DOMINION OF CANADA

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE

FISCAL YEAR ENDING MARCH 31, 1932

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1932

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To His Excellency Captain the Right Honourable the Earl of Bessborough, P.C., G.C.M.G., Governor General and Commander-in-Chief of the Dominion of Canada.

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency, in compliance with 6-7 Edward VII, chapter 29, section 18, the report of the work of the Department of Mines, for the fiscal year ending March 31, 1932.

W. A. GORDON,
Minister of Mines.

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REPORT

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DEPARTMENT OF MINES

FOR THE FISCAL YEAR ENDING MARCH 31, 1932

To the Honourable W. A. Gordon, K.C.,
Minister of Mines,
Ottawa.

Sir,—In accordance with the requirements of Parliament, I have the honour to submit the Annual Report of the Department of Mines for the year ending March 31, 1932.

The year 1932 marks the twenty-fifth anniversary of the creation of the Department of Mines under the authority of The Geology and Mines Act, 1907. The Act, by creating the Mines Branch, provided the technical assistance needed by a youthful industry, and for such expansion in allied activities as might be warranted by subsequent development. During this period of twenty-five years successive governments have extended, wherever and whenever possible, every legitimate assistance to the industry. The progress made during this time has fully justified the attitude that the Dominion Government originally adopted and has since maintained. Canada today has well-established mining and metallurgical industries whose ability to produce is still on the increase; and has resources that have seldom been equalled in any country. These industries find employment for a capital investment of nearly a billion dollars and absorb the labour of nearly a hundred thousand men. It is a further tribute to the wisdom and foresight of the founders of the department to observe that, notwithstanding the tendency towards multiplication of governmental activities that has been manifest during this period, the department, although it has been in the vanguard of those concerned with geology and mineral technology, has kept within the broad field envisioned at the time of its creation.

The year's activities of the department are reviewed in detail hereunder by the heads of each branch and division. These statements show that satisfactory progress has been made in carrying out the functions assigned to the department. In all branches difficulty has been experienced in meeting the demand for increased services and investigations both in field and laboratory. The need for the greatest economy has compelled the department to restrict its activities to those problems that are not only of urgent economic importance but also show some promise of yielding a return in the not too distant future. In the Geological Survey a larger number of field parties could have been usefully employed on the geological mapping of mineral-bearing formations and in general exploratory work. In the Mines Branch a much larger number of technical problems are continuously presented than can conveniently be undertaken with the available facilities. Field work in anthropology and biology, which in previous years has constituted the principal activity of the National Museum of Canada, had to be postponed altogether in 1931-32 owing to lack of funds.

The department has, however, by the application of the utmost economy, been able to maintain its more important economic services at the high level of previous years. Forty-one geological and topographical parties were placed in

the field in various parts of the Dominion, particular attention being paid to localities in which mineral discoveries had lately been made, or were quite likely to be made. An increase is noted in the amount of investigative work undertaken in the technological laboratories of the Mines Branch, notably in those of the Ore Dressing and Metallurgical Division in which the increased interest in gold mining operations is reflected. Mention might also be made of the practical results attending experiments on the separation, washing, sizing, and blending of Canadian coals reported by the Division of Fuels and Fuel Testing. Advantage has been taken by the Geological Survey and National Museum of the temporary reductions in field work to review the records of work undertaken in recent years, and to prepare for publication a number of reports that are mainly of scientific or technical importance.

Of the various investigations conducted during the year those connected with the development of the radium-bearing deposits of Great Bear Lake district in the Northwest Territories are of outstanding importance. Following the first reports, in the autumn of 1930, of the discovery of valuable minerals in this district, arrangements were immediately made for detailed topographical and geological surveys of the known mineral-bearing areas. These were undertaken by the Geological Survey in 1931, and early in 1932 a topographical map and a preliminary geological report were published and distributed to those interested. As it is now known that the mineral-bearing area is larger than was at first suspected, the geological work is being continued. In 1931, also, the area was examined by one of the mineral technologists of the Mines Branch, whose report on the mineral occurrences was immediately published. The possibilities of the area as a potential source of radium decided the Government to undertake an investigation to determine the most economic and practical method of recovering the valuable content of these ores. Considerable progress has been made in this work and very satisfactory results have already been obtained. Fuller details of this investigation, which is being continued in 1932-33, will be found below, in the report of the Division of Ore Dressing and Metallurgy. The demand for the department's publications continues to increase. The publication and distribution of reports constitute two of the principal activities of the department and two that are closely supervised by the administrative officers. The substance of these reports is usually of a technical character, for which only a limited field is available. A continued increase in the demand is, therefore, taken as an indication of growing interest in the department's contribution to the mineral industries.

The more important investigations conducted by the department during the year are described in detail in the summary reports, bulletins, maps, and memoirs published by the Geological Survey, the Mines Branch, and the National Museum. As in previous years much additional information of scientific, technical, and current interest was disseminated through the public and technical press, and by means of addresses by members of the staff. A selection of these papers and addresses is listed on pages 6 to 9. The lectures series on natural resources and kindred subjects, which for years has featured the National Museum's educational activities in Ottawa, was continued during the winter months. A descriptive statement of this feature with a classified list of the lectures delivered during the period 1922-1931 is given in the Annual Report of the National Museum for 1930. The fortnightly newsletter service, now in its ninth year, continued to report current developments in the mining and metallurgical industries throughout the Dominion and was distributed through the Office of the High Commissioner in London to the technical and financial press and to mining, banking, and investment houses in the United Kingdom and on the Continent. The titles of the articles dispatched during the year follow the list of papers and addresses mentioned above.

The department has again to acknowledge the co-operation of various Dominion and provincial government departments, development branches of both large railway systems, banks, chambers of commerce, and other organizations actively interested in the development of mineral resources. As in former years close co-operation was also maintained by the department with the Office of the High Commissioner in London, the Imperial Institute (London), the British Department of Scientific Research, the United States Bureau of Mines and Geological Survey, and with certain scientific and technical societies in the United States.

In addition to his departmental duties, the Deputy Minister served during the year as Chairman of the Dominion Fuel Board, the main activities of which are stated below. He also served on the following official bodies: Council of the Northwest Territories; Advisory Committee on Mining Regulations; National Research Council and several of its associate committees; Special International Niagara Board; Canadian Committee of the World Power Conference; and Advisory Committee on Minerals of the Imperial Institute. With the Minister of Mines he travelled to the Pacific coast in November, 1931, visiting a number of the western mining camps en route. In August, 1931, he accompanied Lieutenant-General Sir William Furse, K.C.B., D.S.O., Director of the Imperial Institute, London, on a visit to the mining districts of northern Ontario and western Quebec. In July, 1931, he presided over the Biological Conference convened at Matamek, Que., by Mr. Copley Amory of New York City, which was attended by a group of prominent scientists from various countries, at which cyclical fluctuations in wild life and other biological problems of scientific and economic interest were discussed. Visits were made by the Deputy Minister to mining districts in various parts of central and eastern Canada, and in September, 1931, a short visit was made by the Assistant Deputy Minister to the Michipicoten, Goudreau, and Sudbury mining districts of Ontario.

Of the different developments in Canadian mining during the year none, probably, surpasses in general interest those reported from Echo Bay district at the eastern end of Great Bear lake, Northwest Territories, in which promising discoveries of radium-bearing minerals and native silver have been made, to which a reference appears above. General economic conditions favouring the gold mining industry stimulated the search for and development of gold properties, and resulted in an appreciable increase in production.

In common with those of other countries, although it is believed to a lesser degree, the Canadian mining and metallurgical industries have not escaped the apparently world-wide effects of the current industrial depression. In 1931 the total value of Canada's mineral production amounted to $227,456,365, a decrease of 18·7 per cent from that of the previous year. However, as prices in 1931 were in many cases considerably lower than in 1930 the drop in value does not imply an equal reduction in volume or quantity output. The largely increased gold production has to some extent offset the lower output of base metals and non-metallics, and has contributed to a corresponding improvement in the general credit situation of the country. In the base metal field, in which Canada has in recent years taken a prominent place, no improvement in the market situation has been made during the year, and recent events, more particularly associated with the copper situation, have emphasized the desirability of a preferential market within the Empire for Empire-produced metals.

The most encouraging feature is the resistance shown by all branches of the mining and metallurgical industries against the trend towards curtailment of production, and their ability to continue to produce in the face of adverse economic conditions. Throughout these industries there is the feeling that present conditions are temporary as well as sub-normal, and confidence that the maintenance of modern civilization demands the increasing use of iron and steel,

copper, nickel, lead, zinc, and non-metallic minerals in industrial fields, with a constantly expanding use of the rarer minerals in the field of science and research.

Canada is one of the few new countries of the world to possess known large resources of minerals, and during the past decade a number of large deposits have been brought into production. The experience of the past year or so has shown that these deposits can be operated at a cost low enough to enable Canadian producers in these difficult times successfully to compete in the world markets. Canadian producers are themselves confident of profitably operating these resources. In the last five years they have spent millions of dollars in their development; huge plants have been built to treat and concentrate the ores, and modern smelting and refining equipment has been installed to process further the resulting product. As a result of these various activities the Dominion can at any time rapidly increase her mineral production and this increase may be expected just as soon as a larger output is justified by general economic conditions.

Dominion Fuel Board

Eight meetings of the Dominion Fuel Board were held during the fiscal year. Many sub-committee meetings were also held to deal with special problems brought before the Board.

During the year the Chairman and Secretary attended conferences with coal mine operators and coal distributors in the various centres, in connexion with questions relating to the movement of Canadian coal under Government assistance and for the purpose of examining proposals for adjustments in the rates of assistance. The question of enabling coal for railway use to be moved under assistance was also considered at these conferences and the possibility of promoting the use of a larger proportion of Canadian coal in certain industries using foreign coal almost entirely was included in the discussions.

In September and October, 1931, the Secretary made a survey of the maritime coal fields. An inspection was also made of the additions to a coking plant in Halifax operating under the benefits of the Domestic Fuel Act. In February, 1932, the Chairman and Secretary gave evidence before the Duncan Royal Commission investigating the maritime coal industry.

At the end of May, 1931, six new Orders in Council providing assistance to the coal trade came into force, four of the Orders in Council previously in force expired. The Dominion Fuel Board was in each case charged with the administration of the new Orders in Council. This administrative work has increased threefold during the year. More than three-quarters of a million tons of coal were actually moved under assisted rates during the fiscal year, involving a cost for assistance of approximately $556,000. Through the assistance, Canadian coal from the Maritime Provinces was placed in a position to compete with imported coals at points as far west as Brockville in Ontario, and western Canadian coals obtained almost complete control of the market in Winnipeg.

Under the test freight rate of $6.75 a ton, Alberta coals continued to be shipped to many points in Ontario for domestic purposes; during the fiscal year 24,144 tons were so moved, at an approximate cost for assistance of $53,600.

The coal mining industry in the coastal regions of British Columbia has been able to take advantage of the bonus offered for coal sold for ships' bunkers and for export to countries other than the United States, a total of 76,499 tons having been so shipped during the fiscal year, at a cost to the Federal Government, for assistance, of $27,196.

The Domestic Fuel Act (1927) continued to be administered by the Dominion Fuel Board. A supplementary agreement was completed with a coking plant in Halifax, N.S., already operating under the act, and now extending its plant. An agreement in connexion with a proposed coking plant in Vancouver, B.C., was under negotiation at the close of the fiscal year.

The annual survey of fuels used for domestic heating conducted for the Board by the Mineral Resources Division of the Department of Mines, was again carried out.

During the year a detailed study was made of the costs of mining at all the chief coal mines of Canada. Mine operators throughout the country provided most generous co-operation in this survey. The information obtained has been of great value to the Board.

A comprehensive study was made of the schemes of assistance rendered the coal industry by the Governments of the various coal-producing countries of the world, and the effects of such assistance upon the industry in general. This study has assisted materially in the consideration of policies of assistance to the industry in Canada.

The Board again takes pleasure in acknowledging gratefully the whole-hearted co-operation of the coal mining industry, of numerous individuals throughout Canada, and of many Government departments.

Your obedient servant,

CHARLES CAMSELL,
Deputy Minister.

OTTAWA, ONT., September 1, 1932.

List of Papers and Addresses

NOTE: Lists of the papers prepared and addresses delivered during the year by members of the staffs of the Divisions of Anthropology and Biology are to be found in the Annual Report of the National Museum of Canada.

General

Canadian Mining Industry, by Hon. W. A. Gordon. Canadian Club, Hamilton, April 27, 1931.

Steadiness and Stability of Canada's Mining Advance, by Hon. W. A. Gordon. Northern Miner, July 9, 1931.

Gold Mining in Northern Ontario and Quebec, by Hon. W. A. Gordon. Ottawa Journal, Northern Ontario Number, October 25, 1931.

Mineral Development in Canada, by Hon. W. A. Gordon. Canadian Club, Morrisburg, October 29, 1931.

Mining Industry and Government, by Hon. W. A. Gordon. Annual Western Meeting, Canadian Institute of Mining and Metallurgy, Vancouver, November 27, 1931.

Canadian Mining Industry, by Hon. W. A. Gordon. Toronto Saturday Night, Annual Mining Review, December 1d, 1931.

Canada's Mining Industry, by Hon. W. A. Gordon. Toronto Globe, Financial Review, January 4, 1932.

Canadian Mining Industry, by Hon. W. A. Gordon. "Canada", New Year Number, January, 1932.

Canada's Mining Industries, by Hon. W. A. Gordon. Electrical News and Engineering, Toronto, March, 1932.

Canada's Position in the Mineral Situation of the British Empire, by Charles Camsell. Presidential Address, Royal Society of Canada, Annual Meeting, May 20, 1931; reprinted Canadian Defence Quarterly, October, 1931.

Future of Mining and Mineral Development of Canada, by Charles Camsell. National Association of Purchasing Agents, Toronto, June 6, 1931.

How the Geologist Fills our Purse, by Charles Camsell. Radio Broadcast CNRO, Ottawa, September 9, 1931.

Canada's Mineral Situation in Relation to the British Empire, by Charles Camsell. University Club, Ottawa, October 8, 1931.

Mining Industry of Canada, by Charles Camsell. Toronto Mail and Empire, Prosperity Number, November 28, 1931.

Changing Aspects of Canada's Mining Industry, by Charles Camsell. Canadian Club, London, January 20, 1932.

Canada's Position in Relation to the World's Metal Markets and Particularly to the British Empire, by Charles Camsell. Sudbury Branch, Canadian Institute of Mining and Metallurgy, February 27, 1932.

Some Aspects of Canada's Mineral Industry, by Charles Camsell. Financial Times, Montreal, March 11, 1932.

Mineral Situation of the British Empire, by Charles Camsell. Western Annual Meeting, Canadian Institute of Mining and Metallurgy, Vancouver, November 27, 1931; Canadian Mining and Metallurgical Bulletin, February, 1932.

Dominion Department of Mines and the Mining Industry, by L. L. Bolton. Rotary Club, Smiths Falls, April 17, 1931.

Explosives—Danger, by L. L. Bolton. Radio Broadcast CNRO, Ottawa, November 17, 1931.

Review of the Canadian Mining Industry, 1931, by L. L. Bolton. Montreal Gazette, Commercial and Financial Review, January 2, 1932.

Field Work of the Geological Survey, 1931, by W. H. Collins. Professional Institute Bulletin, September, 1931.

Geology, Mineralogy, Mining, and Mineral Resources

Batholiths, by Charles Camsell. Radio Broadcast, Toronto, May 20, 1931.

Economic Geology of Canada, 1929, by P. J. Moran. Canada Year Book, 1931.

Recent Developments in Geology, by J. F. Walker. Western Branch, Canadian Institute of Mining and Metallurgy, November, 1931.

Geology of Placer Deposits, by W. E. Cockfield. Canadian Mining and Metallurgical Bulletin, February, 1932.

Life in the Precambrian of the Canadian Shield, by M. E. Wilson. Transactions Royal Society of Canada, 1931, Sec. IV.

Earliest Geological Map in Canada, by E. M. Kindle. Canadian Mining Journal, November, 1931.

Geology of the Likely Quadrangle, by W. E. Cockfield. Western Branch, Canadian Institute of Mining and Metallurgy, November, 1931.

Mining in Portland Canal Area, B.C., by George Hanson. Stewart News, November, 1931.

Occurrences of Marine Triassic in Southern Yukon, by W. E. Cockfield and E. J. Lees. Transactions, Royal Society of Canada, 1931, Sec. IV.

General Features of the Geology in the Vicinity of the Fairview Mining Camp, Similkameen District, B.C., by H. S. Bostock. Bulletin No. 1, 1932, British Columbia Department of Mines.

Defining the Mineral Zones of Northern British Columbia, by F. A. Kerr. Canadian Mining and Metallurgical Bulletin, August, 1931.

Gold in Northern British Columbia, by F. A. Kerr. Canadian Mining Journal, October, 1931.

A Tin-Silver Vein at Snowflake Mine, B.C., by H. C. Gunning. Economic Geology, March-April, 1931.

Lightning Peak Camp, by C. E. Cairnes. Canadian Mining Journal, August, 1931.

Stratigraphy and Structure of the Corbin Coalfield, B.C., with Notes on Mining Development and Preparation of Coal for Market, by B. R. MacKay. Annual Western Meeting, Canadian Institute of Mining and Metallurgy, November, 1931; Canadian Mining and Metallurgical Bulletin, November, 1931.

Natural Gas and Petroleum Prospects in the Prairie Provinces of Canada, by G. S. Hume. Canadian Gas Association, Montreal, June, 1931.

Geology in Relation to the Search for Oil in Western Canada, by G. S. Hume. Oil and Gas Association, Calgary, June, 1931.

Oil Prospects of Great Slave Lake and Mackenzie River Areas, by G. S. Hume. Canadian Mining and Metallurgical Bulletin, March, 1932.

Terminal Moraines of the Pleistocene Ice-sheets in the Jumpingpound-Wildcat Hills Area, Alberta, by D. A. Nichols. Transactions, Royal Society of Canada, 1931, Sec. IV.

Moraines and Glacial Lakes in Southern Saskatchewan and Southern Alberta, by W. A. Johnston and R. T. D. Wickenden. Transactions, Royal Society of Canada, 1931, Sec. IV.

An Area of Little or No Drift in Southern Saskatchewan, by R. T. D. Wickenden. Transactions, Royal Society of Canada, 1931, Sec. IV.

Ontario Iron Ore Deposits; Sudbury District; North Shore of Lake Huron and the Correlation of the Precambrian, by W. H. Collins. Queen's University, December 4 and 5, 1931.

Silver Deposits of Thunder Bay District; Immiscibility in Silicate Melts; Iron Ranges of the Lake Superior Region, by T. L. Tanton. Queen's University, January 14 and 15, 1932.

Grenville Subprovince; Mineral Deposits of the Grenville Subprovince; Provincial and Subprovincial Limitations of Correlation in the Precambrian of the Canadian Shield, by M. E. Wilson. Queen's University, March 3 and 4, 1932.

Story of the Rouyn Copper Deposits; Geology of Thetford Area; Relation of Geology to Mining, by H. C. Cooke. Queen's University, March 10 to 12, 1932.

Anomalous Grain Relationships in the Caldwell Quartzites of Thetford District, Que., by H. C. Cooke. Transactions, Royal Society of Canada, 1931, Sec. IV.

Geology of New Brunswick and Gaspe, by F. J. Alcock. Canadian Mining Journal, March, 1932.

Relationship of the Devonian and Silurian in Gaspe Peninsula and Northern New Brunswick, by F. J. Alcock. Transactions, Royal Society of Canada, 1931, Sec. IV.

Preliminary Note on Ashtonite, Penticton, B.C., by Eugene Poitevin. American Mineralogist, March, 1932.

Uraninite from Huron Claim, Winnipeg River Area, Southeastern Manitoba, by J. S. DeLury and H. V. Ellsworth. American Mineralogist, December, 1931.

Uraninite from Henvey Township, Parry Sound District, Ontario, by H. V. Ellsworth. American Mineralogist, December, 1931.

Monazite Coloured by Carbon from Dickens Township, Nipissing District, Ontario, by H. V. Ellsworth. American Mineralogist, January, 1932.

Gadolinite from Loughborough Township, Frontenac County, Ontario, by H. V. Ellsworth. American Mineralogist, March, 1932.

Abrasives, by V. L. Eardley-Wilmot. Mineral Industry, 1930.

Diatomite, by V. L. Eardley-Wilmot. Mineral Industry, 1930.

Diatomite, by V. L. Eardley-Wilmot. Canadian Mining Journal, September, 1931.

Diatoms, by V. L. Eardley-Wilmot. Ottawa Microscopic Society, May, 1931.

Stanstead Granite Industry, by L. H. Cole. Canadian Mining Journal, July, 1931.

Quarrying and Dressing Stanstead Granite, by L. H. Cole. Canadian Mining Journal, August, 1931.

Quarrying and Transporting Limestone in Canada, by M. F. Goudge. Engineering and Mining Journal, November 9, 1931; Engineering and Mining World, December, 1931.

Limestone Our Most Useful and Interesting Rock, by M. F. Goudge. Radio Broadcast CNRO, Ottawa, February 3, 1932.

Modern Hewers of Stone, by M. F. Goudge. Editors' Group, Professional Institute of Canada, January 21, 1932; Gyro Club, Ottawa, February 17, 1932.

Pitchblende and Silver Deposits of the Great Bear Lake Region, Northwest Territories, by W. B. Timm. Manitoba Branch Canadian Institute of Mining and Metallurgy; Winnipeg Board of Trade and Manitoba Chamber of Mines, Winnipeg, December 14, 1931; Thunder Bay Chamber of Mines, Fort William, December 15, 1931.

Pitchblende and Silver Discoveries at Great Bear Lake, by H. S. Spence. Canadian Institute of Mining and Metallurgy, Ottawa, November 10, 1931.

Radium at Great Bear Lake, by H. S. Spence. Canadian Institute of Mining and Metallurgy, Vancouver, November 27, 1931; repeated at Noranda, Trail, Winnipeg, and Fort William, November and December, 1931.

Radium and Silver at Great Bear Lake, by H. S. Spence. Geological Society of Washington, February 10, 1932; Annual Meeting, American Institute of Mining and Metallurgy, New York, February 16, 1932; Geological Society of Boston, February 19, 1932; Mining and Metallurgy, March, 1932.

Silver and Pitchblende Discoveries in the Great Bear Lake Area, by H. S. Spence. Canadian Institute of Mining and Metallurgy, Montreal, January 26, 1932.

A Pinch of Salt, by L. H. Cole. Men's Club, St. George's Church, Ottawa, March 21, 1932.

Suitability of Certain Sands for Use in Sandblasting, by L. H. Cole. Canadian Ceramic Society, Toronto, February 23, 1932.

Fuels and Fuel Testing

Characteristics and Classification of Canada's Coals, by R. E. Gilmore. National Association of Purchasing Agents, Toronto, June, 1931; Western Canada Coal Review, November and December, 1931.

Review of Field Investigations, by P. V. Rosewarne. Natural Gas Symposium, Ottawa Branch of the Society of Chemical Industry, March 17, 1932.

Development and Present Status of the Turner Valley Field, by W. P. Campbell. Natural Gas Symposium, Ottawa Branch of the Society of Chemical Industry, March 17, 1932.

Western Coal Situation, by F. G. Neate. B. C. Chamber of Mines, Vancouver, August, 1931.

Subvention Excluding More American Coal, by F. G. Neate. Western Canada Coal Review, September, 1931.

Review of Coal Situation, 1931, by F. G. Neate. Montreal Gazette, December, 1931.

Review of Movement of Western Coals into Manitoba Market, by F. G. Neate. Northwest Coal Dealer, December, 1931.

Ore Dressing and Metallurgy

Metallurgy of Gold, by C. S. Parsons. Canadian Mining Journal, July, 1931.

Some Problems in the Control of the Flotation Process, by C. S. Parsons and A. K. Anderson. Canadian Chemical Association, Montreal, May, 1931.

Some Problems in the Treatment of Gold Ores, by the Staff of the Ore Dressing Division. Canadian Mining and Metallurgical Bulletin, November, 1931.

Treatment Processes for the Extraction and Recovery of Radium from Radioactive Ores, by R. J. Traill. Canadian Institute of Mining and Metallurgy, Ottawa, November 10, 1931.

Machining of Steel Is Conditioned by the Quality of the Metal, by H. H. Bleakney. Iron Age, New York, December, 1931.

Ceramics and Road Materials

Federal Department Helps Canadian Clay Industries, by Howells Frechette. Northern Miner, July 9, 1931; Clay Products News and Ceramic Record, January, 1932.

Outstanding Developments in the Science and Industry of Ceramics, by J. G. Phillips. Canadian Ceramic Society, Toronto, February 23, 1932.

Soluble Salts in Clays, by L. P. Collin. Canadian Ceramic Society, Toronto, February 22, 1932.

Methods of Controlling Dust on Highways, by John McLeish. Canadian Good Roads Association, Lucerne-in-Quebec, September 22, 1931; Contract Record and Engineering Review, September 29, 1931; Canadian Engineer, September 29, 1931.

Qualities a Road Stone Should Possess, by R. H. Picher. Roadmaker, vol. 5, No. 4.

Physiography and Topography

Mammillary Mounds of the Bonnechère Valley, by M. E. Wilson. Canadian Field Naturalist, March, 1932.

Scow Brigade on the Athabaska, by F. J. Alcock. Canadian Geographical Journal, February, 1932.

Western Canadian Arctic and Mackenzie River Country, by K. G. Chipman. Rotary Club, Hawkesbury, March 16, 1932.

Interest of Geography, by K. G. Chipman. Women's Club, Hawkesbury, Ontario, March 16, 1932.

Exploratory Surveys at Great Bear Lake, 1931, by R. C. McDonald. Dominion Land Surveyors Association, Ottawa, February 4, 1932.

Studies of the Physiography of the Canadian Shield. III. The Pre-Pliocene Physiographies as Inferred from the Geologic Record, by H. C. Cooke. Transactions, Royal Society of Canada, 1931, Sec. IV.

Esker at Tweed, Hastings County, Ontario, by M. E. Wilson. Canadian Field Naturalist, May, 1931.

The Laurentian Mountains, by A. H. Lang. British Press, through Dept. of Immigration and Colonization, November, 1931.

Palæontology

Notes on Baffinland Fossils, by A. E. Wilson. Transactions, Royal Society of Canada, 1931, Sec. IV.

What Fossils Are Good for, by E. M. Kindle. Canadian Mining Journal, March, 1932.

A New Viewpoint in Palæontology, by E. M. Kindle. Transactions, Royal Society of Canada, 1931, Sec. IV.

Ripple Marks in the Lower Palæozoic of the Ottawa Valley, by M. E. Wilson. Canadian Mining Journal, April, 1931.

Dinosaurs, by L. S. Russell. Radio Broadcast CNRO, Ottawa, March, 1932.

Mining Newsletter Series

(Distributed from the Office of the High Commissioner for Canada in London)

Canadian Granite Used Extensively Throughout the Country, by L. H. Cole.

Iron Ore in Ontario, by T. L. Tanton.

Sodium Sulphate Production from Western Canada Makes Rapid Strides during 1930, by L. H. Cole.

Lightning Peak Camp, British Columbia, by C. E. Cairnes.

Marble Industry in Canada, by M. F. Goudge.

Relation of the Geological Survey, Canada, to the Mineral Industry, by W. Malcolm.

Salt Industry in Canada, by L. H. Cole.

Field Work of the Geological Survey, Canada, 1931, by W. Malcolm.

Investigations of the Mines Branch, 1931, by J. McLeish.

Economic Geology Series of Reports, by W. Malcolm.

Mineral Industry of Nova Scotia, by A. Buisson.

Gold Mining in Canada, by F. A. Kerr.

Review of the Mineral Industry of New Brunswick, by A. Buisson.

Investigations of the Geological Survey in Northern Canada Facilitated by Use of Airplanes, by W. Malcolm.

Michipicoten Mining Area of Northern Ontario, by L. L. Bolton.

Pitchblende and Silver at Echo Bay, Great Bear Lake, Northwest Territories, by D. F. Kidd.

Gold Mining in Eastern Canada, by A. H. A. Robinson.

Oil Developments in Western Canada, by G. S. Hume.

Salt in Western Canada, by L. H. Cole.

Portland Canal Area, British Columbia, by Geo. Hanson.

Canadian Sands Prove Satisfactory for Sandblasting, by L. H. Cole.

Brief Review of Mining in Western Quebec During 1931, by A. H. Lang.

Gold Mining in Western Canada, by A. H. A. Robinson.

Summary Reports of the Geological Survey for 1930, by W. Malcolm.

Volcanic Dust Forms Basis of a Growing Industry in Saskatchewan, by L. H. Cole.

Valuable Deposits of Salt in Maritime Provinces, by G. W. H. Norman.

GEOLOGICAL SURVEY

W. H. Collins, Director

CHANGES IN STAFF AND ORGANIZATION

The Geological Survey this year (1932) completes the ninetieth year of its existence. It is the oldest organization in the government service of Canada concerned with scientific investigation of the natural resources of the country, and is associated in the most intimate and diversified manner with the development of the country. Anyone who desires to know more about its origin, history, and work can obtain, by applying to the Director, two articles entitled "The Geological Survey of Canada" and "The National Museum of Canada" that deal with these matters up to the year 1929.

No additions were made to the staff during the fiscal year 1931-32, and two members, C. O. Senecal and J. A. Robert, were superannuated. Mr. Senecal, who retired on August 24, 1931, had been continuously connected with the Geological Survey since January 3, 1890. Beginning as a draughtsman, he succeeded the late James White as Geographer and Chief of the Draughting Division in 1899. Mr. Senecal undoubtedly deserves to be included in the select group of men whose ability and devotion to the Geological Survey distinguishes it among scientific institutions of its kind. He developed the process of colour lithography now used for Geological Survey maps, published several useful articles on map projections, and was a member of the Geographic Board of Canada.

FIELD AND OFFICE WORK

In accordance with the need for reduction of expenditures throughout the Government service, the field work of the Geological Survey was unavoidably reduced in 1931. Forty-one parties were sent out as compared with fifty-six in 1930. Work was confined largely to surveys and investigations of a necessary or economic character; particular attention was given to gold, one of the few products of the mineral industry not adversely affected by business conditions, and also to petroleum and some other minerals that Canada needs to import from other countries. The various surveys and investigations undertaken are detailed in following sections of this report.

GEOLOGICAL DIVISION

G. A. Young, Chief Geologist, reports as follows:

Yukon

H. S. Bostock and E. J. Lees completed the geological and topographical mapping of Laberge 4-mile quadrangle (latitudes 61° to 62°, longitudes 134° to 136°). A report by Mr. Bostock on the Livingstone Creek placers appears in Summary Report 1931, Part A; preparation for publication of the geological and topographical map of the Laberge quadrangle is now under way. Mr. Bostock also investigated a discovery of lode gold about 50 miles northwest of Carmacks and has given an account of the discovery in Summary Report 1931, Part A.

British Columbia

George Hanson continued a geological investigation of the Portland Canal mining field. His work largely lay in the territory about the head of Bowser river and in Summary Report 1931, Part A, he gives an account of some of the

promising mineral discoveries recently made in that district. The Portland Canal mining field comprises several mineralized areas. Mr. Hanson's objectives are: to investigate the origin and geological relationships of these deposits in their bearing upon prospecting and mining operations, and to map areas favourable for prospecting. Field work will be concluded in 1932, following which it is proposed to prepare a full report, a 4-mile geological map of the field and 1-mile sheets of portions where a larger scale is needed.

W. E. Cockfield carried out three geological investigations in and near Cariboo district. He investigated a portion of Fraser River valley between Quesnel and Soda Creek, where some drilling for petroleum has been undertaken. A report on the petroleum prospects of this district is published in Summary Report 1931, Part A. Mr. Cockfield also made a special geological examination of an area in the vicinity of the more important lode gold deposits on Cadwallader creek, Bridge River district. The results obtained are presented in Summary Report 1931, Part A. They have a direct bearing on mining development work in this important gold camp. His main work was in the Cariboo placer gold area. In continuation of work done by Johnston and Uglow (Memoir 149) he began a survey of the bedrock formations, from which the gold must have been derived, and a study of the topography and glacial deposits, under which the placer-bearing stream deposits are concealed. To facilitate these investigations, especially the latter, vertical aerial photographs were taken by the Royal Canadian Air Force, Department of National Defence, in 1929 and 1930, of six 1-mile quadrangles, between latitudes 52° 15′ to 53° and longitudes 121° to 122°. Control surveys for converting the photographs into 1-mile maps were commenced by the provincial Department of Lands in 1931.

H. C. Gunning commenced geological investigations of an area in northern Vancouver island that forms a part of a 2-mile map-area between latitudes 50° to 50°30′ and longitudes 126° to 127°. Promising discoveries of copper, lead-zinc, iron, and other metals have been made. A report presenting some of the more important results of field work in Nimpkish Lake area is given in Summary Report 1931, Part A. Mr. Gunning also examined a recent lead-zinc discovery near Port Hardy and gives an account of it in Summary Report 1931, Part A.

C. E. Cairnes investigated the mineral possibilities of the country around the north end of Okanagan lake. Placer gold, lode gold, coal, and other mineral deposits have been found in the district. They are described in considerable detail by Mr. Cairnes in a report in Summary Report 1931, Part A. Surveys for a 2-mile geological map of the quadrangle between latitudes 50° to 50°30′ and longitudes 119° to 120° were also commenced jointly by Mr. Cairnes and S. S. Holland.

J. F. Walker completed the geological mapping and investigation of the mineral deposits in Salmo 1-mile quadrangle (latitudes 49° to 49°15′, longitudes 117° to 117°30′). Two types of mineral deposits, one yielding gold, the other lead and zinc, have been mined in this quadrangle and considerable prospecting is still done. A full report and geological map are being prepared.

C. S. Evans began geological mapping and investigation of the mineral possibilities of Cranbrook 1-mile quadrangle (latitudes 49°30′ to 49°45′), longitudes 115°30′ to 116°). The area contains numerous discoveries of lead-zinc ores, gypsum, and iron ore. Further field work is necessary before a report and map can be prepared.

Alberta

B. R. MacKay made a detailed geological survey of the Hillcrest coal mining field in order to provide the mining companies with information about structural and other geological features that constitute some of their mining problems. A hand-coloured geological map on a scale of 1 inch to 800 feet, a sheet of geo-

logical sections on the same scale, and a model showing the geology in all three dimensions have been made for the companies interested. A map, sections, and report have been prepared for publication. Mr. MacKay also examined in detail various sections of the Palæozoic and Mesozoic strata in the district about Hillcrest, for the purpose of securing information that would be of value to those who are engaged in the search for petroleum in the region east of the Rocky mountains. The information thus gained has been published in Summary Report 1931, Part B. He also examined and collected samples of coal from a series of mines across southern Alberta, this work being done in connexion with a classification of coals being made in collaboration with the National Research Council.

G. S. Hume made a detailed survey of the structure and stratigraphy of Two Pine and Fisher Creek areas in the vicinity of Turner Creek oil and gas field. A report, giving the results of his work, appears in Summary Report 1931, Part B. Geological plans on a scale of 1 inch to 200 feet have been supplied to companies and others interested in the development of these structures.

L. S. Russell investigated the geology of various places in Alberta south of latitude 52° with a view to solving questions that have arisen regarding the succession and lateral variation of the strata, matters of very considerable importance to those who are drilling for oil and gas. These results are being embodied in a new edition of the Calgary 8-mile sheet. Mr. Russell also made a careful geological examination of a part of the Blood Indian reserve near Lethbridge where test drilling has been done by companies investigating the area as a possible petroleum field. A report on this area is contained in Summary Report 1931, Part B.

Saskatchewan

F. H. McLearn completed a geological survey of part of the province south of latitude 52°. It is expected that Mr. McLearn's work, begun in 1928, will result in the production of an 8-mile geological map (Regina sheet) and a report dealing with the geology of the region.

R. T. D. Wickenden and D. C. Maddox continued a systematic survey of the Pleistocene and Recent formations (soils) in Regina map-area. This work, which will constitute a basis for soil surveys, for investigation of road materials, building materials, and other non-metallics, and for underground water supply, will be continued in 1932. They also commenced a survey of an artesian water area west of Moose Jaw. A preliminary report upon the latter is given in Summary Report 1931, Part B.

Manitoba

J. F. Wright geologically explored the Oxford House 4-mile quadrangle between latitudes 54° and 55° and longitudes 94° and 96°. The adjoining Cross Lake quadrangle (latitudes 54° to 55°, longitudes 96° to 98°) was in part geologically surveyed by H. C. Horwood under the direction of Mr. Wright. These areas are a part of the Canadian Shield and contain several areas of schists and sedimentary rocks large enough to deserve to be prospected for metalliferous deposits. A report by Mr. Wright on the Oxford House quadrangle appears in Summary Report 1931, Part C.

S. R. Kirk completed a geological survey of the Palæozoic and Mesozoic strata in the province south of latitude 52°. The results of this work will permit the preparation for publication of an 8-mile geological map (Winnipeg sheet).

Northwest Territories

D. F. Kidd commenced geological mapping and investigation of the mineral resources of a region extending east and northeast of Great Bear lake. A report, published in Summary Report 1931, Part C, gives an account of the important discoveries of silver, pitchblende (radium ore), and copper already made in the region. Field work will be continued in 1932.

C. H. Stockwell concluded the geological exploration of a basin of sedimentary strata bordering the east arm of Great Slave lake. A preliminary report appears in Summary Report 1931, Part C. An 8-mile geological map of the region between latitudes 61° to 64° and longitudes 106° to 114° will include the results of his surveys.

L. J. Weeks continued geographical and geological exploration of a region on the west coast of Hudson bay, from Rankin inlet south. Large areas of ancient schists and sediments occur in the region and some mineral discoveries have been made. A general account of the salient features of the region has been prepared by Mr. Weeks and is published in Summary Report 1931, Part C. Field work will be continued in 1932.

Ontario

T. L. Tanton with A. F. Matheson completed a geographical and geological survey of Michipicoten River 1-mile quadrangle (latitudes 47° 45′ to 48°, longitudes 84° 30′ to 85°). Gold, pyrite, iron formation, and indications of other minerals have been found in the area. In addition to this work, Mr. Tanton visited and examined various iron ore deposits in eastern Ontario, as part of a systematic survey of the iron ore occurrences in Canada east of British Columbia and Yukon. This work will be continued in 1932.

W. H. Collins and E. D. Kindle continued geological investigation and mapping of certain features in Sudbury district, particularly of the faults that traverse the nickel basin and appear to form loci for lead-zinc mineralization. A series of 1-mile geological sheets are being prepared.

T. T. Quirke concluded geological mapping and investigation along the north and east sides of Georgian bay. This region contains a variety of non-metallic deposits situated conveniently for transportation by water to manufacturing centres on the Great Lakes. A final report is being written. An area around the abandoned Long Lake gold mine south of Sudbury was also mapped by Mr. Quirke and C. C. Freeman.

A. E. Wilson continued geological mapping of the Palæozoic formations in the Ottawa 1-mile quadrangle (latitude 45°15′ to 45°30′, longitude 75°30′ to 76°). Better knowledge of these formations is required in connexion with drilling of wells and other operations in an area of increasing population. Field work will be continued in 1932.

Quebec

M. E. Wilson commenced a detailed investigation of the geological problems that affect developments in an area adjacent to Noranda, where most of the principal mining properties of the Rouyn field are situated. Field work will be continued in 1932. In the meantime the results of work in 1931 will be supplied to the companies concerned.

A. H. Lang geologically explored a large region in which lies Mattagami lake. Mineral discoveries have been made in the region and there are present large areas of ancient schists and sediments such as in other districts have been found to hold mineral deposits. The results will be incorporated in a new edition of the Nottaway 8-mile geological map. Mr. Lang supervised the work of O. L. Backman who geologically mapped the Makamik 1-mile quadrangle (latitudes 48°45′ to 49°, longitudes 78°30′ to 79°). Field work will be concluded in 1932.

H. C. Cooke continued the investigation of the asbestos, chromite, and other mineral deposits, and the geological mapping of the serpentine belt of southern Quebec where these deposits occur. A report by Mr. Cooke, giving some of the results of his work, appears in Summary Report 1931, Part D.

T. H. Clark and H. W. Fairbairn continued a systematic geological survey of a strip of country 17 miles wide along the Quebec-Vermont boundary. A brief report by Mr. Fairbairn, in Summary Report 1931, Part D, gives information

regarding several mining properties within the area. A series of reports and 1-mile geological sheets of the area between latitudes 45° to 45°15′ and longitudes 72° to 73°30′ are also being prepared.

F. J. Alcock concluded geological investigation and mapping of the country for a width of 5 to 15 miles along the north shore of Chaleur bay. A full report has been written and a 4-mile geological map and a series of 1-mile geological sheets are being prepared.

New Brunswick

The area mapped and studied by Mr. Alcock extends also along the south shore of Chaleur bay.

G. W. H. Norman and G. F. Flaherty completed the geological study and mapping of the Moncton, Hillsborough, and Chignecto 1-mile quadrangles between latitudes 45°30′ and 46°15′ and longitudes 64°30′ and 65°. Natural gas, petroleum, oil-shale, salt, and gypsum, and other minerals occur in this area.

Nova Scotia

Mr. Norman commenced an investigation of the geology of Oxford 1-mile quadrangle with the prime purpose of endeavouring to obtain information regarding the occurrence of salt and related deposits. A report setting forth the general conditions pertaining to the occurrence of such minerals in this part of Nova Scotia and adjoining parts of New Brunswick is presented in Summary Report 1931, Part D.

W. A. Bell concluded the geological survey of the Sydney coal field and bordering districts. Mr. E. A. Goranson, who was associated with Mr. Bell in this work, visited several mineral-bearing localities in Nova Scotia and reports upon them in Summary Report 1931, Part D. A full report and series of three 1-mile geological maps (Bras d'Or, Sydney, and Glace Bay sheets) are being prepared.

General

H. V. Ellsworth examined various occurrences of iron ore and chromite in southern Quebec in which small percentages of vanadium have been reported. A study of vanadium possibilities throughout Canada is contemplated.

TOPOGRAPHICAL DIVISION

W. H. Boyd, Chief Topographical Engineer, reports:

FIELD WORK

Yukon Territory

R. Bartlett carried out exploratory mapping of the Teslin 4-mile quadrangle, latitudes 60° to 61°, longitudes 132° to 134°. Teslin lake and Teslin river within the limits of the area were surveyed and extensive portions of the adjacent country were mapped by photo-topography. Map scale 1 inch to 4 miles. Contour interval 500 feet. Field work will be continued in 1932.

British Columbia

W. H. Miller completed exploratory mapping between Portland canal and Alice arm. Hastings arm was surveyed and considerable portions of the adjacent country explored and mapped by photo-topography. Map scale 1 inch to 4 miles. Contour interval 500 feet. A 4-mile map of the whole Portland Canal mining field and a series of 1-mile sheets of the more important parts of the field are being prepared.

A. C. Tuttle completed the field work necessary for the topographical mapping of the Crowsnest 1-mile sheet, latitudes 49°30′ to 49°45′, longitudes 114°30′ to 115°. Map scale 1 inch to 1 mile. Contour interval 100 feet. In this work both photo-topography and plane-table traverse methods were used.

A. C. T. Sheppard visited the parties of S. M. Steeves and A. C. Tuttle for purposes of supervision and advising on any matters relating to the field work. Supplementary to the above, Mr. Sheppard completed the east half of the Cranbrook sheet, latitudes 49°30′ to 49°45′, longitudes 115°30′ to 116°. Map scale 1 inch to 1 mile. Contour interval 100 feet. In order to meet the needs of the mining industry in that area this work was extended to include an adjoining area to the northwest of approximately 50 square miles. The west half of the Cranbrook sheet was revised and brought up to date.

Alberta

S. M. Steeves completed the topographical mapping of the Nordegg sheet, latitudes 52°15′ to 52°30′, longitudes 116°00′ to 116°30′. Map scale 1 inch to 1 mile. Contour interval 100 feet. He continued the topographical mapping of the Cardinal River sheet, latitudes 52°45′ to 53°, longitudes 116°30′ to 117°. Map scale 1 inch to 1 mile. Contour interval 100 feet. The topographical mapping of the Blackstone sheet was commenced, latitudes 52°30′ to 52°45′, longitudes 116° to 116°30′. Map scale 1 inch to 1 mile. Contour interval 100 feet. In all three areas a combination of photo-topography and plane-table traverse methods was used. The Nordegg sheet is being prepared, but further field work is necessary in the Cardinal River and Blackstone quadrangles.

Northwest Territories

R. C. McDonald in Great Bear Lake area carried out control traverses and position determinations for latitude and longitude to control oblique aerial photography. Map scale 1 inch to 4 miles. More than 2,000 square miles were controlled. Detail from the photographs is being plotted by the Topographical Surveys Branch, Department of the Interior. Photography was by the Royal Canadian Air Force and transportation to and from the area, as well as in the area, was furnished by that organization.

Ontario

A. G. Haultain continued the establishing of elevations throughout the Sudbury nickel basin. These elevations provide data for the sketching of controlled form lines, from serial topography, on the base maps previously prepared in that area. The Copper Cliff 1-mile sheet (latitudes 46°15′ to 46°30′, longitudes 81° to 81°30′) has been completed, and the Chelmsford sheet (latitudes 46°30′ to 46°45′, longitudes 81° to 81°30′) and Wanapitei sheet (latitudes 46°30′ to 46°45′, longitudes 79°30′ to 80°) are in course of preparation. Some further field work is required.

H. N. Spence carried out geographical surveys in Gargantua area, latitudes 47°30′ to 47°45′, longitudes 84°30′ to 85°; in Harmony River area, latitudes 46°45′ to 47°, longitudes 84° to 84°30′; and in Batchawana Bay area, latitudes 46°45′ to 47°, longitudes 84°30′ to 85°. The three map sheets are for publication at 1 inch to 1 mile. The Gargantua quadrangle was aerially photographed by the provincial Forestry Department.

Quebec

J. W. Spence completed the control surveys for the mapping on 1 inch to 800 feet of the area including the Thetford and Black Lake asbestos deposits. He also carried out control surveys for the detailed mapping on an area in the vicinity of Noranda. This area includes the Horne, the Amulet, and the Waite-Montgomery mines and is also prepared on the scale of 1 inch to 800 feet.

Nova Scotia

S. C. McLean completed the triangulation control undertaken in 1930 over the area of the Sydney and Glace Bay coal fields. This furnishes the control for the detailed mapping which is a part of a comprehensive investigation into these coal fields and their seaward extension. Map scale 1 inch to 1,000 feet for the detailed sheets, and 1 inch to ½ mile for a general sheet covering the whole area.

J. V. Butterworth was in charge of the party carrying on shoreline and other surveys for the detailed mapping of the above area.

K. G. Chipman was in charge of the levelling, the co-ordination and correlation of information, and all other matters affecting the detailed mapping in the above area.

OFFICE WORK

The control and computing sections under S. C. McLean carried out all computing, adjusting, and checking for triangulation and traverse control in connexion with the field work. Continued progress was made in the collection, standardization, and availability of control information.

D. A. Nichols completed the physiographic diagram of Canada and enlarged and reclassified the collection of physiographic illustrations for use in schools and colleges. He also undertook the supervision of a model of Canada on the scale of 1 : 1,500,000 on the true curvature of the earth. Specifications were prepared and considerable progress made in the collection of data for, and in the construction of, its various units.

MINERALOGICAL DIVISION

Eugene Poitevin, Chief of the Division, reports:

FIELD WORK

H. V. Ellsworth examined the Cardiff township, Ont., uranium deposits and chromiferous iron deposits in the Eastern Townships of Quebec.

A. T. McKinnon spent five weeks in Ontario and Quebec, where he collected 15½ tons of minerals needed for the preparation of our educational collections.

LABORATORY AND OFFICE WORK

About the usual number of visitors seeking information regarding minerals and mineral occurrences availed themselves of the services of this division. A large number of ores, mineral specimens, and rocks, from all parts of Canada, were examined and reported on as to their commercial or scientific value. Eugene Poitevin continued a study of chromite ores and their associated ultrabasic rocks, of which some of the results were published in Summary Report 1930, Part D. He also continued the study of the minerals occurring in the granite rocks cutting the serpentine of the asbestos area of eastern Quebec.

H. V. Ellsworth studied some minerals from the Great Bear Lake pitchblende deposits. Considerable time was spent on the installation of a Hilger spectrograph purchased in 1929. An investigation into possible sources of vanadium in Canada was begun by the field work above mentioned and by obtaining the collaboration of various officers of the Geological Division working in other parts of Canada.

R. J. Fabry completed the analyses of the following rocks and minerals:

Chromite (purified from foreign minerals) from Montreal chrome pit, Coleraine township, Megantic county, Que. For Eugene Poitevin.

Chromite (purified from foreign minerals) from summit of Olivine mountain, Tulameen, B.C. For Eugene Poitevin.

Manganese ore from near Pearl station, near Port Arthur, Ontario. For T. L. Tanton.

Granodiorite from Pickerel river, near mouth of French river, Ontario. This completes a series for T. T. Quirke.

Normal olivine diabase, from a large dyke at Espanola, Ontario. For T. C. Phemister.

Light-coloured acidic phase of olivine diabase from large dyke south of Kelly lake, near Sudbury, Ontario. For T. C. Phemister.

Quartz-bearing diabase from dyke in Shakespeare township, Ontario, intrusive in Killarnean granite. For T. C. Phemister.

A series of five specimens (Nos. 18-22, 1931, W.H.C.) from across the transition zone between the norite and micropegmatite of the Sudbury nickel irruptive, taken in Maclennan township. For W. H. Collins.

Three out of a series of seven specimens (Nos. 25-31, 1931, W.H.C.) from across the transition zone between the norite and micropegmatite of the Sudbury nickel irruptive, taken on the Canadian Pacific railway near Levack.

MUSEUM WORK

During the year the exhibits in the National Museum have been added to in a small way and the building up of the collections has been continued by adding valuable specimens, mostly by exchange. A list of these specimens is given in the Annual Report of the National Museum.

EDUCATIONAL COLLECTIONS

During the fiscal year just ended 18,661 specimens were used in the preparation of 667 collections which were issued as follows:

Province	Grade 2	Grade 3	Special grade 4	Miscellaneous	Mineral chips	Prospector's	
						Minerals	Rocks
Yukon	0	0	0	0	0	0	0
British Columbia	0	0	0	6	0	69	44
Alberta	0	0	0	0	0	13	9
Saskatchewan	0	0	0	1	0	21	9
Manitoba	0	0	0	0	0	23	11
Ontario	0	39	0	18	1	84	51
Quebec	0	1	200	7	0	13	4
New Brunswick	0	0	0	0	0	4	1
Nova Scotia	0	0	0	0	0	6	2
Prince Edward Island	0	0	0	0	0	0	0
Foreign	1	1	0	13	0	10	5
	1	41	200	45	1	243	136

PALÆONTOLOGICAL DIVISION

E. M. Kindle, Chief of the Division, reports:

FIELD WORK

The field work of W. A. Bell, L. S. Russell, and A. E. Wilson is stated in the section relating to the Geological Division.

OFFICE WORK

Reports and maps by W. A. Bell, F. H. McLearn, and L. S. Russell are referred to in the section dealing with the Geological Division.

An important part of the work of the Palæontological Division has been, as in previous years, the preparation of reports on fossils collected by geologists of the staff for the purpose of correlating the formations dealt with. In addition to collections made by the Geological Survey staff, collections have been studied for the Quebec Bureau of Mines, and the Ontario Bureau of Mines. Various small collections from teachers, students, and others have also been reported on.

The Mesozoic invertebrates have been reported on by F. H. McLearn and L. S. Russell. E. M. Kindle and A. E. Wilson have prepared reports on the Palæozoic invertebrates received. W. A. Bell has submitted reports on five collections of fossil plants. C. M. Sternberg has reported on several small collections of vertebrate fossils.

PREPARATORY WORK

Considerable progress has been made by Mr. C. M. Sternberg, assisted by J. Skillen and J. E. Proulx, in the preparation of a skull of Triceratops from Saskatchewan and an ichthyosaur skeleton from near Fernie, B.C.

Cement duplicates of some of the dinosaur tracks from Peace River Canyon district have been prepared for exhibition near the approaches to the Museum building. One of these, representing a footprint of unusual size, will be utilized as a bird bath.

PLEISTOCENE GEOLOGY, WATER SUPPLY, AND BORINGS DIVISION

W. A. Johnston, Geologist in Charge of the Division, reports:

References to field work by R. T. D. Wickenden and D. C. Maddox are given under the Geological Division.

Examination of samples from well borings made in search of water, gas, and oil formed an important part of the work of the division. Information was supplied to many inquirers regarding the possibility of obtaining underground water supplies. The question has been of especial importance during the past year because of the shortage of water at many places. The division has records of several thousand water wells, mostly obtained through the courtesy of well drillers, and these furnish information as to the possibilities of underground water supplies. The records are far from complete, especially as field investigations have been made in only a few areas; and these are necessary to determine how the water occurs, whether locally or as artesian water extending over large areas, as well as for the collection of records of wells. Logs of wells drilled for oil and gas were also furnished to operators. In some cases these were old logs, as the division has records of most of the wells drilled for oil and gas in the Prairie Provinces and in British Columbia, and many of those drilled in eastern Canada. In other cases the logs were made from the examination of samples received from the operators. Information was also supplied regarding the occurrences of placer gold, and of peat moss which is coming into use for peat litter, insulation, and other purposes, and is being more extensively produced in Canada. W. A. Johnston prepared a report on modes of occurrence and hand methods of mining of placer gold in Canada, which is in course of publication. A report on the surface deposits and water supply of the Winnipeg 8-mile sheet covering southern Manitoba south of latitude 52 degrees is in process of preparation, the map to accompany the report having been issued.

D. C. Maddox examined many of the well samples, particularly those from the province of Quebec, where a search for natural gas has been actively carried on during the past year, by structural studies on the part of several oil and gas companies and by the drilling of several deep holes. According to an arrangement with the Quebec Bureau of Mines the well samples are sent direct to this division and reports on the samples are sent to the operators and to Mr. A. O. Dufresne, Director of the Bureau of Mines, Quebec.

R. T. D. Wickenden examined well samples from the Prairie Provinces, particularly with reference to the occurrence of microfossils. A notable feature of this work is the discovery that correlation of the horizons in different wells can be made by means of foraminifera in some cases where other methods have failed. A study of the deep wells in Saskatchewan has shown that a buried

ridge of Palæozoic rocks, having a greater density than the overlying shale, extends northwest through the southern part of the province. This probably explains the gravity anomalies found in this region by A. H. Miller of the Dominion Observatory. The ridge has a relief of at least 700 feet and younger Jurassic sandstones abut against it on the southwest. These structural features may have some significance regarding the occurrence of oil and gas.

F. J. Fraser, assisted by M. Mahoney, examined many of the samples, particularly the water well samples received during the year. Mr. Fraser continued the work on the mechanical and mineral analyses of rock samples from southern Saskatchewan collected by F. H. McLearn. Data along these lines are now available for over 1,000 samples. He also made a study of the samples from the Amherst well of the Imperial Oil Company in Nova Scotia, in which a great thickness of common salt was found. Numerous tests for potash were made, but none of the samples showed more than one per cent.

Samples from oil and gas wells, received during the year, include 9,690 from Alberta. Most of these were received through the courtesy of the Department of Lands and Mines of the province. There were 225 from Saskatchewan, 152 from Manitoba, 533 from Quebec, and 400 from Nova Scotia. About 400 samples from water wells were also received, chiefly from Saskatchewan and Ontario.

For their valuable co-operation and for information supplied on well drilling, acknowledgments are made to Mr. W. Calder, Director, Petroleum and Natural Gas Division, Department of Lands and Mines, Alberta; Colonel R. B. Harkness, Gas Commissioner for Ontario: Mr. A. O. Dufresne, Director, Bureau of Mines, Quebec; officials of the Imperial Oil Company, Toronto; officials of the Provincial Health Departments; and many others.

DRAUGHTING AND REPRODUCING DIVISION

A. Dickison, Chief of Division, reports:

Maps Published April 1, 1931, to March 31, 1932

Series A	Publication number	Title	Remarks
		BRITISH COLUMBIA	
——	2277	Figure 3. Structure sections of the Slocan series; scale, 1 inch to 4,000 feet.	Geology. To accompany Map 273A—"Sandon, Slocan, and Ainsworth mining divisions, Kootenay district". For memoir by C. E. Cairnes.
279A	2287	Corbin area, Kootenay district; scale, 1 inch to 1,000 feet.	Geology. For report by B. R. MacKay, Summary Report, part A, 1930.
		ALBERTA	
252A	2227	Jumpingpound sheet (west of fifth meridian); scale, 1 inch to 1 mile.	Topography.
261A	2261	Turner Valley sheet (southwest quarter), west of fifth meridian; scale, 1 inch to ½ mile.	Geology.
262A	2262	Turner Valley sheet (northwest quarter), west of fifth meridian; scale, 1 inch to ½ mile.	Geology.
263A	2263	Fish Creek sheet (southwest quarter), west of fifth meridian; scale, 1 inch to ½ mile.	Geology.
264A	2264	Bragg Creek sheet (southeast quarter), west of fifth meridian; scale, 1 inch to ½ mile.	Geology.

Maps Published April 1, 1931, to March 31, 1932—*Concluded*

Series A	Publication number	Title	Remarks
		ALBERTA—*Concluded*	
265A	2265	Bragg Creek sheet (northeast quarter), west of fifth meridian; scale, 1 inch to ½ mile.	Geology.
277A	2284	Jumpingpound sheet (west of fifth meridian); scale, 1 inch to 1 mile.	Geology.
		MANITOBA	
254A	2245	Winnipeg sheet; scale, 1 inch to 8 miles.....	Geology (surface deposits). For memoir by W. A. Johnston.
274A	2280	Oiseau sheet (east of principal meridian); scale, 1 inch to 1 mile.	Geology.
275A	2281	Lac du Bonnet sheet (east of principal meridian); scale, 1 inch to 1 mile.	Geology.
280A	2291	Wadhope area (township 22, range 16), east of principal meridian; scale, 1 inch to 2,000 feet.	Geology. For memoir by J. F. Wright.
		ONTARIO	
276A	2282	Thunder Bay silver area, Thunder Bay district; scale, 1 inch to 4 miles.	Geology. For memoir by T. L. Tanton.
		QUEBEC	
271A	2275	Rouyn-Harricanaw area, Abitibi and Témiscamingue counties; scale, 1 inch to 4 miles.	Geology. For memoir by H. C. Cooke, W. F. James, and J. B. Mawdsley.
		NEW BRUNSWICK AND QUEBEC	
259A	2254	New Brunswick-Gaspe sheet; scale, 1 inch to 8 miles.	Geology.
		NEW BRUNSWICK	
269A	2273	Moncton sheet, Westmorland and Albert counties; scale, 1 inch to 1 mile.	Topography.
		NOVA SCOTIA	
260A	2256	Lake Ainslie sheet, Inverness county; scale, 1 inch to 1 mile.	Geography.
——	2259	New Ross sheet, No. 86, Lunenburg, Hants, and Kings counties; scale 1 inch to 1 mile.	Geology.
		GENERAL	
——	——	Canada and United States (with descriptional chart); scale, 1 inch to 250 miles.	For National Museum use.
——	2285	Normal curves—(Late glacial correlations and ice recession in Manitoba).	Geology. For memoir by E. Antevs.

Maps in Hands of King's Printer, March 31, 1932

Series A	Publication number	Title	Remarks
		BRITISH COLUMBIA	
272A	2278	Slocan sheet, Kootenay district; scale, 1 inch to 1 mile.	Geology. For memoir by C. E. Cairnes.
273A	2279	Sandon, Slocan, and Ainsworth mining divisions, Kootenay district; scale, 1 inch to 4,000 feet.	Geology. For memoir by C. E. Cairnes.
		CANADA	
270A	2274	Aborigines of Canada; linguistic families and tribal locations; scale, 1 inch to 197·3 miles.	Ethnology. For National Museum use.

Other Map-Work in Varying Stages of Progress

—	Title	Remarks
	YUKON TERRITORY	
1	Laberge sheet, 61° to 62°, 134° to 136°; scale, 1 inch to 4 miles	Geology.
	BRITISH COLUMBIA	
1	Prince Rupert sheet, 52° to 55°, 126° to 133°; scale, 1 inch to 8 miles	Geology.
2	Stikine area, Cassiar district, 56° 30′ to 57°, 131° to 132°; scale, 1 inch to 2 miles	Geology.
3	Stikine area, Cassiar district, 57° to 57° 30′, 131° to 132°; scale, 1 inch to 2 miles	Geology.
4	Stikine area, Cassiar district, 57° 30′ to 58°, 131° to 132°; scale, 1 inch to 2 miles	Geology.
5	Salmo sheet, Kootenay district, 49° to 49° 15′, 117° to 117° 30′; scale, 1 inch to 1 mile	Topography.
6	Copper Mountain mining area, Similkameen district; scale, 1 inch to 1,000 feet	Geology. For memoir by V. Dolmage.
	ALBERTA	
1	Cardinal River sheet (west of fifth meridian), 52° 45′ to 53°, 116° 30′ to 117°; scale, 1 inch to 1 mile	Geology.
2	Lovett sheet (west of fifth meridian), 53° to 53° 15′, 116° 30′ to 117°; scale, 1 inch to 1 mile	Geology.
	SASKATCHEWAN	
1	Regina sheet, 49° to 52°, 102° to 109°; scale, 1 inch to 8 miles	Geology.
	SASKATCHEWAN AND MANITOBA	
1	The Pas sheet, 52° to 55°, 96° to 103° 30′; scale, 1 inch to 8 miles	Geology.
	MANITOBA	
1	Winnipeg sheet, 49° to 52°, 95° to 102°; scale, 1 inch to 8 miles	Geology (bedrock).
	ONTARIO	
1	Kenora sheet, 48° to 52°, 90° to 95+°; scale, 1 inch to 8 miles	Geology.
2	Espanola sheet, Sudbury district, 46° 15′ to 46° 30′, 81° 30′ to 82°; scale, 1 inch to 1 mile	Geology.
3	Copper Cliff sheet, Sudbury district, 46° 15′ to 46° 30′, 81° to 81° 30′; scale, 1 inch to 1 mile	Geology.

Other Map-Work in Varying Stages of Progress—*Concluded*

—	Title	Remarks
	ONTARIO—*Concluded*	
4	Rush Lake sheet, Sudbury district, 47° 45′ to 48°, 82° to 82° 30′; scale, 1 inch to 1 mile	Geology.
5	Shebandowan sheet, Thunder Bay district, 48° 30′ to 48° 45′, 90° to 90° 30′; scale, 1 inch to 1 mile	Geology.
	QUEBEC	
1	Duparquet sheet, Abitibi and Témiscamingue counties, 48° 15′ to 48° 30′, 79° to 79° 30′; scale, 1 inch to 1 mile.	Geology.
2	Desmeloizes sheet, Abitibi county, 48° 45′ to 49°, 79° to 79° 30′; scale, 1 inch to 1 mile	Geology.
3	Escuminac sheet, Bonaventure county, 48° to 48° 15′, 66° to 66° 30′; scale, 1 inch to 1 mile	Geology.
	NEW BRUNSWICK	
1	Benjamin River sheet, Restigouche county, 47° 45′ to 48°, 66° to 66° 30′; scale, 1 inch to 1 mile	Geology.
	NOVA SCOTIA	
1	Lake Ainslie sheet, Inverness county, 46° to 46° 15′, 61° to 61° 30′; scale, 1 inch to 1 mile	Geology.

In addition to the foregoing, one hundred and twelve map and other figure drawings were prepared for reproduction by zinc-cut process, for illustrating reports and memoirs of the Geological Survey and bulletins of the National Museum; other draughting and associated work necessary for staff and public use amounted to one hundred and twenty-five items. Duties in connexion with the Geographic Board of Canada were also attended to.

PHOTOGRAPHIC DIVISION

G. G. Clarke, Chief of the Division, reports:

The following work has been done during the fiscal year:

Contact prints, 4 x 5 to 36 x 48	14,136
Bromide enlargements, 4 x 5 to 40 x 72	942
Exposures developed, 3¼ x 4¼ to 6½ x 8½	3,956
Dry plate negatives, 4 x 5 to 11 x 14	603
Wet plate negatives, 8 x 10 to 24 x 30	183
Zinc plates, 11 x 14 to 24 x 36	37
Photostat copies, 7 x 11 to 11 x 14	53
Lantern slides, 3¼ x 4	921
Photos and maps mounted	927
Total	21,758

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Assistant Director, reports:

During the year 53,339 publications of the Geological Survey and National Museum, exclusive of French editions, were distributed. Of these 9,714 were sent to addresses on the regular mailing lists, and 43,625 were distributed in compliance with written and personal requests for named publications, or requests for general or specific information.

LIBRARY

Mrs. F. E. Forsey, Librarian, reports:

Additions to the library during the year include:

Books purchased	404
Volumes received as gifts or exchanges	1,014
Pamphlets	401
Maps	622
Periodicals subscribed for	206
Periodicals and publications of learned societies received by gift and exchange (separate files)	566

Distinct improvements were effected in the filing and care of the map collections. The collection of lantern slides has grown appreciably and considerable progress has been made in labelling and cataloguing. Many sets of slides have been loaned throughout the year to members of the Survey and Museum staffs and to educational institutions.

The availability of additional library space in the spring of 1931 provided relief from the crowded condition of the stacks on the main floor and allowed a reorganization of many sections of the library. In the course of the readjustments, many improvements were effected, obsolete volumes discarded, and publications not relevant to the work of the Survey or Museum distributed to other government libraries.

Among gifts gratefully acknowledged during the year may be mentioned: "Illustrations of Japanese Aquatic Plants and Animals", presented by the Fisheries Society of Japan through the courtesy of the Japanese Legation in Ottawa; "Les Oiseaux de l'Indochine Française", par J. Delacour et P. Jabouille, presented by M. Delacour; and a selection of books from the library of the late Dr. H. M. Ami, presented by Mrs. Ami.

BRITISH COLUMBIA OFFICE

W. E. Cockfield, Geologist-in-Charge, reports:

The work of the British Columbia office indicates the interest that is being taken in the mining industry of the province. Records kept in the office show that the total number of inquiries has increased slightly over 1930. During the year 3,430 visitors registered at the office. Reports distributed totalled 1,799 and maps distributed, 2,079.

NATIONAL MUSEUM OF CANADA

W. H. Collins, Acting Director

Owing to the need for the greatest possible economies, field work in 1931-32 was reduced considerably, and the efforts of the staff were concentrated on the study of the mass of material that accumulates in an institution of this kind, and on thus relieving congestion.

Statements of the progress of the work of the anthropological and biological divisions follow.

The Museum is highly appreciative of the excellent exhibit placed on display by the Entomological Branch, Department of Agriculture. The Acting Director is grateful, also, to other Government departments for valuable co-operation and would mention in particular the Northwest Territories Branch and the National Parks Branch, Department of the Interior, and the Department of Indian Affairs. He also wishes to express to many individuals and institutions, both Canadian and foreign, his most cordial appreciation for donations and exchanges and for assistance rendered in connexion with scientific investigations.

ANTHROPOLOGICAL DIVISION

D. Jenness organized the anthropological program of the Pacific Science Congress, which was scheduled to meet in Vancouver in May, 1932, but which has now been postponed. Besides drawing up a program of subjects to be discussed at the meeting and soliciting relevant papers from scientists in both the New and the Old Worlds, he assembled and edited a volume of papers, by nine authors besides himself, on the "Origin and Antiquity of the American Aborigines". Mr. Jenness also completed a comprehensive text book on the Indians of Canada.

During April, May, and part of June, C. M. Barbeau studied several old collections of Indian handicrafts in the museums of France and England, including the Trocadero Museum, of Paris; the Louvre (Musée de la Marine); the municipal Museum of Versailles; the Jardin-des-Plantes; the British Museum; and the Pitt-Rivers Museum, at Oxford. The collection of the Trocadero is particularly important; it contains a large number of the most ancient specimens extant of North American handicrafts. Valuable comparative knowledge was obtained from the study of these collections, particularly with regard to the origin and evolution of native American handicrafts. Much time was given to linguistic work. The preparation of a large monograph on "The Eagle Phratry —Its Recent Growth among the Tsimsyan" is under way.

H. I. Smith devoted the greater part of his time to the organization of accumulated data on the archæology of Canada and worked on bibliographies of the archæology of Ontario, Quebec, New Brunswick, and Newfoundland.

W. J. Wintemberg completed his report on the culture of the Lawson village site.

During the year a series of special exhibits illustrating some of the finer phases of aboriginal art was placed in the west hall of anthropology. These exhibits are highly suggestive to commercial artists seeking something distinctively Canadian and have attracted much attention.

Accessions to Museum

The additions to the collections of the National Museum have this year been less than usual, owing to the small amount of field work undertaken. This

loss has been offset to a certain extent, however, by the receipt of the large collection of archæological material from the estate of the late Dr. H. M. Ami. Another valuable accession, deserving of special mention, is an interesting wampum record from the Iroquois which was secured through Chief Loft, of Caledonia, Ontario.

The specimens catalogued in the course of the fiscal year fall into the following categories:

Ethnological	50
Archæological	490
Osteological	4
Total	544

The Ami collection is not included in the above table.

BIOLOGICAL DIVISION

R. M. Anderson, Chief of the Division, reports:

FIELD WORK

R. M. Anderson attended the Thirteenth Annual Meeting of the American Society of the Mammalogists held at the Academy of Natural Sciences, Philadelphia, May 12-15, 1931. At the general meeting, by courtesy of the National Parks of Canada, he presented three motion picture films illustrating Canadian mammal life.

While in the United States Mr. Anderson visited the American Museum of Natural History at New York city, and the United States National Museum and the Bureau of the Biological Survey of the United States Department of Agriculture at Washington.

From July 24 to August 1, Mr. Anderson attended a unique biological conference held at Matamek, Moisie bay, Saguenay county, Quebec, convened by Mr. Copley Amory. Mr. Amory has been a summer resident on the north shore of the gulf of St. Lawrence for over twenty-five years and has observed the ebb and flow of animal and plant life of both land and sea. About thirty scientists from Canada, the United States, England, Scotland, and Germany were present. Papers were presented on fluctuations in wild life in various aspects, reports on the ruffed grouse investigations which have been carried on for several years, salmon investigations, cod fisheries, the whaling industry, climate in relation to forestry and other human relations, astronomical cycles, fur-farming and epidemic diseases of animals in a wild state and in captivity, and the relations of all these topics to wild life conservation.

P. A. Taverner, ornithologist, attended the Forty-ninth State Meeting of the American Ornithologists' Union, held at the Book-Cadillac Hotel, Detroit, and the Museum of Zoology, University of Michigan, Ann Arbor, October 20-23, 1931.

C. L. Patch, chief taxidermist, made a biological reconnaissance between Ottawa and Kingston, Ontario, between July 21 and August 19, 1931. Two hundred and four amphibians, reptiles, mammals, and birds, representing 37 species, were collected.

C. E. Johnson, artist, spent some time at Halifax, Nova Scotia, making coloured drawings of Atlantic food fishes, to be used for illustrative purposes, in co-operation with the Department of Fisheries. Thirty-two coloured plates and twenty pen sketches were made, and several plaster casts were made for exhibition in the museum, as well as a collection of marine specimens in formalin.

C. H. Young, collector-preparator specialist, collected and mounted about 500 specimens of Microlepidoptera in the Ottawa district.

PUBLICATIONS

R. M. Anderson completed the manuscript for a museum bulletin on "Methods of Collecting and Preserving Vertebrate Animals." This is primarily intended to give necessary instruction in modern methods for field workers in the interest of the museum and collectors of scientific material in general, as well as giving valuable information to trappers, hunters, farmers, or nature lovers who may wish to collect specimens for themselves or wish to preserve specimens in shape for identification. Work was continued on a report on "Animal Life and Life Zones of Southern British Columbia," and some progress was made on the "Check-List of Canadian Mammals."

P. A. Taverner completed the manuscript and drawings for a bulletin on "Water Birds, Upland Game Birds, and Birds of Prey of Canada," and work was begun on the compilation of a new descriptive book on "Birds of Canada," combining the essential features of his previous works, "Birds of Eastern Canada," and "Birds of Western Canada," which are now out of print.

MUSEUM WORK

Some progress has been made by C. L. Patch, chief taxidermist, in preparation and installation of biological exhibits in the museum hall.

Three hundred and fourteen mammals, birds, amphibians, and reptiles were loaned for nature study and art work in the schools.

Continued progress has been made in detailed study and identification of the accumulated reserve collections of the museum. At the end of the year the catalogued specimens of birds in the National Museum of Canada numbered 25,010, and of mammals 11,427. In connexion with the systematic studies, several consignments of specimens were determined for various collectors and institutions.

Various lots of specimens have been received on loan from the Royal Ontario Museum of Zoology, Toronto; The Provincial Museum, Victoria, B.C.; The Provincial Museum, Regina, Saskatchewan; Museum of Comparative Zoology, Harvard University, Cambridge, Mass.; Museum of Vertebrate Zoology, University of California, Berkeley; the California Academy of Sciences, San Francisco; Bureau of the Biological Survey, United States Department of Agriculture, Washington, D.C.; Field Museum of Natural History, Chicago; and the Charles P. Connor Museum State College of Washington, Pullman, Washington; also from Mr. Stuart Criddle, Treesbank, Manitoba; Mr. Kenneth Racey, Vancouver; Mr. Eli Davis, London, Ontario; and Mr. Wm. H. Moore, Scotch lake, New Brunswick.

NATIONAL HERBARIUM

M. O. Malte, Chief Botanist, National Herbarium, made substantial progress in the work on the flora of Arctic Canada, due in part to collections of arctic plants being obtained as loans from the United States National Herbarium, Washington, D.C., The New York Botanical Garden, New York, and the Gray Herbarium, Cambridge, Mass.

MINES BRANCH

John McLeish, Director

The demand for information respecting Canada's mineral resources, and for investigational work respecting methods of treatment and of untilization continues to tax the available facilities of the Mines Branch. The information that has been, and is being, accumulated is of very great importance at the present time as a contributing factor toward a more serious study of the resources of the British Empire.

Restricted activities in the production of base metals have been accompanied by a greatly stimulated interest in gold mining, which has been reflected in the large number of samples of gold ores received for experimental test work. The finding of high-grade pitchblende ores at Great Bear lake has necessitated extensive test and research work for the purpose of developing methods of recovering crude radium salts. Large-scale technical tests on certain Canadian coals have demonstrated their suitability, when properly prepared and when mixed with other coals, for use in the production of good domestic coke and of gas. These demonstrations are enabling Canadian manufacturers of coke to take advantage of the assistance which the Government has been granting on the movement of Canadian coals, and thus replace the imported with a Canadian raw material.

The total number of employees at the end of March, 1932, was 191, or 6 less than at the end of the previous fiscal year.

During the year, the Director, in addition to departmental administrative duties, served as a member of the Dominion Fuel Board; the Advisory Committee on Mining Regulations; several Associate Committess of the National Research Council; and on the Government Advisory Committee on the Civil Service Superannuation Act. In May, he attended the annual meeting of the Nova Scotia Advisory Board on Fuel Investigations at Halifax; in September, the annual meeting of the Canadian Good Roads Association at Lucerne-in-Quebec; in November, the Third International Coal Conference at Pittsburgh; and in February, 1932, the annual meeting of the Engineering Institute of Canada at Toronto.

The outstanding activities of the Mines Branch during the year are briefly outlined under its several divisions as follows.

MINERAL RESOURCES DIVISION

A. W. G. Wilson, Chief of Division, reports:

The field investigations of technical officers of this division covered mineral industries in all provinces of the Dominion, with the exception of Prince Edward Island; at Great Bear lake in the Northwest Territories, and some parallel studies in the eastern and central United States. At the end of the year, eleven reports on various subjects dealing with mineral resources were in preparation.

Mr. Wilson, in addition to administrative and office duties, spent about six weeks on general field investigations.

H. S. Spence was engaged mainly on investigations of the rare-element and radioactive minerals. He visited the new discoveries of pitchblende and silver at Great Bear lake, Northwest Territories, in August-September, and prepared a report on the occurrences. He also visited occurrences of beryl and rare-element minerals near Pointe du Bois, on Winnipeg river, in Manitoba, and in Renfrew and Hastings counties, Ontario, where prospecting and development were being undertaken. In addition to these investigations he also visited the deposits of

sedimentary phosphate in Crowsnest district, British Columbia, which have been actively prospected during the past two years by the Consolidated Mining and Smelting Company; the new fertilizer plant of the above company, at Trail, British Columbia, designed to utilize the rock of the above deposits; bentonite deposits at Princeton, British Columbia, and Edson, Alberta; a deposit of phosphate near François lake, British Columbia, and various other mineral occurrences, and plants utilizing non-metallic minerals.

L. H. Cole, in association with R. K. Carnochan of the Ore Dressing Division, and W. H. Brissenden, of the Department of Development, Canadian Pacific railway, made an experimental investigation of the cutting and other qualities of certain Canadian sands when used for sandblasting. The work showed that the sands used were equal, and in some cases superior, to imported sands used for the same purpose. A preliminary report on the results obtained has been issued. In association with R. A. Rogers, of the Ore Dressing Division, data obtained from tests on anhydrite samples were compiled and a manuscript report has been prepared. Mr. Cole is now engaged on an investigation of the granite industry.

S. C. Ells was engaged during the field season in determining the limits of the bituminous sand areas toward the east and northeast in the province of Alberta. At the same time an exploration to determine the possible economic value of an area of about 6,000 square miles in extent was completed, and about 60 miles of heretofore unmapped rivers were surveyed. During the course of the work, representative samples of bituminous sands were secured in the extreme northeasterly and extreme southwesterly parts of the area in order to determine possible variations in the character of the bitumens associated with the sand. Mr. Ells' office work included a continuation of his review of the world's asphalt resources. He reports that no process has yet been evolved in Europe that could be adapted to the successful commercial recovery of bitumen from Alberta bituminous sands.

M. F. Goudge continued his investigations into the economic possibilities of Canadian limestones. One result of this work was the discovery that certain deposits of argillaceous limestone in Niagara peninsula, Ontario, are suitable for the manufacture of rock wool, a valuable insulating material. A laboratory investigation of the material was made and a report on the subject was published in August. The field work in connexion with the examination of limestones suitable for building purposes and the study of the technology of the methods of quarrying building stone were completed, and a report on this phase of the investigation is now in course of preparation.

A. H. A. Robinson was engaged during the greater part of the year in completing a manuscript, with accompanying plans, descriptive of lode gold mining in Canada. During the year a number of articles on certain of Canada's mineral resources were prepared for the use of the executive staff. Seven weeks in September and October were spent in northern Ontario and Quebec, investigating current conditions at various mining centres. A special inspection and report were made on deposits of vanadiferous titanomagnetite ores near Mine Centre, Ontario.

V. L. Eardley-Wilmot was engaged throughout the year in a further study of Canadian diatomite deposits. This study has involved extensive field work in Ontario and in the Maritime Provinces, followed by laboratory examinations of the materials collected. During the progress of field work Mr. Eardley-Wilmot also examined occurrences of graphite, beryl, mercury, and garnet.

John Casey, statistician, conducted the fifth annual survey of fuels used for heating purposes in Canada during the year 1930. These surveys covered the domestic fuel consumption in the provinces of Quebec, Ontario, and Manitoba; bunkering coals consumed on the Atlantic coast, in the St. Lawrence basin, and in Manitoba; and the fuel oil consumption in all Canada.

A. Buisson devoted about eight weeks to visiting a number of the leading mining operations in the Maritime Provinces, in Quebec, and in Ontario, this work being in continuation of a plan, begun some years ago, of procuring for the record files first hand information about local conditions in the various parts of the country. Mr. Buisson has prepared for distribution to the press a number of short articles based on this field work. A special survey was made of sintering equipment in use in Canada, which included the compilation of data on the number of machines in use, their dimensions and capacities. A tabulation of data on the dividends paid by Canadian mining companies was also commenced.

C. H. Freeman continued his investigation of moulding sands. Slightly more than three months' field work was devoted to an examination of occurrences in the western provinces, and to securing large-scale samples for laboratory examination. In addition, comparative tests were made on samples of imported sands in general use throughout foundries in eastern Canada. Some specially selected samples were also tested for refractoriness.

E. H. Wait was engaged in a study of current conditions in the natural gas and oil industry of western Canada.

ORE DRESSING AND METALLURGICAL DIVISION

W. B. Timm, Chief of Division, reports an increase in the investigative work carried out in the various ore dressing and metallurgical laboratories, particularly in the investigations on the treatment of gold ores. An increase is also shown in the work of the section dealing with the dressing of non-metallic minerals. The investigation of the treatment of the pitchblende ore from Great Bear lake, Northwest Territories, was commenced, and very satisfactory progress was made. Five investigations were completed and reported on by the section dealing with ferrous metallurgy and in addition a number of co-operative investigations with Canadian steel companies were carried out.

The new ore dressing and metallurgical laboratory building was completed, the equipment installed, and the building occupied in June.

The following additions were made to the laboratory:

A new flotation unit having a capacity of 500 pounds an hour and consisting of three sets of ten cells each with accessory equipment for continuous tests.

A briquetting machine for making sponge iron briquettes and a continuous sintering machine for sintering iron ore concentrates.

Small pilot-plant equipment for the treatment of the pitchblende ore and for the extraction of radium. An electroscopic laboratory was for the measuring and determining of the radium element in the ores and various products from test operations.

A fully equipped mineragraphic laboratory for the microscopic and spectrographic examination of ores and minerals.

Due to economic conditions the research fellows maintained in the laboratories by the Base Metal Extraction Company, Limited, the Cassel Cyanide Company, and the American Cyanamid Company, and who were co-operating in certain investigative work by their respective companies, were withdrawn.

Advantage of the laboratory facilities was taken by metallurgists from operating companies to carry out investigations on their ore treatment problems. This type of co-operative work is invited and the laboratory facilities are placed at the disposal of the mining industry.

FIELD STUDIES

The policy was continued of allowing the chief officers of the staff to visit the milling and concentrating plants, and reduction works, to discuss with those engaged in the mining industry their problems, and so maintain contact with the industry throughout the Dominion.

W. B. Timm spent six weeks in Rouyn district, western Quebec, Kirkland Lake and Porcupine districts, Northern Ontario, and the mining districts of southern British Columbia, visiting concentrators, milling plants, and metallurgical works.

C. S. Parsons spent two weeks in the mining districts of Nova Scotia and New Brunswick where he discussed with the mining officials their ore treatment problems. He also spent a week in the iron ore districts of New Jersey and eastern Pennsylvania, investigating the methods used for concentrating low-grade iron ores and the possibility of applying similar methods to Canadian ores.

R. K. Carnochan spent two weeks in central Ontario, visiting non-metallic mineral deposits and milling plants, such as the occurrence of beryl at Quadville, the uraninite deposit and mill at Wilberforce, the talc mills at Madoc, and the actinolite deposits and mill at Actinolite.

W. R. McClelland spent two weeks investigating the technique of measuring and determining radium element, in connexion with the investigation on the treatment of pitchblende for the extraction of radium. The hazards involved in process work and the precautions to be taken were also investigated. In this connexion he visited Dr. H. Schlundt, at the University of Missouri, Columbia, Missouri, and Dr. C. Lind, at the University of Minnesota, Minneapolis, Minnesota.

T. W. Hardy spent two weeks at the steel plants at Welland, Ontario, and Montreal, Quebec, consulting with the metallurgical staff on problems under investigation in the iron and steel section of the division.

LABORATORY INVESTIGATIONS

In the ore dressing section for metallic ores, C. S. Parsons was assisted by A. K. Anderson, J. S. Godard, J. D. Johnston, and W. S. Jenkins. The following investigations were conducted in the laboratories of this section:

Concentration tests on gold ore from the Howey Gold Mines, Limited, Red Lake, Ontario.

The recovery of gold in ore from the Le Roy Fiedmont Mining Co., Limited, Louvicourt township, Abitibi county, Quebec.

Experimental tests on an arsenical gold ore from The Miller Bay Gold Mines, Limited, Sudbury district, Ontario.

A study of the effects of adding gold refinery slags to raw gold ore treated by cyanidation and also spent carbide used as lime.

The recovery of gold and copper from the ore of the Telluride Gold Mines of Canada, Limited, Englehart, Ontario.

Concentration of molybdenite ore from Alice Arm, B.C.

Concentration of an iron sulphide ore, Goudreau district, Algoma, Ontario.

Experimental tests on gold and silver-bearing ores from the Moss Gold Mines, Limited, Kashabowie, Ontario.

Preliminary concentration tests on ores from Chibougamau district, Quebec, for Metallum, Limited, Montreal, Quebec.

Experimental tests on old cyanide tailings from the Wright-Hargreaves Mines, Limited, Kirkland Lake, Ontario.

Investigation of riffle concentrate from McLeod River Mining Corporation, Limited, Peers, Alberta.

Experimental tests on gold ore from the Baralorme Mines, Limited, Bridge River, B.C.

The recovery of gold from the ore of the Hayden Gold Mines Co., Limited, Timmins, Ontario.

The recovery of gold from the ore of the Le Roy Mines, Limited, Louvicourt township, Abitibi county, Quebec.

Flotation tests on a sample of high-grade cobalt ore from Kenora Prospectors and Miners, Limited, Werner Lake district, Red Lake mining division, Ontario.

Concentration tests on samples of two mill products from the Kirkland Lake Gold Mining Co., Limited, Kirkland Lake, Ontario.

The treatment of a gold-copper ore from Gogama, Ontario.

Amalgamation, flotation, and cyanide tests on gold ore from The Beaufor Gold Mines, Limited, Pascalis township, Abitibi county, Quebec.

Experimental tests on two samples of gold ores from The Reno Gold Mines, Limited, Salmo, B.C.

The recovery of gold from a copper-gold ore from Vidette lake, B.C.

In the ore dressing section for non-metallics, R. K. Carnochan and R. A. Rogers conducted the following investigations:

Screen analysis and examination of sandstone samples from Beauharnois Construction Company, Beauharnois, Quebec.

The crushing of Glauber salts from the Horseshoe Lake Mining Company, Limited, Ormiston, Sask.

The preparation of silica sand from the River Dennis Sand and Clay Company, Limited, Melford, Cape Breton, N.S.

The testing of silica sand from Guigues township, Témiscamingue county, Quebec, for sandblasting.

The testing of silica sand and sandstone from the Beauharnois Power Corporation, Limited, Beauharnois, Quebec.

The testing of syenite from Methuen township, Peterborough county, Ontario, for removal of iron impurities.

The separation of rock from clam shells from Denman island, B.C.

The crushing of slate for the production of slate granules from Pulverized Products, Limited, Montreal, Quebec.

The washing of marl from the General Calcium Corporation, Limited, Milton, Ontario.

The testing of gypsum from Bull River, B.C.

In the Hydrometallurgical and Electrochemical Section, R. J. Traill was assisted by W. R. McClelland. A study was made of the treatment of radioactive ores and minerals, on the methods of measuring and determining radium element by electrocoscopic means, and the hazards involved and precautions to be taken. The investigation of the treatment processes was assigned to R. J. Traill and the electroscopic determination to W. R. McClelland.

In the Iron and Steel Section, T. W. Hardy was assisted by H. H. Bleakney and W. S. Jenkins. The following investigations were conducted in the laboratories of this section:

The production of low-sulphur sponge iron from ore-coal mixtures.

The laboratory concentration of Texada Island ore.

The laboratory concentration of Bathurst iron ore.

The mechanical properties of certain samples of Monel metal.

The semi-direct production of nickel steel from Sudbury copper-nickel ores.

In addition, co-operative work with Canadian steel companies was carried out. These investigations concerned either the production in Canada of material hitherto imported or the improvement of the quality of the product of the manufacturer concerned. The following list indicates the general nature of this work:

The production by the basic electric furnace of a steel used in Canada but imported from abroad.

The annealing of large, high carbon chromium molybdenum steel castings.

The production of a modified composition of austenitic manganese steel for special applications.

The production of cast alloy ring dies.

Investigation of a failed wedge bar from a ball mill lining.

Various minor problems, including thermal analyses, metallographic studies, mechanical tests and normality tests made for various Canadian concerns.

In the Chemical Section of the division, H. C. Mabee, chief chemist, reports increased work over previous years. A larger percentage of the samples submitted by those engaged on the investigations involved much fuller analysis.

FUELS AND FUEL TESTING DIVISION

B. F. Haanel, Chief of Division, reports that large-scale investigations occupied a prominent place in the work of the division. Among the more important investigations completed were:

Research work on Waterford slack coal to ascertain the effect on its storage properties of separating out the fines and fusain.

Washing and sizing of Princess coal and its use as a blending coal in Canadian coking plants.

Boiler tests on pulverized coals and Ontario lignites.

Other research was carried out throughout the year, and during the summer months by university research engineers, on hydrogenation; the nature of the constituents causing clinkering of Maritime Province coals; and studies of the alteration of Ontario lignite and peat in relation to their constitution.

The erection of the commercial briquetting plant was continued and large-scale laboratory apparatus for the hydrogenation of coal tar and coal by a continuous process installed.

Additional to planning and directing the work of the division, Mr. Haanel attended the regular meetings of the Dominion Fuel Board and the summer meeting of the Nova Scotia Advisory Board of Fuel Investigation held in June, 1931. He also held several conferences with officials of the Dominion Steel and Coal Corporation and the Montreal Coke and Manufacturing Company, in connexion with the testing of washed Princess coal in the by-product coke ovens of the latter company at Ville LaSalle, Montreal.

R. E. Gilmore, Superintendent of Fuel Research Laboratories, in addition to his regular supervising duties, assisted in planning the work of the division and in the preparation of the annual "Investigations of Fuels and Fuel Testing." He paid attention to the experimental work on the further development of the F.R.L. method for the low-temperature carbonization assay of coals and took an active part in the program of both the American and Canadian coal classification committees. Mr. Gilmore's responsibilities were further increased by the taking over by the Fuel Research Laboratories of the chemical work pertaining to samples of explosives taken and submitted by the Explosives Division, according to regulations of the "Explosives Act".

E. S. Malloch and C. E. Baltzer, in charge of the Mechanical Engineering Section, conducted and completed two investigations, viz.: *28 boiler tests* on Pyramid grates—of which 11 were hand fired and 17 Reco stoker fired, and *13 domestic boiler tests* on samples of coke from the operation of the F.R.L. by-product coke oven. Twenty pulverized fuel-fired boiler tests were made but not reported on, viz.: 11 on eleven Alberta coals; 8 on two samples of British Columbia coals; and 1 on a sample of Onakawana lignite. Besides the routine work of the section, which included the obtaining, tabulating, and charting of the daily mean temperatures for Ottawa, complete and final reports were made on 38 pulverized fuel boiler tests; 30 tests on 10 samples of British Columbia coals; 5 tests on Onakawana lignite; and 3 tests on the "operating coal." J. R. Kirkconnel had immediate charge of the domestic boiler tests and of the tabulating and charting of the daily temperatures.

R. A. Strong, assisted by E. J. Burrough and E. Swartzman, as the main program of the Carbonization Section, continued coking tests on Canadian bituminous coals. These tests were made in the 2-ton by-product coke oven installation at the Fuel Research Laboratories, a total of 98 12-hour test runs being made on 10 different Alberta bituminous coals, on Michel coal from British Columbia, and on washed Princess coal from the Sydney area, Nova Scotia.

These coals were coked alone and blended with one another and with standard imported coals, with the objective of determining to what extent coals mined in Canada can supplant imported coals now used for the manufacture of coke and city gas. Messrs. Strong and Burrough conducted and reported the results of coking tests on washed Princess coal during November in the commercial by-product ovens at the LaSalle plant of the Montreal Coke and Manufacturing Company, where later in February tests on English coals were also witnessed. On the Princess coal just mentioned a study of its storage characteristics after washing and sizing preparation was made, and it is of more than casual interest to note that a storage test for six months conducted on 35,000 tons of this coal showed absolute freedom from spontaneous combustion. The low ash content of this coal, after preparation, together with its excellent storage properties, render it as a suitable blend for replacing one of the American coals formerly used. Mr. Strong made further progress on the installation of the large-scale experimental briquetting equipment, and with the aid of Messrs. Burrough and Swartzman conducted intermittent scale briquetting tests in a Mashek roll press on coke breeze and Welsh anthracite and mixtures of these, on petroleum coke breeze, and on char from Onakawana lignite. These briquetting tests were in addition to small laboratory-scale carbonization "tube" tests incident to the operation of the by-product oven. The net result of the coking tests was that it was ascertained that: (1) whereas Michel, B.C., coal and certain of the Alberta coals are satisfactory when used alone, most of the Alberta coals are greatly improved when used in admixture with a standard imported gas coal for the manufacture of gas and domestic coke, and (2) that as high as 35 per cent of the washed coal from Nova Scotia can be used at Montreal and still comply with the rigid specifications of the "LaSalle" domestic coke.

A. A. Swinnerton and G. P. Connell continued work on the heat treatment and laboratory assays of oil-shales and bituminous sands. Mr. Swinnerton visited the Maritime Provinces and made a report on the oil-shale development in the Pictou, N.S., and Moncton, N.B., districts. He also co-operated in compiling a report pertaining to an analysis survey of Canadian crude petroleum, shale oil, and bitumen. Mr. Connell continued work on the development of the new F.R.L. method for the low-temperature carbonization assay of coals and made a series of tests on Alberta and British Columbia coals by this method.

P. V. Rosewarne and H. McD. Chantler continued the field and laboratory work of the Oils and Natural Gas Section. Assisted by W. P. Campbell and R. J. Offord, Mr. Rosewarne conducted further investigations on the "weathering" losses incident to the stabilizing for shipment of the naphtha produced in Turner valley and made further fractionating tests on the natural gas from that field. Mr. Chantler brought to completion the analysis part of the crude oil survey and continued the annual gasoline survey work. As part of this survey he made a series of tests in the newly installed knock-testing engine and obtained the comparative octane ratings of typical gasolines marketed in Ottawa. Mr. Rosewarne was also engaged in the chemical analyses pertaining to samples of explosives submitted by the Explosives Division.

J. H. H. Nicolls and C. B. Mohr were mostly occupied on the analytical work of the Solid Fuels Analysis Section; the former paying particular attention to the recording and compiling of the results of the chemical and physical examination of Canadian coals; the latter had immediate charge of the proximate analysis, sulphur and calorific value determinations, and the reporting of the results. Mr. Nicolls made further tests on the oxidation by weathering of the sulphur-containing ingredients of high sulphur coals, examined the relation of the ash content to the original mineral matter in a series of British Columbia coals,

and continued his coal classification studies. The compilation was also made of the "Analyses of Coals and Other Solid Fuels" for inclusion in the annual "Investigations of Fuels and Fuel Testing" for the previous year.

Research Engineers. Special research problems were investigated by three research engineers, namely, T. E. Warren throughout the whole year, and Professors E. A. Smith and G. B. Frost during the summer months. Mr. Warren continued high pressure hydrogenation experiments on low temperature tar from a Nova Scotia coal, and on peat, for their direct conversion into motor fuels, and made two reports on his previous hydrogenation experimental work. He also completed the installation of large laboratory-scale equipment for the hydrogenation of coal tar and coal by a continuous process, the results of which can be more readily interpreted in terms of commercial practice than the previous small-scale intermittent tests. Professors Smith and Frost were active on co-operative research work on Canadian fuels between the Fuel Research Laboratories and their respective universities. Professor Smith continued his studies on alteration by heat of Ontario peat and lignite as part of his investigation as to the constitution of these fuels; Professor Frost was further engaged in ash fusibility studies with particular reference to Nova Scotia coals and made preliminary experiments on the synthesis of oils from water gas ingredients. As a result of work on ash fusibility he was successful in predicting by means of chemical analyses and a three dimensional chart, the fusion temperature of coal ash and to what extent this fusion temperature may be altered by blending with other coals, the ash analysis of which is known.

Routine Chemical Laboratory Work. The routine chemical laboratory work was conducted, as previously, in two sections, namely: Solid Fuels Analysis Section, and the Oils and Natural Gas Section. Mr. Gilmore reports that during the year a total of 2,202 samples of solid, liquid, and gaseous fuels were examined. Of these, 1,538 or nearly 70 per cent pertained to investigations of the division, the remaining 30 per cent originating outside the division. On the same basis, 5 per cent of the total examined was from other divisions of the Department of Mines, nearly 5 per cent from the Department of Pensions and National Health (formerly Department of Soldiers' Civil Re-establishment), slightly over 1·5 per cent from the Department of Marine and National Defence, and nearly 1 per cent from other Federal Government and Provincial Government departments. From public institutions, including the city of Ottawa, 12·5 per cent of the total examined were received, and the corresponding percentages from commercial firms and private individuals were 4 per cent and 1 per cent respectively.

The following is a classification of the various kinds of fuels analysed, arranged according to their origin, as outlined immediately above:

—	—	—	—	Per cent of total examined
1	Samples pertaining to—			
	Fuel testing investigations—			
	Solid fuels; total number samples	.....	1,033	46·9
	Coals (various kinds)	748	.....	.....
	Cokes and chars	273	.....	.....
	Peat and miscellaneous	12	.....	.....
	Liquid fuels; total number samples	.....	325	14·7
	Gasoline and other motor fuels	144	.....	.....
	Lubricating oils	165	.....	.....
	Crude oils	12	.....	.....
	Other petroleums, oils and miscellaneous	4	.....	.....
	Gases from coals, oil-shales, etc	.....	138	6·3
	Natural gas	.....	42	1·9
2	Samples from other divisions of the Department of Mines—			
	Geological Survey—coals	.....	29	1·3
	Explosives Division	.....	68	3·1
	Dynamites	10	.....	.....
	Fireworks and miscellaneous	58	.....	.....
	Other Mines Branch divisions	.....	16	0·7
3	Samples from outside the department—			
	Dept. Pensions and National Health, coals	.....	104	4·8
	Dept. Marine and National Defence, coals, etc	.....	37	1·7
	Other Government departments, coals, etc	.....	14	0·6
	Provincial governments	.....	5	0·2
	Public institutions (including city of Ottawa)	.....	276	12·6
	Commercial firms—coals, oils, and natural gas	.....	93	4·2
	Private individuals—coals, oils, and natural gas	.....	22	1·0
	Total	.....	2,202	100·0

CERAMICS AND ROAD MATERIALS DIVISION

Howells Fréchette, Chief of the Division, reports an increased demand on the testing facilities of the laboratories. The advice of the members of the staff has been sought on a number of technical matters connected with ceramic resources, manufacturing problems, and the utilization of finished products. Such advice is given not only through correspondence and to callers at the office, but the engineers, while on field work, are consulted on many points connected with plant operations.

Information has been furnished to the Department of Public Works as to road material for use at air ports and to the Naval Service regarding specifications for refractories as well as testing special fireclay shapes for oil-burning marine boilers. Assistance was also given to the Royal Mint.

CERAMICS

The results of laboratory work on the investigation of ceramic bodies for electrical heating devices completed by L. P. Collin last year, are already being put into commercial use and Mr. Collin was requested to assist one manufacturer in substituting the magnesia body in place of the body mixture formerly used. Several inquiries have been received for ceramic bodies suitable for porcelain pebble mill balls and liners, further investigation has developed porcelains superior to those on the market for use in pebble mills.

The investigation on control and development of colours of face brick in the Maritime Provinces, carried on by Mr. Collin, has resulted in the production of brick which have already partly displaced imported brick in the Maritimes.

Considerable work was carried on by Mr. Collin in co-operation with a representative of a brick company in the Maritime Provinces to determine the suitability of one of their clays for the production of a buff, salt-glazed brick.

Results obtained in the laboratory were very satisfactory and it is understood that the company will attempt commercial production of salt-glazed brick during the coming summer.

The investigation on the physical properties of Canadian brick, begun last year by Mr. Collin, has been continued.

The investigation of the Canadian refractory industry and raw materials occupied much of J. F. McMahon's time. An advance report summarizing the published information on the fireclay resources of Canada has been prepared for publication. Six weeks were spent by Mr. McMahon in the Prairie Provinces examining and sampling the exposures of refractory clays in southern Saskatchewan. Considerable laboratory work was done on problems of manufacture of firebrick from certain Saskatchewan and Nova Scotian clays and preliminary tests were made on two quartzites for the production of silcia brick. Fifty refractory clays were tested regarding their suitability for the manufacture of fireclay brick.

Mr. McMahon conducted a series of tests on use of a clay from St. Joseph de Beauce as a slip clay for glazing stoneware, and to determine the effects of adding lime, barium oxide, and iron oxide to this clay to produce better colours.

J. G. Phillips completed the laboratory investigation on the bonding of soapstone waste with sodium silicate. The most suitable type of sodium silicate for use as the bonding agent was determined and it is considered that an effective and economic method of processing has been obtained. The results indicate that bonding soapstone dust with sodium silicate will give a practical means of producing marketable soapstone shapes from soapstone quarry, and mill waste.

Additional research was carried out by Mr. Phillips on tender-drying clays to determine more fully the character of their peculiar drying properties.

During the year, 115 samples of clays and shales, 5 samples of feldspar, 6 samples of mineral pigment, 5 samples of diatomaceous earth, 5 samples of silica sand, and 4 other samples, submitted by the general public, were tested and reported upon.

Of the 275 samples of clays tested last year for Mr. F. H. McLearn, of the Geological Survey, 158 have been subjected to further tests for the purpose of estimating their possible commercial value. During the year 283 additional samples of clay were submitted by the Geological Survey and are now in course of testing.

A number of clay and silica samples, said to have been taken from deposits on Missinaibi river, Ontario, were subjected to rather extensive tests by Mr. Phillips to ascertain their suitability for use in the production of chinaware and other high-grade ceramic products.

The research on the manufacture of high-grade refractories from Canadian magnesite continued throughout the year. This investigation is being conducted in co-operation with the National Research Council of Canada.

ROAD MATERIALS

In completing an investigation commenced in 1929, R. H. Picher made a survey of the road gravel resources in that part of the province of Quebec lying south of St. Lawrence river, from Chaudière river to the eastern end of Gaspe peninsula. The work consisted in investigating the character of the gravels, estimating the amount available in each deposit, sampling the more important deposits, and studying the road-making quality of the gravel where it is in actual service.

In addition to the testing of 100 samples collected in the field, 12 samples of rock and gravel from other sources were tested to determine their qualities as road materials.

CHEMISTRY DIVISION

E. A. Thompson, Acting Chief of the Division, reports:

From April 1, 1931, to March 31, 1932, 1,300 specimens have been reported on.

Mr. F. G. Wait retired July, 1931, and was succeeded by Mr. E. A. Thompson as Acting Chief of the Division, who made analyses of 10 feldspar samples, 1 firebrick, 1 clay, 1 supposed bauxite, and 4 samples of water. Fluorine and strontium were determined in a mixed specimen of fluorite and celestite. One sand was analysed for zirconium, and 1 ore for zinc, lead, copper, and sulphur. Six vanadium determinations were made and 1 titanium in a metal sample. Four samples of asbestos were examined for soluble material and an analysis was made of battery and fire extinguisher compounds. Microscopic examinations and identifications were made of a large number of ores and rock specimens.

H. A. Leverin submitted final report on "Investigation of the Peat Litter Industry in some European Countries".

15	complete	analyses of	salt
1	"	"	iron ore
15	"	"	water and brines
1	"	"	baryte
6	"	"	clay
7	"	"	limestone and sand

Several partial analyses and identifications of minerals were made.

A. Sadler had charge of furnace assays, of which 203 were made. He made complete and partial analyses of 16 samples of uranium-bearing minerals, and tested 50 samples for radioactivity. Complete analyses were made of 6 samples of iron ore and 3 feldspars. He also made partial and complete analyses of a large number of clays, rocks, and alloys.

James Moran's work has been divided mainly between the western coal and metal mines and co-operative investigation into the causes of the Ottawa Sewer Explosion of January 28, 1931. Two hundred and eighty-nine samples of mine gases were reported on from the mines of western Canada, and 1 sample of natural gas from Ontario. The investigation of the Sewer Explosion involved analysis of 55 samples for the city of Ottawa, 23 for the Investigating Committee, and 30 for the Ottawa Gas Company. A great deal of original work has been necessary in connexion with this investigation.

C. L. O'Brian during the past year made the following analyses:

119	limestones
55	mineral wool products and raw materials
32	samples of building stones to determine the effects of weathering
28	diatomaceous earths
16	mine airs
10	radioactivity determinations in ores

Six pitchblende ores were analysed for manganese, sulphur, water, phosphorus, and specific gravity. Several miscellaneous analyses were made of ores and rocks, including samples of zinc from the Naval Service and gas purifying material from the Mineral Resources Division.

S. R. M. Badger made the following determinations on limestone and diatomite samples: 249 for sulphur; 130 for phosphorus; 74 for iron; and 193 for manganese.

DOMINION OF CANADA ASSAY OFFICE, VANCOUVER, B.C.

G. N. Ford, Manager of the Dominion of Canada Assay Office, reports:

The net value of gold bullion purchased during the year amounted to $1,609,351.64, being a decrease in value of $421,546.20 as compared with the calendar year 1930. Since September 21, 1931, acting on instructions, this office has continued to make settlement for deposits in Canadian funds, consequently the bulk of the gold from British Columbia province and Yukon territory has

been diverted to the Royal Canadian Mint, Ottawa, where settlement for gold deposits of not less than $5,000 each is being made on the basis of New York funds, or to the United States Assay Office, Seattle, Wash., to which institution gold can be shipped under export licence obtainable from the Department of Finance.

The number of deposits during the year increased 400 as compared with the preceding year, the figures being 1,574 for 1930 and 1,974 for 1931. This is in a large measure accounted for by the increase this year in the number of individuals, shipping direct or through banks, who for lack of other employment have been panning for gold.

The purchase and disposal of the gold bullion deposits during the year 1931 required a total of 2,028 meltings and 2,028 assays, quadruplicate assays being made in each instance. This includes the melting into large bars of the smaller deposits after purchase and of assaying them before shipment.

The aggregate weight of all deposits before melting was 101,617·52 troy ounces and after melting 96,470·27 troy ounces, included in which were 47 deposits containing a large proportion of base metal requiring to be cupelled. The total weight of these deposits before melting was 19,911·32 troy ounces and after melting and cupelling 16,429·73 troy ounces, showing a loss in melting and cupellation of 17·49 per cent. The average loss in melting all other bullion deposited, viz., 81,706·20 troy ounces before melting and 80,040·54 troy ounces after melting, was 2·04 per cent.

The loss in weight by assaying (base and parted silver) was 36·76 troy ounces, making the weight of bullion after melting and assaying 96,433·51 troy ounces, the average fineness of same being 808 gold and 150¼ silver.

The net value of the gold and silver contained in deposits was $1,609,351.64, and was received from the following sources:

Bars, nuggets, dust, and amalgam	Number of deposits	Before melting and assaying	After melting and assaying	Net value
		(Troy oz.)	(Troy oz.)	$ cts.
British Columbia	888	67,349·14	63,230·33	1,107,870 35
Yukon territory	187	27,124·77	26,727·01	437,331 98
Alberta	60	180·94	170·39	3,065 95
Alaska	2	152·09	151·38	2,610 45
Miscellaneous	8	15·23	13·10	222 57
Dental and jewellery scrap	829	6,795·35	6,141·30	58,250 34
	1,974	101,617·52	96,433·51	1,609,351 64

DRAUGHTING DIVISION

H. E. Baine, Chief Draughtsman

The following work was performed by the Draughting Division during the fiscal year ending March 31, 1932:

Plan of the Howland Iron Mine (Irondale), Snowdon township, Haliburton county, Ontario. Scale 300 feet to 1 inch.

Maps of gold areas in Nova Scotia, Quebec, Ontario, Manitoba, and British Columbia, respectively.

Maps to illustrate report on feldspar as follows:

Buckingham-Gatineau district, Quebec. Scale 4 miles.
Perth-Verona district, Ontario.
Hybla district, Ontario.
Mattawa district, Ontario.
Parry Sound district, Ontario.
Sudbury district, Ontario.

Key map of Canada, 35 miles to 1 inch.

Prepared five charts for Dominion Fuel Board.

Prepared seven drawings for Natural Development Bureau.

Two hundred and ninety-five page maps, drawings, charts, and flow-sheets were prepared during the year.

One thousand seven hundred and seventeen negatives and prints were made from the rectigraph machine.

Four hundred and seventy negatives, black and white, and blue prints were made from the blue-print machine.

Four hundred and eighty-five halftones and zinc blocks were sent out, received, and filed during the year.

One hundred and forty-two photographs were received and filed.

DISTRIBUTION OF PUBLICATIONS

During the fiscal year ending March 31, 1932, the distribution of Mines Branch reports, bulletins, memorandum series, press bulletins, maps, lists of mine operators, etc., amounted to 37,499 copies. Mimeographed work was done comprising some 120,000 pages, and 20,000 notification cards were issued.

LIBRARY

Mrs. O. P. R. Ogilvie, Librarian, reports:

Accessions to the Library, 1931

Books (by purchase)	304
Books (by gift)	41
Books (by transfer from other Government libraries)	37
Books (complete unbound volumes)	295
Books added to the circulating division of the Library	90
Canadian Government documents (by exchange and gift)	1,648
British and Foreign Government documents (by exchange and gift)	1,300
Scientific societies' bulletins, proceedings, and transactions (by exchange and gift)	1,708
Trades catalogues (by gift)	486
Periodicals and continuations subscribed for	277
Periodicals and serials presented to Library	382

Twenty-one volumes were bound for the Library

EXPLOSIVES DIVISION

Lt.-Col. G. Ogilvie, Chief Inspector of Explosives

Factories

Ten factories operated under licence during the year, three being engaged in the production of commercial high explosives, and to a lesser degree in that of gunpowder, nitrate mixtures, and propellants, one in the manufacture chiefly of small arm ammunition and detonators, one in that of safety fuse, and another of caps for toy pistols, and three were devoted to the manufacture of fireworks. Another came into operation for short periods as required for the manufacture of fulminate of mercury.

Two accidents, attended by loss of life, occurred in course of operations. The first of these, an explosion in the "Atlas Mix" house at the Nobel factory of the Canadian Industries, Limited, on June 26, resulted in the death of four men. Three of the victims were the men continuously employed in the building; the fourth was a trucker who was caught by the explosion as he was leaving the building. The stage of operation at the time of the explosion was closely determined on investigation, and although the specific cause must be largely a matter of conjecture, the indications were that the explosion was most probably brought about by an inadvertent blow on a film of the mixture, with nitroglycerine not fully incorporated at this stage, when the operator was engaged in scooping the adhering explosive from the sides of the bowl into the path of the wheel. Although this has long been the general practice, and not regarded as a dangerous one, it has been found possible, after extensive trials, to so modify the procedure as to obviate the necessity of scooping the mixture while the machine is in operation.

The circumstances of this accident, and of one at Brownsburg on December 21, have been more fully discussed in the Annual Report of the Division for 1931. The accident at Brownsburg occurred in a building used for mixing primer composition, the few pounds of which present exploded. By the explosion the operator was killed, and the building, which was of light construction, immediately took fire and was destroyed. This destruction, coupled with the fact that the unfortunate victim, working alone, had not been in contact with other employees for over an hour, left very little evidence available from which the cause could be deduced. It appeared, however, that the explosion took place at the bench on which the dry mixture would be deposited for mixing with a gum arabic solution, and may well have been brought about by some inadvertent action at this stage, although the operator was a very reliable man, for many years employed at this work.

An employee of the T. W. Hand Fireworks Company at Dixie, Ontario, sustained severe burns caused by the ignition of composition with which he was filling candles on January 26. The charges are inserted little by little and pressed home after each addition by the plungers of the machine. The flashing of the powder during one such operation was probably due to excessive friction such as might be set up by tight candle, or one not truly uniform and smooth.

At the factory of the Macdonald Metal Products Company, Limited, Waterloo, Que., an employee was injured by burns of a minor character on April 16 when a batch of twenty-five sheets of caps for toy pistols, which she was placing on a bench for examination, flashed. A "sheet" consists of two adhering sheets between which are spaced the small charges for the caps—the whole sheet being subsequently cut up to form separate caps, or strips of caps. In some instances

sheets are found on examination to have the upper and lower surfaces imperfectly adhering, and it is believed that the ignition was caused by friction on the loose composition contained within one such sheet.

Inspections of factories, of which 33 were made by inspectors of the division and 3, supplementary, by deputy inspectors of the Royal Canadian Mounted Police, showed the regulations and terms of licence to be satisfactorily observed.

Magazines

The magazines under licence on March 31, 1931, numbered 334 and, in addition, licences were issued during the year covering the operation of 232 temporary magazines, an increase, in all, of 13 over the previous year.

Thefts from magazines have been more common. A temporary magazine for use on road construction work was broken into and 57 cases stolen. From another temporary magazine 21 cases were stolen, but of these 20 cases were recovered, the thief being detected and convicted. There were eleven other instances involving thefts of small quantities, amounting in all to about 20 cases of explosives and 1,400 detonators.

Following inspection, 290 cases of deteriorated explosives were destroyed on the conclusion of certain large construction operations, also 100 cases of old explosives that had been held at another place for many years without occasion arising for their use. In addition, over 5,000 pounds of high explosives, a few detonators, and a small quantity of black powder, distributed over 22 magazines, were destroyed after inspection.

No accident occurred in connexion with the operations of magazines, but one magazine was destroyed by a bush fire, time having permitted, however, the removal of the explosives. Inspectors of the division made 398 inspections of magazines, and Deputy Inspectors of the Royal Canadian Mounted Police, 195.

Unlicensed Premises

The inspection of stores in which small quantities of explosives and small arm ammunition were kept for sale, and the checking of records of their receipts and issues, was carried out by inspectors of the division, and by the Royal Canadian Mounted Police. Six hundred and fifty visits were made by inspectors, and with the extensive work of the members of the Royal Canadian Mounted Police, who made over 2,200 visits, the premises of dealers were well covered. In these inspections were also included many small stores of explosives held for use by work parties, and only on very rare occasions was it found necessary to have recourse to prosecution to enforce the regulations. The danger of accidents arising, possibly indirectly, from faulty keeping of explosives, is undoubtedly greatest in the case of explosives that have been kept, or allowed to remain forgotten and unsuspected, about dwelling houses and barns. Such, too frequently, figure in reports of accidents arising through playing with explosives; a hazard to which attention is continually being drawn by inspectors and by the police—a cautionary work in which the co-operation of Safety Leagues and the Press has also been welcomed.

Prosecutions

Prosecutions were entered and convictions obtained in seven cases; one in respect to keeping more explosives in a magazine than allowed by the licence, one for keeping dynamite and detonators together, two for violation of the regulations for "detached stores" or "receptacles", two for failing to keep records of receipts and issues of explosives, and one for breach of the regulations for the conveyance of explosives.

Importations

Four hundred and forty-two permits and 47 special permits were issued for the importation of explosives. The rejection of Chinese fireworks presented for importation showed a gratifying decrease in 1931, having dropped from 13 per cent to 3 per cent which would suggest that the careful examination as conducted by the Customs officers, the Royal Canadian Mounted Police, and the Dominion Analyst at Vancouver, has had the effect of causing shippers to make better endeavour to eliminate unauthorized fireworks from their shipments.

Authorization of Explosives

Ten explosives were added to the Authorized List, and changes in the composition of three others were authorized. Three presented for authorization were rejected, and eight authorized explosives were withdrawn from the list on the application of the manufacturers. Two new varieties of fireworks were added.

Accidents

Accidents in the use of explosives, and miscellaneous accidents with explosives, are considered in relation to their causes in the Annual Report of the Division. The fatalities occurring in the use of explosives were markedly below the average of recent years. The number of injured—elsewhere than in mines and quarries—shows an increase, but this may be, in part at least, attributable to greater success in obtaining more complete information of non-fatal accidents. During the year 1931, 9 persons were killed and 62 injured in explosives accidents in mines and quarries, and 18 killed and 71 injured in other operations. The number of accidents from various causes, not directly associated with the use of explosives and mostly due to playing with explosives, showed little change. To playing with explosives are attributed 3 deaths and injuries to 50 persons.

Staff

On the retirement, on March 31, 1931, of the Chief Explosives Chemist, the division ceased to maintain a chemical section. The chemical work of the Division is now carried out in the Fuel Research Laboratories of the Department.

EDITORIAL DIVISION

F. Nicolas, Editor-in-Chief

During the fiscal year twenty-eight separate English publications were issued by the department, consisting of annual reports, memoirs, bulletins, and pamphlets; there were issued, also, two lists of mine operators and mines. Four reports were published in French.

At the end of the fiscal year there were in the hands of the King's Printer seven English reports and one French translation of the Geological Survey, two English reports of the National Museum, four English reports and two French translations of the Mines Branch, and one English report and one French translation of the Explosives Division. Several reports, also, were being edited preparatory to dispatch for printing, and several French translations are now in course of preparation.

The following list includes the publications issued by the various branches of the department during the fiscal year, under the supervision of the Editor-in-Chief, and the French publications distributed[1] during that period:

General Index

A general index, bringing the indexing of all Geological Survey reports up to the end of 1926, is now available on application.

DEPARTMENT OF MINES

Report No.

English Publications

2297. *Report of the Department of Mines for the Fiscal Year ending March 31, 1931:* 61 pages; 2,000 copies; published January 28, 1932.
Separate: *Educational Services of the Geological Survey:* 2 pages; 1,000 copies; published January 22, 1932.

GEOLOGICAL SURVEY

English Publications

General Instructions, Geological Survey and National Museum: 49 pages; 500 copies; published May 4, 1931.

Published Maps (1917-1930, Geological Survey)—compiled by P. J. Moran: 16 pages; 1,000 copies; published October 8, 1931.

2266. Memoir 165. *Studies of Geophysical Methods, 1928 and 1929*—by L. Gilchrist, J. B. Mawdsley, A. S. Eve, D. A. Keys, H. G. I. Watson, and J. H. Swartz: 225 pages; 1 plate; 66 figures; 11 plans; 3,000 copies; published November 5, 1931.

2267. Memoir 166. *Geology and Ore Deposits of the Rouyn-Harricanaw Region, Quebec*—by H. C. Cooke, W. F. James, and J. B. Mawdsley: 314 pages; 3 plates, 28 figures; 1 map; 3,000 copies; published September 17, 1931.

2268. Memoir 167. *Fort William and Port Arthur, and Thunder Cape Map-areas, Thunder Bay District, Ontario*—by T. L. Tanton: 222 pages; 6 plates; 1 figure; 3 maps; 2,500 copies; published September 29, 1931.

2283. Memoir 168. *Late-Glacial Correlations and Ice Recessions in Manitoba*—by E. Antevs: 76 pages; 1 plate; 7 figures; 2,000 copies; published November 17, 1931.

2288. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1930, Part D:* 143 pages; 1 plate; 5 figures; 3,000 copies; published January 21, 1932.
Separate: *Deep Borings in Ontario, Quebec, and the Maritime Provinces*—by W. A. Johnston: 18 pages; 100 copies; published March 31, 1932.

[1] The distribution of English publications was made as usual by the branches that prepared them.

GEOLOGICAL SURVEY—*Concluded*

Report No.

English Publications—Concluded

2289. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1930, Part B:* 103 pages; 7 figures; 1 table; 2,500 copies; published January 13, 1932.

Separate: *Deep Borings in the Prairie Provinces*—by W. A. Johnston: 24 pages; 100 copies; published March 31, 1932.

2292. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1930, Part A:* 196 pages; 3 plates; 10 figures; 1 map; 3,000 copies; published January 14, 1932.

2293. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1930, Part C:* 131 pages; 8 figures; 2,500 copies; published January 5, 1932.

2296. Memoir 169. *Geology and Mineral Deposits of a Part of Southeastern Manitoba*—by J. F. Wright: 150 pages; 9 figures; 1 map; 2,500 copies; published March 24, 1932.

Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1931, Part C. Separate: *Oxford House Area, Manitoba*—by J. F. Wright: 25 pages; 1 figure; 250 copies; published February 5, 1932.

NATIONAL MUSEUM OF CANADA

French Translation

Bulletin 66. *Etudes floristiques sur la région de Matapedia, Québec; Notes sur la flore de Saint-Urbain, comté de Charlevoix, Québec:* by Jacques Rousseau: 30 pages; 2 plates; 3 figures; 2,000 copies; published May 18, 1931.

MINES BRANCH

English Publications

707. *Chrysotile-Asbestos in Canada*—by Capt. J. G. Ross: 146 pages; 34 plates; 8 figures; 6 charts; 4,000 copies; published November 25, 1931.

720. *Investigations in Ore Dressing and Metallurgy, 1929:* 208 pages; 1 plate; 1 figure; 4,000 copies; published May 19, 1931.

721. *Investigations in Fuels and Fuel Testing, 1929:* 131 pages; 8 plates; 8 figures; 3,300 copies; published March 30, 1932.

Separate: *Analysis of Natural Gas from the Turner Valley Field, Alberta:* 27 pages; 3 plates; 4 figures; 500 copies; published May 2, 1931.

Separate: *Tests on Sydney Coal in the Illingworth Low-Temperature Carbonization Retort:* 23 pages; 3 plates; 3 figures; 500 copies; published September 5, 1931.

722. *Investigations in Ceramics and Road Materials, 1929:* 143 pages; 3 plates; 18 figures; 4,000 copies; published October 17, 1931.

723. *Investigations of Mineral Resources and the Mining Industry, 1930:* 82 pages; 5 plates; 2 figures; 4,000 copies; published December 16, 1931.

723–1. Separate: *Bituminous Sands of Northern Alberta; Operations During 1930:* 11 pages; 3 plates; 2 figures; 300 copies; published June 30, 1931.

723–2. Separate: *Possible Industrial Uses for Bentonite:* 23 pages; 500 copies; published April 8, 1931.

Helium in Canada from 1926-31 (Advance Section of *Investigations of Mineral Resources and Mining Industry, 1931):* 13 pages; 500 copies; published December 31, 1931.

The Suitability of Certain Canadian Sands for Sandblasting (Advance Section of *Investigations of Mineral Resources and Mining Industry, 1931):* 11 pages; 15 plates; 300 copies; published December 30, 1931.

Lists of Mines and Mine Operators in Canada:

Cement Mills: 1,000 copies; published May 18, 1931.

Stone Quarries: 1,500 copies; published July 3, 1931.

Report No.

French Translations

676. Les Abrasifs, Partie II: *Corindon et Diamant*—by V. L. Eardley-Wilmot: 53 pages; 5 plates; 6 figures; 1,250 copies; published July 24, 1931.

678. Les Abrasifs, Partie III: *Le Grenat*—by V. L. Eardley-Wilmot: 73 pages; 4 plates; 19 figures; 1,250 copies; published December 11, 1931.

EXPLOSIVES DIVISION

Report No.

English Publication

29. *Annual Report of the Explosives Division for the Calendar Year 1930:* 19 pages; 2,000 copies; published June 2, 1931.

French Translation

30. *Rapport annuel de la Division des Explosifs pour l'année civile 1930:* 18 pages; 1,000 copies; published June 30, 1931.

DISTRIBUTION OF FRENCH PUBLICATIONS

The French publications of the Department of Mines, including those of the Geological Survey, the National Museum, the Mines Branch, and the Explosives Division, are distributed by the Editorial Division under the supervision of P. E. Lévesque, in charge of the Translation Office. During the fiscal year 1931-32, 8,158 copies were distributed in Canada and foreign countries, as follows: 3,736 copies to addresses on the mailing lists, through the Printing Bureau Distribution Office, and 4,422 copies in compliance with written or personal requests, from this office. This distribution does not include, however, the publications sent out directly by the Dominion Fuel Board and the Explosives Division to their correspondents.

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ACCOUNTING DIVISION

ACCOUNTANT'S STATEMENT

E. A. Sawyer

The funds available for the work and the expenditure of the Department of Mines for the fiscal year ending March 31, 1932, were:

—	Grant	Expenditure	Grant not used
	$ cts.	$ cts.	$ cts.
CIVIL GOVERNMENT—			
Salaries—			
Department	97,160 00	86,578 49	10,581 51
Mines Branch	232,345 00	221,405 36	10,939 64
Geological Survey	317,980 00	301,435 95	16,544 05
	647,485 00	609,419 80	38,065 20
Contingencies	15,000 00	8,913 79	6,086 21
DEPARTMENT—			
Explosives Division	10,000 00	8,386 52	1,613 48
MINES BRANCH—			
For investigation of mineral resources, etc	300,000 00		
Salaries and wages		158,333 24	
Ore Dressing and Metallurgical Division		33,352 99	
Fuels and Fuel Testing Division		30,357 64	
Mineral Resources Division		14,788 06	
Ceramics and Road Materials Division		5,913 07	
Mechanical Section		4,328 87	
Dominion Fuel Board		1,623 92	
		249,197 79	50,802 21
For publications, English and French, etc	50,000 00		
Publication of reports, maps, etc		21,096 42	
Salaries and wages		9,904 00	
Printing, stationery, typewriters, etc		6,386 39	
Library		3,292 27	
Miscellaneous		1,616 58	
Advertising		947 91	
Chemical Division		686 25	
		43,929 82	6,070 18
To compensate J. H. Fortune for quarters	100 00	97 77	2 23
DOMINION OF CANADA ASSAY OFFICE—			
For maintenance of Assay Office, Vancouver	25,500 00		
Salaries		20,880 00	
Assayers' supplies		1,380 82	
Miscellaneous		875 31	
Premium on bonds		390 25	
Electric burglar alarm service		360 00	
Typewriters, repairs, and stationery		69 22	
		23,955 60	
Less assaying and refining platinum		26 00	
		23,929 60	
Add adjustment 1930-31		02	
		23,929 62	1,570 38
GEOLOGICAL SURVEY—			
For explorations, surveys, and investigations, etc	190,000 00		
Explorations, surveys, and investigations		117,315 95	
Salaries and wages		36,966 80	
Equipment and supplies		6,794 57	
Miscellaneous		1,711 61	
Photographic work		718 47	
		163,507 40	26,492 60

ACCOUNTANT'S STATEMENT—*Continued*

—	Grant	Expenditure	Grant not used
	$ cts.	$ cts.	$ cts.
GEOLOGICAL SURVEY—*Concluded*			
For publication of English and French editions, etc.	70,000 00		
Printing reports, etc.		36,401 74	
Salaries and wages.		18,278 47	
Publication of maps, etc.		9,764 71	
		64,444 92	5,555 08
For maintenance of offices and museum, etc.	65,000 00		
Salaries and wages.		27,288 97	
Stationery, printing, typewriters, etc.		11,402 94	
Library		4,917 72	
Instruments and repairs.		4,915 17	
Miscellaneous.		3,052 55	
Lectures and motion pictures.		1,885 93	
Photographic Division.		1,459 71	
Advertising.		987 02	
Chemicals and drugs.		721 65	
Postage.		711 50	
B.C. Office.		250 84	
		57,594 00	7,406 00
For Museum equipment.	12,000 00		
Salaries and wages.		3,967 20	
New equipment and material.		2,947 82	
Maintenance		327 96	
		7,242 98	4,757 02
For purchase of specimens.	2,000 00	849 58	1,150 42
MISCELLANEOUS—			
To provide for payments to railways, etc.	1,428,000 00	721,400 82	706,599 18
Grant to Imperial Institute.	9,733 33	9,733 33	
MISCELLANEOUS (Statutes)—			
Domestic Fuel Act (1927) payments.		15,592 56	
Miscellaneous gratuities.		684 00	

Summary

Civil Government salaries.	647,485 00	609,419 80	38,065 20
Civil Government contingencies.	15,000 00	8,913 79	6,086 21
Department.	10,000 00	8,386 52	1,613 48
Mines Branch.	350,100 00	293,225 38	56,874 62
Dominion of Canada Assay Office.	25,500 00	23,929 62	1,570 38
Geological Survey.	339,000 00	293,638 88	45,361 12
Miscellaneous.	1,437,733 33	731,134 15	706,599 18
Miscellaneous (Statutes).	16,276 56	16,276 56	
	$ 2,841,094 89	1,984,924 70	856,170 19

ACCOUNTANT'S STATEMENT—*Concluded*

DETAILS OF REVENUE

Revenue for the Department of Mines for the Fiscal Year ending March 31, 1932

Casual Revenue

	$ cts.	$ cts.	$ cts.
DEPARTMENT—			
Sale of explosives permits	1,826 10		
Sale of equipment (Explosives Division)	625 00		
Sale of publications-Lignite Utilization Board	6 00	2,457 10	
MINES BRANCH—			
Account sale of peat plant and interest	2,175 00		
Assays and analyses	1,235 10		
Sale of publications (Mines Branch)	320 04		
Sale of equipment	242 51		
Sale of publications (Dominion Fuel Board)	60 40		
Sale of peat fuel	52 70		
Miscellaneous revenue	497 36	4,583 11	
DOMINION OF CANADA ASSAY OFFICE—			
Profit on bullion	1,913 08		
Sale of residue	773 11		
Assays and analyses	3 00	2,689 19	
GEOLOGICAL SURVEY—			
Sale of publications	1,886 34		
Sale of minerals	945 83		
Sale of equipment	603 15		
Sale of relief models	305 00		
Miscellaneous revenue	432 98	4,173 30	13,902 70
FINES AND FORFEITURES—			
Explosives Division fines		205 00	205 00
PREMIUM DISCOUNT AND EXCHANGE—			
Exchange—			
Geological Survey on U.S. Money Orders	1 66		
Mines Branch on U.S. Money Orders	1 21		2 87
			14,110 57

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