per cent. of copper and about 40 to 42 per cent. of sulphur, and the balance is iron, which may or may not be utilized; that is, you get 3 per cent. of copper, 35 to 42 per cent. of sulphur, 30 per cent. of iron and the rest is earthy matter, fully 20 per cent. of waste.

Q. Is that iron of any great value?—No; it is comparative waste as well.

Q. Then they pay freight on this waste in order to get it there to make sulphuric acid?—Yes.

By Mr. Baker :

Q. Do you mean to say that there is 20 per cent. of earthy matter?—Silica is included in this 20 per cent. which is also included as waste.

Q. And freight is paid on that as well?—Yes.

Q. Is not some of this so-called waste of merchantable value?—Twenty per cent. of it is lost altogether, but 30 per cent. of it is of merchantable value, sometimes.

By the Chairman :

Q. When the sulphuric acid is manufactured we get it back into the country and pay freight and duty on it, I suppose?—They pay freight and import duty on it into the United States, and we pay freight and duty on it to get it back.

Q. What is the value, do you think, of these Orford smelting works that are now standing idle?—From \$100,000 to \$150,000.

Q. As a practical mining man, will you state to the Committee what value do you think the country is getting, if any, from the work of the Geological Survey of Canada, in so far as applied to mines?—I am not aware that it is of any value whatever.

Q. Do mining men, like yourself, attribute any value or importance to it?—No; we scarcely know there is such a thing, from a mineralogical and metallurgical point of view.

Q. In what way do you think the Geological Survey might be of practical value to the mining industries of the country?—It would be impossible, of course, to keep the public fully informed upon it, but they should know whether we have any mines or not.

Q. Would not mineral statistics be of great importance?—Yes; mineral statistics and maps of the mines, and general information as to the natural laws regulating and governing deposits, which is the most important feature of it. The veins in traversing the earth meet cross veins; when they meet cross veins the great point is to know what is the effect, because, if I go and expend money in an opposite direction from where I should find the vein, there is so much lost. In these mines where they

meet cross veins the effect is to produce what is known in coal mines as a downthrow or an upthrow, and in a copper mine as heaves, a right or left heave. If I work on horizontally—that is, continue my drift on the level, as usual—if it is a downthrow, I would, as a consequence, be above it, and if an upthrow, below it. In the same way, if, on meeting a cross vein of copper, I kept straight ahead, if it is a right heave, I would, of course, be to the left of it, and if a left heave, to the right of it, thus failing to meet with the vein at all. As an instance in the Capelton mine, in one of the drifts, at the point where the vein meets the cross course, there is a left-hand heave of about 54 feet and, of course, if we had gone straight on, or to the right instead of the left, we should have been so much out, and would have probably imagined that the vein had disappeared.

By Mr. Baker :

Q. Do your remarks apply to the world generally?—Yes; there is a general rule even for the irregularity of veins. In districts they are similar and generally perhaps the world over. Veins are also subject to dykes and slides and other important variations. A “horse” is a split in the vein occasioned by the intrusion of rock. The inclination of the vein and the angle at which they meet the cross-veins has a great deal to do with the throw or heave. The most instructive book I ever read on the subject was that of William Jory Henwood, in the Geology of Cornwall, Devon, and Summerset, England. These rules will apply to the whole world, of course varying in different districts, but there is a degree of uniformity to them, within the limits of particular districts, and it is important that the records of them should be obtained and preserved, so that wherever capital is invested in the various districts it may have the advantage of the experience of those who have gone before.

By the Chairman :

Q. Do they keep records of mineral development and maps of mines in Great Britain?—Yes; each mine keeps a record of its production and a map of the mine, and I believe it is imperative now, by law, to keep maps of all the mines, on account of all the late accidents. For instance, when one mine is near the other, and the mines having been abandoned for 40 years, perhaps, and work is again resumed, unless maps are kept to show the extent of the working and their proximity to each other, the water from one might burst into the other and drown the men at work. I have known several such cases.

Q. So that you think, apart from the value of these plans and maps for economical purposes, they ought to be insisted upon for public safety?—Certainly.

Q. You would recommend that these maps should be published and placed somewhere where they would be matters of public record and easily accessible?—Yes; especially as the mines are assuming large proportions.

Q. What is your opinion as to the practical value to this country, of the establishment of sulphuric acid works and agricultural fertilizers in connection with it?—Very valuable. The thing is now under consideration and I believe a company will shortly be formed; in fact there is a company formed for that purpose, and they are looking round for a proper site, and of course they are considering the questions of detail.

Q. You think then, there is a market in this country for sulphuric acid, if its manufacture is encouraged?—Yes; I think there is a large demand for it in this country, besides manufactures from it might be exported.

By Mr. Baker :

Q. What kind of veins are there in Eastern Canada, from your point of view? I have heard the expressions “true fissure vein” “gash vein,” and “segregated vein” —The whole answer turns on what you understand by a vein.

Q. It is a space, so to speak, of a certain width, in which the mineral deposit is continuous?—The real contention on these points is, are they parallel with the stratification or do they cut it?—A vein may cut the stratification at a very acute angle or at right angles. As a matter of fact, the veins in the Ascot district do cut the stratification at such a very acute angle that it might escape notice. The length of the vein in the Hartford mine and in the Albert and Crown mines is from

1,800 to 2,000 feet, and it has been traced for about two miles, but the important commercial question is not so much whether they are veins but whether the deposits will pay.

Q. What are the indications of a true fissure vein?—Cutting the stratification, as according to the accepted idea of a vein.

Q. Have you any knowledge, either personally or by hearsay, of the mineral deposits of British Columbia?—No; I have known men who worked out there.

Q. They seem to say that everything is upside down there, and where you should go to the top the ore is on the bottom, and where you should go to the right it is to the left?—If they would closely observe the breaks, they would be able to form some idea.

By Mr. Ferguson:

Q. Do you think there is a market in Canada for sulphuric acid, or could it be shipped abroad?—It could be shipped abroad, probably not in the form of sulphuric acid, but associated with phosphates in the manufacture of superphosphates and other products, into the manufacture of which sulphuric acid enters. The company I represent have some idea of starting the manufacture of sulphuric acid. If they get some encouragement, they would also make superphosphates and other chemical compounds. There is a large demand for it in France, and the Eastern Provinces would use superphosphates too. The retail price of superphosphates in England is £4 a ton. They import not only superphosphates, but they get the Tarsis ores.

Q. They say there is a large quantity of phosphates exported to England?—Yes; for the purpose of making superphosphates.

Q. You say they produce it there for about £4 a ton?—They sell it in the district of Devon at £4 a ton retail, and they give a discount to the farmers for cash payments.

Q. What encouragement do you think such a Company ought to have or would be necessary to induce them to engage in its manufacture in this country?—I think they should be allowed to bring in their plant and their material to make the plant free of duty.

Q. Would that amount of encouragement conduce to that end?—I think they ought to have a subsidy. There is a rebate on articles manufactured from iron in Canada, when it is exported. We are now in our mine, working copper by smelting and making a 3 per cent. article into a 25 per cent. article, that requiring labor for its production. To do that we incur great expense in material besides the labor. A large part of the material is taxed and our copper has no privilege at all and has to be sold in a free market, if in Great Britain, or to pay import duty if sent to the United States. All the capital invested in the mines is foreign capital, either from Great Britain or the United States. If we could get some way of getting a subsidy on our 25 per cent. article in proportion to the manufacture, it would be a great encouragement.

By Mr. Baker:

Q. These mines to which you have referred as putting out 5,000 tons a month, do they pay?—I may mentioned that one mine which is in the hands of a single firm, commenced with the production of from 200 to 300 tons a month and have gone up to 2,000 tons a month.

Q. They would then have, under the most favourable circumstances, a fair return for their money?—They are now working under the most unfavourable circumstances; the copper is a low per cent. ore and we do not use in this country the sulphur, which forms a very large proportion of the product of the mine.

By Mr. Ferguson:

Q. Do you think it is important that our Geological Survey should point out these things to us?—Yes; some of these rudiments might be taught in the public schools, and you could thus train boys to observation, for this work. I have been working in Canada for thirty years, and I have gone by the natural laws, as obtained by me from Henwood's Geology. I have found that the natural laws, allowing for circumstances, are to a great extent the same as in the old country.

Q. So far as you know, has the Geological Survey of this country been of any practical benefit to practical miners in pointing out and directing them where they should go to look for minerals?—No; so far as I know.

Q. And you do not think any mines have been called into existence as a result of the work of the Geological Survey?—So far as I know, the discovery of all the mines in this country have been accidental discoveries; for instance, as regards the Harvey Hill mine, a farmer found a peculiar stone after a tree had been uprooted, and he showed it to some friends to ascertain what the stone was, and they said it was copper and some parties took up the mine and worked it. He might have sent it to the Geological Survey, for all I know.

Q. So that, as far as you know, it has been of no value in pointing out where mines might exist or where they did exist?—Not so far as I know.

By Mr. Lesage:

Q. Do you know anything of the gold of the Chaudière district?—No.

Q. Do you know whether it is referred to in the reports of the Geological Survey?—I have never read of it there.

HOUSE OF COMMONS, OTTAWA, 27th March, 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the Chair. R. W. HENEKER, Esq., D.C.L., of Sherbrooke, P.Q., was called and examined.

By the Chairman:

Q. You are the Commissioner of the British American Land Company, and succeeded Sir Alexander Galt in that office, I believe?—Yes, I have been their Commissioner for nearly twenty-nine years.

Q. You are also Chancellor of Bishop's College?—Yes.

Q. And President of the Eastern Townships Bank?—Yes.

Q. You have resided for the last twenty-nine years in the Eastern Townships?—Yes.

Q. Were you acquainted with Sir William Logan?—I was very intimately acquainted with him during his lifetime, and had constant communication with him.

Q. And have always felt, I suppose, a good deal of interest in geological matters, in so far at least as the commercial interests of the country are concerned, mineral deposits, for instance?—Yes; I have always had a great deal of interest in these matters. I am essentially not a scientific mineralogist or geologist, but I have always felt an interest in any work of practical value to the country.

Q. What were Sir William Logan's own views with reference to the direction of the work of the Geological Survey, in so far as it regarded the mineral resources and the economic minerals of the country as distinguished from its purely scientific functions?—He gave a great deal of attention to those matters, and was always ready to give advice and assistance in every way to those who contemplated expending capital in the development of these mines. I have known him, even at the instance of one or two persons, to go out to mines for the special purpose of giving his advice with reference to their exploration. He always guarded himself carefully as to giving an opinion which might induce the expenditure of money, and as to whether mines would become profitable or not. As well as being a geologist, he was a practical miner, having been engaged in mining works in South Wales, so that his advice was of a very practical character. He gave advice with reference to the Harvey Hill mine and of the Acton deposit, the latter of which he always declared was not a mine in a true sense, but a bed or pocket of copper. He also visited the mines at Capelton when they were first opened, and made several reports on them, as well as those at Roxton and Ham, in the latter of which I was one of the unfortunate ones, having spent \$30,000 in attempting to develop the mine there. He always gave to those who sought his advice the advantage of his practical ability as a miner, and his scientific knowledge as a geologist. He also visited the Slate Quarry at Melbourne

and the Lime Works at Dudswell. With reference to the gold discoveries at the Chaudière, I might say the largest nugget of gold was discovered by a old man named Oatey under his charge. It will thus be seen that in addition to all the purely geological work performed by him, he gave special attention to the mineral resources of the country. I do not think we could easily find such a man as Sir William Logan; he was such an enthusiast that he did not hesitate to spend his own money when he could not get assistance from the Government. But the great geological work which he did was the preparation of his geological map of the Eastern Townships; for that purpose he searched the Crown Lands Office for correct maps, and he also came to me as the Commissioner of the British American Land Company, for assistance, as our map was the best practical map until recently. In making these maps one surveyor would do one township, and another another, and, as in many cases the lines would not meet, he would go into the field himself for the purpose of reconciling these discrepancies, being to all appearances, incapable of being over-worked or exhausted. He was an enthusiast and at the same time a man of an essential practical mind; his intercourse with the people who went to visit him was most pleasant, and he always endeavoured to explain, in the most simple manner, anything they wished to know, avoiding technicalities; in fact, he was altogether a most remarkable man.

Q. Was the Survey administered under his direction in such a way that the public could get all the information that had been obtained up to that time with reference to mines and minerals?—Certainly. He was willing to give information upon every possible point, and he was always very careful to guard himself against holding out inducements to people, but would tell them at once what measures to take for the purpose of exploring in a practical and satisfactory way, and give them every information with regard to the economical opening up of these veins.

Q. And there were no mineral discoveries throughout the country which did not receive his personal attention or the attention of members of his staff?—No; he always encouraged people to approach him, receiving them in the most cordial manner. I may also say that he had a very able assistant in Dr. T. Sterry Hunt, who was at that time the mineralogical chemist of the Survey. Dr. Hunt came out and gave lectures at Sherbrooke on the characteristics of the deposits of the Eastern Townships, and was always ready to give assistance and advice. These two gentlemen, Sir William Logan and Dr. Hunt, were, I think almost unparalleled in the efficiency of their work.

Q. What was the reputation and standing of the Survey at that time in other countries, and with scientific men in other countries?—It was of the very highest character. Of course, Sir William Logan was not merely a Canadian geologist, but his reputation was world-wide. He was received, when he went to the meetings of the British Association for the Advancement of Science, as the discoverer of the supposed fossils in the Laurentian rocks with the greatest possible honor, and he was also in constant communication with the geologists of the United States and worked in harmony with them.

Q. And the great interest which he took in geological matters also attracted attention to Canada?—Certainly. It was he who pointed out the fact that we were the oldest country in the world, in a geological sense. If anything would have made me a geologist at the time, it would have been my acquaintance with Sir William Logan.

Q. Without any reflections upon the *personnel* of the present staff, what is your impression as to its relative standing and importance in the eyes of other countries?—Of course, I do not want to reflect upon Dr. Selwyn, who I have always supposed was a very able man, and who was brought out here under the best auspices, having been asked to come out here by Sir William Logan, but he had a very difficult task to succeed Sir William. I do not think he stands upon the same level as Sir William Logan, whom I must place upon the same level as Sir Roderick Murchison and men of that sort. However, I expect that Dr. Selwyn is a man of scientific attainments, but for the reasons I have mentioned I should say, that the present staff does not occupy the same position before the world as the old staff did.

Q. The present expenditure in connection with the Geological Survey has reached very large proportions, much exceeding those which were placed at the disposal of Sir William Logan. What is your impression as to the practical results, under the present administration? Do they correspond, in your opinion, with this increased expenditure?—I am scarcely able to answer such a question as that, because the country has so largely increased in its area.

By Mr. Baker:

Q. Has it ever come to your knowledge that any discourtesy has been accorded to anybody by Dr. Selwyn, or that people were not treated in the same way as they had been before by Sir William Logan?—No. Personally, I know very little of Dr. Selwyn. I have supposed that on account of the North-West and the consolidation of the various Provinces into a Dominion must have greatly increased the labors of the Geological Survey, and that naturally the new territories would attract more attention than the older ones.

By Mr. Dawson:

Q. But the Survey does not now stand as high in the estimation of the public as it did in Sir William Logan's time?—No, it does not; but I think that may be attributed to the fact that people are now much more interested in questions of commercial importance and of the development of our material resources, everyone looking for an immediate return for their expenditure. It is also important to a new country to have its general characteristics known, in mapping out our work for the future.

Q. Have you any knowledge of having any direct advantage from the Survey?—What I think we really want is a series of careful statistics. At present we have no statistics at all, and I think that of importance, whether they be of copper or iron, or as regards our quarries, such as slate and lime; anything, in fact, bearing upon the mineral resources of the country should be embodied in statistics for reference, so that not only those who are more immediately connected with them, but the outside public as well, would be kept informed on the mineral resources of the country. I think this might be done at very little cost. Every manager of a mine or quarry should be obliged to report from time to time to the Geological Survey, as to the actual working of the mine, the result of the deposits, and also the output. This information would do an enormous amount of good to the country, as it is very hard to find out, from private sources, any information of this kind.

By Mr. Holton:

Q. Are you familiar with the United States Survey and its method of working?—I know that they employ a great many able men in the collection of their statistics.

Q. I would like to ask you what practical good is at present accomplished by the Geological Survey of Canada?—The question is, from what point of view you take it. If you look upon the Geological Survey from a scientific point of view, and it is always held that that is a very important matter; even in the old countries the importance has only recently been acknowledged, and measures have been taken to map out the country. But apart from this, there is the commercial question, and speaking from that point of view, of course it is very important that we should get information from which a financial result might be obtained. There are two sides to the question: one purely scientific and the other purely commercial.

Q. Our desire is to develop what is called the practical side?—I think there is very little being done in that direction, but scientific discovery also leads to the saving of money. For instance, the question of coal was a very important one in the old Surveys of Canada. Sir William Logan claimed that these deposits were not to be found in the Quebec group and when people made pretended discoveries of coal he always decied them, and was at the same time very much abused for it.

By Mr. Dawson:

Q. Mr. Macfarlane still pretends that coal may be found in the Quebec group?—Yes; but still Sir William strongly opposed that idea, and gave his scientific testimony in support of his view.

By Mr. Wood :

Q. Would there be any difficulty in getting these statistics concerning the workshops of the mines?—There ought to be no difficulty and, from a business point of view, there should be no objection. It is easy to obtain statistics from saw-mills, manufacturers of textile fabrics, and other industries. In the manufacturing cities of the United States the amount of raw material used per annum, as well as the product, is published annually, besides the cost of labour and other details with reference to these manufactures. It seems to me that this is essential to the success, commercially speaking, of a country.

By Mr. Holton :

Q. As a guide and encouragement to capitalists?—Yes.

By Mr. Dawson :

Q. Sometimes it happens that, from a cursory survey, they make a report of the whole country in a few years without examining it very closely, and that, to a very large extent, prevents capital being brought into the country?—No doubt; and that is the danger of expecting too much from a geological report.

Q. Sometimes they speak very disparagingly of the workings of the mines?—We have very valuable mines in the neighbourhood of Sherbrooke, and enormous sums of money have been spent in developing them. At Capelton there are four mines being worked, with varied results, a great deal depending upon the management. They have spent enormous sums of money on what is known as Henderson's process.

By Mr. Holton :

Q. What do you think of the establishment of a School of Mines?—I think it would be very valuable. The question is, whether we are a large enough country; they have Schools of Mines in England, Germany, &c.

Q. Our country is only small in one respect, that of population. We have enormous mineral resources?—It is a question of administration, and one for the Government to consider, whether they must rely, for the present, upon other countries for men of this kind, or whether they will supply them themselves, and also, perhaps, feed other countries.

Q. Do you not think great advantages would accrue to this country by the encouragement of scientific studies?—Yes.

Q. And can you think of any more valuable scheme?—There is no question about its being valuable; and every class of our education should be thorough. I am an educationalist myself, being a member of the Council of Public Instruction of the Province of Quebec, and I would, therefore, be in favour of increasing our means of education, but the Universities cannot do it of themselves, as they have not the funds.

Q. But I think the Geological Survey might undertake that department of education?—That is a question of expense.

Q. The question of expense being satisfactorily answered then, it should be done?—Yes. We should have scientific men, who have been properly trained in a metallurgical sense, instead of a practical miner, who merely goes by the rule of thumb.

Q. My own opinion is, that the best men are Canadians?—Although an imported Englishman myself, still I agree with you. If you can get a man in the country who is properly trained for the work, it is better to do so, because I am satisfied that any man coming from abroad has to learn the ways of the country, and must unlearn a great deal.

By the Chairman :

Q. You have spoken about the large expenditure that has been made in experimenting in the smelting of ores in the Eastern Townships, many of which have proved unsuccessful. Is it not as important to have a record kept of all the failures, as well as the successes, as a guide for the future expenditure of capital, and also a warning to people hereafter against a particular process?—I hold that that is a necessary part of the statistics.

By Mr. Wood :

Q. That is the part which I thought the companies would not desire to have published?—I do not see any objection to it; their records show it.

By the Chairman :

Q. You have spoken of a very large expenditure in mining operations in your vicinity. Are you aware that the ore is going out in its raw state?—Almost the whole of it goes out in its crude state.

Q. For the purpose of utilizing the sulphur, it is sent to the United States. If there were manufactories here for the working of the ore, it would naturally give employment to a good many men here in the country, would it not?—Yes. At present they are making only pure copper, and the sulphur, which forms the largest part of the ore, is wasted. The ores at Capelton are mostly low-classed ores, while those at Acton are high-classed ores.

By Mr. Wood :

Q. Can you make any other suggestions with regard to the collection of statistics?—The only other suggestion which I would make, besides those I have already made, is that we should get, as soon as possible, general geological and detailed maps of particular sections of the country.

Q. Have you seen any of the maps of the Survey?—I saw a map of the Eastern Townships when it was being prepared, and I have applied to Dawson Bros., in Montreal, to see if it was published. I have occasion to use that map, and being at present in Ottawa, I intend to visit the Museum and get what information I want from these maps for the purpose of sending it to England.

By Mr. Dawson :

Q. Prof. Selwyn has issued a sheet in the report for 1880-81-82, in which he gives colors and names to all the different rocks, and it differs very materially from what we have before been used to, and also from the published maps in other countries. Do you not think that is undadvisable?—I should say that was a mistake. I think we should endeavour to harmonize with other countries in all that bears upon the nomenclature.

Q. Because in other countries they will not know what he is doing?—It increases the work of the student. I think nothing should be done in that direction except by such bodies as the British Association for the Advancement of Science, and not by private geologists.

ALEXANDER SIMPSON, Esq., Manager of the Ontario Bank at Ottawa, was also called and examined.

By the Chairman :

Q. Have you had occasion to consult the Geological Survey of Canada frequently, in reference to mining properties, and if so, will you state what the practical result of your enquiries has been, and give illustrations, as far as you remember them?—I have had occasion to see Dr. Selwyn four or five times in connection with the different properties in which we have been interested, and about which I have been able to ascertain as much information as possible. Of course, I know nothing of geological matters, but I have generally found Dr. Selwyn's reports of a very meagre description. He seems to have no maps that can tell very plainly what should be known, and he has scarcely any information with regard to the workings of the mines. I had occasion, a short time ago, to ask him, in regard to probably one of the best known iron mines in this district, but he told me he had never heard of the mine and knew nothing about it. I asked him to go out to the mine with me, which he did, but he was considerably prejudiced against it on account of the money which was spent in the machinery, and seemed, from the very first, to damn the property. We have had other reports from practical men in England, but of course the mine has not been developed to any great extent, and it is a matter of opinion.

Q. Previous to that, had he, or any of his staff, ever inspected the mine?—The mine is only seven or eight miles from Ottawa, and he admitted that he, or any of his staff, had never been there, and he had no report at all worth mentioning in the office in regard to it. However, at my request, he visited the mine, and his report was quite contrary to any report received upon it. I also asked him with regard to a plumbago mine down near Buckingham, and he, or any of his staff, had never been near the mine, and the information he had received was probably by hearsay. The mine was considered a very valuable one, and considerable money was sunk in it.

By Mr. Holton :

Q. When you did this, did Dr. Selwyn think it was his duty to get the information, although not possessed of it at the time?—He was very courteous, and deprecated the fact that he did not have it, and laid it down to not having a staff sufficient to prosecute the work in the manner in which it should be prosecuted, and that he had only one man whom he could send into the field, from British Columbia to Cape Breton. However, I went there for information, and did not get it.

By the Chairman :

Q. And these enquiries were all made in the interest of capitalists?—Not only in the interest of capital in the country, but in the interest of capital that was waiting to be put into it.

Q. Did your failure to obtain the information you desired operate against the interests of which you have been speaking?—I should think it would most strongly operate against the introduction of capital. If we consider that the Geological Survey of Canada does not possess the information, I do not see where we could go for it.

Q. But did it operate in any way in this case?—I do not know, but other parties who talked about trying to raise capital have repeatedly remarked to me that the information they received from the Geological Survey was so meagre that they did not feel at all satisfied, and they had to use reports obtained for them. I also had occasion to see Dr. Selwyn about asbestos deposits in the Eastern Townships. He showed me a map several years old, which, he said, he could not rely on, and he could not give any information. In one of his reports he had about a page and a-half or two pages about the mines of the country, but the information about it was of a very meagre description.

By Mr. Holton :

Q. You spoke about the map as unsatisfactory. Do you know what map?—He said that it was not sufficiently new, and did not show any practical results; it showed the formation of the rocks, but no mineral discoveries.

By the Chairman :

Q. No recent discoveries?—None at all.

By Mr. Holton :

Q. Do you know what map it was?—No; but I know he said it was an old map, and he could not give it as being reliable.

By the Chairman :

Q. But still it was the latest in the Department in relation to that section of country?—Yes. As regards information about mines of practical interest to capitalists or banks, he could give me no information as to the output, or the possible or real value of the property.

By Mr. Holton :

Q. Have you had occasion to ask Dr. Selwyn or members of his staff for such statistics?—Yes; on several occasions.

Q. And you received but one reply on all occasions?—Yes. In the case of this iron mine, I think it was a great shame that more information has not been obtained by the Geological Survey regarding it, because there is a very large amount of capital sunk in it, and at present a very large company has been formed in England to work it, which I hope will be started in a few weeks, and in all cases they have had to send their own experts to judge of the value of the mine.

Q. I would like you to express your opinion as to the value of mineral statistics, to the public?—I consider that that would be the most valuable work which the Survey could undertake in the interest of the public. If the Survey is merely to show the appearance of rocks, &c., it may be possibly interesting to scientists, but certainly not to the general public.

Q. You think, then, it should have a practical side as well as a scientific?—Yes.

By the Chairman :

Q. What practical benefit do you think the public is obtaining at present from the large expenditure of \$92,000 annually for the Survey?—I could not say. As far as I have already stated, I consider that we are receiving no benefit. It may be of scientific value, but I cannot see that it is of any value to business men and capitalists.

Q. You have referred to the asbestos mines of the Eastern Townships, and that there is no information in the Department regarding them. Is it not a fact that this is an exceedingly interesting discovery and has attracted a great deal of attention in the last few years?—Yes; more especially in the last few years.

Q. Do you not think that it was a question of such geological interest that it should have attracted the attention of the Survey?—I should imagine so. In that case, as in the others, I was obliged to go to private parties to obtain the information I desired.

HOUSE OF COMMONS, OTTAWA, 28th March, 1884.

The Select Committee on Geological Surveys met this afternoon, Mr. HALL in the Chair. WILLIAM McINTOSH, Esq. of Buckingham, P.Q., was called and examined.

By the Chairman :

Q. You have been connected for some time with the phosphate interests in the Ottawa Valley, have you not?—I have been connected with the phosphate industry for three years in the vicinity of Kingston, and for three years in the vicinity of Ottawa.

Q. How long is it since the phosphate deposits in Canada have been worked for their commercial value?—They have been worked for the last twelve years, to my knowledge; of course, they were discovered some time before that.

Q. Will you give to the Committee an idea of the extent and value of the phosphate deposits in Canada?—Phosphate is found in the County of Frontenac, in Ontario, in a great many of the townships there, including Bedford, Loughboro, Storrington, Sherbrooke, &c. Phosphate is also found on the line of the Kingston and Pembroke Railway, and although the deposits are not so great as those in the Province of Quebec, they are equal in quality, where found in large beds, but they are more on the surface.

Q. About what percentage do they range from?—In Ontario, for the last four years they do not average over 76 or 77 per cent.

Q. How extensive are the works in that district in developing these interests? Has a good deal of attention been paid to it?—Large works were carried on by the firm of Scheiff & Fleursham, of London, Eng., which were the most extensive. They went to the depth of about 150 feet. That is, at North Burgess, back of Perth. I was connected with those works.

Q. What was done with that phosphate?—It was shipped to England in its raw or crude state. The quality and quantity when they quit work at that depth was equal to what it was on the surface. There were other extensive works carried on there under the supervision of Mr. Davis. I think Capt. Adams and Messrs. Gillespie, Moffatt & Co., of Montreal were connected with it.

Q. What was done with that phosphate?—That was also shipped to a foreign market.

Q. Are these works still being carried on?—No, not so extensively.

Q. Approximately, how many hands were employed in the development of the phosphate interests in that section of country, when you were there?—Probably

300 or 400 men. In the vicinity of Storrington and Bedford a great many farmers have it on their properties in small pockets or deposits, and they mine a few tons of it during the summer time, and take it to Kingston, where they always find a market for it.

Q. What do they realize for it?—The average price I have paid for it was \$12 to \$14 a ton, according to the quality.

Q. Will you now explain to the Committee the extent and nature of the work that is going on here in the Ottawa Valley? Over what section of country does the phosphate extend?—The most extensive work is now being carried on at the Rivière aux Lièvres. To my knowledge the region where phosphate is to be found is about thirty miles in width, and I have been as far as 100 miles to the north, and found it.

Q. So that you have reason to believe that that country is underlaid with phosphate of a greater or less richness.—Yes.

Q. What is the output?—The Union Phosphate Mining and Land Company has given out about 3,200 tons during last year. At this mine a year ago there was not a tree chopped, nor a road to the works, and at the present day we employ eighty men, and we have steam drills, hoists, tramways and cobbing house. This is an American company, and we have stored at the station to date 2,850 tons. The High Rock Phosphate Mining Company, adjacent to ours, has given about 5,000 tons during the past year, of which about 4,500 tons have been stored at the station. The output of the Emerald Phosphate Company has been about 3,000 tons, and of the Dominion Company about 1,200 tons. There are also several other mines in operation, which are worked by private parties on a small scale.

Q. Would you give the Committee an approximate idea of the gross output in that region?—The output during the last year—that is from last spring to this spring—and stored at Buckingham station, is about 14,000 tons.

Q. What quality of ore do you bring to the station?—Anything over 75 per cent. is considered a marketable phosphate.

Q. And anything under that?—It is hard to find a market for it. We never bring ore to the station that is less than 68 per cent. We do not send anything below 75 per cent. to England, and the grades between, say 68 and 75 per cent. we find a market for in this country, probably at Chicago, and anything below 68 per cent. is considered as refuse and unfit for shipment.

Q. Then, of course the real product of the mine, including what you call refuse, is vastly more than these figures you have given?—Certainly.

Q. How many men are employed to produce this output?—From 300 to 400 men are employed in this industry in that section of country.

Q. Is this ore that is brought from the mines to the railway station sent away in its raw state?—Yes; all of it.

Q. None of it is manufactured into fertilizers in this country?—But very little, to my knowledge.

By Mr. Dawson:

Q. Where is it sent to?—England and Hamburg (Germany), are the chief markets.

By the Chairman:

Q. What is the cost of freight from the railway station at Buckingham to the European ports?—About \$7 a ton, on an average.

Q. What range of prices is realized in England and Hamburg from the sale of this raw phosphate?—The average price per ton for a guarantee of 80 per cent. during the past year, has been from 1s. ½d. to 1s. 3d. per unit. 1s. ½d. per unit would be about \$22.45 per ton.

Q. How much cash does your company disburse there in a year?—Since we began, we have disbursed over \$60,000, and we have been working only one year.

Q. Have you induced a good deal of American capital to come here for investment in these mines?—Yes.

Q. There is some English capital invested there also, is there not?—Yes; it is the success of the High Rock Company that has attracted the attention of capitalists, and induced them to invest in other properties.

Q. What assistance, to your knowledge, has the Geological Survey of Canada ever rendered towards inducing either foreign or domestic capital to be invested in the development of the phosphate interests?—None, to my knowledge. I find it one of the greatest difficulties to induce capitalists to come here without showing them the practical results of my working. We have nothing of the kind to refer them to, to get reliable information, in the way of reports made by scientists or anything of that kind.

By Mr. Dawson :

Q. If they come to the Geological Survey here they could get no information?—No; I knew of some parties who came here, and they went away disgusted.

Q. They would be just as likely to throw cold water upon it as not?—I never saw these parties afterwards. There have been scientists there exploring, surveying, mapping, etc., and I cannot get any information that is worth anything to me, nor can I get any report with anything in any part of the volumes issued by the Geological Survey. The only two I know of are Dr. Harrington and Mr. Willimott, and their work was devoted to East Wakefield and East Templeton. So far as the Rivière aux Lièvres, where the biggest deposits and the largest works are, is concerned, I cannot find anything in the Geological reports of any benefit. There was a Mr. Vennor, who labored in Buckingham, but I cannot find any report. They have whole pages written on private properties, but there is nothing to attract the attention of capitalists, either in England or the United States. Last year our company made a special business of bringing it before the Americans, and I have written several letters to the *Mining Record*, of New York, and also to my principal, Mr. Williams, and I see, at a meeting held in the United States, Dr. Hunt read a report on the Canadian phosphates, which will do a great deal of good. He has given some practical information which he got from the Manager of the High Rock Company, which produced as much as all the others together, until last year. It is difficult to get information from any other source than from these companies themselves. They have brought scientific men from the State of Pennsylvania to report upon it. So many people have been led astray by false statements, that we want something in the form of reliable reports, that could be relied upon by the investor or purchaser, and to which we could refer them. I noticed these remarks of Dr. Hunt, and I thought they would do a great deal of good.

By the Chairman :

Q. This essay by Dr. Hunt was recently read before the American Society of Mining Engineers, and had no connection whatever with the Geological Survey of Canada?—There is one other thing to which the attention of the Survey should be directed—at present we have to do it amongst ourselves, and we do not propose to do it for the benefit of the whole country—and that is, to ascertain the extent of the phosphate deposits. That question has often been asked me, and has never been answered yet.

By Mr. Dawson :

Q. You mean the extent of country?—Yes; and also the depth. It has been found to the depth of 150 feet, and the desopits are, to my own experience, larger as we go down. Although they are intersected every 12 or 15 feet by rock, they are in pockets, and get larger as they go down.

Q. You have no reason to believe that they die out?—If experiments were made which would lead to the putting in of expensive machinery, my impression is that we might go down 300 or 400 feet as easy as we now do with the whim and horse. In order that this difficulty might be overcome, test holes might be made with the diamond drill, in the vicinity of where the largest deposits have been found, to the depth of 500 to 1,000 feet; it would not be very expensive, and it is really a thing which should be done by the Government, in the general interests of the country.

Q. Do the leads go pretty uniformly down?—Where you get into the centre of the hill, the deposits go down pretty vertically.

Q. Do they keep a uniform shape in going down?—There is no such thing as a pyroxene vein. It occurs in deposits or pockets, and is found in the leads of pyroxene rocks.

Q. Would that not operate against the diamond drill in boring it, because if the rock is corrugated, it might be reached and still be missed?—If you take an angle of 45° you would cut the leads.

By the Chairman:

Q. You think that the principal rules which govern these deposits ought to be determined by the Government or by the Geological Survey?—Undoubtedly.

Q. Would you give the Committee your opinion as to the value and importance of procuring and preserving mineral statistics in some office like that of the Geological Survey?—That would be of the greatest advantage to practical miners like myself, to get a report of what has been done in each of the mines and put it before the public, and it would be just the thing to induce capitalists to invest their money. The only visit ever paid me from the Geological Survey was last summer, by a Mr. Torrance, who was equipped with very poor tools—I might say they were not fit to send a man to the field with—and, to the present, I have heard nothing of the results of his operations. I think the people of this country ought to get the benefit of this information at the exact cost of printing and publishing, and there should be no commissions on it to book-sellers to increase its cost.

By Mr. Dawson:

Q. Would it not be greatly to the advantage of the phosphate industry if people going to the Geological Survey were able to get reliable information regarding it, and would it not lead to the development of the country if strangers and capitalists coming here were able to get reliable information?—That is just what we want, and would greatly facilitate our work. So far we have had a hard time of it, in working up the business and showing that there is money to be made at phosphate mining by practical work. One thing, however, that would greatly aid us in inducing capitalists to invest, would be to make use of our refuse. Something must be done in this direction; I have spoken to several capitalists about it, and they seem willing to take hold of it. I am speaking of the manufacture of fertilizers, super phosphates, and other powders, that could be manufactured along with the same business. There is a large amount of phosphate, from 60 to 65 per cent., which is at present wasted, and if this were manufactured into these fertilizers, we could make our quality much higher and much more uniform for shipment. If this refuse or waste were utilized in this way, it would almost pay the working of the whole mine. Another which might be mentioned is that we have large deposits of copper pyrites, which contain a good deal of sulphur, and which is very injurious to the vegetation close by, and this might be used in the manufacture of fertilizers, if some encouragement were given to a company in the way of a site for the buildings, free from taxation, and their machinery be allowed to be brought in free of duty. In the Province of Quebec a large quantity of superphosphates was brought from France by the Provincial Government, and distributed round to the farmers, but I am sorry to say it was of poor quality, and some of it is lying at the stations yet. If the Government, after a company was established here, would take so much of the manufactured article and distribute it round to the farmers and get a direct report as to the benefit of it, they would open up a market for the manufactory, after it got into good running order. Our farmers here are not educated to use fertilizers, and that is why I think that method should be adopted to establish a sale of the article, and in doing so they would be greatly assisting in the development of the phosphate industry.

Q. You have no reason to suppose that phosphate extends beyond the region or tract of country you have mentioned?—I have no reason to doubt it.

Q. It might extend up the Ottawa here?—We cannot tell. There is said to be some back of Quebec. Of course my statements are all practical and of my own knowledge.

Q. And you have reason to believe that the area over which it extends is much greater than you have mentioned?—I have no doubt it extends over a much greater area.

By Mr. Holton:

Q. Are you a geologist?—Nothing more than what I have read.

Q. You are a practical miner?—Yes.

Q. Has your experience, as a practical miner, been gained in this country alone?
—No.

Q. Are you acquainted with the Geological Surveys of other countries?—Nothing but in Canada.

By Mr. Baker :

Q. Taking a hundred parts of phosphate, what are its component parts?—The following analysis of Canadian phosphate was made by Mr. G. H. Ogston, of London, England :

Moisture.....	·10
Water of combination.....	·50
Phosphoric acid.....	37·60
Lime.....	51·52
Oxide of iron and alumina.....	1·50
Magnesia, &c., not determined.....	5·18
Carbonic acid.....	·60
Insoluble matter.....	3·00
	100·00
Equal to tribasic phosphate of lime.....	82·10
Equal to carbonate of lime.....	1·36

Q. What price does the 75 per cent. article bring in England?—We sold it last year for 1s. 4d. per unit, and now it is worth 1s. 1d. per unit. That is for the long ton. The price per ton ranges from £4 7s. 6d. to £5.

Q. What price does the phosphate that ranges from 68 to 75 per cent. fetch in Chicago?—There have been no sales during the last two years; we cannot sell it.

Q. Could you sell it if the price were lowered?—It would not pay for shipment. What we sold was for \$7 a ton at the banks of the Ottawa River. We could find a market for the high grade article at a good price; we could have sold 50,000 tons one year if we had had it.

Q. Do I understand that there is no appreciable amount of the phosphate manufactured and sold in Canada?—It was manufactured at Brockville and at Kingston, but not prosecuted to any extent.

By the Chairman :

Q. Is it not a fact that large quantities of fertilizers are imported into this country from the United States?—Yes.

Q. Is there any reason why it could not be manufactured in this country with equal advantage?—No; there is no reason why it should not be manufactured just as cheap.

Q. Then you think a company would be fairly entitled to a little encouragement from the Government to work up these raw material here?—Yes; it would be the means of bringing in a great many more capitalists. I understand that the Crown Lands Department of the Province of Quebec, which has a vast body of land rich in phosphates, is governed in its sales by information which it gets from the Geological Survey of Canada, and if so, they certainly labour under a great mistake, as that information is entirely unreliable. The attention of the Government should be paid to the prospector and pioneer, who is a most useful man in developing the mineral resources of the country, and calling attention to their value, and unless he is protected there is no use in his continuing his work. Just now some speculator very often gets the benefit of the poor man's work.

HOUSE OF COMMONS, OTTAWA, 29th March, 1884.

The select Committee on Geological Surveys met this morning, Mr. HALL in the Chair. EDWARD J. CHAPMAN, Esq., of Toronto, was called and examined.

To the Chairman :

I have been for thirty-one years professor of mineralogy and geology in the University of Toronto, and during the last five or six years I have acted as professor of mining geology and as saying in the School of Practical Science, Toronto. Before I came to Canada, I was professor for two years in the London University College, England, and I acted there also as a mining engineer. I might also say that I am a Doctor of Philosophy of Goegen, Hanover, and some few years ago the University of Queen's College honored me by giving me the degree of LL.D, although I did not belong to the Presbyterian body, and I am the author of some five or six works on these subjects, published within the last few years.

Q. Where was your geological education obtained?—Chiefly at Clansthal and various parts of England; also slightly in France; and of course to a great extent on this continent. In thirty-one years one always learns.

Q. During your residence in this country, in addition to your study of geological studies you have devoted a good deal of attention to practical geology and the mineral resources of the country, have you not?—I have made a considerable number of reports myself, which have been printed with maps on the mineral lands and deposit in various parts of the Dominion.

Q. What mineral section of the Dominion have you visited?—Chiefly the North Hasting's section, comprising Peterborough and Victoria, in connection with the iron industry, and also the north shores of Lake Superior and Lake Huron, as well as Cape Breton and Nova Scotia. I have published several works on mineralogy, and one work on the practical minerals, and how to work them, and another on the minerals of Central Canada.

Q. You have kept yourself informed, I suppose, as to the methods under which Geological Surveys are conducted both in this and other countries?—Yes.

Q. Did you know the late Sir William Logan?—Quite intimately and each work that he published. Of course I have not the opportunity of making surveys of late, being anchored a great part of the year in Toronto, so that my hands are to a great extent tied. I can only do laboratory work, &c. To show the number of people that come to me, I kept a record for one year (1882), and had 216 applicants, to whom I gave information, free of charge, about economic minerals. In North Hastings I examined some eight or ten properties, and almost immediately after I went to Echo Lake, near Lake Huron, for some Ottawa people, I think. When I got back, and before I had time to write the report, an American Company got me to go between Haliburton and Bancroft. They are now trying to get help from the Government to build a railway there. In Peterborough and Victoria I examined as many as thirteen different properties, collecting minerals and analyzing them. I once went to Sherbrooke, a good many years ago, to look at some copper deposits, and I also visited the Bay of Fundy for a gentleman in Halifax the north shore of the Grand Manan.

Q. Will you state to the Committee your impression as to the present system and administration of the Geological Survey of Canada, as compared with its system and administration under Sir William Logan?—I did not quite approve of the system as followed by Sir William Logan, and I have often told him so, but he said it was forced upon him, and he could not help it. I think, however, it is decidedly retrograding, from a practical point of view. Most of the reports now are purely scientific, whereas the Survey was clearly instituted to convey to the Canadian people practical information respecting the mineral resources of the country. Now they are almost all purely scientific, and really they are not intelligible to ordinary people, although of considerable interest to geologists. I may add that I have derived from them very great benefit in my position as teacher of these subjects, and more especi-

ally in the earlier reports. Nevertheless, I can quite understand that practical people will derive no benefit from them at all.

By Mr. Mulock :

Q. Just a handmaiden to the student?—Yes; and to the professor; and even then I had to devote much time and trouble to get out what was useful from a great mass of details.

By the Chairman :

Q. From a scientific point of view only are the late reports growing more or less interesting?—Much about the same. There is no doubt Prof. T. Sterry Hunt was a great loss, and his reports could be made use of by practical men. People even come to me from the States and say : Where can I find a geological report and map of such a district? I am obliged to say that it cannot be found, except in detached portions.

Q. Considering the wants of a new country and its desire to attract immigration and capital, do you not think the attention of the Survey should be more directed to our economic minerals and to our mineral resources and development, than to anything else, if we had not time to accomplish everything?—Most decidedly. A great deal of money seems to be expended in the minute and microscopic examinations of fossils, &c. ; most valuable, it is true, but I think they should be made at private cost, and not worked out at the public expense, because they are practically useless, except from a scientific point of view. Indeed, if I may be allowed, I might say that the present reports seem rather to be addressed to the Geological Society of London or the geological section of our Canadian Royal Society, instead of to the people at large. Sir William Logan considered that the primary object of the Survey was to collect and afford practical information regarding the mineral resources of the country. I am sure in his life you will find that stated, when Mr. Draper, who was at that time Premier, told him : "If you can show that really any practical results will accrue from the Survey, well and good, and no doubt we will find the money for it, but the Legislature will never vote any money for a purely scientific research." We have drifted into that, I am afraid. These gentlemen want, naturally, to make a scientific reputation.

Q. They feel more pride in establishing a reputation abroad among scientists than they do in establishing a reputation amongst the common classes of the country?—Most undoubtedly; it is a natural inclination of scientific men, and I do not altogether blame them, from their professional standpoint.

Q. In what estimation is the Geological Survey held at present, as compared with its reputation in foreign countries, in the time of Sir William Logan?—I am hardly prepared to give an opinion upon this subject. It would take a long time for the reputation which it had to diminish, and then there has been no opportunity of seeing any remarks in scientific papers or journals upon these late reports, because they are all too recent. I have not the slightest fault to find with the reports, as scientific reports, but I certainly think they ignore the primary object for which the Survey was instituted.

Q. You have spoken about a great many enquiries having been made of you, in consequence of your familiarity with our mineral resources. Are they not the kind of enquiries that would naturally be made of a Geological Survey, properly conducted, in such a country as this, and should not those parties making these enquiries be able to get practical information from the Survey?—I should think so. It is stated in the last volume of reports, that information is being constantly given to applicants at the office of the Survey, and I have no doubt that is the case.

Q. To put it to a practical test, you have never made any enquiries?—No.

Q. Would you give to the Committee, in brief, your impressions, from the observations you have made yourself, as to the extent and value of some of our mineral resources, particularly the iron deposits in the neighborhood of Hastings, to which you have referred?—I may reply that there are numerous very valuable deposits of magnetic iron ore and hematite in the more northern parts of the counties of Victoria, Peterborough and North Hastings, as well as in other parts of both

Ontario and Quebec, but those mentioned are more especially known to me. Some of these deposits are of great extent, practically inexhaustible, and of great richness and purity.

Q. Of what percentage?—It is not so much the percentage of an ore that the smelter looks to as its purity. They run from 60 to 65 per cent. and are, as a rule, practically free from sulphur, phosphates and titanium, &c.

Q. Have these deposits attracted a great deal of attention from the public during the last few years?—Yes; especially from the capitalists of the United States.

Q. Are you aware that almost all those large deposits have been secured by American capitalists?—A great number of them, probably all that I have visited, a very few being in the hands of Canadians.?

Q. Could you give us some idea as to the amount of capital invested there or the number of people working at those mines?—The greater number of them are not worked. Some gentlemen connected with the mines there are trying to get aid from the Government for a railway. The Wollaston mine, which I examined, is largely worked, and some 200 men or more are working there.

Q. Do you think much public attention has been called to these rich deposits by the Geological Survey of Canada?—Decidedly not.

Q. Do you not think it is a field in which the force and energies of the Survey should have been directed?—I think so; in fact, all these deposits have been found by explorers, who go in and report upon them. As regards the officers of the Survey, most of whom are well-known to me, there cannot be any doubt, in my opinion, of their scientific ability. Dr. Selwyn, the Director, is undoubtedly a very able geologist, but of course I know nothing of his method of arranging matters with his staff, or of the internal arrangement of the Survey. Dr. Bell, Dr. Dawson, Mr. Whiteaves, Mr. Hoffmann, and Mr. Fletcher, the latter being an old student of mine, are undoubtedly the best men that could be found for their positions. The more subordinate members of the staff, with the exception of Mr. Tyrrell, also a student of mine, are personally unknown to me, but I have no doubt that they are equally efficient.

Q. The material, then, which the Government have within their reach for the construction of a Geological Survey, you think is ample and of the very best quality?—Yes; of course they could always get specialists for special work.

Q. Then you think that any failure to obtain practical results in the Survey would be rather in the system than in the *personnel*?—Quite so.

By Mr. Baker :

Q. You think the necessary geological material is there, if properly distributed and administered?—Yes; there is the machinery, if properly handled.

By Mr. Cameron :

Q. Do you consider the publication of geological maps important in connection with the reports?—I consider the publication of these maps exceedingly important, but I think that smaller maps of a convenient size—index maps, if they please to call them so—should be published at once, accompanied by a plain report, explanatory of the map itself, and giving lists of economic minerals, with their analyses, current values, and other points of value in connection with them, and if these reports could be accompanied by a few plates, showing commonly occurring distinctive fossils, their value would be greatly enhanced. Some of these maps might be issued with very little delay; others would necessarily require a longer time for their preparation, but I think in every case a certain limit of time should be fixed and at its expiration the best results that could be collected within that limit should be given at once to the public. In the United States small volumes are frequently issued containing matters of this kind, and at a very low price. Some of these lithograph views and photographs in the Canadian reports are more suited to a work like "Picturesque Canada" than to a geological report.

Q. How often are they published?—Only from time to time. A man came to me the other day and asked me about maganese. I told him that the principal deposits were in New Brunswick, and he said: "Where can I find a good, plain description of those; with maps?" I could not tell him where to find them. They have now issued

these very fine maps, but that is not what the gentleman wanted; he wanted something more simple.

By Mr. Wood:

Q. Would the publication of these maps you refer to require much time?—They do, if you enter into too much details; but it should not take much time to issue one of these plain maps, as there should be plenty of material, as the Survey has been going on now for about forty-two years.

Q. You think that with the amount of time and money which has been spent there has been quite time enough for any work of this kind?—Yes; as regards the more remote districts of British Columbia and along the Rocky Mountains, very great scientific detail is not at present needed.

By Mr. Cameron:

Q. Are you aware that there are large deposits of manganese in Cape Breton?—No; they had not been found when I was there. I was shown some samples there, but I have always been careful about these things, as I have been so often deceived.

Q. You spoke about Mr. Fletcher, who worked in Cape Breton. Do you not think it is an unreasonably long time to have these reports delayed for five years?—Certainly; of course the answer would be that they would be making them more complete. If I had anything to do with it, I would take up and complete one or two districts at a time, and publish, at as early a date as possible, index maps, showing broad, general features, irrespective of minute scientific details. This map should be accompanied by a short, plain report, explanatory of its leading features.

By Mr. Wood:

Q. What staff would you require to do that?—It might be done at once, and where so much of the ground has been gone over, a very small staff would be sufficient. Of course, I can hardly say what materials they have collected.

Q. But suppose you take a few years back, what staff would they require?—Probably four or five men, but they need not all be skilled geologists.

Q. Would you require more than one skilled geologist?—One ought to be able to bind all the work together.

Q. That is, one skilled geologist, with three or four assistants?—Yes.

By Mr. Dawson:

Q. You have written several works on geology and mineralogy, have you not?—Yes; five or six.

Q. I know that they are very generally read throughout the country by scientific institutions, colleges, &c., are they not?—Yes.

Q. You have stated that the present staff of the Geological Survey are only anxious to distinguish themselves abroad as scientists. Do you think that this report, containing all that they have done for 1880-81-82, will add very much to their reputation abroad?—It will attract attention. There is Dr. Dawson's report on the coal of the Bow and Belly River Districts, in the North-West, which will certainly attract attention abroad.

Q. But take it all together, is it not a very poor result for three years' work, for the public at large?—Yes; for an expenditure of \$90,000 annually.

Q. Do you think that these changes in the nomenclature of our rocks, and the introduction of new colors as designating certain descriptions of rock—do you think this is advisable, or do you not think it would have been better to adhere to the old colors and methods?—I think it quite legitimate for the Director to use what colors he wants, so long as he publishes an explanation of them.

Q. Do you not think it would lead to confusion in nomenclature throughout the world?—I think there is no strict rule for coloring geological maps.

Q. Any geologist may adopt any coloring he wishes for his geological explanations?—Yes; I think so.

By Mr. Baker:

Q. Would it not be better if he used the coloring and expressions that have been used long before?—I think it would have been better if he had kept to Sir William Logan's colors.

By Mr. Dawson :

Q. You say you have examined the country about Lake Huron and Lake Superior ?
—Yes.

Q. And that country is very rich in minerals, and from the character of the rock you would think that it would be a very important region as regards minerals, would you not?—I think so.

Q. You have seen the silver mines of Lake Superior?—Yes.

Q. The Silver Islet mine turned out remarkably well, and from the character of the country, I suppose you would imagine that it would be safe to predict that it would become a very important silver-bearing region in time?—I think so; although many people may burn their fingers by opening them; but, of course, these experiments have to be tried.

Q. Then there are also very valuable copper deposits on Lake Superior and Lake Huron; if utilized, they will become valuable?—Yes.

Q. As they have done already at the Bruce mines?—The Bruce and Wellington mines are practically pretty well played out.

Q. But they yielded large and handsome returns at one time, and a great deal of money was made there?—Yes.

Q. And there are similar ores along Lake Huron, at Echo Lake for instance?—Yes; some fifteen miles back from the lake in Echo River.

Q. There are also abundant indications of copper along Lake Superior, are there not?—Yes; but they have not yet been opened out.

Q. Except at Michipicton Island and Maimause?—Yes; but not successfully.

Q. At Maimause they say they are successful now?—It is hoped so, but it has been taken up and dropped several times.

Q. I think you have explained yourself pretty fully as to the greater value our Geological Survey would be if there was some office or Mining Bureau attached to it, where people could get information as to the prospective value of the mines being found?—Yes; I think that would be an important addition to the work of the Survey.

Q. And such an office as that might very well be connected with the Geological Survey?—Yes; indeed some years ago, when I was consulted by the Hon. Sandfield Macdonald, on the subject of establishing a School of Mines in Ontario, I said to him that there was scarcely the necessity of going to that expense, but that I thought a Bureau of Mines, where trustworthy information could be obtained, might be very legitimately established. Doubts might naturally be cast on reports made by private individuals, on the supposition that they were not strictly impartial, although no doubt would be cast upon the honesty and ability of the gentleman giving the report.

Q. You have expressed the opinion that capabilities of the members of the staff of the Geological Survey are fair and good, but that it seems to be in the administration of the Department that the failure to give general satisfaction exists?—No; I could hardly say that. I know nothing of the internal working of the Survey. I should hardly like to say that the Director is at fault; I believe him to be a thoroughly good geologist.

Q. And all his staff are good men?—Yes. I think they seek to enter into too many scientific details, by which practical matters are lost sight of.

By Mr. Baker :

Q. I understood you to say that, in a large extent of territory like that of British Columbia, it was not necessary to prosecute the work of the Geological Survey with the same degree of minuteness as in other Provinces?—What I meant was, that in the Rocky Mountain district of British Columbia and the North-West Territories it was not possible, at present, to enter into very minute details or a lengthened examination. What we want there is careful exploration.

Q. You are of opinion that it is valuable to expeditiously publish these small reports, with maps, according to sections of country?—Yes; even if they were only rough sketches or index maps.

Q. They would be more valuable immediately than waiting for a long exhaustive report?—Certainly.

Q. Have you ever been west of the Rocky Mountains?—I have been to Colorado, but I have not been as far as the Rocky Mountains on Canadian territory.

Q. Have you any personal knowledge of the mineral wealth of British Columbia?—No; except in making assays of ores which were sent to me by various parties.

Q. What samples of ore have you had?—Copper, gold, coal and iron ore, from British Columbia. Amongst others, I may mention that I have made analyses of iron ore from Texada, for Mr. DeCosmos.

Q. Has no ore been brought to your notice from the Howe mine, at Jarvis Inlet, British Columbia?—Very frequently they do not tell me the exact location, for fear I might give information to enable parties to “jump” the land.

Q. Then you really do not know that there is valuable ore in British Columbia?—Judging from the character of the rocks, as already known, I should say that there must be many valuable mineral deposits in British Columbia.

Q. But you have no personal knowledge as to particular districts in which these deposits are?—No.

Q. Have you seen any very valuable copper ore, and if so, what percentage has it been?—I could hardly tell that.

Q. Is it a high grade or low grade ore?—High grade ores. A copper ore holding 3 per cent. is considered good. The Cornwall ore, in England, when brought to bank rarely exceeds 2 per cent., but by dressing, the richness is, of course, brought up to about 20 or more per cent. The copper ore from the Bruce mines averaged, before the mines were closed, no more than $1\frac{1}{2}$ per cent., but were brought up by dressing to 21 per cent., before being shipped to Swansea.

Q. Then, you have not seen any of the high grade copper ore from British Columbia, averaging 65 to 70 per cent.?—No.

Q. Is it not usual in copper deposits to find large deposits of silver underneath?—It is very unusual.

Q. But copper is sometimes found in veins with very valuable metal?—Yes; there is, of course, no reason why it should not be so; but it is unusual for silver to be found with copper, in large quantities.

Q. But the native copper of Lake Superior is associated with small quantities of native silver. In valuable copper ore, are not gold and silver very important factors?—Not as a rule. Nearly all copper pyrites holds a little gold, but as a rule, it would hardly pay to take it up.

Q. You have already stated that you have no personal knowledge of British Columbia. Have you any knowledge, from hearsay, of the economic value of the coal deposits of Vancouver Island?—There is no doubt that they must be very great. There have been some very good reports published in former years on the coal deposits of Vancouver Island. At any rate, these reports served to impress people with the value of these deposits, from a mineral point of view. I have examined some of the samples, and they are really nearly as good as the bituminous Ohio coal.

Q. And how do they compare with the old country coals?—As a rule, it is somewhat inferior to the Wallsend or Milford Haven coal, but still it is very good coal.

By Mr. Dawson :

Q. The coals of the North-West and of Vancouver Island are in a very different geological horizon to the carboniferous coals that come from Europe?—Yes.

Q. In fact, it is quite a new discovery to get good coal so high up in the series?—Yes, when first made. The old term, carboniferous formation or period, refers to the fact that workable beds of coal were supposed to be limited practically to that geological horizon.

Q. So that this coal of the North-West, which may be designated true coal, belongs to a much more recent formation, and is in a different horizon, geologically speaking, from what it was supposed at one time true coal could exist?—Yes; except ordinary lignite, which has been known for years to occur in the Cretaceous and Tertiary formations.

Q. But this ordinary lignite or brown coal was never supposed to be true coal?—It is a coal, but not, of course, the ordinary bituminous coal.

By Mr. Baker :

Q. Does the coal of Cape Breton, Nova Scotia, the North-West Territories and Vancouver Island, all come under the same category?—The Cape Breton coal is from the true carboniferous formation, the others essentially from the cretaceous.

Q. Is there any difference between the coal of Cape Breton and Nova Scotia proper?—No; not practically.

Q. Does the coal of the North-West Territories come under the same category, and is it of the same age and description as that found in Vancouver Island?—A good deal of it is essentially so; some of it a little more recent than others, but practically all the same age.

By the Chairman :

Q. We are informed by the officers of the Survey that the results of their work are shown by the Museum and by the published reports of the Geological Survey. Taking into account that the annual expenditure has now reached about \$90,000 per annum, and having before you the volume of the geological reports for the three years, please state to the Committee whether you think the results, as thus indicated, are commensurate with that expenditure?—I cannot say that I do. Of course, I do not know how much matter may have been collected and withheld from publication at present, but judging from the reports actually issued, I certainly think that the sum of \$90,000 per annum is greatly in excess of the practical results. I would certainly say that the practical results, as already published, are not commensurate with an annual average expenditure of \$90,000.

Q. What suggestions would you make as to methods in which the system or administration under which the Survey is conducted could be improved?—As already stated, I think there is the greatest necessity for a speedy publication of small index maps, showing broad, general features, irrespective of minute scientific details. The Museum and Laboratory, I think, should be permanently maintained, so that persons applying for information, as regards the economic mineral products of any particular district, could readily obtain it there. I might also suggest lists of economic analyses, current values and other particulars of a practical character, together with mineral statistics of the districts generally. To sum up, my opinion is, that as at present conducted, the results of the Survey are of too scientific a character as opposed to practical results.

Q. In fact, they aim at too much?—Yes.

Q. And the more important practical results are to a great extent ignored in these reports?—Yes.

By Mr. Dawson :

Q. The fact is, that the Survey, as at present conducted, has too much of a geological and too little of a practical character?—Yes.

By Mr. Baker :

Q. Have you ever found that young Canadians are any more insubordinate or not amenable to discipline than young men of a similar age in England, or Ireland, or Scotland, or America?—I have had experience both in England and here. Of course lads will be lads.

Q. You do not think that young Canadians are less amenable to discipline than others?—No.

Q. It has been stated to the Committee that there is a certain amount of insubordination or want of discipline on the part of young Canadians. If that does exist, you are of opinion that a certain amount of tact would overcome it?—Speaking generally, yes.

By Mr. Dawson :

Q. It was stated that on account of young Canadians not being amenable to discipline, they were not so well qualified for positions on the Geological Survey as young Englishmen?—I should say one would be just as good as the other. I would

employ Canadians, other things being equal. Young Canadians are every bit as good, but not better, and of course if you bring young Englishmen out here they will not be so well posted with regard to the country as Canadians.

HOUSE OF COMMONS, OTTAWA, 1st April, 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the Chair. Alfred R. C. Selwyn, LL.D., F.R.S., of Ottawa, Director of the Geological and Natural History Survey of Canada, re-appeared before the Committee and was again examined.

By the Chairman :

Q. Since you were before the Committee, Mr. Torrance has completed and submitted to you his work for the last year in the Valley of the Ottawa, has he not?—Yes.

Q. What is your impression about the report, from the little you have been able to examine it?—I received it on the 28th of March. From what I have been able to examine of it, I consider that it is a good and useful report.

Q. It is in reference to the phosphates of the Ottawa Valley?—Yes. It is a report of fifty-nine pages.

By Mr. Holton :

Q. How many months' work does this report cover?—The instructions were given to Mr. Torrance on the 17th day of May, 1883, and this report was handed to me on the 28th of March. There is a map referred to, which does not accompany it, Mr. Torrance explaining that it was not quite ready.

Q. It is virtually Mr. Torrance's work of the year?—Yes.

By the Chairman :

Q. What action is taken by the Department in reference to a report of this kind, when it is presented?—It is submitted to me; I carefully read it and decide as to its fitness for publication—that is, whether it is fit for publication or desirable to publish *in extenso*. In every case where it is not published, an abstract is made of it, and is published in my preliminary report, the author's name being mentioned.

Q. Has this been the procedure with all the reports that have been submitted to you since your connection with the Survey?—Yes.

Q. Every report that has been submitted to you has been examined and either appears *in extenso* or an abstract made of it in your Report of Progress?—Yes; I go through them all and make corrections and suggestions.

Q. In the natural course of procedure, when would this report of Mr. Torrance's be given to the public?—Owing to the late date at which the reports are sent in, usually, there is not time to publish them—that is, to print them and correct the proofs—the same spring, and therefore they stand over until the following spring.

Q. So that the work, for instance, which was done by Mr. Torrance in the summer of 1883 will not be given to the public until 1885?—The spring of 1885 or the winter of 1884.

Q. Do you not consider that a change ought to be made in that respect, and if these reports are valuable, that the public should get some benefit from them without so long a delay?—I think it is often desirable, and moreover, it has been done in several instances. Dr. George Dawson's report on the coal of the North-West, which was considered of immediate value, and was published at once, is an instance of this. I think in many cases it would be desirable to do so; and in fact it has been the custom, and has been done repeatedly.

Q. You mean that they have been published in anticipation of the regular report of the year?—Yes.

Q. How many instances of that kind have there been?—I could hardly tell, but there have been several. Another report of Dr. George Dawson's, on the mines and minerals of economic value in British Columbia, was also published immediately.

Q. Have reports by other members of the staff than Mr. Dawson been published in that way?—No; because they have never been prepared in that way. The observations on economic minerals have always been embodied in the report. There are other reasons why this has not been done hitherto, and that is the question of expense. This no longer exists now, as the Government have been good enough to increase the annual allowance, and probably a system could be adopted now that was not possible before.

Q. These reports of Dr. Dawson's which were published separately and in advance of the regular volume were afterwards reprinted in the volume of the year, were they not?—Not exactly; in the reprinting of them there were considerable additions and amendments, the result of further observations:

Q. But the same work appears in the regular volume?—Yes.

Q. Is not the same remark applicable to the Report of Progress by the Survey? For instance, the work done for three years during 1880-81-82 was not published until the year 1883, and is just given to the public?—That is a matter of necessity. You cannot in all cases complete the work in one year. Observations have very often to extend over several years before the results can be given, and more especially has that been the case in view of the expenditure. It is not advisable to publish partial results, but that has to some extent been got over by officers publishing in scientific journals or reading papers before scientific societies, giving the results of their observations as far as they went. In that respect the system I have adopted is precisely that which prevailed under Sir William Logan. The whole system of publication has been similar, both as regards prior publication or publication with the annual report.

Q. Take, for instance, the phosphates of the Ottawa Valley. That section has been attracting a great deal of attention during the last two or three years, especially the attention of American capitalists. Do you not think that it would have been advisable that the work which was actually going on in that region should have been conveyed to the public in some form, so as to give intelligent information with reference to these phosphate deposits?—We can convey it in no other form but by the reports, and reports upon that have been published from year to year. If people will not read the reports we cannot help that. You will find a reference to the apatite not only in the last one, but there is the fullest reference in other reports.

Q. Take the report for the three years, 1880-81-82?—It does not represent three years' work, and that is not a fair statement to make.

Q. It is unfortunate, then, that that date should have been put on the volume?—That date is put on it to bring it up to the present time.

By Mr. Holton:

Q. Would it not be more honest to publish the volumes without any reference to dates at all?—I have no objection, but it is stated in the report that it does not represent three years' work.

Q. I have looked through this last volume?—But you should have looked through the others.

Q. I have looked at this as a sample?—One volume is not a sample of the reports. The last one is an exceptional report.

Q. I think it is, and I think it is quiet a poor sample. It seems to me that our annual volume published annually as the Report of Progress should show the work done each year?—I think that has been done. The preliminary report shows the year's work.

Q. Then it should not be published as a year's report?—It is distinctly stated that it goes on from one year to another. The fiscal year and the calendar year are not the same, and therefore we cannot make them correspond. I have here a volume of reports issued by Sir William Logan and representing nine years' work, from 1842 to 1850.

By the Chairman:

Q. Those were the first years of the Survey?—The first nine years of the Survey. They did not commence work until 1843?—The report is dated "Montreal, December, 1842."

Q. But they did not go into the field until May, 1843?—As regards the reports, I may mention that in twenty years Sir William Logan published 2,200 pages, while in ten years I have published 3,800 pages as the work of the Survey. These are the facts, but now this report, 1880-81-82, which happens to be dated in a peculiar manner, simply to bring the date up to the time, and for no other object, is taken as a sample of the whole work, and I hold that that is very unfair.

Q. Will you inform the Committee what information the public have received in any other form than in this volume for the last two or three years?—A part of the work of 1880 appears in the last volume. There is a report of 1879-80, of over 700 pages, which is called the report of one year's work.

Q. That volume was published in 1881?—Yes.

Q. So that it clearly embraces no work since the year 1880?—I am not quite sure of that. There are reports of the Survey from 1875 to 1881—six volumes—in every one of which there are maps, illustrations, details about economic minerals, and yet this last volume is held up as a sample of the work. I put it to the gentlemen of this Committee to say whether that is a fair representation of the work of the Survey.

Q. I think it is confirmatory of the representation made to the Committee that the work of the Survey was not as efficient as it was formerly?—Why call particular attention to that report?

Q. Because it represents the most recent work of the Survey?—How does the size of the book prove the efficiency of the work—

Q. It proves the extent of it?—Take this report for 1880, which is the same date as the other.

Q. You do not quite understand me. It has been said that the work which has been going on for the last three years is not as efficient as the former work done by the Survey?—On what ground do they say so?

Q. I have stated that this Report of Progress for 1880-81-82 does not give evidence of the same extent of work as was previously carried on?—Of the last year only.

Q. It is three years' work?—It is not three years. In all fairness, you should take a few years back. To what particular work do you refer?

Q. Take, for example, the report of 1879-80. That was published in 1881, and therefore it contains none of the work that has been done since 1880? Is that correct?—I think so.

Q. Has there been anything given to the public since 1880, with the exception of this last volume?—There has been a great deal; there are other documents regarding the work of the Survey that have been given to the public, although not exactly in the form of a report.

Q. You now have an opportunity of correcting any misapprehension in that respect?—I cannot correct it, except by referring to the whole series of volumes by the Survey, and which must be done in order to arrive at a just conclusion.

Q. In addition to the work of these two years, as published in the volume of 1880-81-82, what work has been done?—A great deal of work has been done. It cannot all be done in one year.

Q. Cannot you specify it?—The surveys of the country and the maps which are in course of preparation. There is also the Museum given to the public.

Q. But according to your own statement the other day, the Museum has not increased very materially in the last twelve years?—I will ask any one who saw it in Montreal, and who have seen it here, if they can, in fairness, say that it has not increased.

Q. I am referring to your own statement the other day?—In Montreal the number of visitors in one year would probably be 1,600, while here we have as many as 1,500 in one month.

By Mr. Dawson:

Q. Then it is much better here than when it was in Montreal?—Yes; it is improved, and to whom is it due? Yet that volume is held up to represent the work of the Survey.

Q. That volume professes to represent the work of three years?—No; it simply represents a statement of the work that has been going on.

By the Chairman :

Q. During these years?—Yes; during those years. The results are not all finally returned yet; it makes a statement of the work, but in no sense does it represent all the work.

Q. What the Committee wish to get at is, what benefit it is to the public, other than through the Museum and the published reports?—I do not suppose the public are getting any benefit from the Survey, in a published form, but they are getting great benefit in an unpublished form, such as the giving of advice to miners in respect to mines. So much is that the case that I can show the Committee, by written proof, that in several instances the capital brought into this country, to work the mines, is due directly to my name in London, if that is any benefit to the country.

Q. It is, certainly?—I can give you conclusive evidence on that point. I will ask to put in this letter, which is written by a well-known geologist, whose reputation is world-wide, and who has been more or less identified with geological investigation in Canada for many years. The letter, which is from Mr. Jules Marcou, now resident in Cambridge, Mass., is as follows:—

“CAMBRIDGE, MASS., 42 GARDEN STREET, 10th October, 1881.

“Director A. R. C. SELWYN, Ottawa, Canada.

“MY DEAR SIR,—Many thanks for your kind letter of the 4th instant; the five volumes of Report of Progress, 73-74, 74-75, 75-76, 76-77 and 78-79, the notes on geological nomenclature and coloring of geological maps, and the index of colors and signs now in use by the Canadian Survey.

“I looked over some of the reports, reading only your own introductory report for each volume, and I congratulate you heartily upon the great work which you conduct with such ability and success, for those reports are more comprehensible, more important, and far above those published fifteen years ago.

“Yours devoted,

“JULES MARCOU.”

That is from a gentleman I never saw in my life.

By Mr. Dawson :

Q. What is his position?—I cannot say; he is a professor at Harvard University, at Cambridge, Mass., I fancy. He is a well-known man, at any rate, and a man who is capable of judging of the value of reports.

Q. Had you only 4,000 copies of your reports struck off in former years as you have now?—Not nearly so many; about 1,500 in former years, I think.

Q. Then they are not generally circulated. A circulation of 4,000 is nothing for this Dominion?—There I quite agree with you.

Q. And they are sold at only two bookstores, Dawson's, in Montreal, and Durie's, in Ottawa?—I have to cut my coat according to my cloth. The liberality of Parliament, however, will remedy this; in the meantime, this vote has not been available, as it only took effect since the beginning of the fiscal year on the 1st of July. I quite agree with you that it should be sold at a merely nominal price.

By Mr. Cameron :

Q. I would like to ask if Mr. Marcou was a personal friend of Sir William Logan?—I do not know anything about his relations with Sir William Logan.

Q. You have no knowledge of any personal quarrel?—I do not know of any personal quarrel. There might have been a difference of opinion about the Quebec rocks, but that yet exists, and that could not be the cause of any personal quarrel. At any rate, I never saw Mr. Jules Marcou in my life.

Q. This letter may have been intended as a reflection upon Sir William Logan?—I cannot say.

By the Chairman :

Q. You have adopted the opinion of Mr. Marcou?—No.

By Mr. Dawson :

Q. This difference of opinion with Sir William Logan may have led to the present opinion of Mr. Marcou, that the Survey is much better conducted than it was fifteen years ago?—Mr. Marcou certainly had nothing to do with Sir William Logan, and as regards my ability to conduct a survey, I may read a reference made by the President of the Geological Society of London, also a man whom I never knew, in speaking of the death of one of my late assistants in Australia, Mr. Richard Dani-tree, C.M.G., whom I trained in geological work. The reference which I will quote is as follows: "In 1869 he was appointed Government geologist for North Queensland, whilst the late Mr. C. D'Oyley H. Aplin was appointed to a similar post in the southern part of the same colony. The Queensland Government were able to secure the latter gentleman's services through the parsimony of the authorities of the Victoria colony in breaking up one of the most complete Geological Surveys ever organized, except, perhaps, that of the United States Territories, under Dr. F. V. Hayden."

Q. Who was the gentleman who wrote that?—The President of the Geological Society of London, in 1879, Mr. Henry Clifton Sorby.

Q. Dr. Hunt is looked upon as a very accomplished man, is he not?—Yes, as a chemist and mineralogist and theoretical geologist, but he knows nothing about stratigraphical geology.

Q. Geologists differ among themselves, too. For example, at Thunder Bay, I believe, there is a divergence of opinion as to the Aminiki group. Dr. Hunt has written on that subject, and has published a very interesting report about it. I believe you have yourself written something on the subject also, and there is a difference of opinion as to the geological age or horizon which these rocks occupy, a difference equivalent to no less than 20,000 feet, vertically, in geological position. Is that not the case?—Those are matters of investigation. I have differed with Dr. Hunt on certain questions of stratigraphical geology. A great many of Dr. Hunt's views are based on theory, and not on personal investigation of the stratigraphy.

Q. But Dr. Hunt investigated the rocks. He was a long time up at Thunder Bay, and examined them pretty thoroughly; but I merely made the remark to show how geologists differ in opinion. They differ as much as these miners who are developing the mines?—I told Dr. Hunt plainly that he had not thoroughly investigated the matter. I never write about anything which I have not personally investigated.

By the Chairman :

Q. I notice in your Report of Progress a reference to the work of a number of the members of your staff, whose reports do not appear in the published volume?—Who are those?

Q. There are a number of references, Mr. Fletcher's, for instance?—Every report Mr. Fletcher has given me, except the last, has been published. He writes his reports well, and is a very faithful worker and does his work well. The last has not been published, owing to circumstances.

By Mr. Cameron :

Q. This report was delayed on account of the maps?—Yes; it was partly owing to that and also partly owing to the late date at which I received the report. As I have stated before, we cannot stay in town and sacrifice the summer to get out the reports, and to get them out when they are handed in at this time of year would necessitate the sacrificing of all the summer's work. Unless, therefore, it is something specially interesting or of immediate importance, its publication is deferred until the next year.

By the Chairman :

Q. You had a Mr. Laflamme on your staff, had you not?—No; I employed him only last year to undertake an investigation, and here is his report, which I have gone through, and which is now waiting for publication.

Q. When was the work done?—Last summer.

Q. Where?—In the Valley of the Saguenay.

Q. When was the report furnished?—I think it must have been at the close of the season, in December, probably; it was after I returned from the field, at any rate.

Q. There is no reference to that report?—No; but there is a reference to it in the Minister's report; full particulars of it will be published in the report of the Survey itself.

By Mr. Dawson:

Q. I suppose you would consider Prof. Chapman a good geologist?—Like Dr. Hunt, he is an excellent chemist and mineralogist, but he is not, I conceive, what we call a field or stratigraphical geologist. As an instance of this, I may say that Prof. Chapman published a report on the Haycock Iron mine, which I do not hesitate to say is entirely misleading, because he did not understand stratigraphical geology.

Q. Prof. Chapman took occasion to speak in very high terms of you, Dr. Selwyn, as being a very able geologist, although he could not say very much for the report, and I thought, perhaps, that the feeling was reciprocated, and that you had a very high opinion of him, but it seems you have not?—This letter which I hold in my hand has been in the hands of Mr. Simpson ever since I examined the mine, at the request of Mr. Simpson, of the Ontario Bank. After having been out to the mine and examining it carefully, spending a whole Saturday there, with Prof. Chapman's report in my hands, I gave him my distinct opinion about it. Referring to Mr. Vennor's report, which was published in one of our annual volumes, I found no information about this mine, and while I found no information about this particular mine, the Hull mine was fully reported on, full details being given of it. I have written to Mr. Vennor, asking him his opinion about the Haycock mine, which is given in the following letter, and which I may say entirely coincides with my own:—

“MONTREAL, 8th November, 1884.

“DEAR SIR,—In reply to yours of the 6th, I have always thought Prof. Chapman's report extremely visionary, as regards the probable quantity of ore in the Haycock iron deposit. The general conditions of this never struck me favourably. It is clearly a series of interstratified layers and masses in an iron ore horizon, which gives indications of the ore at very many points, but nowhere to any great extent. Prof. Chapman seems to think these layers and masses will or do run together into an extensive deposit in depth. Why? I see no indications of this, but rather the reverse. Most of the large deposits of iron ore in the Laurentian are the result of a fold of the layers or beds sharply upon themselves. Thus, the Seymour deposit at Madoc is a synclinal, the Hull mass an anticlinal; but the Haycock deposits are enclosed in a comparatively even or straight stratification. Possibly you read an article in the *Globe* of 4th November. This is clearly written in the interest of Mr. Haycock. In my humble opinion, though the quality of the ore is undoubtedly excellent, the mine has, so far, proved a decided failure. I would, however, conceive of its making a very considerable “show,” were the beds upon the beds sharply folded upon themselves. I have traced the Hull (Baldwin and Forsyth) deposit for a great number of miles, but in no one place does it again assume such proportions as where folded over on the anticlinal near Hull. I do not think, Sir, you yourself would feel disposed to attach any weight to Prof. Chapman's wild estimate respecting the quantity of ore in this mine, although the report on quality is undoubtedly correct.

“Yours respectfully,

“HENRY G. VENNOR.

“ALFRED R. C. SELWYN, F.R.S., &c.,

“Director Geological Survey of Canada, Ottawa.”

This was Mr. Vennor's candid opinion, and he probably did not give this opinion in his report, because he thought, had he done so, he would have been doing an injury to private interests.

Q. Might it not very often injure mining interests for geologists to express such opinions without sufficient investigation? It is to be supposed that these people, before they begin to open these mines, bring scientists and practical men to examine them, and are not these experts just as likely to know quite as much as the officers of the Geological Survey?—Certainly not; simply because they have not examined the geology of the country; they come here as perfect strangers and they know nothing about the country. It has been rather made a subject of attack that we have never reported on mines, and still you ask me whether we might not injure the mining interests of the country by making these reports.

Q. It is, of course very wrong for people to express these ideas without sufficient knowledge, but are not experts who have had considerable experience in mining in possession of as much knowledge regarding mines as the officers of the Geological Survey. The members of the Geological Survey are officers of the Government, and from their high position what they say has a very great effect; as, for example, a mine is supposed to be a good one, mining experts have pronounced it to be so, but along comes a geologist, strong in the spirit of controversy, with some fine-spun theory. He expresses an adverse opinion, and opinions thus readily expressed, without sufficient investigation, are very prejudicial both to the public interest and to the miner, whose credit is so far injured that he finds it difficult to get money to work these mines. Is that not very often likely to be the case?—I do not think it is likely to be the case, because no geologist will express an authoritative opinion. On the other hand, I have expressed opinions which resulted in bringing capital into the country. With reference to the Haycock mine, I may say that Mr. Simpson, of the Ontario Bank, came to me one day, and said, "Mr. Selwyn, I wish to consult you about a mining matter." I said, "Well, Mr. Simpson, I shall be very glad to give you all the information in my power." He said, "We have advanced very largely on this property, and I wish to get your opinion as to the value of it." I then said to him, "I know the Haycock mine by repute only; I have not been there, but I have read Prof. Chapman's report, and Mr. Vennor, of the Geological staff, has examined the whole country; he was requested to report on the minerals, including the iron deposits, and did so. I will turn to his report and see what information he gives about it." And what I have already stated occurred, namely, that I found no information. I then told Mr. Simpson that I was sorry I could not give him any satisfactory information about this matter. He then asked me if I could make it convenient to go out and visit the mine and give him a report. I said to him "We do not ordinarily make mining reports for private individuals, and it is not considered a part of the duty of the Survey to do so, but if you wish it particularly, I should like, for my own information, to see the mine, and I can go out some Saturday, if you wish, and give you my opinion." He sent a buggy to my house about eight o'clock in the morning of Saturday, the 4th November, 1872, and I spent the whole day there, carefully examining the mine, in company with the gentleman whom he sent out with me. When I came back I wrote to Mr. Simpson, distinctly stating my opinion, which was decidedly adverse, and I pointed out my reasons for coming to this decision, saying that I had not time to write him a long report. He then asked me who I would recommend to give him a report, and I recommended Mr. Hamilton Merritt. Some time after that I met Mr. Simpson, and I said to him: "Well, Mr. Simpson, what have you done about the mine?" to which he replied that Mr. Haycock was going home to England to raise more money to carry on the work. Later on—I am unable to give precise dates—but some months later, I met Mr. Simpson again, and I asked him what success Mr. Haycock had met with in England, to which he replied that Mr. Haycock had been very successful, and that the gentlemen who had taken this matter up, were sending out an expert to examine the mine, and on his report they would act. He also added: "We must keep him away from you Mr. Selwyn." I said that it was no business of mine, but if he came and asked me, I would give him my opinion candidly. The expert came out, and I never saw him, and I did not know who he was, or anything about him, but I found out afterwards quite acci-

dentally, having met this gentleman, Capt. Retallack, at Rideau Hall, and whose name had been mentioned to me by Col. Dennis, who was then asking my advice and opinion about some mines he was taking up in the Rocky Mountains.

Q. Was Col. Dennis then Deputy Minister?—No; he had resigned.

Q. It was quite recently, then?—Last year. I said I never met Capt. Retallack until I met him at Rideau Hall, and I associated him in my mind as being a Cornish mining Captain. Shortly after his name had been mentioned to me by Col. Dennis—I, supposing, of course, that he had had been brought out by Col. Dennis—I was introduced to him at Rideau Hall, when I found that he was a military man and had been an A.D.C. in Canada. I had a long conversation with him about mines in general, and I asked him if he would not come and visit the Museum next day. He did so, and we had a very long conversation about mines and about the English capital invested in mines here. Incidentally the Haycock mine came up, and he asked me my opinion about it, which I gave him. I did not know then that he had ever seen it, but it turned out that he was the expert whom Mr. Simpson wished to keep away from me. He listened to all I had to say, but he did not tell me that he knew the Haycock mine or that he had anything to do with it. Shortly after he met Dr. Dawson, to whom he said: "If what Mr. Selwyn says about this mine is true, it is a very serious matter; I am heavily interested in it." Dr. Dawson said to him that he did not know anything about it, but he would look him up everything he could find on the subject, and I believe he did so. At that time Capt. Retallack had in his possession a prospectus marked "private and confidential," which was issued in London, and in which Capt. Retallack's and Mr. Haycock's names appeared, and also in which my name was most unwarrantably used.

Q. As dooming the mine?—No; as speaking highly in favor of it.

Q. Whereas you doomed it?—Most decidedly.

Q. The mines of the Eastern Townships, for instance, do not owe much to the Geological Survey, for they have been adversely reported on and represented as consisting of pockets in rocks folding back on themselves, and so disturbed that no continuous lode could be found. Yet these are now yielding handsome returns and giving employment to a large number of people. Is not that the case?—I deny that altogether. I am not aware that it is the opinion of geologists.

Q. The other day we had evidence from a very high source that these mines were now being worked at an annual expenditure of a quarter of a million of dollars, and that some of them had proved very valuable?—What mines are those?

Q. I do not know the names of the mines; but I think they are near Lennoxville. The Haycock mine itself might prove very rich, might it not? We have instances of that kind in Lake Superior?—That is all supposition.

Q. Yes; I fancy there is a great deal of supposition?—That is the opinion of certain geologists, but the proof of the pudding is in the eating of it.

Q. But the Silver Islet mine was reported against, and still they have taken a good deal of valuable ore out of it?—Will you state what report?

Q. I am not here to answer questions, but to ask them. It was generally supposed that there was nothing to be found there, and then Mr. Macfarlane went up there and reported on the mine, taking with him \$15,000 worth of specimens down to Montreal. He and Col. Sibley came and developed the mine, and they took out three or four millions of dollars?—Has that anything to do with geology?

Q. The country generally was run down there?—I cannot refute the statements of geologists generally.

By Mr. Wood:

Q. Has the Haycock iron mine been worked or developed at all, since?—No; it is standing still, as far as I know. Large sums of money have been expended upon it, but not since the period I have spoken of.

Q. Not since you gave that opinion?—No.

Q. Then there is no means of ascertaining from actual experience whether your information with regard to the mine is correct or not?—That can only be done by further sinking.

Q. And that has not been done?—No. Of course, I have other ways of supposing that I have been correct, which these experts who go out there have not.

By the Chairman:

Q. Are there practical tests made in the chemical department of the Survey of ores that are sent in?—Yes, constantly: every report shows it.

Q. Are the records of these examinations kept?—Yes; precise records.

Q. And dates fixed to them, so that the matter might be tested afterwards?—Yes; most of the tests made in the Survey are not those of developed mines. They are specimens sent in from all parts of the country.

Q. Can you tell, from recollecting in reference to any tests that have been made of the iron deposits of the Eastern Townships, as to whether they were condemned or approved?—Dr. Hunt made all these.

Q. But recently, within the last five or six years?—We have not made any recently, that I am aware of.

Q. An impression prevails there that the Geological Survey reported that the iron deposits of the Eastern Townships contained titanium?—That was Dr. Hunt's report long ago.

Q. Did he, as a matter of fact, report so?—Yes; it is my impression that he did so. However, the analyses are given in the report. The facts are there.

Q. But the most thorough tests that have been applied to them show that they contain no titanium?—That may be deposits not tested. Of course, I am speaking on the authority of Dr. Hunt, supposing him to be a first-rate chemist.

Q. A report has been sent to the Committee to the effect that in consequence of a report made by you in reference to the Acadia Charcoal Iron Company, the directors of that company passed a resolution making a contribution to you of \$700 for that report?—In 1872, Mr. Livesey, of the Londonderry iron mines, asked me if I could examine and report on this mine. I gave him the answer which I give to everybody, that as a rule we did not give reports to private mining companies without permission or instructions from the Minister. Mr. Livesey, as I believe, was connected with Sir Hugh Allan in relation to this mine. Sir Hugh Allan got permission from the Minister for me to go with Mr. Livesey and make the report. I did so, spending considerable time there. I carefully examined the whole property, and made a survey of it, and transmitted the report, when finished, to I forget whether Sir Hugh Allan or not. Sir Hugh Allan's letter to me was as follows:—

“MONTREAL, 8th June, 1872.

SIR,—We have arranged with Mr. Livesey that we are to ask you to go down to Nova Scotia and give us a report on the iron deposits of Londonderry, and the coal areas he proposes to sell to us at Springhill.

We especially desire to know the probable quantity of hematite ore, and whether it may be regarded as of such permanent continuance as would warrant us in fitting up expensive works.

“Yours truly,

“HUGH ALLAN.”

Some time afterwards Mr. Livesey asked me whether I had received a cheque from Sir Hugh Allan. I said I had never heard anything about any cheque whatever. He then explained that they had been so satisfied and pleased with my report that they had unanimously decided to make me a present for the work I had done for them. The amount, I think, which Mr. Livesey mentioned, was \$500. On the 27th June, 1874, I received the following letter from Mr. Livesey:—

“HALIFAX, 27th June, 1884.

“MY DEAR SIR,—Your note of the 18th, addressed to the mines, has been forwarded to me here. I am now writing to Mr. Stephen, and will incidentally request him to remind Sir Hugh of his shamefully neglected duty. I have also communi-

cated your message to Mr. Gould. You don't allude to your expected visits to these parts, but I trust it has not been abandoned or adjourned. It would give me much pleasure to see you at Springhill, where, in a few days, we shall have our English boring machine in operation upon an important, but problematic, portion of the coal-field. Please write or telegraph me to the iron mines, Londonderry, a few days before you start. If there is, as I believe, an official plan of Springhill on a pretty large scale, I should be glad to receive a copy, if not against regulations. It would be extremely useful to us in our explorations. If a tracing has to be made of it, I will repay the cost.

"Yours faithfully,

"JOHN LIVESEY.

"A. R. C. SELWYN, Esq., Montreal."

After this again I met Mr. Livesey—I cannot remember the date—but he again asked me if I had received this money, to which I replied that I had never heard anything more about it. He then handed me a cheque for \$200, which, he said, he considered was his share of the amount awarded. That is the whole history of the case, from the beginning to the end. That report I afterwards published, with subsequent additions to it, in the report of the Survey, because I considered it valuable in the mining interests of the country.

By Mr. Dawson :

Q. All you received was \$200?—Either \$200 or \$250, I cannot recollect which. It occurred twelve years ago.

By Mr. Holton :

Q. I would like to ask you for further information with reference to Dr. Rae's remarks on Dr. Bell's map?—This is Dr. Rae's answer to my first letter:—

"4 ADDISON GARDENS, KENSINGTON, 27th June, 1883.

"DEAR SIR,—I beg to acknowledge your favor of the 13th instant, on the subject of a letter of mine on the 'Hudson's Bay route' published in the *Canada Gazette* of the 3rd May. It gives me pleasure to reply to your questions, and make such explanations as appear to me requisite. First, you say I mention 'statements made by Dr. Dawson.' I find that I nowhere mention a Dr. Dawson in my letter, and know well that my friend, Dr. G. M. Dawson, your assistant Director, is incapable of making any such statements as those which I have called in question. The Mr. Dawson I referred to is the M. P. of that name; in fact, the first paragraph in my letter might, I think, have made that point clear, as I specially alluded to the debate in the Dominion Parliament.

"I am glad you sent me copies of the proposed maps of Moose River, in which I put in very roughly, from *memory*, the corrections required.

"There are or were in my day two islands to the N.W. of 'Inner Ship Hole,' called the 'ship sands,' and these islands were separated by a deep and swift stream from the N.W. shore of the river, which occupied about twenty minutes to paddle across in a canoe. Spring tides, aided by a gale of wind, sometimes cover these islands with several feet of water; on one of these occasions a friend and myself nearly lost our lives. We were lying under our canoe, where I have marked X. during a pitch dark night, when the tide came upon us; to cross the river to the N.W. shore was impossible, as our frail ship would soon have been swamped, so as the water rose I pushed our canoe over the island to the one nearest the 'Ship Hole,' where some willows, about ten feet high, grew; providentially, my steering was accurate, and no man ever heard a more grateful sound than the scraching of the willows (I could not see them) against the bow of our canoe.

"If the Moose River is as your map shows it to be, the X should have been well inland on the main shore of the left bank of the river.

"My first voyage in the Hudson's Company's ships was outward bound in 1833, and our long detention by ice in the Hudson's Strait occurred in July, *certainly*, and probably during the early part of August.

"In the same Autumn (1833), I think in early October, possibly the latter week of September, but I cannot give you the exact date without hunting up old documents in the Hudson's Bay House, both the York Factory and Moose ships were forced to winter in the Bay, the one at Charlton Island, the other at Churchill, there being a compact barrier of ice across the mouth of the Bay.

"My two other voyages were homeward bound, and the passage of the Strait was made in, I think, September, and the first part of October. All I am certain of is that the dates did not run so late as November.

"I ought perhaps to say that it is no business of mine what may be the form of maps published by the Dominion Government, but having been asked, when in Canada, last autumn, my opinion about a contemplated railway to Moose, and being shown a map placing a railway on a strong current river for the distance of a couple of miles, as if it had been dry land, I was bound to tell them the truth; the truth, at least, as it was in my time. These gentlemen told me of other information they had received of less importance, but equally erroneous, which I did not think worthy of notice, but all tending to show the navigation of the bay in a most favorable light.

"Believe me, dear Sir, faithfully yours,

ALFRED R. C. SELWYN, Esq., LL.D., F.R.S., &c.,

"JOHN RAE.

"Director of Geological Survey, &c."

The next letter, from Dr. Rae, was as follows:—

"4 ADDISON GARDENS, KENSINGTON, 20th November, 1883.

"DEAR DR. SELWYN,—I have just received your letter of the 7th instant, referring to the north branch of the Moose River. In reply to your kind enquiry, I must say that it is *possible*, by some great convulsion of nature, that the north branch of the river may have ceased to exist, but in the usual course of things such an event was not at all likely. I merely said something on this head to give Dr. Bell a *meagre* chance of being right. You may make this north branch even wider than I showed it on the rough sketch I sent you, unless the ship sands have greatly increased in width. Having traced and mapped by observations with compass, sextant and chronometer, nearly 1,800 miles of Arctic coast and land previously unexplored, I had got into a way of trying to do things accurately, as far as my means would allow, and when I had to meet some of the surveys of the *best* (they were not all *best*) of the Government naval officers, I was about right with them. It is forty, not fifty years since I was at Moose, but it is half a century since I went there first.

"As you are no doubt interested in the Hudson's Bay route between Manitoba and England, I fear that this year's experience of the Hudson's Bay Company's ships will not brighten their prospects. Both ships were a month or more in the ice on their outward voyage, the ice being met in the Bay far to the south.

"The Moose ship got home only a few days ago; the York ship has not yet turned up.

"Believe me, very truly yours,

"ALFRED R. C. SELWYN, Esq., LL.D., F.R.S., &c."

"JOHN RAE.

Q. I see here a map "sketched by Mr. C. H. Rockwell, of Tarrytown, N. Y., 1883"?—Yes; the next one is a copy of Dr. Bell's map, and the remarks which appear in red are those of Mr. Parsons. Then the other map is one published in 1774, exactly one hundred years ago, by some explorers. I might also say, that I think a great deal more evidence ought to be brought before the Committee before it closes its labors, because hitherto any witnesses that I have asked to be heard, have not been called, and witnesses only on the opposite side have been heard. However, Dr. Bell has made charges very distinct and definite against me and I have in that matter called attention to his inaccuracy.

By Mr. Dawson :

Q. Is it not your experience, Dr. Selwyn, that, although scientists may have their different views, when they are at home they are always a very happy family?—It does not appear to be so in the Geological Department here. There is no harmony.

By Mr. Holton :

Q. Why is there not harmony?—I cannot tell. I was not aware of anything that should create discord.

By Mr. Dawson :

Q. But we were not aware that these witnesses would give evidence one way or the other. The witnesses which were called were men of such high character and standing; take Dr. Hunt, for instance, a man whose reputation is world-wide, who would suppose that he would take a side?—Everybody would who knows anything about the matter.

Q. And Prof. Chapman?—Prof. Chapman said nothing against the Survey.

By Mr. Holton :

Q. Why does harmony not exist in the Survey?—I was aware that Dr. Bell and Dr. Hunt were both offended with me, and I suspected they had taken steps to make trouble amongst the employés.

Q. Dr. Hunt is not at present a member of the Survey?—He was but not now.

Q. I am speaking of the present interference?—I believe Dr. Bell is always scheming. Sir William Logan himself said so, years ago.

Q. Surely Dr. Bell has not more control than you?—It is not control, but discontented persons can lead young men with them.

Q. You unhesitatingly attribute this discord to Dr. Bell?—I do not know that there is any discord in the Survey.

Q. You have said so?—Between Dr. Bell and myself. There is no discord between myself and Dr. Dawson, Mr. Whiteaves and Mr. Hoffmann; with none of them, in fact, except Mr. Fletcher, which, I think, was due mostly to his small salary. I have the whole correspondence.

Q. You have stated that the whole cause of the discord which exists is attributable to Dr. Bell?—Yes; there is no discord, except between Dr. Bell and myself, that I am aware of.

By Mr. Baker :

Q. Am I right in drawing the conclusion that the report of Mr. Torrance on the phosphate regions is a good and useful report?—I have not carefully looked over the whole of it yet, but from the little I have seen of it, that is my impression.

Q. What led to his dismissal or the discontinuance of his services?—Simply because he was employed temporarily. He was not appointed at all, and the sole reason was, that I considered he was altogether too slow with his work. I said to him, "If you cannot do this work more rapidly, Mr. Torrance, I do not think you will succeed in it, and you had better seek employment elsewhere." If I had any feeling for him, it was one of friendship. I have letters from him thanking me for my kindness in recommending him to people, &c. When he went out to this region, he spent six weeks in cutting a single line of four miles in length, and he also spent twenty days in Montreal getting information from Mr. Vennor, and when I find a man so desultory as that, I say he is not fitted for the work.

Q. This discontinuance of his services then, is more to be attributed to his slowness than any want of ability?—Yes; it was no want of ability.

Q. As regards Dr. Bell's map, of Moose River, is it possible for any surveyor, in so short a time as three days, to delineate upon a map the sinuosities of the coast line and to make it of any practical use?—I certainly think not.

Q. But Dr. Bell informed the Department that this was only a rough sketch, taking from two and a-half to three days, probably?—He did not; he thought it was a survey.

Q. Did he state so?—It is stated so on the map.

Q. Do you think it is possible to make a survey of so large an area in so short a time as three days?—No, I do not but I do not; know how long Dr. Bell was occupied in making it.

Q. Is it usual for the officers of the Geological staff to make what is necessarily conceded to be nautical Surveys?—No. They are instructed to make the best survey they can, but always to state the circumstances under which it is made. All actually measured lines, only, should be drawn in full on the map; all others should be dotted.

Q. This map has really the appearance of a complete map; I mean to say that the shoals are marked as indicative of five-fathom lines, as the outer defining of the shoals, the configuration of the various islands. The whole map seems to impress one with the idea that it has been carefully prepared?—Yes.

Q. Any one taking it up, as I do now, would think it was a carefully prepared map. Did Dr. Bell, in forwarding it to the Department, clearly and distinctly state that this was simply a rough sketch done in his own time, and not forming any part of his duty as a member of the Geological Survey?—No; it is always a part of the duty of a member of Survey where no maps exist, to make them, and where any does exist to improve it, but always to state the circumstances under which it is made.

Q. Is it generally expected that officers of the Geological Survey shall make what cannot be otherwise than a nautical survey?—They are simply supposed to make sketches of the coasts that they traverse, and often, for the sake of making the map more useful, we take information from the marine charts and put it on the maps, always stating that such and such work is adopted from existing charts.

Q. This map of Moose River impresses me with the fact that it is more or less a trigonometrical survey?—Yes; I should think so.

Q. Are officers of the Geological Survey supposed to know all the matters required for the making of a correct trigonometrical survey?—No; but a traverse survey, and a triangulated survey, to some extent.

Q. But the principal points are not checked by a series of back angles, &c.?—In some instances, not all; in fact I consider our surveys generally to be rather sketches than surveys. I have made such myself of the whole of the Saskatchewan River, and which is published in one of our reports.

By Mr. Holton :

Q. Dr. Bell has stated that he handed this map in simply as a sketch, and that he did not want it used?—When I called attention to Dr. Rae's letter, he then wished to withdraw it, but up to that time he had got it engraved and printed, with a view of having it go into the report to illustrate it. I pointed out to him that it had been printed, and that all this expense would be thrown away. I then treated the matter in the manner in which I have done, and the circumstances in connection with which have already been related to the Committee.

ERNEST GAUJOT, Esq., of Bellville, Ont., Mining Engineer and Manager of the Philadelphia and Canada Phosphate Company, was also called and examined.

By the Chairman :

Q. You have devoted a good deal of attention to the iron and gold deposits in the vicinity of North Hastings, Ont?—Yes.

Q. Have you conducted mining operations in either or both of these minerals?—Yes; both.

Q. To what extent?—I may say that I happened to be connected with the Consolidated Gold Mining Company, near Marmora, in Hastings County.

Q. How long ago?—I went there in 1880 and remained until the beginning of 1882.

Q. And what did you accomplish during that time?—When I went there several shafts were sunk to a depth of from 10 to 20 feet. I continued one shaft to a depth of 200 feet, and the others to a depth of about 80 feet.

Q. What was the rock formation, quartz?—No; mica slates, and the outer walls were in the granite formation.

Q. Did you push out any leads or adits?—Yes; some were pushed to a distance of about 70 feet and others to a distance of about 160 to 170 feet.

Q. How many men did you employ?—About 200. Part of that mine had been previously called the Gatling mine and the Tuttle mine.

Q. How long were your operations continued?—Until the beginning of 1882.

Q. With what result?—The result, as far as the vein was concerned, was very good, but when I left the works were not completed. There were several veins, but they were not opened; they had been explored and trial pits sunk, but not opened. There were four pits.

Q. How wide was the vein that you worked?—From 8 to 24 feet.

Q. Was the gold pretty uniformly disseminated through the veins?—The vein matter was mispickel or arsenical pyrites. I never worked on a large scale, but have made a great many assays. It was worth from \$6 to \$200 a ton.

Q. Did you put up a crushing mill?—I commenced one, but did not finish it.

Q. Is that work now going on?—Yes.

Q. Are there several mines in that vicinity?—Yes; the Feigle and Gladstone Mine were being worked when I worked the Consolidated, and there are also a great many other mines not being worked at present, because they are all waiting to see the success of the Canada Consolidated. I have also visited the mine since, and the vein has improved. It is one of the largest veins I have ever seen, and I think I have seen every mining district in the world. There has been some difficulty in the treatment of this ore. It is very refractory ore to treat, and one process, called the Chlorination process—which, in the United States, proved a success on a large scale—and which seemed, with this ore, to work very well on a small scale, but not on a large scale; however, it seems to work better now.

Q. But they have demonstrated, at least, the existence of large deposits of rich gold-bearing ore?—Yes. The shaft is 210 feet deep now, and the levels are much longer than when I was there, and they have improved both in quantity and quality.

Q. How many men are employed now?—I think about eighty. I extracted a great deal of ore, and they do not need so many men, because they have about 10,000 tons of ore ready for treatment.

Q. How extensive does this gold deposit appear to be; over what extent of country?—About ten miles in length, and I know of four veins within about 80 or 120 feet. The vein is laid out on a geological map, made by Mr. Vennor a few years ago, and which, I believe, is pretty correct. I have seen a good many sulphuret veins, also gold-bearing, in the County of Hastings.

Q. What is your impression as to its proving a source of great wealth or richness hereafter?—I have no doubt at all about it. The only thing, as I said before, is the process, about which there is a little difficulty. I know by experiment with the old amalgam process, that we could treat very successfully and get out about 80 per cent. of the mineral, but with the Chlorination process we have been able to get out 96 per cent. on a small scale. This does not only produce gold, but in roasting we save the arsenious acid, as a bi-product, which is also valuable.

Q. As to the iron deposits, are they in the same locality?—Yes; they commence at Madoc, about ten miles from Marmora, and extend about sixty miles north.

Q. And what is the width of the iron-bearing belts?—The widest is, I should say, about three miles.

Q. What development has there been of these deposits? What works have been carried on?—In many cases shafts have been sunk; I think the deepest is about 80 or 90 feet.

Q. What is the quality of the iron?—Specular, hematite and magnetic.

Q. About what percentage of iron is there in the rock?—I found the average of the hematite about 54 per cent., and the specular or magnetic goes about 63 to 66 and 67 per cent.; in fact, of very good quality.

Q. How much sulphur does it contain?—One belt contains a good deal of sulphur but it is very well defined.

Q. How much titanium?—None, as a rule.

Q. Is the iron industry in that locality being carried on extensively for commercial purposes?—Not at present. With the duty of 75 cents, heavy railroad freights and heavy canal tolls, it is not possible to do much at the present price of iron.

Q. But there is a bonus given by the Government?—That is for home production.

Q. Why should it not be done?—I have tried to show that it could be done. There could be a profit of \$4 a ton on pig iron, which, even in good times, would be a large profit, but it has been difficult, so far, to induce men to do it.

Q. Have these iron properties been secured to a great extent by capitalists from abroad?—A good many.

Q. And they have more interest in taking the ore out of the country in a raw state than by putting up smelting works here?—Yes. An impression seemed to prevail in Eastern Pennsylvania, New Jersey and New York, that the importation of foreign ore killed the home mines, but I think that is all bosh, because for every ton of imported ore they can use one ton of their own ore, by combining the two together and each aiding the smelting of the other.

Q. They require rich ores like those of Hastings?—Yes.

Q. How many men do you think are employed up there in the mining industry at present?—At present not more than 200.

Q. From what you say, I should think the supply was almost inexhaustible?—It is; I know of my own personal knowledge of about fifty beds.

Q. And you think they are permanent veins?—Some are. In the hill deposits at Wollaston we have reason to believe it is a permanent vein or belt. They have a shaft of 100 feet and are still working it. With a diamond drill they have proved it to be deeper.

Q. Have these iron deposits been reported upon by the Geological Survey?—Some of them have. The hematite, &c., of the Madoc district have been referred to by Mr. Vennor, Mr. Macfarlane and Dr. Hunt. A great many new beds have been discovered.

Q. How long is it since they have been visited by any member of the Survey?—I came here in 1880, and have not seen them there since. The Americans have a great deal of confidence and have been largely bought up by gentlemen from Cleveland, Cincinnati, Pennsylvania, &c. I have letters asking me to make reports with the view of purchase, and a good many are interested already. Some iron men of Cleveland have lately acquired about 100,000 acres in that vicinity, for the purpose of securing the iron deposits which are believed to exist there. Galena, copper, mica, asbestos and phosphate is also discovered in Hastings County, but not developed.

HOUSE OF COMMONS, OTTAWA, 2nd April, 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the Chair. SCOTT BARLOW, Esq., of Ottawa was called and examined.

By the Chairman:

Q. You are connected with the Geological and Natural History Survey of Canada?—Yes as surveyor, draughtsman and explorer; I am chief draughtsman at present.

Q. How long have you been connected with the Survey?—Since November, 1856.

Q. Your father was connected with it before you?—Some few months, I think; in June of that year.

Q. You knew the late Sir William Logan?—Yes, and since I joined the Survey I have been with him in the working of his field notes and everything in that connection.

Q. There has been some discussion before the Committee in reference to the work done by Sir William Logan, during the last years of his life, in the Eastern Townships, It is said to have been represented by a certain map. Would you give us the history of that work and the map itself?—That is the map of the Eastern Townships as we called it. Sir William had been working on that for several years. When my father and myself came on the Survey a good many geological facts had been placed on other maps on a smaller scale, but inaccurate and imperfect in many places. Sir William discovered that he could not put his geology upon it properly, and my father being a draughtsman, was asked about it. My father said he could compile one from the material in the Crown lands Department; that was the topographical part of it, which was what Sir William chiefly wanted. Sir William said inaccurate topography created a wrong idea. I think we went to Toronto—the seat of Government was there—and copied the plans of the Townships and also got some other information; we also utilized the railway surveys. I also deduced some facts from the map of the British American Land Company, which, I think, was prepared by Mr. Wells, and we got maps of the International Boundary, on the 45th line, made by the Commission, and also the Boundary Survey between New Brunswick and Canada, and the Admiralty charts. A good deal of work was also done by various members of the staff, in the several townships, pacing here and there many thousands of miles, taking roads chiefly, and anything in connection with mines or escarpments where rocks were exposed. These roads were placed upon the map and, of course, having the township lines tolerably correct, when they were fitted in through my father's skill, we made a very good map of it. I assisted him, as Sir William Logan states, in the atlas, which came out in the large report in 1863.

Q. What connection did Sir William Logan have with that map?—Sir William's work was, of course, geological.

Q. Did you hand it over to him?—No; it was there for his use, but the material being deficient in some parts, it was kept unpublished. The geological part, in most of the areas, was ready to be placed on it from other maps and sketches, so that Sir William was waiting for the map to be finished.

Q. His part of the work was done and ready to be placed on the map when it was finished?—Yes; the portion on the north of the St. Lawrence was not complete, and Mr. Webster was sent out to complete it, by pacing a number of roads, so that it would be ready for publication in 1872. (The survey was commenced when Sir William Logan was Director.) Dr. Selwyn refers to it in the report for 1872, I think, and promises it the next year. It would have been ready that year, but my father was taken away from it to other work wanted by Dr. Selwyn and, of course, he had to lay it aside. Some time after Dr. Selwyn was appointed Director-in-Chief. Sir William would frequently come to the Survey to see my father. He would generally drop in of a morning, and would say, "Well, Mr. Barlow, how are you getting along with the Eastern Townships map?" to which my father would have to reply, "Oh, I am doing something else, Sir William." He would then say, "How is this; I am afraid, Mr. Barlow, that I will be dead before this map is finished;" to which my father would again reply, "I cannot help it, Sir William; I am placed at other work; I would like to finish it." Sir William often repeated this, in his anxiety to get that map out, until he left for England, finally.

Q. Do you think it was his wish, up to the time he left the country, that that map should be published?—So far as I know; everything he said gave me that idea. He had no doubt about the correctness of his theories, and he wished to publish it to the world to show that he was right; at least that is my opinion. My experience of him was, that he was not a man to arrive hastily at any conclusion; he was a very just man.

Q. That map has never been published as a geological map, has it?—Not as a geological map, although on three of the sheets geological lines were placed and were engraved in London. I myself put on many of the lines preparatory to it being engraved, having Mr. Richardson to help me in getting the geological lines in, and Sir William put on many of them himself, and one or two copies, I believe, he colored himself with his own hand.

Q. Are these still in existence?—They have been so mixed up that I cannot tell where those colored by Sir William are.

Q. They were left in charge of the Survey when Sir William resigned his connection with it, were they not?—A number of them were, but some I lost track of. I do not know whether Sir William took them to England or not.

Q. Have you ever seen any in the Survey since his death?—I have not seen the ones that he colored with his own hand. Some were colored by his instructions and some by Dr. Selwyn's.

Q. In what form has the map been published?—It has been published as a topographical map, by Walker & Miles, Toronto, and last year by Dawson Bros., Montreal.

By Mr. Holton

Q. I understand you are chief draughtsman of the Survey?—Yes.

Q. As such, I suppose you have duties in connection with the preparation of maps which are published in connection with the reports?—For two or three years or more nearly all the connection I have had with them is to give them the framework or foundation. I give the geologists the foundation or projection, and they work in the geological information themselves.

Q. Can you explain why it was that the map in connection with Mr. Fletcher's work in Nova Scotia and Cape Breton, in 1877, has never been completed or published?—I think the reason was not on Mr. Fletcher's account, for I believe he had it ready. The only difficulty, in my mind, was that the engravers or lithographers were not ready, but I think it could have been got ready.

Q. Who is responsible for this delay?—Dr. Selwyn has the whole control of the work. When maps are returned by them, I am asked to approve them, and I generally do, because it makes no difference.

Q. And you feel inclined to blame the lithographers and engravers?—I think that if the lithographers and engravers had been posted they could have done the work. I do not know whether it was Dr. Selwyn's duty to post them or not, but I suppose it was. Perhaps he did post them, to the best of his ability, but I am confident that I could have had those maps done if I had had to do with it.

Q. Would the same remarks apply to the maps which were prepared and intended to accompany the reports of last year?—Yes; they could easily have been prepared.

Q. Were all the maps published in the last volume with Mr. Ells' report, which should have accompanied it?—As near as I can remember, I think all the maps that could be conveniently got ready were published with Mr. Ells' report, and I am not aware that Mr. Ells wished any more published at that time.

Q. Are you a practical field geologist?—I have had a good deal of work to do in the field.

Q. In connection with the Survey?—Yes.

Q. In what direction?—During the first year of my service I was down on the south shore of the St. Lawrence with the late Mr. James Richardson, in 1857.

Q. Were you not subsequently employed in the Springhill coal field in Nova Scotia?—Yes; that was in 1870.

Q. Did you prepare a report of your work in that section?—I made summary reports, but I have never been able to make a detailed report of my work in the field. It has been in connection with coal fields, and a very difficult field to work, and the amount of money at my disposal was very small, so that it did not give me a fair chance. I complained to Sir William Logan, in 1871 or 1872, and told him I was disgusted with the slow progress I was making. My work was in connection with a coal field, and he being very much acquainted with the Welsh coal fields, complimented me and said that a coal field was not worked up in a day, and for me not to be too anxious as he had no doubt I would make a good job of it. "Do not be too anxious," said he, "it is the work of years."

Q. Was this summary report intended for publication?—Yes; as it would satisfy the country that there was something being done of use to miners.

Q. Why was it never published?—I was removed from the field in 1878; I never got enough money, but had to do the digging and boring by hand, and consequently, Dr. Selwyn withdrew me from the field.

Q. After how many years' work was it that you were withdrawn?—I dare say, six or seven years.

Q. Was the result of your six or seven years' labor lost?—No; it will be of use yet, and will be worked yet.

Q. But has not been utilized so far?—Not very much; of course, in connection with the coal seams, it has been utilized, but the topographical map of the county of Cumberland has never been published, and cannot be published until some further topographical surveys and geological examinations are made.

By the Chairman:

Q. The expenditure for the Survey has now reached, approximately, a sum of about \$90,000 per annum, a very much larger sum than was formerly given to it, during Sir Wm. Logan's administration, and greatly in excess of the amount assigned to Sir William Logan. Will you give to the Committee your opinion as to the practical efficiency of the Survey, as compared with its expenditure. Is it, in your opinion, producing results proportionate to that expenditure?—Well, I can hardly answer that. It sometimes seems to me that it is not producing results in proportion to the expenditure, in comparison with what was done in Sir William Logan's time. Perhaps I am prejudiced, but I think that the small sum, that was granted under Sir William Logan's rule, resulted, in proportion, in a great deal more work being done. There does not seem to be now the same combination as there was then; every man almost, seems to take his own way of doing his work handed over to him to do. They are told: "There is your field, work it up," and a few general instructions are given, which may be utilized or not.

Q. Do you not think there is unnecessary or unfortunate delays in giving to the public the result of the work of the Survey, year by year?—It seems very slow in some cases.

Q. For instance, these maps that are published in connection with this last report of 1880-81-82. This report was published in 1883 and only furnished to the public within the last few weeks, and contains the maps—first, to illustrate Dr. Bell's reports of 1875, 1877 and 1881, and all the geological maps of eastern and northern New Brunswick, to illustrate Mr. Ells' work in that district, which was performed in 1881-82. Does it not seem possible and practicable to give to the public, in the form of these maps, the result of that work without waiting so many years for it. If the work is important, is it not equally important that the public should get the benefit of it before all interest in the locality has disappeared?—Sometimes the trouble is that the whole area has not been examined, and to publish a map of part of the exploration would be of no value, and I think that has been the trouble with Mr. Ells' maps, which could not be got ready for a number of years. Hence, the reports were also a puzzle without the maps.

Q. It is very necessary that these maps should be published along with the report?—Yes: to give the people a general idea of the work, but to publish a map for every season's work is utterly impossible. With the limited area that is examined it would cost too much, and so they generally wait until a section is finished and then publish it. Of course if a portion can be cut off, it is published, but it all depends with the Director, if he sees fit or thinks it necessary to do it.

Q. Is there not some method of publishing preliminary maps, called, I believe, index maps?—Occasionally that is done, and perhaps it might be done more than it is. It would give an idea of the work until a more detailed map could be got ready.

Q. It would help to illustrate the report, at least?—Yes; and they could be run up in a short time.

Q. Do you think it would be of advantage to the public if more attention were paid by the Survey to our mineral deposits and mining industries?—Yes.

Q. Could not this work be done without much additional expense, by utilizing the time of the present staff?—Some years ago there was a collection of mineral sta-

tistics made, but I think it was dropped, chiefly through the dislike which mining owners and managers had of making their results known. In my own case, they refused to give information by letter, but had there been properly appointed officers (who were competent men) they could have gone round and collected the statistics without much additional expense. It would only require the salary and expenses of a competent mining engineer. It requires a personal visit to the owners and managers of mines to overcome their dislike. They are afraid of the public knowing too much about their business, and a competent mining engineer could show them that it was to their interest and benefit, and that he will not publish more than is necessary, and will not publish anything in connection with their private business. But the matter lapsed, and little odds and ends may have been collected, but were not embodied in the reports. Mr. Hoffmann, I believe, has a great deal of mining information, which he will give to those who visit him.

By Mr. Lister :

Q. Do I understand you to say that the work done in recent years is not in proportion to the work done by Sir William Logan?—Yes.

Q. What territory did Sir William Logan cover? As a fact, were not his surveys confined to the old Provinces of Upper and Lower Canada?—Chiefly from Gaspé to Lake Superior.

Q. But under Dr. Selwyn's administration, or since Sir William's resignation, the work has been extended to the North-West Territories, British Columbia, and the Lower or Maritime Provinces?—Yes.

Q. In view of that fact, how does it now compare with what it was in Sir William Logan's time?—It is a great deal more.

Q. It may be more in dollars and cents, but in view of the fact that the territory is much increased?—It seems to me that what was done then was better and more effectually done.

Q. Was it not easier to make surveys within the boundaries that then existed, or in other words, has it increased the cost very materially on account of the distance from the base of operations, from British Columbia to Cape Breton?—Yes.

Q. Still, in your opinion, the cost is much greater in proportion to the work done than it was then?—It seems to me so.

Q. Have you ever calculated, or is it merely a rough guess?—Occasionally I have calculated. I am not making any positive statement, but just an approximate estimate: It is not a close calculation; I do not feel very much interested in the matter, it not being in my department.

By Mr. Wood :

Q. Do you know whether Sir William Logan supplemented what he got from the Department from private means of his own?—Occasionally he did. I know I told him that all the salaries were too small, and he said that was the case, but in better times he hoped to increase them.

By Mr. Lister :

Q. I suppose that the work, since Sir William Logan's resignation, has consisted more of work which has been carried on in the outlying Provinces, rather than in the old Provinces?—Yes.

By Mr. Holton :

Q. Have you done anything of importance since Confederation in the old Province of Canada?—Sir William worked there.

Q. Since Confederation in 1867?—Sir William was constantly working in the Eastern Townships, when he had time; that was the chief work that was done in the older Provinces. I do not remember much that has been done since Confederation, except in the Eastern Townships.

GEORGE CHRISTIAN HOFFMANN, Esq., of Ottawa, was next called and examined.

By the Chairman :

Q. How long have you been connected with the Geological Survey of Canada?—Since September, 1872.

Q. You are one of the Assistant Directors?—Yes.

Q. What was your previous scientific training and experience?—I have been following chemistry for about thirty years. I was brought up to chemistry and metallurgy in the Royal School of Mines in England and in the Royal College of Chemistry.

Q. Had you any practical experience in Geological work before coming here?—No; I confined myself almost exclusively to chemistry and metallurgy.

Q. Will you explain to the Committee what is your occupation now in that capacity?—To examine all the ores and minerals which may be brought to the Survey, and to make analyses of all descriptions, and to receive visitors who have any minerals for identification and to give them information in regard to their probable economic value; and also, in case of their asking after certain minerals, to tell them where such they may be had.

Q. Your analyses, then, are not limited to specimens that are furnished by the Geological staff?—By no means. I should add that last year, four or five months out of the year were spent in making single determinations of iron or copper, or work of such a nature—what you would call fragmentary work to outside visitors—and also assays of gold and silver.

Q. Is this work done gratuitously for the public?—Yes.

Q. And in what form is the information conveyed to them?—Either personally or by letter.

Q. Is a certificate or report furnished?—The certificate is in the form of a letter. Very often a great deal of this work cannot be formulated into a report, and it is therefore not known to the public at large. When it is of value to the public generally, it is published in my reports.

Q. You keep a record of all the analyses made?—Yes. I ought perhaps to mention that, in addition to the duties I have already mentioned, I also make analyses for all the departments.

Q. Although you have no direct personal connection with the geological branch of the Survey, still your long residence there and connection with it, have given you opportunities for judging as to its methods and efficiency?—Hardly; because my attention is so much engrossed with my own work, too much so, at any rate, to pay much attention to any of the work of the Survey, outside of my own branch.

Q. Then you would hardly feel competent to express an opinion as to the general efficiency of the Survey?—I hardly think it would have much value.

By Mr. Holton:

Q. You stated that your position on the staff was that of Assistant Director?—Yes.

Q. Have you any other title?—Chemist and Mineralogist.

Have you not been called Inspector of Mines?—That was gratuitously given to me by outsiders, but I never made the slightest pretension to it.

Q. Has that not appeared in connection with your work?—No; not at any time. The only place where it was pointed out to me was in Starke's Almanac.

Q. So that is a title you disclaim?—Yes.

Q. Have you ever had any practical mining experience?—I was connected with iron works in South Wales as an amateur. I have gone over the works in company with the Superintendent, but that would hardly justify me in claiming any experience.

Q. You have had no technical training as a Mining Engineer?—No.

Q. Have you ever entertained or expressed an opinion as to the value of the collection and preservation of mineral statistics?—I think they are very difficult to obtain, and unless every reliance can be placed on them they would be worse than useless. People are adverse to giving information which is intended for publication. You would not like to have the Manager of a Company, in which you were interested, giving information adverse to the mine, which he, perhaps, would have to do if he told the truth, and that is where the difficulty comes in.

Q. Are you not aware that the work of gathering and preserving such statistics is undertaken and performed by the Geological Surveys of other countries, in the

United States, for example?—Yes; I am aware of that. They are armed with exceptional powers, and after all it may be open to question how far the returns are what they ought to be. A person can make a return and tell you the truth, but he can also tell you half the truth, and therein lies the difficulty of getting absolutely accurate and true statements.

Q. Am I to understand that it is because of the difficulty of obtaining accurate statements that you consider it inadvisable for this Survey to undertake such work? Scarcely in that light. That is a difficulty which I see in procuring statistics. Of course correct statistics would be valuable if they could be obtained. There is no question as to their value. It was started in our Survey when Mr. Robb undertook the collection of statistics, and he met with very great difficulties.

Q. I have been told that at one time you suggested the revival of that system in our Survey?—I think always the best information is given. The officers and field men wind up their reports with the names of economic minerals, as a rule, and in my own report I give the localities where the minerals occur, but when it comes to returns, that is where the difficulty comes in.

Q. Did you ever in any report, or otherwise suggest to your chief or the Government, the advisability of collecting mineral statistics?—No, I think Dr. Selwyn is fully alive to their importance. I always collect the information as it is brought to me.

By the Chairman:

Q. You say you were brought up in the School of Mines in England. Would you furnish the Committee with some information as to the constitution and functions of that School?—It was for the training of men in all the various branches of science relating to mines.

Q. Are its functions limited to theoretical teaching?—Yes. Of course a man could have an opportunity of visiting mines in England. There are so many that he has no difficulty in obtaining practical information during the recess.

Q. I had an impression that it interested itself in the collection of mineral statistics?—Dr. Robert Hunt, who was connected with it did that.

Q. But was the work of the School limited to teaching?—He was a professor of the Institution, but he was an officer of the Government apart from that.

Q. Was it as Professor of the School of Mines, or as being connected with the School of Mines that he collected these statistics?—No, that was a specialty.

Q. How did he obtain these statistics?—I am hardly competent to make any statements in regard to that.

Q. They are very complete and accurate, are they not?—I could not say. I do not think they were ever obtained by personal visits on his part. I think the collection was made entirely by provincial officers. It was known that he was the person who collected these statistics, and the information was sent to him by the provincial officers. In addition to the duties which are entrusted to me, which I have mentioned, I may add that I also act as Curator to the mineralogical section, and am superintendent, under Dr. Selwyn, of the arrangement and labelling of the specimens.

Q. And what portion of your time do you think is devoted to that?—It depends on circumstances. I always go round every day, and then I devote a portion of my evenings to manuscript work in connection with it.

By Mr. Lister:

Q. I understand you to say that Dr. Selwyn was always fully alive to the importance of collecting this mining information?—That has always been my impression.

Q. Have you recently recommended that that should be done?—I had no occasion to recommend anything; such was Dr. Selwyn's desire. I always accepted it as a fact that it was his wish.

Q. Have you expressed yourself in favor of that being done?—I should always do so.

Q. But have you done so within the last few months?—I do not remember having done so recently.

Q. But you are in favor of it being done?—Provided accurate information can be procured.

Q. But you say it cannot be done?—Not accurately.

Q. Then you are not in favor of it. The interests of the miners would prevent you getting accurate information?—Such is my impression.

Q. Then you consider the attempt would be fruitless?—Yes; I consider it would be abortive. I think it appeals to everybody's reason that those who have mines which do not turn out well will not give information to that effect, as they will then lose their chance of getting what they paid for it. These are mostly matters of speculation.

By the Chairman:

Q. You are assuming, of course, that the mines are all unproductive, and that they are being carried on for the purpose of inviting the public to invest in their capital, but I suppose some of the mines are profitable?—Yes.

Q. There would be no objection to their giving information about those mines?—No; but they would only form a few of the whole.

Q. But would it not be in the interest of the public at large?—It would, but not to the individual, and the individual could not afford it.

Q. Have not these objections existed in other countries where these statistics are collected?—I could hardly say. Then the question arises as to how far these statements are accurate. They may be misleading.

Q. You do not know that they are?—No.

Q. But they are received as accurate?—Yes; and therefore might create the greater amount of trouble.

By Mr. Holton:

Q. Are you aware as to how these mineral statistics are collected in the United States?—No; I am not competent to give an opinion upon that point.

Q. What system is adopted in England?—They are generally furnished to the Inspector of Mines by Prof. Smyth, who has charge of one of the most important mining sections in England, the Duchy of Cornwall, and who was a member of the School of Mines.

By Mr. Lister:

Q. Do you know whether Dr. Selwyn has ever recommended that proper steps should be taken for the collection of these statistics?—I think Dr. Selwyn has given his attention to the collection of statistics.

Q. But you are not aware that he has ever recommended it?—No.

Q. Although you say for years he has been alive to its importance?—Dr. Selwyn has always impressed upon me the importance of making notes of the information brought to me by visitors in connection with mines and minerals.

Q. Do you know whether any investigation has been made as to how these statistics are collected in other countries?—I do not.

Q. You do not know whether any steps have been taken to ascertain that?—I am not aware.

JOSEPH F. WHITEAVES, Esq., of Ottawa, was called and examined.

By the Chairman:

Q. How long have you been connected with the Geological Survey of Canada?—I was appointed palaeontologist to the Survey in 1876, and assistant director the year after, but was first requested to join the Survey by my predecessor, Mr. Billings, in 1874. He asked me then to undertake a large section of his work,

and after seeing Dr. Selwyn I agreed to this, so that I was assisting Mr. Billings for two years before receiving a permanent official appointment upon the staff. For the last two years of his life the late Mr. Billings was in such a poor state of health that most of the work of the office, as regards palaeontology, was done by myself. In Sir William Logan's time I had worked occasionally, in an informal way, for the Survey by revising the list of post-pliocene fossils in the "Geology of Canada" for 1863, and by examining and reporting upon zoological collections made by various members of the staff.

Q. What had been your previous scientific training and experience?—I am a native of the City of Oxford, in England, and attended the Professor of Geology's indoor and outdoor classes at that University, and have worked at the palaeontology of the district and published the results in the report of the British Association for 1860, and in the "Annals of Natural History" for 1861. Was elected an honorary member of the Ashmolean Society of Oxford, in 1857, for a zoological contribution to its transactions, and a Fellow of the Geological Society of London in 1859.

Q. Your experience in this country is limited to your connection with the Survey?—By no means. I had been Curator and Recording Secretary of the Natural History Society of Montreal, for twelve or thirteen years before joining the Survey, have conducted five deep-sea dredging expeditions in the Gulf of St. Lawrence, two at my own expense, and three on behalf of the Department of Marine and Fisheries, and have devoted my whole life since 1861 to the study of the Zoology and Palaeontology of this country.

Q. Your work is almost exclusively in the Geological Museum here, I suppose? You do not do much field work?—Not now, as it is my chief business to examine all the collections of fossils that are brought in, to name and report upon these, to describe new species, and to identify the horizon of rocks from collections brought in by the explorers in the field.

Q. Do you keep a regular record of your work?—A record is kept of all specimens received and of collections distributed, and a summary of the work done in our department is annually made. It may here be stated that since May, 1883, about 325 pages octavo of biological and palaeontological reports, illustrated by 23 octavo lithographic plates, have been issued by the Survey, in addition to the last Report of Progress. The publications referred to are as follows, a copy of each of which was laid upon the table:

Catalogue of Canadian Plants. Part 1. By Prof. J. Macoun	192 pages.
Contributions to the Micro-Palaeontology of the Cambro-Silurian Rocks of Canada. By A. H. Foord.....	26 pages and 7 plates.
Palaeozoic Fossils. Vol. 3, Part 1. By J. F. Whiteaves	43 pages and 8 plates.
Mesozoic Fossils Vol. 1, Part 3 (Sheets 1-4, of 16 pages each.) By J. F. Whiteaves....	64 pages and 8 plates.

Q. Do these reports form any portion of the annual printed volume of the Survey?—Most of our reports, so far, have been printed as separate memoirs. It sometimes happens, however, that I contribute notes to reports in the shape of lists of fossils.

Q. The last published volume of reports does not contain any of your work in the form of reports?—Not more than indirectly, I had something to do with the publication of that report, such as proof-reading, &c. I have each year to write an account of the work done in our Department, for the Minister of the Interior, for publication in the Departmental Report.

Q. You are not a geologist, in the ordinary acceptance of that term?—It is impossible to be a good palaeontologist without having a sound practical knowledge of geology.

Q. What is your opinion as to the practical efficiency of the Survey, and its system and administration, as at present conducted?—I think the Survey is in a very

high state of efficiency, so far as I can judge, as high as it has ever been. That, however, is only my private opinion.

Q. Looking at it from the public standpoint or view, do you not think it would be more efficient if more attention were paid to the mineralogical interests of the country, and that, besides the reports which have been published of the geological work done in the field, reports were also published of our mineral resources and mining industries?—I scarcely think that any opinion I might express upon that subject, as coming from a person who has devoted himself almost exclusively to sciences of a different nature, would be of much value.

Q. Then you do not feel prepared to give an opinion upon these points?—I have no doubt, speaking in a general way, that it would be of advantage to get as much information together as possible, of a practical or economic nature, but am not prepared to express a very decided opinion upon that point, because I have not followed, as closely as I might have done, the exact course which the Survey has taken in that direction.

By Mr. Holton :

Q. Is any time devoted by the members of your staff to the training of young men for the work of the Survey?—To a certain extent. For instance, young men come into my department; they work under me and gain all the information I can give them. It is also my duty to give all the information I can to the general public.

Q. How are the other departments of the Survey in that sense?—The men who enter the Survey in the other departments become assistants first, after which they learn what they can in the field or laboratory, are then promoted, and so on.

Q. The Survey is in no sense a training school?—In one sense it is. We do not do here what is done in Jermyn St. in the School of Mines—that is give lectures, &c.—but in another sense it certainly is an educational institution, as we endeavor to exhibit in the Museum as large a number of named species as possible in the departments of palæontology, zoology, botany and archaeology.

Q. Have you any opinion as to the desirability of the training of young men in scientific pursuits being undertaken by the Survey?—It seems to me that this is already done by the Universities up to a certain point.

Q. Is it your opinion that that work is done effectively by our Science Schools?—I think our Universities are doing the work as effectively as can be expected under the circumstances. The President of Columbia College says the very best scientific education a man can have is direct contact with nature itself.

Q. Is it your opinion that a young man can secure in Canada a thorough scientific training, such a training as would be necessary to fit him for scientific work here?—I should think sufficiently so, to fit him for work here or anywhere. For example, my predecessor, Mr. Billings, was originally a lawyer, but he was almost entirely a self-taught man, and was one of the best authorities on the fossils of the Silurian and Devonian rocks in the world.

Q. Is it your opinion that with such a training as you think can be obtained in this country, Canadians are the best men for the work of this Survey?—Most decidedly, other things being equal.

JOHN MARSHALL, Esq. of OTTAWA, was next called and examined.

By the Chairman :

Q. You are connected with the Geological Survey as book-keeper and accountant?—Yes.

Q. How long have you been connected with the Survey?—Since the 4th March, 1872, in conjunction with Mr. Grant, now executor of Sir William Logan's estate.

Both of us were connected with the settlement of the estate Sir William Logan as well as with the Geological Survey.

Q. You have no other duties besides those of book-keeper and accountant, I suppose?—None, with the exception of looking after the correspondence, which I do as well.

Q. Do these duties occupy your time pretty fully?—They more than fully occupy my time, taking into consideration the regular hours of the Survey.

Q. What are the regular hours of the Survey?—From 9.30 to 4 o'clock, but I am generally there until 5 and 6 o'clock, and sometimes until 11 o'clock at night.

Q. Discharging these duties solely I suppose you would hardly feel competent to express an opinion as to the general efficiency of the Survey in reference to its Geological work?—Nothing but an individual opinion. I think it is as efficient, if not more so, to day, than it ever was.

Q. Efficient in the sense of giving information in which the public has benefitted, or in adding to scientific geological knowledge?—In both.

Q. In what respect has it added useful, practical knowledge for the benefit of the public during the last three years, say?—Partially in the extension of the Museum, which is better than ever it was, and information given by the management of the survey to the public.

Q. By means of the reports published?—Both by means of the reports and orally.

Q. Are there many applications for information by individuals to the Survey?—Yes, quite a number. The year that Dr. Selwyn was here looking after the removal of the Survey to Ottawa, in 1881, his time was very much taken up with giving information to the people who came for it. We arrived here in May 1881.

Q. When Dr. Selwyn is absent are these enquiries made of other members of the staff?—Yes.

Q. What do you think is the average weekly or monthly applications of that nature?—I could hardly say. By referring to the letters I could of course tell the number of written applications.

Q. You could give the Committee some approximate idea, I suppose. Are there 500 applications a month or 50?—I could not say just now.

Q. You could say whether there were nearer 50 than 500?—There would be nearer 500 than 50. Probably, on an average of 150 to 200 a month. Still I would not be positive as to the exact number.

By Mr. Holton:

Q. Have you had a scientific education?—No.

Q. In what capacity and at what salary was it that you were engaged?—The Survey paid a slight portion of my salary. I was assistant to Mr. G. R. Grant who was then secretary and accountant.

Q. At what salary?—My salary from the Government was only \$100 a year.

Q. What were your duties as such assistant?—To help Mr. Grant to look after the accounts and correspondence.

Q. When was your salary first increased, and to what was it increased?—It was increased in 1877 or 1878, when I had something like \$400 from the Government, to, I think, \$900.

Q. And at present what is your salary?—\$1,400.

By the Chairman:

Q. What is your age?—I am twenty-seven years of age.

Q. You were very young then when you first became connected with the Survey?—I was fifteen years of age.

By Mr. Holton:

Q. Do you receive any pecuniary advantage, either directly or indirectly, in addition to that salary?—No.

Q. Have you ever had any correspondence or discussion with the Auditor-General's office about the accounts of the Survey?—Yes.

Q. What was it about?—About the vote of the Survey and other items relating to it. If I required information I would ask the Auditor-General.

Q. I suppose your accounts are audited?—Yes.

Q. On these occasions have you had any difficulties or discussions as to the appropriations charged, &c.?—None whatever.

By the Chairman:

Q. There was no criticism on the part of the Auditor-General as to the charges made, was there?—There was a criticism about the removal of the Survey from Montreal to Ottawa—a criticism as to the legality of making charges against the appropriation of the Survey.

By Mr. Holton:

Q. But the expenses of field parties have never been discussed or alluded to?—Not that I am aware of.

By the Chairman:

Q. Was all the appropriation for the last year used?—Yes, and more; it was exceeded by \$89 and some cents. I might explain that the over-draft of the appropriation was caused by the account from the Queen's Printer not having come into the office until some time in August, and it would be almost impossible to provide for it out of the limited amount at Dr. Selwyn's disposal, on the 30th of June, at the end of the fiscal year.

Dr. A. R. C. SELWYN, the Director of the Survey, who was present, exhibited to the Committee a medal which he had to-day received from the Royal Society of New South Wales, and which was accompanied by the following letter:—

“MOSS VALE, NEW SOUTH WALES, 25th February, 1884.

“MY DEAR SELWYN,—You will probably have almost forgotten, by this time, as it is now nearly six years since we met at the Paris Exhibition and Geological Congress, and we have had no communication since.

“But I have the pleasure to inform you, that as a slight recognition of your services to geology, and especially that of Victoria, the Clarke Memorial Medal has been awarded by the Royal Society of New South Wales; as honorary Secretary it is my pleasing duty to forward it to you and to inform you of the award, but as I am away from Sydney for a change, I am unable to send you the official notification, but will forward it on my return. This note is merely to let you know that the medal will be posted to you by this mail, as the United States postal people make a fuss about forwarding such things. I hope you will not mind making enquiries in case it does not turn up with this. I had a good deal of trouble to get Dana's taken.

“I hope that you are quite well, and that I shall have the pleasure to meet you again before long. It is not easy for me to get leave, but if possible I want to run home next year, and shall, perhaps, take the American route.

“With kind regards and best wishes,

“Yours very truly,

“A. LIVERSIDGE.”

HOUSE OF COMMONS, OTTAWA, 3rd April 1884.

The Select Committee on Geological Surveys met this morning, Mr. HALL in the chair. CHARLES J. PUSEY, Esq., of New York, was called and examined.

By the Chairman:

Q. You are interested in the mining district of Hastings; are you not?—Yes; in the County of Hastings, and also Haliburton, Ontario.

Q. How long have you been connected with them?—Since 1878.

Q. What were your previous connections with mining matters and where?—I had been connected with iron works in Pottsville, Pennsylvania, principally.

Q. And were you attracted to Canada by reason of this iron deposit in the vicinity of Hastings?—Yes.

Q. Do you represent a company, or is it an individual investment?—I went there first individually, and afterwards organized a company.

Q. In what way did you learn that there were such deposits?—I learned of them first by parties bringing properties in the the Madoc and Snowdon districts to my notice, and I looked the matter up in the Geological Reports of Sir William Logan and then I came to Ottawa and personally examined the district surrounding Ottawa, and in the rear of Kingston, and the Madoc and Snowdon districts.

Q. Will you give the Committee some idea as to the extent and value of these mineral deposits, over what section of country do they extend, and how rich are the ores?—I found that these ranges of ores extended through from Ottawa westward, as far as we examined, to the township of Snowdon, County of Haliburton.

Q. And how many miles would that be?—About 150 miles.

Q. And what parallel do these veins occupy?—They are not continuous veins, but there are various deposits within the ranges. The widest which we found was in the Madoc district, from Madoc to Bancroft, a distance of 50 miles, and narrower at Ottawa and Snowdon.

Q. You are referring now to the iron deposits?—Yes. This refers to the iron deposits only.

Q. What is your opinion, from the investigations you have made, as to the extent of these deposits within these regions?—I think there are some very large deposits—a great many of them.

Q. What quality of ore is it?—Generally magnetic.

Q. Is it an ore that is easily worked?—It is.

Q. About what average of purity or percentage of magnetic ore is there in the ordinary samples you have taken out?—It varies very much. In answer to that I would refer you to a statement which I prepared and submitted to the Crown Land Department of Ontario, giving a statement as to the ores that I had examined and analyzed up to that time. It is to be found in the Sessional Papers of the Province of Ontario for 1883. My communication was dated Madoc, Ontario, 18th December, 1882, and the following are extracts from it:—

“From the developments already made we find two distinct ranges or belts of iron ore, known, in our explorations as the north and south ranges; what is known as the south range of the district has been traced as far east as the Ottawa River, and in which some very large mines are being developed in the townships reached by the Ontario Central and Kingston and Pembroke Railways. A few miles to the north of this range is the north range or belt, which we have explored for a distance of fifty miles eastward from the township of Snowdon, through Glamorgan, Monmouth, Cardiff, Faraday and Dungannon. The character of the ore in each end of the territory explored, as well as at many intermediate points, is of precisely the same character, showing a fine crystalline structure, with scarcely any variation on the percentage of metallic ore.

“The results of these explorations I deem of very great importance, having demonstrated the existence of two distinct ranges or belts of iron ore, extending from the Ottawa River, in a general south-west direction, through the Province of Ontario. And from the experiments made, there is no doubt but that in these two ranges there exists a great many very large and valuable deposits of iron ore, almost all of which are of great value, on account of the absence of phosphorus.

“I append a statement, showing analysis of ore from most of the deposits now being worked, or which are known to be workable deposits, in order to show the value of the Canadian ores generally, as compared with ores from the various districts in the United States and from foreign countries, upon which the Bessemer works are obliged to rely for their supply of ores.

“I find, on a careful comparison with other districts, that the Canadian ores are generally much richer in metallic iron, and are without a rival in any other country, so far as freedom from phosphorus and other deleterious substances in objectionable quantities, is concerned.

"The development of mines in the various districts in the Province may seem to those who are not accustomed to the difficulties to be encountered, to have been very slow, but I find upon an examination of the official records, that in 1879 the entire shipment was only 2,699 tons, with a steady increase ever since, until the present year they are 51,758 tons, a much larger increase, and under greater difficulties than were experienced in opening up the Lake Superior mines in the United States."

Q. Will you state to the Committee what you have done in the way of developing the iron mines in those regions?—We have explored a great many in the Madoc district; we operated the Seymour mine very extensively and shipped between 15,000 and 20,000 tons of ore. We went down to a depth of about 110 feet, and operated along a vein of about 150 feet; we found, on an average, a regular vein of about 26 feet.

Q. And was it of equal breadth and richness at the bottom where you left it?—No; at the bottom we ran into a fault, where the vein was pinched to a width of 16 feet, but we demonstrated, at another opening, that the same vein continued on down to the depth of at least 40 feet lower than the inside workings. We also developed what is called the Brook mine, in the northern part of Hastings.

Q. How extensively?—We found that the vein became so sulphery that we did not continue to work it. We developed a great many properties, but only shipped from these two that I have mentioned.

Q. What do you do with the ore that is shipped from that region?—A great deal of it is shipped to the Cambria works, at Johnstown, in the United States.

Q. Do you find these ores richer than those in the United States? Are they valuable as a flux in reducing other ores?—As a rule they are richer than the ores of the United States; they are probably not to be compared to the Lake Superior mine, as regards richness, but they are better as regards purity.

Q. Do you work them themselves, or in conjunction with other ores?—In conjunction with other ores. We operated in the Snowdon district, what was called the Victoria mine and the Howland mine, both magnetic ore, and in that district we have a very large deposit of brown hematite, about the only one we have found in the country. We have not shipped much ore from there on account of the difficulty of communication, the railway being five or six miles off. We developed that range with a view of getting a railway through there. I may say that we have not demonstrated the width of the vein in the Howland mine; we have been down 80 feet, and worked across it, as we supposed, 33 feet without finding any wall, all being solid ore. We have really not found the bounds of the mine yet at all. These are all the mines we have worked.

Q. Do you know of any mines worked by other companies or individuals, in that region?—Not in that region.

Q. In any other region?—There has been a great deal of work done some 40 miles north of Madoc, in the township of Wollaston, by the parties connected with the Ontario Central Railway Company.

Q. Is there any export duty on the ore?—No.

Q. Have you any duty to pay to bring it into the United States?—Yes; 75 cents per ton.

Q. Is that upon the gross ton?—Yes; upon the gross ton of 2,240 lbs.

Q. Have you considered the subject of smelting that ore here in this country?—We have, very carefully.

Q. What are your conclusions?—We thought it could be manufactured with charcoal to very good advantage.

Q. In consequence of charcoal being obtained in the vicinity extensively and economically?—Yes.

Q. And do you propose to erect works?—We do.

Q. But for any other process of reducing, you think it more advantageous to have it done in the United States?—Yes, at present.

Q. Is that because of the increased manufacture here, or on account of the market for the manufactured article being better in the United States?—On account

of the market. Charcoal iron can be exported to the United States with advantage where anthracite or coke iron could not.

By Mr. Ferguson :

Q. Ho do these ores compare with other ores with regard to purity?—I am personally familiar with the iron deposits throughout the States of the Union and I am also familiar with the iron deposits in other countries by studies of the subject and I have no hesitation in saying that the ores of this region in Canada are freer from objectionable matter and better adapted for the manufacture of Bessemer steel than the ores of any other country in the world. I now produce a copy of a letter which I addressed on October 12th, 1882, to the Chairman of the Tariff Commission in the United States, on the iron deposits of Canada. The letter is as follows:—

“ PHILADELPHIA, October 12th, 1882.

“ Hon. J. L. HAYES, Chairman Tariff Commission.

“ DEAR SIR,—Not having the opportunity of appearing before you personally to present facts and suggestions concerning the importation of Canadian iron ores, to which I desire to call your attention, I beg to hand you the same in writing.

“ The constantly increasing demand for iron ores suitable for making Bessemer steel has led to the most thorough examination of every district in our country for the purpose of obtaining such ores in sufficient quantities; but with few exceptions our own ores are not well adapted to that purpose.

“ In consequence of the scarcity in our own country and the rapid increase in the production of Bessemer steel, the manufacturers after exhausting every effort to secure a supply from mines within our own country, were compelled to seek a supply elsewhere which has resulted in large importations of this class of ore from Spain, Africa, and other countries; but the large demand caused examinations to be made with a view to procure at least a portion of the supply needed from places nearer by, which has resulted in attention being called to the iron ore deposits of Canada, particularly those of the Province of Ontario, which as already developed, has shown to be of very great extent, and with very few exceptions are equally well suited for Bessemer purposes as the ores being imported from Spain.

“ The accompanying statement shows the analysis of most of the deposits in Ontario and includes only such as would be worked.

“ Some twelve or fifteen other mines have been opened from which I have not received the analysis, but am told they are all good Bessemer ores. You will observe on the list thirty-five mines are named, and out of these only three are unfit for Bessemer purposes, on account of the presence of too high a percentage of phosphorus, and only four of them have sufficient titanium to be objectionable.

“ I also include herein a copy of the records showing the amount of ore mined and exported from Canada to the United States during the years 1878 to 1882.

“ From these two statements you will recognize the undoubted value of these ores to our manufacturers; at the same time the development of the mines and the shipment of the ores to our country are quite out of proportion and this can be attributed to the following causes:

“ 1. The cost of mining in Canada is nearly as great as in our own country, and its nearness to our markets causes a much higher dutiable valuation that usually prevails in case of the Spanish ores, which does not average over \$2.50 per ton.

“ 2. The annoyance resulting from improper valuations, which has so often seemed like a disposition on the part of our officials to discriminate against this trade, that our manufacturers, many of whom are already directly interested in many of these properties, have hesitated as to investing any sums of money beyond what was necessary to test the quality and quantity of the ore.

“ 3. The low cost of mining the Spanish, ores by reason of cheap labour, their low market value at point of shipment, the low rate of freight to this country, as compared with the higher cost of labour in Canada, and the difference of duties under

the present system along with the doubts and uncertainties always attendant upon developing new mining districts, are unfair discriminations against Canada.

"On account of the absolute necessity of our manufacturers having these ores, many of them have already secured properties in Canada, and of the mines now being worked, they are without exception under the management of our people, so that we are not only discriminating against Canada but against our own direct investment of capital, which we have been compelled to make on account of not being able to get the required quality of ore in sufficient quantities within our borders.

"Now I contend that when we cannot get the kind of ores necessary in our own country, we should, if it were deemed politic to discriminate in the adjustment of our tariff, consider carefully our relations with the various Governments of the different countries from which we can draw our supply of raw material, and in this case while the discrimination is so clearly against Canada it must be admitted that our trade relations with her are far more important than that of any other country from which we can get these ores. The amount of American coal consumed in Canada yearly is now and will continue to be far in excess of the amount of ore we will import from there. Aside from other branches of trade which are equally important to us, our trade with them must necessarily continue to increase from year to year, so that I claim an adjustment of the tariff with Canada, by which these ores can be brought in free of duty, will not to any appreciable extent interfere with similar interests in our own country but will greatly promote our Bessemer interests as well as being the means of directly adding to the volume of general business between our country and Canada.

"I would therefore suggest for your consideration that steps be taken towards a treaty with Canada which will include the admission by our country of all Canadian iron ores free from duty, provided the Canadian Government will remove the duty and admit our anthracite and bituminous coal into their country free of duty.

"Under the circumstances, such a treaty would undoubtedly be very important to both countries, and all things considered no sacrifice to either, but so advantageous to both in the interchange of traffic, that the general prosperity of both countries would be prompted thereby.

"Trusting these suggestions may receive your careful consideration,

"I am, yours truly,

"CHAS. J. PUSEY,

"42 Pine Street, N.Y."

ANALYSIS of Iron Ores from the Province of Ontario, Canada

Name of Mines.	Location.	Metallic Iron.	Phosphorous.	Titanium.
Seymour Mine	Near Madoc, Ont.	68.83	.0104	None.
Dominion	do	57.81	Trace.	do
Brooke	do	68.37	.023	do
Wallbridge	do	64.61	Trace.	do
Moore	do	64.99	do	do
Dufferin	do	64.60	.013	do
Nelson	do	56.58	.006	do
Bentif	do	68.40	.005	do
Mullett	do	59.25	.013	do
Sexsmith	do	57.18	.017	Trace.
Orton	North of Madoc	60.30	.027	2.47
Baker	do	62.20	.057	None.
Wollaston	do	60.52	None.	do
Coulson	Near Bancroft	66.13	.020	do
Dungannon	do	69.77	.020	do
York Branch	do	50.49	.959	do
Bancroft	do	68.27	.012	do
Wager	Near Tamworth	61.12	.017	do
Faxton	Near Kinmont	55.12	Trace.	do
Swamp Lake	do	62.60	.008	do
Victoria	East of Kinmont	61.02	.052	Trace.
Howland	do	61.48	.01	None.
Imperial	do	45.82	.02	do
Ledyard	do	55.00	.02	do
Pine Lake	do	53.60	.007	7.91
New York	do	70.38	Trace.	None.
Monmouth	do	70.50	do	do
Cardiff	do	62.10	.180	Trace.
Thompson	North of Kinmont	67.11	.701	None.
Hull	Near Ottawa	58.44	Trace.	do
Haycock	do	68.34	do	2.34
Glendower	North of Kingston	64.83	.01	1.32
Chaffee	do	52.36	Trace.	11.43
Roberts	do	62.64	.009	None.
Thunder Bay	North Shore of Lake Superior	61.36	None.	Trace.

While the above analysis only shows metallic iron, phosphorous and titanium, the analysis was in every case made full and complete, but in no case was there found any other deleterious substances in objectionable quantities.

EXPORTS of Iron Ore from Canada to the United States, for the Years ending June 30th.

From.	1878.	1879.	1880.	1881.	1882.	Total.
Port Hope, Ont.			227	3,969	300	4,496
Whitby		117		654	376	1,147
Belleville		912	15,981	4,698	15,606	37,187
Kingston	3,020	1,680	7,040	11,863	20,359	43,962
Ottawa			6,928	22,259	5,828	35,015
	3,020	2,699	30,176	43,443	42,469	121,907

By Mr. Holton :

Q. Did you state how long you had been in the country?—Yes; since 1874.

Q. I suppose you are a trained mining engineer?—No; I do not lay any claim to being a mining engineer or a scientist, but I am a practical iron worker.

Q. Have you, in the course of scientific or mining prospecting in Canada, had occasion to apply to the Geological Survey for information and assistance?—No; I have not. I have referred to the reports, but they did not give me the information I wanted; I have never made a personal application to the office.

Q. What is your opinion of the value to the public of carefully collected mineral statistics?—I might state that up to the year 1878 there had been no practical working of the ores in Canada, and the United States found the lack of knowledge. We then introduced the Seymour ore and some ore from the Forsyth mine, and from that time forward the knowledge of Canadian ores has been known throughout the United States, and capital has been brought here to do the working of the ores. The value of the ores was demonstrated through the working of these two mines.

Q. Is it your opinion, as a practical man, familiar with these subjects, that the collection and preservation of such statistics as I have referred to would aid materially in the development of the mineral resources of the country?—I think it would be the means of drawing capital here, which otherwise you would not get.

Q. Has that been the effect in the United States?—Yes; I think it has, to a very great extent. The lack of knowledge, as to the value of these deposits, has lost you the capital from there.

Q. Have you formed any opinion as to the efficiency of the Geological Survey of Canada?—Well, I have really given so little attention to it that I would be hardly able to answer your question. I have examined some of them, and found so much irrelevant matter, that I did not care to bother with them.

By Mr. Baker :

Q. Have you any knowledge of the extent, nature and value of the coal in Vancouver Island?—I have not.

Q. And consequently you cannot tell how it compares with the coal in the opposite territory of Washington, either personally or by hearsay?—I understand, from those who are interested in it, that it is superior to the coal in Washington Territory.

Q. And fetches a higher price in the San Francisco market?—Yes.

Q. Do you not think it would be mutually beneficial if reciprocity between the United States and Great Britain were entertained in the matters of coal, coke, and iron ore?—Yes; to both countries.

Q. Are you aware of any steps having been taken in this direction?—In 1882 a Commission was appointed by a Congress to revise the United States Tariff. That was the origin of this movement towards reciprocity in coal, coke and iron ore, which has resulted in the introduction of a Bill which I have prepared for the present Session of Congress, asking the United States Government to take off the duty on coal, coke and iron ore when the Canadian Government does the same. This Bill is now under consideration in Congress.

Q. And I suppose the Canadian Government are equally waiting to do the same? Who is to take the first move?—Yes; I suppose so.

Q. Do you think that reciprocity, if carried into effect, would be equally reciprocal as regards both countries?—I think so.

Q. You know as a fact, do you not, that the export of coal from the Province of British Columbia is equal to, if it does not really exceed, all the other Provinces put together?—It is probably double the amount of any of the other Provinces. About 200,000 tons of coal are exported annually to the United States from British Columbia, while about 100,000 tons are exported from Cape Breton and Nova Scotia. The following statement shows the coal imported into Canada from the United States for the year ending 30th June, 1883, and also the coal and iron ore exported from Canada to the United States during the year ending 30th June, 1883:—

Coal Imported into Canada from the United States for the Year ending 30th June, 1883.

Province.	Anthracite.	Bituminous.	Coke.	Total.
Ontario.....	339,586	736,176	7,267	1,183,029
Quebec.....	208,532	3,869	494	212,895
Nova Scotia.....	19,355	3,618	.....	22,973
New Brunswick.....	43,911	638	.....	44,459
Manitoba.....	13,919	90,628	129	104,676
British Columbia.....	356	373	2	731
Prince Edward Island.....	1,597	43	.....	1,640
Total.....	727,256	835,345	7,892	1,570,493

Coal and Iron Ore Exported from Canada to the United States in the Year ending 30th June, 1883.

From	Coal.	Iron Ore.
Ontario.....	.....	42,745
Quebec.....	2,120	.....
Nova Scotia.....	110,150	.....
New Brunswick.....	17,670	.....
British Columbia.....	172,863	1,890
Total.....	302,803	44,635

JOHN MACOUN, Esq., of Ottawa, botanist to the Geological and Natural History Survey of Canada, was called and examined.

By the Chairman :

Q. How long have you been connected with the Geological Survey, and in what capacity?—As botanist I have been permanently attached to the Survey for two years, up to last January, but for ten years I have gratuitously examined all the botanical collections made. In 1875 I was appointed by the then Government as botanist with Dr. Selwyn, to British Columbia, and I spent the whole summer there botanizing. That report appears in the Geological Report for 1875-76.

By Mr. Holton :

Q. I believe you are attached to Mr. Whiteave's department?—He has control of the Natural History department, and I belong to that branch of the Survey.

Q. He is your chief?—He is my chief, but he never interferes with my duties. When I was made aware of my permanent appointment, I went to Mr. Whiteaves and said I was subject to his orders.

By the Chairman :

Q. What has been your previous training and experience?—I do not wish to be egotistical, but twenty years ago I was an authority on geology; however, during the last four or five years especially, I have put geology out of sight, because I am on another line. For thirty years I have studied geology, and was a Professor of Botany and Geology in Albert College, Belleville, from 1868 to 1879, when I resigned. In 1866 I was considered an authority in the City of Belleville, and was sent out to examine the gold region north of that city, in the interests of those who had money invested in the mines, and my report was so satisfactory that they hedged in time and saved money. Of course this was not in a public but in a private capacity. I might mention that as early as 1862 Sir William Logan wrote me that he would have me appoint-

ed on his staff, only his means were so small he could not promise me enough to live upon (I was married at the time), so I was not attached to the Survey at that time.

Q. Would you care to furnish to the Committee your views as to the general efficiency of the Geological Survey under its present system?—I have not the slightest objection to give my views. My views are my own and I am responsible only for them. In 1872, Mr. Sandford Fleming, asked me to accompany his expedition to British Columbia to examine the great plains. I made a report then that suited Mr. Fleming, and when Dr. Selwyn saw it, he said: "I wish I could have that man with me on my contemplated expedition to British Columbia." At that time, Mr. Mackenzie's Government was in power, and when I was applied to by Mr. Fleming, I said I was doubtful of being appointed; however, I was appointed by Mr. Mackenzie. I never saw Dr. Selwyn until I reached Victoria, where we had our first conversation. He said to me, "Now, Mr. Macoun, try and do as well for me as you did for Mr. Fleming and I will do by you as Mr. Fleming did," and that was, "Macoun, do the best you possibly can, and you will get all the credit you deserve." Well, I, of course, worked hard all summer, and took all the notes I possibly could. That report was published in 1875, and there were 120 or 130 pages of it. That gave me this impression of Dr. Selwyn, that if you work hard he will give you credit, and that has been my impression up to the present time. My impression of Dr. Selwyn is that if he finds one of his subordinates doing the best he possibly can he will give him a good show and do the best he can for him. Dr. Selwyn, if he were to send me on an exploration, would say, "How much money will be required to make such an exploration," and he would give the amount to me, and allow me to choose my own assistants, and my aim has always been to be successful. I know of no instance, so far, in which Dr. Selwyn has not done this. I have been ten years backwards and forwards, and so far as my information goes, I believe Dr. Selwyn's aim is to have good work done and give good results to the public. I have known no instance where he has interfered in any way.

Q. Then your impression is that where the work of the explorers has not been published in the annual volume it is because it was not of a nature to be embodied in the report?—I positively do, and I will tell you on what I base it. I am an old professor and teacher, and as an examiner, when I found the paper of a young man who thought he knew very little, and actually did know little, I would consider it, but when I received the paper of one who thought he knew a great deal and knew less, I would throw it out. If I were in Dr. Selwyn's place I would not publish any report papers unless they were of sufficient value to be published. It is a serious matter to publish what is called science, but which has no scientific value at all. These are my impressions only.

Q. Would it not be more in the public interest, if such men are attached to the staff, that they should be discharged at once and that no expenditure should be made upon their explorations and no time wasted in making them?—Yes; that is precisely my impression. It is a great mistake to give means to men who are incompetent, because their work has got to be done over again, and it is thus twice paid for.

By Mr. Baker:

Q. Do you think that your impressions have been subsequently substantiated, and if so, cite instances?—I will answer that in this way. If it is shown that Dr. Selwyn has suppressed valuable reports, then, in my opinion, Dr. Selwyn is wrong.

Q. We all agree to that?—I cannot answer your question except in a particular way.

Q. Do you not think that reports coming from persons who are supposed to be competent should be given to the public for what they are worth, the Director, if he does not agree with them putting a note at the bottom of the report to that effect?—I feel just this way, that where the Director is satisfied that the report is inaccurate he would be doing a great wrong to himself if he allowed it to go to the public as a correct report.

Q. But if he qualifies it by a statement that he does not agree with it?—That is his own business. If you refer to a particular instance, then I will answer your question.

Q. But I wish to ask a general question?—And I have given a general answer.

By Mr. Dawson :

Q. Dr. Selwyn, the Director of the Geological Survey, who is now present in the room, is your superior officer, I believe?—Yes.

Q. You spoke of incorrect reports being sent in, which you believe to be to the general advantage to suppress?—I did not state so.

Q. But you implied that they were?—Very well; I will even admit that I implied it.

Q. You are not aware of any particular inaccurate reports having been sent in, are you?—Dr. Selwyn never showed me the report of any gentleman and asked me my opinion, or read me any portion of it in any case.

Q. Then you have no actual ground for supposing that incorrect reports were sent in, unless any of these published reports were incorrect?—Dr. Selwyn has refrained from publishing reports that have been sent in to him, and if he did so on the ground of their being unsatisfactory, in my opinion he was acting quite right. If he suppressed reports through spleen, or spite, or from any other cause than their want of value, then I decidedly say that he was wrong.

Q. That is a very general opinion, which no one would dispute. If any incorrect report was sent in he would be justified in holding it back. But you do not mean to specify any particular instance?—No. I am speaking merely from my impressions and from my experience, and I have just as long an experience as many others, about thirty years.

Q. Most of the members of the Committee have read, with a great deal of interest, your reports and the information you have given with respect to that great tract of country north of Lake Superior, and of your journey from Kaministaquia to Rainy River. Do you not think it is highly desirable that this very large region extending from Abittibi Lake away westward to the waters of the Rainy River and down to the south of Hudson Bay, between Lake Superior and Hudson Bay, which forms a great portion of our territory, should be examined, in order to obtain information as regards its flora, and to judge of its climate from that?—I do, and over two months ago Dr. Selwyn pointed out to me, on the map in his room, this very tract of country, and it is set down for me this summer to examine the country on the line of the Canadian Pacific Railway, from Nipissing westward to Kaministaquia. I am very glad that you mentioned that, because I think it is important that a man like myself should be in that country. I have studied botany so long that I could tell the climate from the flora.

Q. It is to be hoped that your explorations will not be confined to the mere line of the Canadian Pacific Railway, but that they should extend from Hudson's Bay to Lake Superior, on the other side?—I will do what I am told.

Q. Do you not think it desirable that it should be done?—I believe that the country is considered valuable, and should be examined.

Q. Its geographical position renders it a matter of very great consequence to the country at large that its value should be ascertained, as regards its agricultural capabilities, its mineral resources and everything relating to it?—I think so.

Q. A little to the north of the Canadian Pacific Railway the rivers are navigable, and the tributaries of the Moose River running down to Hudson's Bay could be navigated with little canoes, so that the navigation down to Hudson's Bay would not be expensive?—I will tell you, honestly, that I would not allow any subordinate that would be sent with me, the privilege of examining a tract of country without I had my eye on him.

Q. But you could judge as to his conclusions?—I have not the greatest of faith in subordinates carrying out their instructions.

Q. I am very glad that the subsequent information we have got establishes the accuracy of your former report with regard to that country?—I examined the Kaministaquia Valley, in 1869.

By Mr. Holton :

Q. You have in your answers to the Chairman's questions, stated a good deal with regard to Dr. Selwyn's capacity and qualifications, but nothing with regard to

the general efficiency of the Survey. I would like you to state to the Committee if it is your opinion that the Survey stands as high in the scientific world as it did in times past, and whether it is now doing good practical work for the benefit of the country?—As regards the general efficiency, as far as I can see, the aim of the Director and the staff is to do the work as efficiently and as completely as possible, but the efficiency of the Survey is marred by chronic dissatisfaction in the minds of some of the members. I cannot say what is the cause of that dissatisfaction; I thought it was small salaries, but I am told it is not.

Q. How long has this dissatisfaction existed?—Since I joined the Survey, and for years before as well. If I were on my oath, I would say that I always believed that it was dissatisfaction on account of small salaries.

Q. In what way does this dissatisfaction appear on the surface?—Grumbling and chronic discontent.

Q. How does it evince itself?—If one does not like a person, one will try to thwart him, and that is the outcrop of the discontent on the staff. In other words, Dr. Selwyn has the interests of the country, and the interests of the Survey more at heart than any other member of the staff. If I am dissatisfied with Dr. Selwyn, I will try to thwart his ideas, and I believe there is on the staff a tendency to thwart the ideas he wishes to carry out.

Q. Why should this be so?—When St. Paul was at Ephesus, one section shouted, "Great is Diana of the Ephesians," and another section, "Great is the other God." The Diana of the Survey is Dr. Selwyn, and the Diana of the past is Sir William Logan, and the cry of one section is, "Great is Diana of the Ephesians," and the other section, "Great is the present God."

Q. Will you please give briefly and succinctly your opinion of the present efficiency of the Survey?—In my opinion, as I said in my first statement; I have studied geology for thirty years.

Q. But you are not answering my question?—I am. I have watched the progress of the Survey, and I tell you, Sir—and I challenge contradiction—that the Survey stands higher to-day than it ever did in the scientific world.

Q. How do you know it?—Because I read scientific papers. Geology is a progressive science, and anyone who says not knows little about it, and hence cannot make a statement. Geology being progressive, if men stand still in connection with geological knowledge, are they not going behind? I tell you, if you read the reports of the Geological Survey you will find that it has progressed from crude notions to fixed ideas.

Q. I want you to state your authorities for distinctly stating so?—I will mention two names. Sir William Logan commenced in 1844, and he published a report, and I have read every report since that time up to the last one that was issued, and it has been constant progress, and to-day Canadian geology stands higher than it ever did before.

By the Chairman:

Q. —It ought to be, after forty years?—Exactly.

By Mr. Holton:

Q. What is to-day thought of our Geological Survey amongst the scientists of England, France, Germany, Italy and the United States?—With the exception of what I have heard in this City of Ottawa, I have never seen a statement against the Survey, either in print or heard it from any scientific gentleman. When Prof. Hyatt, of the United States, was here at the Royal Society, he stopped at my house, and I had a long talk with him about it.

Q. I am not asking what these people generally say or will not say, but what is the opinion amongst scientists in these countries with regard to our Survey. Take England, for instance?—Can you show me in print one statement in opposition to the Survey?

Q. I am not here to answer questions but to ask them, and I will ask them too?—Give me a chance to answer.

Q. I am giving you every opportunity?—How can a man make such a statement off-hand.

Q. You made a statement that you read all the reports. Do you feel competent to express an opinion upon the question I have submitted to you?—Yes.

Q. Then express it?—I have expressed it.

Q. I have asked you?—You must be a lawyer.

Q. No; I am a politician?—Oh no, you are ahead of a politician.

Q. The desire of this Committee, as it is my own desire, is to have the fair expression of opinion of all the gentlemen who come before us, as to the points. We are not scientific men, but we are very anxious to know just how this Geological Survey of ours stands to-day. What is its reputation among the scientific men of England?—I will send in written authorities if you will allow me.

Q. But in your opinion, as a scientist?—If you are a lawyer you want the documents.

Q. Generally speaking, I would prefer documents, but it is your own utterances I want now. You have stated to us that you feel competent to express an opinion. Express it?—Have I not done so.

Q. No; you have shot off in 500 different directions?—I can get documents from the United States.

Q. We don't want that?—I am unable to give any authorities from recollection in support of the position I have taken in reference to the standing of the Survey in other countries.

Q. Is the Survey at present doing good practical work?—I believe so. The men who are now on the staff—Mr. Fletcher, Mr. Ells, Dr. Bell and Dr. Dawson—I leave out Dr. Selwyn because he is at the head, but these other four gentlemen are all competent and willing men. These men I know, from personal experience in the field, will go into difficulties and dangers that would cause bigger men to shudder, and these go to their work in the proper spirit. Dr. Bell has been twenty-five years on the staff, and he ought and I believe has improved every year; Dr. George Dawson ought to be improving every year, and Mr. Ells and Mr. Fletcher are both old men on the staff, and surely they ought to be learning every year. I am positive they are doing good practical work for the country.

Q. Where are we to find the results of this work?—In the special reports; in the maps, and in the amount of material that is now in hand in the office of the Survey, when put in proper shape. If you only knew what these men do for the pittance they get, you would be of a different opinion.

Q. We do not express any opinion as to inefficiency. We want yours?—They are doing good work, of practical benefit to the country.

By Mr. Baker:

Q. You evidently infer that we have preconceived notions of the inefficiency of the Survey?—If I expressed any such opinion, I take it back. I am asked my opinion as to the efficiency of the Survey, and I answer that I know no man who shirks his work.

By Mr. Holton:

Q. Can you not draw a line between the service and the men who do that service?—I do.

Q. Then your mind is more acute than mine?—If the summation of the work is impractical, the men are impractical. I may be illogical, but I think if the men are practical, the result of their work is practical, and I say they are practical and efficient men.

By Mr. Dawson:

Q. You consider them all good geologists—Messrs. Dawson, Bell, Fletcher, Ells and Whiteaves?—Mr. Whiteaves is a specialist, like myself.

Q. You consider them all competent and efficient men?—Yes.

Q. But there is a little dissatisfaction and grumbling?—Yes.

Q. It seems to be more in the organization and arrangement than any want of capacity?—There is no want of capacity; nothing stops grumbling so much as a liberal allowance to live upon, especially if you are a married man.

By Mr. Holton:

Q. How many special reports have been published by the department with which you are connected during the last ten years?—I cannot tell that, but I can tell the

number last year. I published one, Mr. Whiteaves has published, or is publishing, three, and Mr. Foord published another, and I think there might have been another, but I am not sure. At any rate, I know of these five for a certainty, and the amount of knowledge that was required to publish these is not knowledge that could be gathered in a few days. It is the accumulation of years, as all scientific knowledge must be.

Q. Are members of the Survey encouraged by Dr. Selwyn, or allowed to contribute to scientific societies and scientific papers outside of the Survey reports?—Yes; but if they write to a scientific paper, they must say that it is written by a member of the staff, in other words, the survey must get the credit for what is written. It is transmitted through the Director.

Q. That is a rule of the Survey?—Yes; it is as regards myself. Dr. Selwyn told me some time ago, when I first wrote for the Royal Society, that if the paper was the result of knowledge obtained on the Survey, it was but right that the Survey should get the credit for it.

By Mr. Baker :

Q. You have stated in your evidence that if you were instructed by the Director of the Survey to do a certain work, you would do it at all hazards?—Yes.

Q. Would you obey orders and break owners?—Yes.

Q. But your discretion might lead you to do otherwise?—When I was sent out by Mr. Lindsay Russell, he would say, if I could not strictly carry out my instructions, owing to circumstances, I was to use my discretion. Dr. Selwyn never did this, but he implied it. I think if Dr. Selwyn said to do a thing I would obey orders at all hazards.

Q. As a professor and a scientist, you do not consider that you have any discretionary power or any individuality when you are so sent out?—When I am sent out to do a certain thing I consider I must do as I am told, if possible, but I may do more and get additional information which is not in my instructions at all.

Q. Supposing you receive your instructions to go to the western extremity of the North-West Territories to perform a certain work, and that on arrival there you find it utterly impossible to prosecute that work to advantage and with a judicious expenditure of the public money, would you still consider it your duty to go on with it?—"Can't" is not in my vocabulary. If I found it impossible when I got there, and that it would be an injudicious expenditure, I believe I would *not* carry it out.

Q. Then you would not obey orders?—There is no such thing as "can't" in my vocabulary.

Q. You say, with the exception of yourself, which is evincing no small amount of egotism, that Dr. Selwyn has the interests of the Survey more at heart than any member of the staff?—No; I put myself with the great majority. I said that Dr. Selwyn had the interests of the Survey more at heart than *any* other member of the staff.

Q. You mean to say that nobody has the interests of the Survey more at heart than the present Director?—Yes.

Q. Now, you mentioned, in speaking of the officers of the Survey, that certain gentlemen ought to be, and certainly were, improving. You made one exception to this. You stated that Dr. Dawson ought to be improving, but you did not say whether he was. Did you intend to convey the idea that he was not?—No; I think he is the most progressive man on the staff.

Q. You are of opinion that the small salaries are a serious drawback to the zealous prosecution of the work by the gentlemen composing the staff?—Yes; and I believed at the time that it was the cause of the dissatisfaction.

By Mr. Dawson :

Q. Geologists seem to differ among themselves quite as much as miners do. For example, Dr. Hunt has written some interesting articles on a very important group of rocks, which he calls the Animikie or Thunder Bay group. Dr. Selwyn differs from him, as to the age or horizon of this Animikie group, and believes it to be lower by many thousands of feet than the Keweenaw group on the opposite side of the Lake. There is a difference between them, of some five miles or so, as to the relative altitude of these two groups, while other geologists, equally capable of judging, place

them on about the same horizon. So with regard to the Quebec group, there is a great diversity of opinion among scientists. They seem to toss and twist the earth's surface in the way that best suits their different views, yet they must criticise the miners, who are at least, quite as consistent as they are, and far more practical?—I am very glad you mentioned that. There was quite a discussion at the meeting of the Royal Society, last spring, about it between, Dr. Selwyn, Dr. Hunt and Mr. Macfarlane. I don't think that Dr. Hunt could have been up there.

Q. Yes; he was, for he stayed a week at my house?—He showed very little knowledge of it, at any rate. After hearing the discussion I came to the conclusion, and nearly all others who heard him, that Dr. Hunt was talking about what he did not clearly understand. Dr. Hunt is an eminent chemist, but he is not eminent as a stratigraphical geologist.

Q. Do you not consider Prof. Chapman an eminent geologist?—He wrote a little book on geology, and if he knew as little about the rocks in the east as in the west, he knew very little about them.

Q. To give a practical turn to the information I have elicited from you, do you not think that the time of the Survey is too much taken up with those matters which are not of interest to others, with the exception of scientists and geologists? A great deal of hair-splitting has taken place with regard to these rocks, such as the Quebec group and the Animikie group, which may be very interesting to scientists, but not the general public, and which has taken up too much of the time of the Survey. Do you not think so?—I agree with you that this hair-splitting among geologists is of no interest to anyone outside of themselves, and if money is spent foolishly, for the settling of these questions, it is of course impractical, but the difficulty is to tell where the hair-splitting comes in, and where it does not.

Q. But still you are of opinion that the whole Survey might have a more practical turn?—I would say that my branch is the real practical one, while the geologist would say that his branch was.

Q. Nobody denies that we receive a good deal of advantage from the Geological Survey, but the question is, might it not be improved?—Certainly.

By Mr. Baker :

Q. Do you mean to tell the Committee that Prof. Chapman, who has been teaching geology in Toronto University for a great many years, knows nothing about it?—Only as regards the western rocks. The eastern ones I know little about. He wrote a book and talked about rocks he never saw.

Q. Then the Committee is to understand that your remarks simply refer to the western rocks?—Certainly. It would not be prudent for me to speak about matters of which I profess to know very little.

(The following circular was sent to several Scientific Institutions and Professors of Science.)

“ OTTAWA, March , 1884.

“ DEAR SIR,—A Committee has been appointed by the House of Commons of Canada ‘to obtain information as to the methods adopted by the Geological Surveys of this and other countries in the prosecution of their work, with a view of ascertaining if additional technical and statistical records of mining and metallurgical development in the Dominion should not be procured and preserved.’

“ The Committee is desirous of procuring information from persons connected with Geological Surveys, Bureaux of Mineral Statistics, &c., in other countries, in reference to recent progress in those departments, with a view of recommending to Parliament such modifications in our own system as will tend to render it more efficient and successful.

“ The Committee will therefore consider it a favour if you will furnish it with a list of works on the above subjects, published by you or under your direction, or the works themselves, if furnished by your Government for general distribution, and will also be much pleased to receive your views upon the subjects mentioned and specially:—

"1st.—As to the desirability of procuring and preserving mineral statistics.

"2nd.—As to the desirability of calling special attention to the various minerals of economic interest, their application, their extraction and their treatment.

"3rd. If desirable, whether the work should be done in connection with and as a subordinate department of the Geological Survey, or by a separate and independent department or bureau.

"A reply at your early convenience will oblige,

"Your very truly,

"ROBERT H. HALL, *Chairman.*"

"UNIVERSITY OF NEW BRUNSWICK,

"FREDERICTON, N.B., 20th March, 1884.

"DEAR SIR,—I have the honor to acknowledge the receipt of your communication of March 13th, asking, on behalf of a committee of Parliament, my opinion upon certain points connected with the collection and preservation of mining and metallurgical statistics within the Dominion. In complying with the request, I may state that such views as I have to offer have been suggested to me partly through personal observation, extended over some fifteen or twenty years in connection with the geological investigations of this Province, and partly through the perusal of geological reports elsewhere.

"As to the general question of the desirability of 'obtaining and preserving technical and statistical records of mining and metallurgical development,' only one answer can, I think, be given. The more complete, thorough and accurate such statistics the greater their value, and the greater the necessity for their preservation in a permanent and readily available form. This necessity is universally recognized in all communities of advanced civilization; the only differences are as to how such results can be most effectually obtained. It may not be out of place to give here a brief statement of what has been done in this Province in this direction.

"My present position was assumed in 1861. Up to that period the only publications bearing upon the mineral resources of New Brunswick were those of Dr. A. Gesner, and of Prof. J. W. Johnston, the former being a series of reports on the geology of the Province; the latter chiefly on its agricultural capabilities, but including also references to its geology. In both, the references to economic minerals are few, scattered, incomplete, and subordinate to the presentation of other subjects.

"With a view to inform myself better upon these particular topics, as well as to obtain a basis for their future investigation, I undertook, in 1864, by the advice and with the pecuniary assistance of Governor Gordon, to visit different sections of the Province and to collect such data as were available, relating to the condition of its mining industries at that time, the results of which examination were subsequently printed and presented to the Provincial Legislature. They, however, from the want both of time and means, were necessarily of a very meagre and unsatisfactory character. A copy of the report in which they are contained is herewith transmitted.

"Subsequent to the publication of this report 'on the Mines and Minerals of the Province,' my attention has been directed, with but little interruption, to the study of its geological structure up to the present time, partly by private exploration and partly in the service of the Provincial and Dominion Governments. I am thus brought to consider the ways and the extent to which the official surveys, and more particularly the Geological Survey Canada, as conducted in this Province, has operated in the direction referred to.

"The instructions under which I have acted, received first from the late Sir W. E. Logan, and later from his successor, the present Director of the Geological Survey, have, in most instances, related primarily to the determination of the age, position and structure of the rock formations in different sections of the Province,

with a view to the construction of correct topographical and geological maps of the districts surveyed. This, I believe, to be the first and most essential requisite of every systematic Survey. While recognizing this, however, as the main object to be attained, at least in all preliminary investigations, I have always understood it to be the duty of those thus engaged to observe the occurrence of all minerals likely to be of economic interest, to collect such data as were available concerning them, and to embody the information thus obtained in the reports submitted. On reference to these reports, it will be found that in most instances special chapters or sections are contained, devoted to this subject, and containing as complete information as it was possible to obtain relative to the subjects discussed. In addition to these chapters, special reports have been prepared on the Grand Lake coal field, on the Albertite deposits of Albert County, on the iron ores of Carleton County, and on the economic minerals of the Province in general, for use at the Philadelphia Exhibition.

"In 1870, a circular relative to the collection of mining statistics was prepared by the present Director of the Geological Survey, and distributed in this Province, the answers to which, as compiled by Mr. Robb, are contained in the Report of Progress for 1871-72. Great difficulty was experienced in obtaining the desired information, and the returns, as far as they relate to this Province, are both meagre and incomplete. No systematic records of work since done have, so far as I am aware, been made.

"As to the desirability of a change in the methods of obtaining and preserving such information, it is my belief that this can be best done through the employment of one or more officers, whose special duty it shall be to personally visit and investigate the condition of various mining industries, to collect and preserve statistics relative to the latter, and from time to time to publish reports thereon, with suggestions as to profitable fields of exploration, improved processes, new applications, &c. My criticism upon the present system, if any, would be that it leaves the information desired scattered through many volumes, in connection with a variety of reports, and in a form which, through the difficulty of finding it, makes it practically unavailable to the great mass of the people. Such work should also, I think, be in the hands of a trained specialist or expert, rather than in those of the ordinary surveyor, whose time and attention are already sufficiently occupied in other directions. I see no reason, however, why such work should not be subordinate to the general work of the Survey and to its head, and believe that the best results would be attained by such subordination. This is the case with most of the Surveys of which I have any knowledge, and especially with the National Survey of the United States, as recently organized; though sometimes, as in Nova Scotia, the duties of such an office may be to a large extent, performed by a Special Commissioner of Mines.

"I may here further suggest, as being in my mind a desirable change from the system now followed, that collections of rocks, minerals, fossil sand economic products should, as far as possible, be made in duplicate, one set to be forwarded for permanent preservation in the Geological Museum, at Ottawa the other to remain in the Province where the collection is made, and where it is chiefly of service for purposes of instruction and reference. Such local collections, which could be easily made, would greatly assist such publications as are referred to in your second question, and of the desirability of which I entertain no doubt.

"I have the honour to be, Sir, Your obedient servant,

ROBERT N. HALL, Esq., M.P.

"L. W. BAILEY."

"HALIFAX, NOVA SCOTIA, PROVINCIAL MUSEUM, 20th March, 1884.

"DEAR SIR,—I appreciate highly your courtesy in asking my advice on the subject of geology, and the development of the mineral resources of our great Dominion. As, however, the Director of the Geological Survey, and I have had occasion to differ in opinion so often on radical points in geology, I am afraid that suggestions made by myself would be ungraciously received on his part, and consequently would remain a dead letter.

"The last reports for 1880-1-2, just received, are certainly largely disappointing as far as relates to geology. I would remark first, in regard to the new name, Geological and Natural History Survey. It may have been expedient to add Natural History to the Geology. I think the two should have been kept apart, and placed under separate directorates. The two get wonderfully mixed up in the reports. Second, a new nomenclature is being introduced which is very bewildering, and different from that of all Surveys with which I am acquainted, e.g. H. M. Geological Survey of Great Britain, the great Surveys of the United States, and from that taught by standard works on geology, and the teaching of our colleges and schools of science. In Nova Scotia, which has been my special field of work for the past twenty years, and which has been a field for geological research for upwards of forty years, where eminent geologists, home and foreign, and skilled mining engineers, have successfully operated, the "geological corps" is commencing to operate *de novo*, a region not being considered examined, if the "geological corps" has not examined it. From the reports it seems that new maps topographical have to be constructed for geological purposes, although the Nova Scotia Government has subsidized a party in the construction and publication of county maps of the whole Province, which I, at least, have found easily convertible into geological maps, and which the late Sir Wm. Logan recommended and used when I was assisting him in his surveys of Pictou and Antigonish County. These maps are used in the Mines Department of the N. S. Government, and are found well adapted for indicating mining areas.

"My own geological work has been fully reported in the Journal of the Geological Society of London, 1863 and 1864, and in the proceedings and transactions of the Nova Scotia Institute of Natural Science, from 1867 to the present time. This has been illustrated by maps, which have not been published. These were used in my classes in Dalhousie College.

"The transactions, which are now largely out of print, are to be found in the Parliamentary Library—the Geological Survey Library—as well as in libraries throughout the world.

"The statistics of the mines of Nova Scotia are contained in the series of Annual Reports issued by the Hon. Commissioners of Mines and Works.

"I think that an officer of the Geological Survey should have charge of mining statistics.

"The Hon. Mr. Gayton, Commissioner of Mines and Works, says he is ready to furnish the reports referred to or give any information that it is in his power to give, relating to maps and statistics.

"I have the honour to be, Your obedient servant,

"D. HONEYMAN.

"ROBT. N. HALL, Esq., M. P., Ottawa."

"MINES OFFICE, HALIFAX, 21st March, 1884.

"SIR,—In answer to your letter of March 13th, I beg permission to remark :

"1. I consider the collection and preservation of mineral statistics a matter of very great importance. The Nova Scotia Government, the owners of the chief minerals found in the Province, have been very particular on this point for some years past. I enclose A. B. C. D. gold and coal returns which will show that they are very comprehensive. The returns form a condition of all leases, and their neglect renders the lease forfeitable.

"They are made under oath, See (E) Mines and Minerals Act, sections 53, 62, 102, 108, &c., &c., and are always exacted. In the case of mines not held under lease from the Government, annual returns of ores raised and labour performed are required. See (F) Miners Regulation Act, section 15. Summary penalties are also thereby provided for neglect. From these various returns are compiled the statistical tables shown in (G) Mines Report, pages 38, 64.

"It will thus appear that our system is practically working, and it is frequently referred to by investors. Full statistics are essential for legislative purposes, as they check unfounded assertions, evidence, direction of trade, show its relation to foreign mineral trade, and furnish the safest data for mining legislation.

"I give an instance at present affecting this matter.

"We have been levying our royalty on large (or screened coal) only, allowing fine (or slack coal) and that used about the collieries to pass free. Desiring to meet the demands arising for unscreened coal (coal to be sold as it comes from the miner) and to check any excessive use of coal about the mines, we are proposing to put an equivalent royalty on all coal raised. Thanks to our returns of total production, of large coal sold, small coal sold, and of the amounts of each used by workmen, and by engines, &c., we can readily fix the equivalent, otherwise tedious and expensive checkings would be required before any conclusion could be arrived at.

"2. My opinion on the second point may be best expressed by referring you to the transactions of the North of England Mining Institute (Newcastle-on-Tyne) which contain papers of mine on the various Nova Scotia coal fields. The composition of Canadian coals, the iron, gypsum and gold of Nova Scotia (copies of the last forwarded to you), also similar papers of a more local character in the transactions of our local institute. Also, report to Provincial Government on Nova Scotia minerals, 1881. (Copies sent). Copies of these papers will be found in the library of the Survey. The subject is one of much importance.

"3. In Nova Scotia the collection and compilation of the statistics referred to is performed by the Inspector of Mines, who is best qualified, from his practical acquaintance with each mine, to detect any errors, &c. I would not be inclined to consider that the collection of mineral statistics in the Dominion, considering the available work being done here, requires 'a separate bureau or department.' Legislation is necessary to provide means for collecting returns and to punish neglect. This having been obtained, it would be necessary for the Government to be able to give an assurance of the general correctness of such returns. In order to effect this, some one must be practically acquainted with the mining operations of the Dominion, by more or less frequent visits to the localities where mining is in progress, to detect attempts at improper returns, and all returns should pass through such person's hands. Such person might, preferably, be a qualified mining engineer and mineralogist, and his familiarity with the subject of Dominion mines and mineral statistics would make his services very valuable to the General and Local Governments.

"I think that the Geological Survey staff should have a mining engineer attached to it. In connection with this, I refer you to Geological Survey Report, 1866-69, containing a most valuable report by the late Mr. Hartley, M.E., made under direction of Sir W. Logan, on the coals of Pictou County, which report is highly prized by all connected with that coal district. Such work has not been repeated.

"Surveys of mineral districts are not valuable, unless made by a field geologist having had special training in mining and prospecting. In all such surveys the advice and co-operation of a mining engineer are requisite to ensure a proper appreciation of the economic aspects of the survey. Reports by a well qualified man on the prospective value of districts, casually referred to as metalliferous in the reports of the field geologists, would be specially valuable, and it must be remembered that the geological mapping of different strata, and the economic consideration of the minerals contained in them, are two different subjects.

"I would suggest that through the appointment of such an officer on the staff of the Survey, both the collection of statistics and the preparation of special reports on economic minerals and mining districts could be arranged for.

"At present we require principally from the Survey work in districts showing or expected to show mineral deposits of economic value, and that, so far as is proper, the Government should set forth such mineral values. It is perhaps a little too soon for the Survey to attempt to rival the profounder researches of well-endowed European Survey staffs, working over ground already surveyed and mapped out. In my opinion, the work of the Geological Survey has been unfairly hampered by being

diverted into colonization surveys, natural history, &c., to the prejudice of legitimate geological work.

"I trust the above may prove of service to you, and will be pleased to hold myself at your further commands.

"I remain, yours obediently,

"EDWARD GILPIN, JR.,

"*Government Inspector of Mines, Province of Nova Scotia.*"

"R. N. HALL, Esq., M. P.,

"Chairman of Committee Geological Survey, Ottawa."

"BELOIR, WISCONSIN, 22nd March, 1884.

"DEAR SIR,—In reply to your question, I would answer: (1) That there is, in my judgment, no question as to the desirability of procuring and preserving mineral statistics; (2) Nor as to the importance of calling special attention to the various economic resources of industrial development. (3) This, in my judgment, can be best done as a department of the Geological Survey.

"I sincerely hope that your Parliament may enact suitable laws for securing to your large domain the benefits of an organized bureau of industrial mineral and mining statistics.

"Yours very truly,

"T. C. CHAMBERLIN,

"*State Geologist.*"

"ROBERT N. HALL, M. P.,

"Chairman, Ottawa, Canada."

"KINGSTON, 22nd March, 1884.

"DEAR SIR,—In reply to your circular of 19th March, I beg to state that I have published no works bearing on geology, except a very brief outline of 'The Geology of the Maritime Provinces,' and a list of 'The useful Minerals of the Maritime Provinces' in Roe's 'Atlas of the Maritime Provinces.'

"1st. Large areas of the Dominion are useless for agricultural purposes, but rich in mineral wealth. The utilization of such regions is desirable in the interests of the country, and would add materially to its prosperity. I am, therefore, of opinion that 'procuring and preserving mineral statistics' would be useful for the purpose of calling the attention of capitalists and others interested in mining to the amount and value of the work performed from year to year in different localities.

"2nd. The 'calling of special attention to the various minerals of economic interest, their application, their extraction, and their treatment,' and permit me to add, their localities, would furnish parties desirous of engaging in mining operations with valuable information which could only be obtained otherwise at great expense, or probably, not at all. The reliability of such information is of prime importance.

"3rd. Though the general character of the work required to be done by a 'Bureau of Mineral Statistics' differs from that of a 'Geological Survey,' a subordinate department ought to be sufficient to perform the work required. Much of the information desired is obtained by the Survey, and the duties of some members of the staff coincide very nearly with those which would devolve upon members of a new department. Some means by which parties finding ores could ascertain their value without much trouble or outlay is very desirable.

"I have the honour to be, Sir, your obedient servant,

"JAMES FOWLER,

"*Lecturer on Nat. Science, Queen's College, Kingston.*"

"ROBERT N. HALL, Esq., M. P.,

"Chairman of Committee on Geological Survey."

"NORTHERN TRANSCONTINENTAL SURVEY,
"NEWPORT, R.I., March 25th, 1884.

"DEAR SIR,—I have yours of the 13th March, 1884. I have the honor to send you certain publications relating to the canvass of our mineral industries for the tenth Census, and also a copy of the first publications of an economic survey of part of the North-West, together with a report of the methods followed in that survey. These are the only reports of Surveys made under my direction, of which I have copies for distribution.

"In reply to your questions, I would say: 1st.—That it seems to me extremely desirable to collect and preserve the statistics of mineral industries. 2nd. I consider it equally desirable to call attention to the various minerals of economic interest, existing within your territory, together with an authoritative statement of the character and value of the individual deposits. I consider that the questions relating to the methods of extraction and treatment would be very properly left to the investigations of consumers, since this portion of the work, to be of any value, would require the employment of a different class of expert knowledge from that which will necessarily be required in studying the deposits themselves, and describing them; and also because, while the intrinsic character of the materials as occurring in nature does not change, the methods of extraction and treatment, on the other hand, are so subject to constant improvements and variations in different parts of the consuming world, that it would be extremely expensive and comparatively useless to attempt an annual review of such improvements.

"In regard to your third question, I would say that practice has shown that this work, which strictly belongs under the head of economic geology, is not to be undertaken by men who have devoted themselves to strictly scientific work. It should be done by the best young graduates in mining engineering that can be had, and who should, before entering upon it, visit as widely as possible the different localities where various ores, minerals, and construction materials are worked, in order that they may become acquainted not only with the manner of occurrence, but with the relative economic value of the materials as they occur. In this I have particular reference to the products of quarries—slate, marble, freestone, &c., as well as asbestos, mica, whetstones, and all that class of more or less important products, of which very few geologists are acquainted with more than one or two in quarries proper.

"It appears to me that such a work should be put under a distinctively economic geologist, who might himself have either an independent department or be in charge of a subordinate department of the Geological Survey.

"I should further consider that such a work should begin with a thorough canvass, similar to the one carried on by us for the tenth Census of the United States—that is, every known locality containing minerals of economic value, whether worked or not, should be visited, and commercial samples taken of its products, and these samples should then be subjected to the processes of testing or analysis, according to the requirements of the case. At the same time, the statistics of production, where workings exist, should be a part of the work.

"This work once done for the whole country could then be very easily kept up by a smaller permanent department.

"Yours respectfully,
"RAPHAEL PUMPELLY, *Director.*"

P. S.—The complete volume of my department of the Tenth Census is not yet issued.

"ROBERT N. HALL, Esq.,
"House of Commons, Ottawa, Canada."

(Translation). "LAVAL UNIVERSITY, 15th March, 1884.

"SIR,—In your capacity of Chairman of the Committee of the House appointed to deal with the Geological Survey of Canada, you have been good enough to put to me certain questions as to which you are desirous of having my opinion. I beg to

say in reply, firstly: that the *practical* utility of a Geological Survey for a country still young and little known, such as ours, cannot be overestimated. It is quite certain that we have still much to learn about the mineral resources Canada offers us, and no one can throw more light on the subject than an official body of competent men, entirely severed from political intrigues and coteries, and devoting their time, their energies and known ability to promoting the development of our mineral wealth. In furtherance of that object, it seems to me that these men should grapple very specially with the practical side of the geological problems they would have to solve, deal at once and constantly with our mining enterprises, do everything in their power to direct individual explorers, and thus, year by year, save the enormous sums which are utterly wasted in futile explorations.

"The early reports of the Commission were specially remarkable in that respect, and I consider that it is one of the branches of geological enquiry which should receive most attention and development. To give but one instance, we have in Beauce auriferous lands which are, without doubt, highly important, and notwithstanding the explorations made in that section by the Survey, there is still much to be done in the way of examination in detail.

"As to comparing the benefit derived by the country from the Survey with the expense it involves, the question is one of very great delicacy. I consider that it is always sound policy to remunerate liberally men of ability who devote their time to scientific research. Nothing paralyzes zeal and impedes research so much as wearying anxiety of a life in which everything must be calculated with the greatest minuteness if, at the end of the year, both ends are to be made to meet.

"The Survey is costly, it is true, but the results of its labors are, in general, highly important. That the publications, of late years, have produced less sensation than those which preceded them, cannot be denied. But the causes of this may be numerous. In the first place, a man of Sir William Logan's undeniable high standing and intellect, a man of genius and wholly devoted to his profession, is not easily replaced. Moreover, the withdrawal, shortly after Sir William's death, of several extremely eminent men, such as Mr. Sterry Hunt and Mr. Macfarlane, the death of Mr. Billings, &c., largely contributed to deprive our Geological Survey of a portion of the prestige it formerly enjoyed. Besides, the class of work now being done by the Survey is, perhaps, of a nature not so well calculated to strike the public mind as that of earlier days, when everything was new, when each explorer brought in a wealth of important discoveries.

"You ask me, moreover, whether I am of opinion that the defects of our Geological Survey, defects complained of by many, are due to its organization or to the manner in which it is conducted.

"The information I possess on this subject is very slight. I have no precise idea of the organization of the Survey. I do not know the special attributes of the Director and of the subordinate officials. The reports of the Survey have not reached us regularly here of late years, and most of the time we have got them indirectly, through friends in Parliament. Hence, as I do not even know whether the Survey is bound to send its reports to the principal institutions of the country, I must know very much less about its interior working.

"As regards improvements to be suggested, I would most urgently suggest and pray that special attention be given to *our* mineral wealth. This is my opinion, one point of the very first importance. And in this connection let not the older Provinces be forgotten. The last word respecting them, and especially Quebec, has not, by any means, been said. I believe that detailed and methodical researches may give excellent results. Let the Survey not abandon mines in operation. Let a special Board, for that object, be created amongst its members, so that the public may be informed as to the development of our resources. Some of the Provinces have already established Boards for themselves; and so evident is their usefulness that there is no hesitation in completing their organization by adding to the number of members composing them.

"The Geological Survey has added to its old title that of "Natural History Survey." This opens up to it a vast field of research and labor, and the practical results, under proper direction, will certainly be of the highest importance.

"Lastly, I would say, let men of talent, to whatever nationality they may belong, be freely appointed to the Survey. Doubtless these appointments to the several positions on the Survey cannot be a mere matter of patronage; men of ability must be found. But the search for merit and scientific acquirement must be a thorough search; otherwise, there is danger of overlooking men who would have rendered real service, and selecting persons of an inferior talent, who may happen to be forthcoming or recommended.

"Such, Mr. Chairman, are the ideas which occur to me in relation to the enquiry ordered by the House as to the Geological Survey. The subject is an exceedingly difficult one, owing to the thousand and one little secondary or personal questions which may spring from it, but it is also a highly important one, which I am happy to see entrusted to a Committee so enlightened as yours. I am quite confident that the Canadian Geological Survey will emerge from the little storm through which it is now passing, full of vigor and ready to undertake fresh discoveries. With skilful and enlightened management, with good understanding between the members composing it, it is capable of rendering immense service to the country.

"With very great respect, your obedient servant,

"J. A. K. LAFLAMME."

"ROBERT N. HALL, Esq., M.P., Ottawa."

"HARVARD COLLEGE, CAMBRIDGE, MASS., March 26, 1884.

"DEAR SIR,—I have your circular of the 18th inst., concerning the methods of conducting Geological Surveys. My acquaintance with this class of work was mainly acquired as Director of the Kentucky Geological Survey, a position which I occupied for eight years.

"The works published during the period in which I had charge of this Survey were as follows:—

"Reports of progress, consisting of special reports concerning matters of economic importance, assembled in five volumes. There are about fifty of these separate reports. Each was separately published; the whole afterwards assembled, year by year, in volumes of about 500 pages.

"Second, memoirs, of which two (2) volumes were published. These contain matters of purely scientific interest.

"My experience is, that the State of Kentucky found it very profitable to publish the most detailed economic reports that could be prepared. To give these reports their full value, they should be arranged to prepare the way for exploitation, other than exploration. Besides the reports, I found it very advantageous to provide intending adventurers with all the help in the way of advice, on the ground, that they desired, at its actual cost.

"I think that it would be a great mistake to separate the statistical work from the investigation of the geology. Every mine should be frequently examined by the Government geologists. This work can be combined with the statistical enquiry. It is cheaper to do the work all together.

"As to the desirability of procuring and preserving mine statistics, there is hardly any room for doubt. In no other way can a chief geologist see what is from time to time the economic development of the resources that it is his business to keep in mind.

"The Kentucky Survey is at present under the management of my former pupil, later my assistant, Mr. Proctor. I have sent your letter to him, requesting him to forward to you such reports as are still in store.

"Pardon me a suggestion that is pertinent to your general enquiry, though not in the list of questions you put in your circular. The Canadian Survey has done a *great deal* of good *Scientific* work. It seems to me that you are now in a position to begin the exposition of your resources, with reference to the needs of your people. In this way it will be easy to define the interests of its more general work, if properly done—this economic exposition will help rather than hinder the scientific results which it seeks to obtain.

"To take a case in point, The Island of Cape Breton abounds in mines, yet there is no place where an economist can get an idea of what these mines are. The coal and iron of that field are known in a general way, but one hundred pages of detailed economic reports would put them before the public in a way that would certainly be profitable to your country.

"Very respectfully yours,

"N. S. SHALER"

"ROBT. N. HALL, Chairman, Ottawa."

"NEW HAVEN, Conn., 23th March, 1884.

"ROBERT N. HALL, Esq., Chairman of the Committee of the House of Commons of Canada with reference to the work of a Geological and Mining Survey.

"DEAR SIR,—Your communication of the 13th inst. was duly received.

"With respect to your request that I furnish a list of my own works connected with Geological Survey, I have to say that my geological investigations have been carried on privately, and consequently, my publications are scattered through various volumes of the American Journal of Science, and are given in a brief and disconnected way in my Manual of Geology and my Treatise on Mineralogy.

"On the other points in your communication I would reply as follows :

"I believe it to be very desirable that Mineral Statistics should be collected and preserved under Government direction.

"This work does not necessarily come within the duties of a State Geologist. But it could be connected with a Survey, provided it be entrusted to a separate agent, who should make it his special business. Such information is often collected with difficulty on account of the unwillingness of owners to make known the state of their affairs, and it is in danger of being largely erroneous as a consequence of interested misrepresentations, the fluctuations in the conditions of mines, and the uncertainties of ordinary methods of obtaining values or estimates of values by samples. The work, therefore, requires special qualifications, very different from those needed in a Geological Survey.

"Respectfully yours,

"JAMES D. DANA."

"STATE GEOLOGICAL SURVEY,

"UNIVERSITY OF ALABAMA, TUSCALOOSA, 29th, March 1884.

"DEAR SIR,—Your communication of March 13 has been received. The reports issued by this Survey have been sent from time to time to the Director of the Canada Geological Survey. I have at present only those for the years 1875, 1876 and 1881-82. Should these not be found in the Survey library, I will take pleasure in sending them. In answer to the two first questions, I should say, without hesitation, that I deem it desirable to collect and preserve mineral statistics of the states and countries, and to 'call attention to the various minerals of economic value, their applications, extraction and treatment;' and in regard to your third question, my

opinion is, that such would be best done under the supervision of the Director of the Geological Survey, and not by a separate and independent bureau, since in the latter case a duplication and overlapping of work could scarcely be avoided.

“Very Respectfully,

“EUGENE A. SMITH,

“*State Geologist.*”

“R. N. HALL, M.P.,

“Chairman Committee, House of Commons, Ottawa.”

“RICHMOND, 31st March, 1884.

“DEAR SIR,—In reply to your circular of 17th March, I beg to say that in my opinion it is very desirable for the promotion and welfare of the mining industries of our country, that mineral statistics should be procured and preserved. To me, this is so evident as to require no argument in its support.

“It is in my opinion, equally desirable that special attention should be called to the various minerals of economic interest, their application, their extraction, and their treatment. I am further of opinion that these desirable results, will be best attained, by a separate Department having that special end in view; for, I am aware, that economic mineralogy is often looked upon as but an illegitimate member of the geological family, and apt to be treated with neglect in consequence; but as the efficiency of the Department will be the measure of its success, it is necessary that it should receive no half hearted support, in order to be useful.

“I might give you a list of some publications by other Governments, but I have no doubt you will receive all this information from other sources, much more fully than I would be able to offer it.

“I remain, yours truly,

“R. N. HALL, Esq., M.P.,

“Chairman of Geological Committee.”

“GEO. H. PIERCE.”

“ST. STEPHEN, N.B., 31st March, 1884.

“DEAR SIR,—In answering your request for an expression of my views upon the matters under consideration by your Committee, I would, at the outset, state that I hold the degree of Bachelor of Arts from the University of New Brunswick, from which institution I graduated with honors in National Science in 1877. During my undergraduate course, I devoted much of my time to the study of the physical sciences and received two prizes for proficiency therein, one of them being a gold medal presented by His Excellency, Lord Dufferin. I began work upon the Geological Survey of Canada on 29th June, 1877, acting the first season as assistant, first to Prof. Bailey and afterwards to Mr. Ells. During the winter of 1877-78 I attended a course of lectures at McGill College, in mining and assaying, besides devoting considerable time to the practical work of the Laboratory. When not at the College during this winter I was at work in the office of the Geological Survey, and I may thus claim a continuous service in this Department from the 29th June, 1877, to 9th May, 1883. During the season of 1878 I acted as assistant to Mr. Ells, and I again assisted Prof. Bailey in 1879. During the seasons of 1880, '81, '82 I was in charge of a survey party. I am not in a position to refer you to any report of my work, as I have not yet handed any in for publication. If it is any part of the duty of your Committee to enquire into the reasons for my report not being handed in, the Director of the Survey can show you the correspondence in reference to the matter. I will only say this, that Dr. Selwyn's action rendered it impossible for me to complete my report, the suppression of which entails upon the public the loss of the results of four seasons's work and of the expenditure of several thousand dollars.

"I will say, briefly, in regard to the three general questions you desire answered: (1.) That there can be little doubt of the 'desirability of procuring and preserving mineral statistics,' not only as a means of ascertaining the mineral wealth of the country and of indicating to capitalists the proper direction of investment, but as well as a means of increasing our exact knowledge of the subject of mining itself, and of furnishing an important datum in political economy in regard to the question of supply and demand. This is a matter which cannot be carried out by private enterprise, and even if it were the results would lack the confirming authority of an official report, as most other reliable statistics are prepared under the authority of Government. For the same reason a Geological Survey should be a public institution, maintained solely by the State, its officers being removed from all private influences as to explorations and the preparation of reports.

"(2.) It will not need my confirmation to prove the vast importance of 'calling special attention to the various minerals of economic interest, their application, their extraction, and their treatment.' I can conceive of no matter of greater importance to the human race than a thorough knowledge of the mineral composition of the earth's 'crust;' for we are dependent upon the product of the mine to an almost incredible degree. Since so much importance attaches to minerals and their products, most Governments of civilized countries have established geological surveys with a view to ascertaining definitely the exact mineral, as well as agricultural, resources of their respective States.

"(3.) I conclude that you will not think it necessary for me to enlarge upon the 1st and 2nd questions, but perhaps your Committee may give some consideration to my views concerning the question whether the collection of mining statistics and the furnishing of information in regard to economic minerals ought to be the province of the Geological Survey, or of a 'separate and independent department or bureau.' To illustrate my views on the subject of geological science, I will quote from one of the works of a distinguished English writer on geological subjects: 'The study of geology presents itself in two great aspects—one purely scientific, and appealing to the intellect; another mainly practical, and appealing to the industrial necessities of life. In its scientific aim, it examines, maps out, and arranges the rocks of the earth's crust into formations and life systems according to their composition, relative positions and fossil contents; endeavoring to deduce therefrom a connected history of our globe and its successive aspects from the earliest to the most recent times. In its practical effort it takes advantage of this chronological arrangement of rock formations, and endeavors to discover in each those minerals and metals, their quality, quantity, and accessibility, which bear so directly on the acts and industries of civilized existence. Though thus apparently separate, the scientific and the practical cannot in reality be disjoined. The more exact our knowledge of the position and sequence of rock formations, the more certain our economic explorations become; and the more successful our industrial adventures, the greater will be the impetus given to the extension and exactitude of scientific research.' And again: 'There is no profession that comes so intimately in contact with geological phenomena, or stands so much in need of a knowledge of geological truths, as that of the miner and the mining engineer. It is true that mining was practised, and in many instances successfully, long before geology had shaped itself into a science, but even the most successful practice was local and limited, and wanted that grasp of general truths which could enable it to pronounce on other districts, and deal successfully with their altered phenomena. The discrimination of the same formation in distant localities, the varying nature of sedimentary deposits, the relations of the eruptive to the stratified rocks, and the laws regulating the direction, character and effects of faults, dykes and veins, these, and many kindred problems, can be solved only by a pretty extensive acquaintance with the facts and principles of geology. It is true that much in successful mining depends upon mechanical appliances—sinking, lifting, hauling, pumping and ventilation; but the most skilful appliances will not compensate for ignorance of the nature, position, variations, and interruptions of the substances the miner may be in quest of. It is in this way that a knowledge of geology

becomes of use to the miner and mining engineer, whether working among stratified deposits like those of the coal formation, or in metalliferous veins, like those which traverse the older formations.' To my mind there can be no other use for the Geological Survey of Canada, except that practical one of pointing out localities where minerals are found, their extent and mode of occurrence. This was the object in view when the Survey was organized, and it is only when it has so widely departed from its original purpose, and consequently become of the least practical utility to the country, that such attention is called to it as it is now receiving from your Committee, and from the public generally. If the Geological Survey of Canada is not to have the duty of collecting mining statistics and furnishing all necessary information in regard to minerals and their application, it would be difficult for me to understand the necessity of so great an outlay of money as is annually spent in its maintenance.

"It is perhaps chiefly required of me to give such information as I have acquired concerning the Geological Survey, and to point out what I conceive to be its defects. The duty is not wholly an agreeable one, for though I am greatly devoted to the study of geology and think to have attained to some proficiency therein, it is certainly an unpleasant task for a young man to criticise the acts of his seniors, especially where his criticisms are not above the suspicion of being influenced by personal prejudices. But I can assert that so far as it is possible for me to sink the person in the professor, I have done so, and what I have to say is said solely in the public interest and in the interests of true science.

"So far as I could learn during nearly six years' service on the staff of the Geological Survey, there was no recognized system of work, the individuals of the corps being guided largely by their own inclinations, and oftener hindered by the caprice than aided by the advice, skill and judgment of the Director. In the important matter of the selection of the field of work, no attention was paid by the Director to the practical question of the probable economic results to be derived from the examination of any particular locality; and frequently if work had been carried out in strict accordance with the instructions of the Director no practical results could possibly have been attained. And it was a matter of general observation that many admirable and highly important surveys had been only partially carried out, while many others of very little or no importance had been completed, with little to show for, frequently, a very large expenditure of money except, perhaps, a highly colored and inaccurate map or a wordy and unpractical report. And I wish to say here that, though I do not desire to make a scape-goat of Dr. Selwyn for all the shortcomings of the Department under his direction, I do believe and think I am able to show, that had the Director been at all competent, or, even being incompetent, had he possessed the slightest tact in the selection and management of men, the Survey would never have become so thoroughly disorganized; and that it is disorganized must be evident to all. I believe Dr. Selwyn to have no measure of fitness for the position he now holds. I know that he is deficient in the proper knowledge of stratigraphical geology, and so far as I am competent to judge, I believe he has but little information in regard to chemistry, mineralogy, and palæontology. As to his executive abilities, I have no high opinion; and in his treatment of his subordinates he was notoriously partial. Perhaps it will not be necessary for me to enlarge upon this subject, though if your Committee desire I can quote much to substantiate my statements. I will repeat, however, that the great defect in the present system of the Survey management is the want of a proper *head*.

"It has been said in evidence before you that there was too much topography being done by the Survey; but with a somewhat more intimate knowledge of this matter, as it relates to the present management of the Survey, than possessed by the witness referred to, I would submit that it is impossible to obtain too much accurate topography. Accurate topographical maps are the basis and absolutely necessary preliminary of accurate stratigraphical geology. But what the learned gentleman mistook for 'too much topography' is really nothing more than too much multiplication of useless and inaccurate maps. It is true, however, that too

much of the time of the geologists is spent in the preparation of their maps. Geologists are not necessarily draughtsmen, and even if they were their rough, hard work in the field rapidly destroys that peculiar delicacy of touch and flexibility of fingers, as well as steadiness of hand, so necessary for the finer work of draughting. The geologist ought to plot out his work on a large scale, but to the draughtsman belongs the task of compiling and reducing the work upon one plan and to one uniform scale. While I was on the Survey staff the geologists were expected, in most cases, to be their own map makers; while the regular draughtsman, always an eminently capable man, and whose duty it ought to have been to prepare all maps for publication, was engaged upon other work, that required but little skill and could have been done as well by any of the young men of the office. As a proof of what I state, I would refer you to a careful inspection of the published sheets of the geological map of New Brunswick, prepared by Mr. Ellis, partly assisted by myself. Neither of us possesses the draughting skill necessary for the preparation of a map on so small a scale, yet the first sheets of this map were given to the engraver as they left our hands, without being submitted to the examination of that most careful of draughtsmen, the late Mr. Robert Barlow, who was at that time on the Survey. Of these maps I can speak in the most positive terms, and I can say that so inaccurate are they that they ought never to have been published; though I cannot think any blame attaches to Mr. Ellis or myself in the matter, for we carried out the instructions of the Director, and the responsibility is his. I would say further, that under Sir Wm. Logan's management the maps of the Survey were standard maps, prepared with the greatest possible accuracy and remaining to day as the best maps in existence of the regions they illustrate; while *all* of the maps prepared *solely* under Dr. Selwyn's instructions are practically useless, or at the best faulty and inaccurate. Among all this mass of useless and expensive rubbish I can refer with pleasure to the geological and topographical maps of Mr. Hugh Fletcher. To my knowledge no such work as he has done has ever been attempted in Canada since the days of Sir Wm. Logan, and few could have done it so thoroughly as Mr. Fletcher. An inspection of his work, which, as well as of that of the other members of the staff, ought to be made by your Committee, will prove the correctness of my statements.

"Another great defect of the Geological Survey was the great disproportion between the indoor and outdoor staff, the former greatly outnumbering the latter. It is self-evident that this is the reverse of the proper arrangement. Of course, now, since the entire staff is on the Civil List, it is a matter of less consequence, but when the salaries, as well as the cost of explorations were paid out of the annual grant, the progress of the Survey was greatly hindered. But, even since this obstacle has been removed, there seems no real necessity of retaining the services of so many permanent indoor officials. I do not care, unsolicited, to make any individual references in this connection, and will only point out the simple, general fact.

"Want of sufficient and proper instruments greatly impeded the work of the field geologists. Those used by the Survey were, for the most part, purchased in the days of Sir Wm. Logan, and were mostly used up or damaged through accident or carelessness. Dr. Selwyn rarely trusted to the intelligence of his subordinates when they made requests for proper instruments, and they were generally put off by him with inferior ones, or refused them entirely. Unless new instruments were purchased last year, I consider that a new set should be purchased at once. In purchasing instruments some consideration should be paid to the opinions, or it may be, prejudices of the persons using them; for different persons prefer different styles of instruments in doing the same work, and if a man is suited in his instruments he cannot urge the contrary as a cause of any defect in his work. This principle, however, ought to be reasonably restricted, as it might be liable to abuse, though it is not apt to be.

"The present system of publishing reports has long been a matter of complaint. The large annual report, often delayed for more than a year in order that some particular report might be included in it, published as it is, at a great cost, and sold for a high price, has shown itself a signal failure in the only object it could possibly

attain—the dissemination of geological knowledge. Each report should appear separately, and as soon as possible, after the survey to which it refers, has been completed. It should be accompanied, if possible, by all maps that have been prepared for it, and it should contain all the chemical and paleontological notes that really belong to it. I mention this latter fact because it has come under my notice that chemical analyses have been published in a separate report, and not in their proper place, in connection with the geologists' full description of the rocks and minerals that have been analysed. This is not always possible, but cases have occurred where the rule could easily have been observed. No report should be withheld because the chief officer is not in accord with the views of the writer. When a geologist writes a report, of course he assumes the responsibility of it; and the Director should do no more than express dissent to the opinions of the writer in a prefatory note. Reports should have the freest possible circulation, and should be sold for a merely nominal price. The most practical, and hence the most useful geological reports with which I am familiar, are those of the Second Geological Survey of Pennsylvania, and they are prepared in this manner; and I have no doubt that the Canadian Survey could receive many very valuable hints from this Survey in other matters besides the reports. It is well, where possible, that reports on localities should be as full as possible, but this will sometimes cause too great delay, and in these cases preliminary reports should be prepared; for it should always be borne in mind that the first duty of the Survey is to serve the public, which can be best done by publishing the results of the surveys as early as possible.

“I fear my paper will attain too great a length if I continue to point out so many defects in the Survey, but before closing, I would like to make a few suggestions which may be of some service to you. And first, I would suggest that, in view of what has come to light in the investigations carried on by your Committee, it would be a proper thing for your Committee to point out to the House the advisability of making some enquiry into the causes which have led to the resignation of so many members of the staff; with a view, if possible, of having some, or all, of these officers reinstated. They were all competent and well trained men, mostly diligent and enthusiastic in their work; and in nearly every case the resignations from the staff have been the cause of the loss to the public of valuable information for which it has paid, and which it has a right to receive or know the cause of its suppression. If some of the resigned members of the Survey could be reinstated without compromising the dignity of Parliament, or the discipline of the Service, certainly the public will be the gainer.

“Whatever the composition of the staff, the prime object should be to make the Department in the highest degree practical. Attention should be paid to the character of soils as well as to the occurrence of minerals, and the purely scientific aspect of geology should only be kept in view so long as it helps to throw light upon upon the more important practical and economic object of the Geological Survey. It would, no doubt, facilitate the work of the Survey if some separation could be made of topography from geology, and in this way the geologist could have more time to devote to his special work; but the only real advantage to be thus gained is the advantage of time.

“It is sometimes necessary to abandon a survey temporarily, though it may be important, to engage in one of still greater importance. Neglect of this has conduced greatly to the disgust felt by mining engineers for the Geological Survey, as the staff were employed in some work of no real practical importance at the time highly important work was requiring their attention. I have known many instances of this, and have wondered that the public stood it so long.

“It seems to me unwise for any portion of the grant to the Geological Survey to be spent in ethnological studies. These studies are no doubt attractive, and in some ways important, but they have no manner of connection with the practical geology at present required in Canada. The kind of pictures illustrating reports seems to me not to be in accord with the objects of the Survey, and if no illustrations of a purely geological nature can be made, it would be better to save the expense altogether and

not publish any. Useless maps, too, have been published; maps that have no sort of reference to geological matters or matters connected with any branch of natural history.

"In regard to the appropriation for the Survey, I would say that I consider it ample if carefully and economically expended. I consider most of the present members of the staff highly efficient men, but some of them are strangers to me, and of them I do not speak. I have not gone into any great detail in my criticisms or suggestions, though I am prepared to do so if you desire it. I will simply say, in conclusion, that from the time I first became acquainted thoroughly with the Geological Survey of Canada up to the present, I have felt the deepest regret that so important a branch of the Civil Service should be so grossly mismanaged; that greater and more important results were not obtained for the large outlay of money and the number of skilled men employed. And above all, so far as I was personally concerned, I felt keenly the great injury being done to the science of geology in allowing one of the best Surveys in the world to become so degraded; and I would desire strongly to impress upon you the fact that the investigations now being held by you are quite as much in the interests of the development of science as in the interests of the people of Canada. I regret that I have been unable to incur the expense of a trip to Ottawa to appear personally before you, for I am satisfied that this paper is not as full as it should be, and that I have not brought out sufficiently strong many important matters. Many of my general statements require illustrations of particular things to impress them on the mind, and in this paper I have not cared to enter into those matters; but I have no doubt that from a variety of sources you have been able to obtain all the information which I have failed to supply. Thanking you for the honour you have done me in asking for my views on the Geological Survey of Canada, and regretting that I have responded so imperfectly to your request,

"I am, dear Sir, very sincerely yours,

"WALLACE BROAD."

"ROBT. N. HALL, Esq., M. P.,

"Chairman Select Committee House of Commons, Ottawa."

"GEOLOGICAL SURVEY OFFICE,

"DUBLIN, 4th April, 1884.

"SIR,—I have had the honour to receive your letter of the 18th of March, in which you ask for my opinion on three special points connected with the Geological and Mineral Surveys of the Dominion of Canada.

"First, As to the desirability of procuring and preserving mineral statistics. Upon this point I apprehend there can be no second opinion. The necessity for this was so urgently felt by our Government, that in or about the year 1854 a special department was organized under the charge of Mr. Robert Hunt, F.R.S., for collecting returns of the production, export and import, of coals and other minerals for the United Kingdom. The returns have been annually published and have proved to be of the utmost value, as showing the progress of mining industry in the United Kingdom and as bearing on the question of our mineral resources, a question which at some future time may have to be seriously considered in reference to the Dominion of Canada itself. On this subject I would beg to refer you to my work on the coal fields of Great Britain, &c., 4th edition, 1881. Stanford, London.

"Second, As to the desirability of calling attention to the various minerals of economic interest, &c. As to the desirability, this must also be admitted, probably the question as to the mode in which this can be done is the one of greatest importance. I am glad to know that in the Reports of Progress of the Canadian Geological Survey, the able Director, Doctor Selwyn, and his subordinates, give due attention to objects of economic value. If these reports are sufficiently circulated it becomes a question whether it is not more judicious for the State to leave to private enterprise the ques-

tions of the 'application, the extraction, and the treatment of the minerals themselves.' In my opinion this is so.

"Thirdly, Whether the work should be done in connection with the Geological Survey or by a separate and independent department. From what I have stated my reply would only bear upon the first of your questions. It seems to me desirable that there should be kept up a connection between any department for collecting mineral statistics and the Geological Survey, because the officers of the staff may have frequent opportunities of procuring such statistics and of forwarding them to the central office; at the same time, there should be one head of this department, who would be responsible directly to the Director of the Geological Survey and through him to the Government.

"I have the honour to be, Sir, your obedient servant,

"EDWARD HULL,

"*Director of the Geological Surveyor of Ireland.*"

"ROBERT N. HALL, Esq.,

"*Chairman of Committee, House of Commons, Ottawa.*"

"UNITED STATES GEOLOGICAL SURVEY,

"WASHINGTON, D.C., 12th April, 1884.

"SIR,—I have the honor to acknowledge your favor of the 13th ult., in which you requested to be furnished a list of records of mineral statistics published by the United States Government, and in which other questions relating to the collection and publication of mineral statistics are propounded. In reply thereto I beg permission to make the following statement:

"The reports of the United States Mining Commissioners began in 1866 with that of Mr. J. Ross Browne. In 1863 Mr. Browne was succeeded by Dr. Rossiter W. Raymond, who continued the publication of this series till 1876, in which year the appropriation was withheld. These reports, however, were limited in scope to the territory west of the Rocky Mountains and to the subject of gold and silver mining, with merely incidental reference to the working of quicksilver, argentiferous lead and copper deposits.

"In 1876 a series of statistical and descriptive papers were prepared by the American Commissioners at the Centennial Exhibition in Philadelphia.

"In 1878 Mr. James D. Hague was appointed a Commissioner to visit the Paris Exposition, and he subsequently published a short report on foreign mining industries—his monograph being included in the 'Reports of the United States Commissioners at the Paris Exposition.'

"In 1880 Mr. Horatio C. Burchard, Director of the Mint, began the publication of annual reports on the production of gold and silver in the United States. These are dated for the calendar years 1880, 1881 and 1882. One will be published for 1883 also.

"At the Sensus of 1880 a detailed examination of the mines was attempted under the direction of officers of the Geological Survey. The final reports are still in press, but I take pleasure in sending you a bulletin on the production statistics, issued in 1881.

"In 1882 the Geological Survey was authorized by Congress to collect and publish statistics of mines other than those of gold and silver. I send you our first report, entitled, "The Mineral Resources of the United States," prepared by Mr. Albert Williams, jun. As this includes a short chapter on gold and silver, it is the first comprehensive exhibit of the kind issued by Government.

"Referring now to the questions with which your letter concludes, I have the honor to make the following suggestions:—

"1. As to the desirability of procuring and preserving mineral statistics.'

"Many civilized nations have collected and published statistics of mines and mining, and the consensus of opinion expressed by statesmen, business men and publicists is that they are of direct and practical value. Simple statistics of production are much valued by merchants, manufacturers and miners; indeed the trades usually attempt the collection of such statistics through their organizations or representative journals, in cases where this is not done by Government. The knowledge of a country's mineral resources is of value to statesmen and to all who are interested in public affairs.

"2. 'As to the desirability of calling special attention to the various minerals of economic interest, their application, their extraction, and their treatment.'

"The value of mineral statistics is greatly increased if, in connection therewith, there be published such descriptive material as will give a knowledge of the existing state of the industries connected therewith, especially in regard to improvements in technical practice.

"The office through which the statistical reports are issued should serve as a bureau of information on subjects within its scope, to be freely accessible to citizens of the state for such matters as the determination of specimens, &c., and even for advice in cases which do not interfere with the interests of professional engineers, geologists and chemists.

"3. 'If desirable, whether the work should be done in connection with and as a subordinate department of the Geological Survey, or by a separate and independent department or bureau.'

"In reply to this question, I beg to express the opinion that the Geological Survey should be required to execute this trust, for the following reasons:

"(a) It is to be assumed that the gentlemen most competent to perform this task are employed in the Geological Survey as professional experts; and the reputation of the corps of gentlemen engaged in the Geological Survey of the Dominion fully warrants this assumption.

"(b.) The work of a geological corps has for its prime economic object the exposition of the conditions under which the mineral wealth of a country may be utilized, and while prosecuting such investigation the additional work of preparing the mineral statistics could be carried on at a slight increased cost compared with that necessary to maintain an independent bureau.

"(c.) The objections which statesmen may properly urge to the multiplication of official bureaux will be avoided thereby.

"I am, with great respect, your obedient servant,

"J. W. POWELL,

"*Director U. S. Geol. Survey.*"

"ROBERT N. HALL,

"Chairman Committee on Mining and Metallurgical Statistics,
"House of Commons, Ottawa, Canada."

(2 accompanying books.)

"UNIVERSITY OF THE STATE OF MISSOURI,

"COLUMBIA, Mo., 12th April, 1884.

"SIR,—Owing to accidental neglect, I have delayed, perhaps, until it is too late, to give my expression with regard to rendering the Canadian Geological Survey more efficient. I am thoroughly conversant with the work of the Canadian Survey, being myself a Canadian, and having held a Chair of Geology in one of the Canadian Universities, until called here by greater inducements than my country afforded.

"In this State there have been organized several Surveys, of whose reports copies will probably be found in the Geological Library at Ottawa; if not, I may be able to procure copies for it.

"The United States, since 1866, has had several Geological Surveys organized for the Territories, but they are now all consolidated and form a bureau, not only of

the Territories, but of the States, which undertakes to investigate geological questions irrespective of the investigation of localities. One of the features of the Canadian Survey (with a few exceptions) during later years, has been to send parties exploring all over a vast territory, with the general omission of special work, which will stand the tests of time. In fact, most of the recent work (for the last dozen years) can be considered only as a reconnaissance, and it will be necessary to go over it again, and in this way the usefulness of the work falls far short of its character prior to 1870.

"One of the most prominent features of the United States Survey has been to investigate principles and publish *memoirs* which render our Survey famous throughout the world, but which the Canadian Survey, in recent years, almost entirely lacks. (Being a Canadian, I feel justified in my criticism). The manner in which the reports are published falls far short of their greatest utility.

"I would suggest that there should be a department of mining statistics, under the direction of an assistant director of the Survey, whose duties will embrace the collecting of information on mining and quarrying, and economic minerals generally, and that the reports shall refer to each Province separately.

"The Survey should publish full monographs on Canadian fossils, whether of old or new species. Also, it should lend aid to special writers, and publish their works free of cost, as has been done by the United States Survey, as many of these studies would cost too much for private enterprise. At the same time, this character of expenditure would be of great service to the scientific world, and elevate the character of the Survey.

"These remarks do not apply alone to fossils, but in the various explorations collections of minerals should be made, and monographs on various departments of natural history should be published.

"There should be published, from the various reports already made, final reports on various subjects in each Province. These reports should not be a compilation of the various reports, nor a synopsis of them, but full reports on various subjects, with the verbose utterances left out, as referring to each locality.

"Further, the Survey should have more field officers in proportion to the house or home officers, and that while some of them may be engaged in general explorations, others should be occupied in making complete surveys of those localities which demand most immediate attention, or in investigating special subjects.

"I have the honour to be, your obedient servant,

"ROBERT N. HALL, Esq., M.P.,

"J. W. SPENCER."

"Chairman of Committee of Investigation of Canadian Geological Survey."

The Committee on the Survey of the Department of the Interior, which was established in 1870, was the first of its kind. It was organized to study the various lands owned by the Government and to report on their disposition. The Committee was composed of several members, including the Secretary of the Interior, and it held numerous public hearings. Its report, published in 1872, was a landmark document in the history of public lands management. It recommended that the Government should sell the lands to the highest bidder, and it provided a detailed account of the various lands and their uses.

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I have the honor to be, your obedient servant,
J. W. BURNETT
Secretary of the Interior

Committee on the Survey of the Department of the Interior
Washington, D. C.

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