DOMINION OF CANADA

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE

FISCAL YEAR ENDING MARCH 31, 1933

OTTAWA
J. O. PATENAUDE, ACTING KING'S PRINTER
1933

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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, 1933.

W. A. GORDON,
Minister of Mines.

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REPORT

OF THE

DEPARTMENT OF MINES

FOR THE FISCAL YEAR ENDING MARCH 31, 1933

To the Honourable W. A. GORDON, K.C., M.P.,
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, 1933.

The year 1933 marks the entrance of the Department of Mines on the second quarter century period of its history. Canada's mineral industry has made remarkable progress since 1907, the year of the creation of the department, and today Canada enjoys an enviable status among the mineral nations of the world. The extent to which the department has contributed to this progress may be summed up by stating that in virtually every mineral development of consequence there is evidence of its activity, both as participant and as pioneer. The ceramic industry, a vigorous and expanding industry today, is being greatly aided in its development by our ceramic laboratories. Research and investigative work under the department's direction has shown that the Canadian building-stone industry is in a position to meet, successfully, competition in the domestic market from outside sources. As an outcome of experiments in our fuel research laboratories, conducted in many cases with the co-operation of the industry, coals from Canadian sources are penetrating into markets formerly enjoyed exclusively by imported coals. During the past ten years in particular, most of the milling and metallurgical plants placed in operation are using treatment methods, or slight modifications of such methods, that have been devised in the department's ore dressing and metallurgical laboratories. As in most of these cases the assistance given has been a prerequisite to successful operation, and as the properties concerned are now contributing notably to the Canadian mineral output, the practical value of such assistance is at once apparent. It is doubtful if there are anywhere on the American continent, or perhaps in the world, such facilities for experimental and test work as are provided by the laboratories of the Ore Dressing Division of the Mines Branch. The Geological Survey, established in 1843, had gained recognition long before the creation of the department. Its participation in the development of Canada's mineral resources is too well known to require comment.

The department's activities for the year are reviewed in detail hereunder by the heads of each branch and division. A perusal of these statements will show that the more urgent economic services to the mining industry have been maintained despite the substantial decrease in appropriations, necessitated by a continuance of unfavourable industrial conditions throughout the year. Ten of the thirty-five parties assigned to field work by the Geological Survey were engaged in the exploration and mapping of several of the most promising mineral areas in Yukon and the Northwest Territories, and in the northerly parts of British Columbia, Saskatchewan, Manitoba, and Quebec. Additional parties

conducted detailed investigative work in several of the older mineral areas throughout Canada, of known economic interest. Activities of the National Museum staff were limited to office and laboratory work as no funds were available for field investigations.

Activities of the Mines Branch were concentrated chiefly in an effort toward improvement in treatment methods and in products, the lowering of production costs, and the replacement of imported materials by domestic products. Heightened interest in the search for gold accounted for a substantial increase in the number of investigations in the ore dressing and metallurgical laboratories. Mention may also be made of the data prepared for, and the technical advice supplied to, the Canadian Government at the Imperial Economic Conference, by the Mineral Resources Division.

Intensive investigations on radium ores from Great Bear Lake area resulted in the formulation of a treatment method that is now being used as a basis for the recovery of radium by the Eldorado Gold Mines, Limited, at its Port Hope plant. The method devised, it is believed, will reduce the length of operation necessary to produce radium salts from three months, the time reported to be required by the Belgian process, to less than half that period. This work, carried out in the department's ore dressing and metallurgical laboratories, is regarded by leading metallurgists as an outstanding contribution to metallurgical science. The nature of the Canadian ores is such that treatment methods used elsewhere are not applicable. For this reason, it is a source of satisfaction to record the accomplishment in this report. Geological investigations were continued in the area during the 1932 field season and the first official geological map has since been issued.

The demand for publications showed little change from previous years, and in the case of the two reports on gold the demand was exceptionally keen. A feature worthy of note is the great excess of publications distributed in reply to casual requests over those forwarded through the regular mailing lists.

Information of scientific, technical, and current interest other than that contained in the maps and reports was disseminated through the public and technical press and by papers and addresses by members of the staff. A selection of these papers and addresses is listed on pages 5 to 8.

The series of lectures presented during the winter months, a phase of the activities of the National Museum of Canada, proved highly popular both to adults and to the children. Through the medium of its fortnightly newsletter service to the High Commissioner's office in London, the department has kept interests in the Old Country posted on the more outstanding developments in the Canadian mineral industry. Judging from correspondence to hand this service, which is now in its tenth year, is regarded virtually as a necessity by a large part of the overseas clientele. The titles of the articles dispatched during the year are shown below the list of papers and addresses.

The department's activities were greatly facilitated through the co-operation received from other departments of the Federal Government; from the various provincial departments; from development branches of the two large railways; and from banks and chambers of commerce, and such other organizations as are actively concerned with the development of our mineral resources. Contacts 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 were maintained as in former years.

The Deputy Minister, in addition to his departmental activities, served as Chairman of the Dominion Fuel Board, the main activities of which are shown below. He also served on the following official bodies: National Research Council, and several of its associate committees; Council of the Northwest Territories; Canadian Committee of the World Power Conference; Advisory

Committee on Minerals, of the Imperial Institute; and the Executive Committee of the Fifth Pacific Science Congress, 1933. During the Imperial Economic Conference he acted in an advisory capacity to the Canadian Government.

A new high record in the value of gold output, and in exports of copper; a search for gold, more intensive than any heretofore undertaken, with results that have been particularly gratifying; the erection of Canada's first radium extraction plant; and, above all, a further remarkable demonstration of its ability to weather a severe economic storm, are the highlights of the Canadian mineral industry during the year under review.

With gold as a notable exception among the metallic minerals, and with a few scattered exceptions among the non-metallics, declines were recorded both in value and quantity of output throughout the whole list of minerals. Clay products and other structural materials bore the brunt of the decline. Conditions were ideal for the gold industry, and operators, exploration companies, and prospectors were not slow to take advantage of them. Mill capacities were increased, abandoned mines reopened, older areas given a finer combing, and new fields explored. Placer deposits, many of which had been dormant for years, were again given attention.

The outlook for the gold industry is particularly bright. Ample reserves are available at practically all the larger properties; exploratory work is disclosing extensions of new ore-bodies; new properties, which were being prepared for production in 1932, are among the contributors to the output for the current year; the high price received for the metal has made possible the serious consideration for development of deposits that would otherwise be given little attention. In addition, any improvement in base metal prices will be reflected in an increased output of gold obtained as a by-product of such operations.

Conditions under which the base metal industry operated during the year were the antithesis of those existing in the gold industry. Yet, against such discouraging conditions, and in the face of a prohibitive copper tariff enacted by our biggest customer, many notable achievements could be recorded. This country, in the last decade, has advanced from a position of distinctly minor importance to a point where it may be seriously suggested that no other country is more vitally interested in the conditions surrounding international trade in base metals. The Dominion's exportable surplus of the metals—lead, zinc, and copper—amounts in normal years to some 300,000 tons. Canadian producers must then be prepared to meet competition, sharp or otherwise, depending on world economic conditions, from other base metal exporting countries. In this connexion it is of interest to note that James Y. Murdoch, President of the Noranda Mines, Limited, is authority for a statement to the effect that the major part of Canada's production of copper can be made at a cost of 5 cents a pound or less—which means that no other copper exporting country can undersell the Canadian producer and continue to operate at a profit. Canada is equally as well situated in respect to lead and zinc. Canadian producers of lead, zinc, copper, and nickel have shown good salesmanship in their efforts to maintain and to extend their export trade.

Canada's non-metallic industry is largely free from the worries of trade barriers. The outlook, then, is much less involved than that of the base metals, and is dependent mainly on the vicissitudes of the industry. One of the brightest features bearing on the outlook is the increased tendency toward a greater use of Canadian products in the domestic markets.

Near the close of the fiscal year determined measures were being taken by the leading nations of the world to deal an effective blow to the industrial stagnation of recent years. Canada's mining enterprises, industrialized as they are to a high degree, are in a strategic position to step into line with contemporary industries on the road to normal activity.

Dominion Fuel Board

Eight meetings of the Dominion Fuel Board were held during the fiscal year, in addition to many sub-committee meetings.

In April a new Order in Council approved payment for assistance for Canadian coal used in coking plants. In May a number of the Orders in Council providing assistance to Maritime coal were combined in a new Order in Council, which also provided increased assistance designed to enlarge the market for Maritime coal, particularly in facilitating the extension of existing markets to points in Ontario farther west than had been heretofore attainable. The conditions under which assistance could be obtained on coal for railway use were also further extended. The provisions of this Order in Council were further amended in July and in November. The Dominion Fuel Board, as with previous Orders in Council assisting in the movement of coal, was charged with the administration of the Order, and this administrative work continues to increase from year to year.

During the fiscal year approximately 1,151,000 tons of Canadian coal were moved under assisted rates, at a cost to the Government of approximately $986,000 as compared with the movement of 776,000 tons in 1931 at a cost of $556,000.

The Domestic Fuel Act (1927) continued to be administered by the board. During the year an agreement in connexion with a coking plant in Vancouver was completed, part of the new plant being placed in operation early in 1933.

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.

The survey of coal mine operating costs, initiated in 1930, is now being carried out annually. For 1931 these costs were compiled in a chart which was published and distributed in 1932 to those interested. A similar chart will be published during the summer of 1933 covering the costs obtaining in the calendar year 1932.

The customary inspections of the coal mining districts and of coking plants operating under the Domestic Fuel Act (1927) were carried out by the Secretary and adjustments made of difficulties arising in the administration of the Orders in Council covering coal movements and of the Domestic Fuel Act.

Prior to the Imperial Conference the board was asked to prepare special memoranda covering the fuel situation in Canada, and the board also carried out an investigation of the factors entering into the import trade in anthracite.

During the year the board, in co-operation with the National Development Bureau, published a booklet on "The Insulation of New and Old Homes," the third of a series on allied subjects.

Many conferences with coal mine operators and coal distributors were held by the Chairman and Secretary and many schemes proposed for the benefit of the industry were examined and analysed.

In the summer of 1932 the Secretary while on leave in Great Britain made a critical examination of the conditions and costs existing in connexion with export of British coals, with particular reference to the anthracite trade.

The board once more acknowledges with pleasure the hearty co-operation received from the members of the coal industry and from many individuals and Government departments throughout Canada.

Your obedient servant,

CHARLES CAMSELL,
Deputy Minister.

OTTAWA, ONT., July 7, 1933.

List of Papers and Addresses

General

Progress of Mining, by Hon. W. A. Gordon. Annual General Meeting, Canadian Institute of Mining and Metallurgy, Montreal, April 7, 1932.
The Mining Industry, by Hon. W. A. Gordon. Kiwanis Club, Kirkland Lake, Ontario, July 5, 1932.
Brief Review of the Mining Industry in Quebec, 1932, by Hon. W. A. Gordon. Christmas Number, The Quebec Mining News, Amos, Que., December 17, 1932.
Some Features of Ontario's Mining Industry, by Hon. W. A. Gordon. The Star, Sudbury, December 31, 1932.
Mining in Canada, by Hon. W. A. Gordon. Financial Review Edition, The Globe, Toronto, January 2, 1933.
Canada's Mining Industry, by Hon. W. A. Gordon. "Canada," New Year Number, January, 1933.
A New Year's Message, by Hon. W. A. Gordon. The Miner, Vancouver, B.C., January, 1933.
The Mining Industry in 1932—The Outlook, by Hon. W. A. Gordon. Commercial and Financial Review Number, The Gazette, Montreal, January 4, 1933.
Canada's Mining Industry, by Hon. W. A. Gordon. Saturday Night, Toronto, January 21, 1933.
What the Gold Mining Industry Means to Canada, by Hon. W. A. Gordon. Radio Broadcast, CNRO, Ottawa, February 28, 1933.
The Mineral Position of the British Empire, by Charles Camsell. Paper presented at Annual General Meeting, Canadian Institute of Mining and Metallurgy, April 5, 1932.
Canadian Base Metal Producers Ready to Take Advantage of Trade Agreements, by Charles Camsell. Canadian Gazette, London, January, 1933.
Canada's Mineral Industry, 1932—The Outlook, by Charles Camsell. Financial Times, Montreal, March 3, 1933.
Canada's Position in Empire Mineral Development, by Charles Camsell. Presidential Address, Annual General Meeting, Engineering Institute of Canada, Ottawa, February 7, 1933.
The Ceramic Industry, by Charles Camsell. Address before the Annual General Meeting, Canadian Ceramic Society, Ottawa, February 27, 1933.

Geology, Mineralogy, Mining, and Mineral Resources

Field Work of the Geological Survey, 1932, by W. H. Collins. Canadian Mining Journal, July, 1932.
A Pitchblende-Silver Deposit, Great Bear Lake, Canada, by D. F. Kidd. Economic Geology, March-April, 1932.
Oil Prospects of the Great Slave Lake and Mackenzie River Areas, by G. S. Hume. Canadian Institute of Mining and Metallurgy, Montreal, April 6, 1932.
Talcum at Madoc, Hastings County, Ont., by M. E. Wilson. Canadian Field Naturalist, April, 1932.
Deformation a Factor in Producing Linear Batholiths, by F. A. Kerr. Royal Society of Canada, Sec. IV, May 28, 1932.
Placer Deposits in Northern British Columbia and Southern Yukon, by F. A. Kerr. Canadian Mining Journal, May, 1932.
Silica Content of a Quartz Vein-Forming Solution, by H. C. Cooke. Royal Society of Canada, Sec. IV, May 28, 1932.
Mining Opportunities in Manitoba, by J. F. Wright. Canadian Institute of Mining and Metallurgy, Winnipeg, June 6, 1932.
Geology and Gold Prospects of the Area about Island, Gods, and Oxford Lakes, Manitoba, by J. F. Wright. Bulletin Canadian Institute of Mining and Metallurgy, August, 1932.
Great Bear Lake-Coppermine River Area, by D. F. Kidd. Bulletin Canadian Institute of Mining and Metallurgy, September, 1932.
Monashee Creek Placers, Osoyoos District, British Columbia, by C. E. Cairnes. Canadian Mining Journal, October, 1932.
Notes on Hydraulic Area, Cariboo District, British Columbia, by W. E. Cockfield. Western Meeting Canadian Institute of Mining and Metallurgy, Vancouver, November 29, 1932.
Great Bear Lake, by D. F. Kidd. Rotary Club, Vancouver, November 29, 1932.
Gold in the Taku River District, by F. A. Kerr. Western Annual Meeting, Canadian Institute of Mining and Metallurgy, November 29, 1932.
Samson's Shoulder Stone—an Erratic near Perth, Lanark, Ontario, by M. E. Wilson. Canadian Field Naturalist, November, 1932.
Great Bear Lake Developments in 1932, by D. F. Kidd. Western Branch, Canadian Institute of Mining and Metallurgy, Vancouver, December 2, 1932.

Mineral Possibilities in the Vicinity of Cranbrook, Kootenay District, B.C., by C. E. Cairnes. Western Branch, Canadian Institute of Mining and Metallurgy, Vancouver, December 2, 1932.

Geology of Gaspe Peninsula: Picturesque Gaspe: Geology of New Brunswick, by F. J. Alcock, Queen's University, Kingston, December 7 and 8, 1932.

Lacustrine Concretions of Manganese, by E. M. Kindle. American Journal of Science, December, 1932.

Portraying Geological Structure of Canadian Coalfields, by B. R. MacKay. Transactions, Canadian Institute of Mining and Metallurgy, 1932.

Experiments with the Settling of Bentonite in Water, by E. M. Kindle. Bulletin, U.S. National Research Council, 1932.

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Plumb-line Difficulties and Gravity Anomalies in Gaspe Peninsula and Their Significance, by F. J. Alcock and A. H. Miller. Transactions Royal Society of Canada, Sec. IV, 1932.

Form and Mechanics of Intrusion of the Nimpkish "Batholith," by H. C. Gunning. Transactions Royal Society of Canada, Sec. IV, 1932.

Varved Clays of Tide Lake, British Columbia, by George Hanson. Trans. Royal Society of Canada, Sec. IV, 1932.

The Character of the Coast Range Composite Batholith of Northern British Columbia, by F. A. Kerr. Transactions Royal Society of Canada, Sec. IV, 1932.

Problems of the Lower Cretaceous of the Canadian Interior, by F. H. McLearn. Transactions Royal Society of Canada, Sec. IV, 1932.

Solifluction and Other Features in Northern Canada, Shown by Photographs from the Air, by D. A. Nichols. Transactions Royal Society of Canada, Sec. IV, 1932.

Notes on Some Deep Wells in Saskatchewan, by R. T. D. Wickenden. Transactions Royal Society of Canada, Sec. IV, 1932.

Accessory Minerals in the Study of Granite Batholiths, by J. F. Wright. Transactions Royal Society of Canada, Sec. IV, 1932.

The Geological Investigation of the Canadian Shield (Canadian Portion 1882-1932), by G. A. Young. Transactions Royal Society of Canada, Sec. IV, 1932.

Growth of Theories of Formation of Ore Deposits in the Last Fifty Years, by H. C. Cooke. "Fifty Years of Retrospect," Royal Society of Canada, 1932.

Fifty Years of Pleistocene Geology in Canada, by W. A. Johnston. "Fifty Years of Retrospect," Royal Society of Canada, 1932.

Trends in Fifty Years of Canadian Stratigraphy, by F. H. McLearn. "Fifty Years of Retrospect," Royal Society of Canada, 1932.

Some Aspects of the Geological Studies of the Canadian Shield, by G. A. Young. "Fifty Years of Retrospect," Royal Society of Canada, 1932.

The Petroleum Prospects of Canada: Stratigraphy and Structure of the Foothills and Plains of Alberta, by G. S. Hume. Queen's University, Kingston, January 13 and 14, 1933.

The Mining Industry in Yukon, by H. S. Bostock. Engineering Institute of Canada, Ottawa Branch, January 26, 1933.

The Blue Limestone of Hastings County, Ontario, by M. E. Wilson. Canadian Field Naturalist, February, 1933.

Placer Deposits of Hydraulic Area, Cariboo, B.C., by W. E. Cockfield. British Columbia Chamber of Mines, Vancouver, February 10, 1933.

Geological History of Clay Deposits of Ontario, by J. F. Wright. Annual Meeting Ceramic Society, Ottawa, February 27, 1933.

Abrasives, by V. L. Eardley-Wilmot. Mineral Industry, 1931.

Diatomite, by V. L. Eardley-Wilmot. Mineral Industry, 1931.

The Chemical Nature of Limestones as Revealed by the Outcrop, by M. F. Goudge. Logan Club, Ottawa, April 13, 1932.

Anhydrite, an Undeveloped Mineral, by L. H. Cole. Joint Meeting of Manitoba Chamber of Mines and the Manitoba Branch of the Canadian Institute of Mining and Metallurgy, Winnipeg, August 29, 1932.

Anhydrite: an Undeveloped Mineral Resource, by L. H. Cole. Saguenay Branch, Engineering Institute of Canada, Arvida, October 19, 1932.

Character of the Pitchblende Ore from Great Bear Lake, by H. S. Spence. Canadian Mining Journal, November, 1932.

The Romance of Glass, by L. H. Cole. Boys' Division, Y.M.C.A., Ottawa, December 30, 1932.

Preparing for the Imperial Economic Conference, by A. W. G. Wilson. Canadian Mining and Metallurgical Bulletin, March, 1933.

Fuels and Fuel Testing

Investigations conducted by the Division of Fuels and Fuel Testing with a View to Assisting the Coal Industry of Canada, by B. F. Haanel. Before Rocky Mountain Section, Canadian Institute of Mining and Metallurgy, Blairmore, Alberta, March, 1933.

Ore Dressing and Metallurgy

Electric Steel, by T. W. Hardy. Iron and Steel of Canada, May, 1932.

Brittleness in Low Carbon Steel, by H. H. Bleakney. Transactions, American Society for Steel Treating, October, 1932.

Pitchblende and Radium, by R. J. Traill, W. R. McClelland, and M. H. Haycock. Ottawa Branch, Society of Chemical Industry, November, 1932.

Ceramics and Road Materials

Outstanding Developments in the Science and Industry of Ceramics, by J. G. Phillips. Canadian Ceramic Society, Ottawa, February 27, 1933.

Clay Testing, by Howells Fréchette. Canadian Ceramic Society, Ottawa, February 28, 1933.

Physiography and Topography

Surveys at Great Bear Lake, 1931, by R. C. McDonald. Bulletin Canadian Institute of Mining and Metallurgy, May, 1932.

Means of Travel in Northwestern British Columbia, by F. A. Kerr. British Columbia Miner, June, 1932.

Roches Moutonnées near Kaladar, Lennox and Addington Counties, Ontario, by M. E. Wilson. Canadian Field Naturalist, September, 1932.

Palæontology

Fossil Vertebrates of Canada, by L. S. Russell. McGill University, Montreal, April 11 and 13, 1932.

Two New Theropod Dinosaurs from the Belly River Formation, by C. M. Sternberg. Canadian Field Naturalist, May, 1932.

Footprints, by E. M. Kindle. Canadian Mining Journal, June, 1932.

A Useful Foraminifera Horizon in the Alberta Shale of Southern Alberta, by R. T. D. Wickenden. Journal of Palæontology, June, 1932.

Fossil non-marine Mollusca from Saskatchewan, by L. S. Russell. Transactions Royal Canadian Institute, July, 1932.

The Skull of *Leidyosuchus canadensis*, by C. M. Sternberg. American Midland Naturalist, July, 1932.

Notes on the Pamelia Member of the Black River of the Ottawa Valley, by A. E. Wilson. American Journal of Science, August, 1932.

A New Fossil Crocodile from Saskatchewan, by C. M. Sternberg. Canadian Field Naturalist, September, 1932.

Palæontological Notes, by A. E. Wilson. Canadian Field Naturalist, September, 1932.

New Variety of *Valvata lewisi* from the Pleistocene of Ontario, by A. LaRocque. Canadian Field Naturalist, December, 1932.

Contributions to the Stratigraphy and Palæontology of Skidegate Inlet, Queen Charlotte Islands, B. C. (cont.), by F. H. McLearn. Transactions Royal Society of Canada, Sec. IV, 1932.

Mollusca from the McMurray Formation of Northern Alberta, by L. S. Russell. Transactions Royal Society of Canada, Sec. IV, 1932.

Three Fernie Jurassic Ammonoids, by F. H. McLearn. Transactions Royal Society of Canada, Sec. IV, 1932.

New Species of Foraminifera from the Upper Cretaceous of the Prairie Provinces, by R. T. D. Wickenden. Transactions Royal Society of Canada, Sec. IV, 1932.

Ordovician Fossils from the Region of Cornwall, Ontario, by A. E. Wilson. Transactions Royal Society of Canada, Sec. IV, 1932.

A New Species of *Merychippus* from the Miocene of Saskatchewan, by L. S. Russell. Canadian Field Naturalist, January, 1933.

The Great Stone Book, by E. M. Kindle. Forest and Outdoors, January, 1933.

Canadian Dinosaurs, by C. M. Sternberg. Royal Astronomical Society, Ottawa, January 27, 1933.

Relationships and Habitats of Troodon and the Nodosaurs, by C. M. Sternberg. Annals and Magazine of Natural History, February, 1933.

Prehistoric Footprints in Peace River, by C. M. Sternberg. Canadian Geographic Journal, February, 1933.

Pekin Man, by L. S. Russell. Civil Service Review, March, 1933.

Mining Newsletter Series

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

Selenium in Canada, by A. Buisson.
Oil Prospects of the Mackenzie Basin, Northwest Territories, by G. S. Hume.
Silver Situation in Canada, by A. Buisson.
Geological Maps a Valuable Aid to Mineral Development, by W. Malcolm.
Cadmium in Canada, by A. Buisson.
Promising Mineral Areas to be Explored, by W. Malcolm.
Diatomite as a High Temperature Insulator, by V. L. Eardley-Wilmot.
Gold Mining Activities in Manitoba, by J. Francis.
Gypsum in Canada, by L. H. Cole.
Mineral Developments at Great Bear Lake, Northwest Territories, by D. F. Kidd.
Mines Branch Investigations 1932, by J. McLeish.
Foraminifera of Value in Canadian Boring Operations, by W. A. Johnston.
Research Paving Way for Development of Anhydrite, by L. H. Cole.
Rock Wool for Insulation, by M. F. Goudge.
Mining Developments in Manitoba and Saskatchewan during the Summer of 1932, by J. F. Wright.
The Gold Industry of Northwestern Quebec, by A. Buisson.
Portland Canal Mining News, by G. Hanson.
Use of Canadian Coal for Production of Domestic Coke, by B. F. Haanel.
Recent Developments in the Cadwallader Creek Gold Belt, Bridge River District, B.C., by W. E. Cockfield.
Placer Gold Activities in British Columbia and Alberta, by C. S. Parsons.
Yukon Territory, 1932, by H. S. Bostock.
Kirkland Lake Gold Area, Ontario, by A. Buisson.
Active Search for Gold in Northern British Columbia, by F. A. Kerr.
The Porcupine Goldfields, Ontario, by A. Buisson.
Mineral Possibilities North of Great Slave Lake, by C. H. Stockwell.
Canada's Gold Industry, 1932, by A. Buisson.

GEOLOGICAL SURVEY

W. H. Collins, Director

CHANGES IN STAFF

Four members of the staff resigned or were retired. E. R. Faribault accepted superannuation on January 1, 1933, after fifty-one years of distinguished service as a geologist, continuously since July 1, 1883. Except for one exploration at Chibougamau Lake, Quebec, for the Provincial Government, his work was done entirely in Nova Scotia, and our present knowledge of the geology, geography, and mineral resources of that province is largely due to the work of Mr. Faribault and his contemporary, Hugh Fletcher. Outstanding among his accomplishments is a study of the gold deposits of Nova Scotia.

A. H. Anrep, specialist on peat, resigned, September 1, 1932, after twenty-four years' service. F. D. Moore, Museum Helper in the Division of Mineralogy, accepted superannuation on May 15, 1932, and Miss J. L. Armstrong, clerk, resigned on March 1, 1933.

FIELD AND OFFICE WORK

The impetus of prospecting and mining gold has so largely offset depression in other branches of the mining industry that there has been little if any decline in the demand for maps and reports. During this fiscal year 51,155 reports and maps were distributed as compared with 53,339 last year, 35,495 in 1930-31, and 48,766 in 1929-30. There has been a corresponding maintenance in the demand for field work—exploration and surveys of areas that are being prospected and investigation of mineral developments. Increasing use of the airplane by prospectors for transportation has greatly enlarged the accessible territory for mineral exploration.

Although most of the field work of 1932 related to the search for gold some of it was directed to the no less important task of studying geological problems with which other branches of the mining industry, already seriously affected by the general business depression, have to contend. Field work on coal is the outstanding example. For some years this work has been confined entirely to investigations in the more important producing coal fields where structural and other geological conditions affect the quality of the coal and the whole course of mining operations. To render the resultant information more easily understood by mine operators a special type of transparent model has been designed for showing the coal seams in true three-dimensional form.

The demand for field work has not much diminished, but owing to the need for economy, less work was undertaken. In 1932, thirty-five parties were sent out as compared with forty-one in 1931, and fifty-six in 1930. Each investigation is briefly explained in following sections of this report.

GEOLOGICAL DIVISION

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

Yukon

H. S. Bostock commenced geological mapping and investigation of Carmacks 4-mile map-area (latitudes 62° to 63°, longitudes 136° to 138°). This quadrangle is one of the as yet unmapped areas most easily accessible to pros-

pectors and in it a gold strike has recently been made. As it lies on the border of the unglaciated region its examination may also yield results of economic value in connexion with placer deposits of the Yukon. Mr. Bostock visited Dawson to collect information regarding the mineral industry. A review of mining activities during 1932, prepared by him, appears in Summary Report 1932, Part A II.

British Columbia

F. A. Kerr completed geological mapping and investigation of part of Taku River 2-mile quadrangle (latitudes 58° 30′ to 59°, longitudes 133° to 134°), an area of about 600 square miles bordering Taku River and extending eastward from the International Boundary. Promising gold deposits have recently been discovered in this district. They are reported upon by Mr. Kerr, in Summary Report 1932, Part A II.

George Hanson completed geological investigation of the Portland Canal mining field. A 4-mile geological map of this important area and a comprehensive report dealing with the numerous mineral deposits are now being prepared.

H. C. Gunning continued geological mapping and investigation of the Nimpkish Lake 2-mile map-area (latitudes 50° to 50° 30′, longitudes 126° to 127°), northern Vancouver Island. He gave particular attention to Zeballos River area where small but rich gold-bearing veins are attracting considerable attention. A report on this area appears in Summary Report 1932, Part A II. Mr. Gunning also examined a mineral occurrence on Quadra Island, reported to hold carnotite. This work resulted in the discovery of vanadium-bearing strata as detailed in a report by Mr. Gunning and H. V. Ellsworth, published in Summary Report 1932, Part A II.

W. E. Cockfield and J. F. Walker continued geological investigation of the Bridge River gold-bearing district. Some of the more important results of their work appear in a joint report in Summary Report 1932, Part A II. Messrs. Cockfield and Walker also completed geological mapping and examination of the Quesnel Forks 1-mile map-area (latitudes 52° 30′ to 52° 45′, longitudes 121° 31′ to 122°). Mr. Cockfield examined the placer deposits and Mr. Walker the bedrock geology. A joint preliminary report on this work appears in Summary Report 1932, Part A I, and a preliminary edition of the geological map is being prepared. The field lies within a region now attracting much attention on account of both its placer and lode gold deposits. As a result of the greatly increased interest being displayed in the region, an abridged, second edition of Memoir 149, "Placer and Vein Gold Deposits of Barkerville, Cariboo District, British Columbia", by W. A. Johnston and W. L. Uglow, has been published in Summary Report 1932, Part A I. Mr. Cockfield also investigated occurrences of magnesite near Clinton. A report on this work appears in Summary Report 1932, Part A II.

C. E. Cairnes continued geological mapping and investigation of the Cranbrook 1-mile map-area (latitudes 49° 30′ to 49° 45′, longitudes 115° 30′ to 116°). This area holds many important metalliferous deposits. Mr. Cairnes visited mineral properties (including placers) in adjacent districts and reports upon them in Summary Report 1932, Part A II. He also investigated the possibilities of underground water supplies at Summerland, Okanagan Lake. A report setting forth his findings has been furnished the municipality.

G. S. Holland, under the supervision of C. E. Cairnes, completed geological mapping of the west half of the Vernon 2-mile map-area (latitudes 50° to 50° 30′, longitudes 119° to 120°).

Alberta

G. S. Hume explored an area in the vicinity of the International Boundary and between Waterton Lakes, Alberta, and Flathead Valley, B.C. Extensive seepages of oil and gas occur in the area. The results of Mr. Hume's work appear in Summary Report 1932, Part B. Mr. Hume also made a detailed investigation of the Birch Ridge area southwest of Bragg Creek, Alberta. A report outlining the structural features of this area as related to the possible presence of oil and gas, appears in Summary Report 1932, Part C. The major part of the field season was devoted by Mr. Hume to continuing the geological mapping and investigation of the Wildcat Hills 1-mile map-area (latitudes 51° 15′ to 51° 30′, longitudes 114° 30′ to 115°). This map will be one of a series planned to cover the foothills in a region where much effort has been expended in the search for oil and gas.

B. R. MacKay investigated the coal deposits of Blairmore map-area and made special detailed studies of the two coal fields respectively centring about Blairmore and Coleman. The results of this detailed work in the form of large-scale models have been furnished the operating companies. A general account of the coal resources of the district is included in Summary Report 1932, Part B. Mr. MacKay also examined and collected samples for study and analyses from the coal seams of a number of localities in southwestern British Columbia and southern Alberta, in connexion with the classification of coals being carried out under the auspices of the National Research Council.

L. S. Russell commenced the geological mapping and investigation of Peace River 8-mile map-area (latitudes 55° to 58°, longitudes 116° to 124°). During the season he covered a large part of the Alberta section of the map-area. The area so examined lies partly in the eastern plains section where the water supply is an important problem, and partly in the foothills where coal seams of good quality are known, and there are possibilities for petroleum and natural gas.

Saskatchewan

R. T. D. Wickenden continued a systematic survey of the surface deposits of Regina 8-mile map-area (latitudes 49° to 52°, longitudes 102° to 109°). He also studied underground water conditions in the vicinity of Rouleau, Yorkton, and Melville.

D. C. Maddox made a survey of artesian water areas in the west half of Rush Lake and the east half of Elbow map-areas. A preliminary report on these areas is given in Summary Report 1932, Part B.

J. F. Wright geologically surveyed the eastern half of Amisk Lake 2-mile map-area (latitudes 54° 30′ to 55°, longitudes 102° to 102° 30′) where many gold discoveries have been made in past years and continue to attract much attention. An account of the mineral deposits is presented in Summary Report 1932, Part C.

Manitoba

J. F. Henderson began a study of Granville Lake area on Churchill River (latitudes 56° to 57°, longitudes 100° to 102°). Preliminary results indicate that the district merits the attention of prospectors.

H. C. Harwood completed the geological mapping and investigation of Cross Lake map-area (latitudes 54° to 55°, longitudes 96° to 98°).

Ontario

E. D. Kindle and W. H. Collins continued the investigation and remapping of Sudbury nickel basin and vicinity, as a basis for future prospecting for nickel-copper and lead-zinc deposits. The first two of a series of four 1-mile map sheets are being prepared for publication.

C. S. Evans commenced the geological mapping and investigation of an 8-mile map-area lying between the Niagara escarpment and the 79th Meridian. A knowledge of the thicknesses and structure of the Palæozoic formations that underlie this region is important for development of the various non-metallic resources, including natural gas, and also from the standpoint of underground water supply.

Alice E. Wilson continued geological mapping of the Palæozoic strata of the Ottawa 1-mile map-area (latitudes 45° 15′ to 45° 30′, longitudes 75° 30′ to 76°). Better knowledge of these formations is required in connexion with drilling of wells, and other operations.

Quebec

M. E. Wilson continued detailed investigation of a limited area that includes the Noranda, Amulet, and Waite-Ackerman-Montgomery mines in the vicinity of Noranda. The investigation is designed to learn as much as possible about the source of the ores and the structural and lithological conditions that govern the extent and position of the ore-bodies. It was undertaken at the request of the several mining companies, who, after attempting it individually, concluded that better results should be obtainable by pooling their data in the hands of an independent and impartial organization. As the mapping of sections of the area are completed, the resulting information is made available to the mine managements directly interested.

A. H. Lang completed geological mapping of the Palmarolle (latitudes 48° 30′ to 48° 45′, longitudes 79° to 79° 30′) and Taschereau (latitudes 48° 30′ to 48° 45′, longitudes 78° 30′ to 79°) 1-mile map-areas. The maps are now being prepared for publication. Advance copies of the more important part of the Palmarolle map, representing the district within which the Beattie mine lies, are available.

O. L. Backman, under the supervision of A. H. Lang, completed geological mapping and investigations of Macamic 1-mile map-area (latitudes 48° 45′ to 49°, longitudes 78° 30′ to 79°). This work is part of the general program of mapping Rouyn-Harricanaw River region over which prospectors are gradually extending their activities.

J. S. Stevenson, under the supervision of M. E. Wilson, undertook a revision of the geology of Ville Marie map-area (latitudes 47° 15′ to 47° 30′, longitudes 79° to 79° 30′) as represented on existing maps. He was unable to complete the work in one season.

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 giving some of the results of this work appears in Summary Report 1932, Part D.

F. J. Alcock examined feldspar deposits in the vicinity of Quetachu Bay on the north shore of the Gulf of St. Lawrence.

A. H. Miller, of the staff of the Dominion Observatory, continued the investigation of various geophysical prospecting methods that is being conducted jointly by the Department of Mines and the Department of the Interior. Mr. Miller devoted most of his time to investigations in Thetford area. The geological results obtained are briefly summarized in the report by H. C. Cooke in Summary Report 1932, Part D, and a fuller report is being prepared by Mr. Miller.

New Brunswick

F. J. Alcock completed geological mapping and investigation of the Loch Lomond (latitudes 45° to 45° 15′, longitudes 65° 30′ to 66°) map-area.

A. H. Miller and G. W. H. Norman, as a result of a special investigation made in the neighbourhood of Moncton, were able to demonstrate that certain types of concealed geological structures bearing upon the accumulation of oil and gas could be outlined by magnetometric methods.

Nova Scotia

G. W. H. Norman continued geological mapping and investigation of the Oxford map-area (latitudes 45° 30′ to 45° 45′, longitudes 63° 30′ to 64°). Interest in this area lies chiefly in the gypsum and salt deposits.

T. L. Tanton commenced a re-examination of the iron ore occurrences of Nova Scotia and New Brunswick. The greater part of the season was devoted to the study of the Nictaux-Torbrook field. With the assistance of J. T. Wilson a magnetometric survey was made of an area that includes a development of the iron beds. The study of the general geology was conducted by E. H. Lovitt under the supervision of Mr. Tanton.

F. J. Alcock examined the gold-bearing deposits on Second Gold Brook, Middle River district, Cape Breton. The results of this examination are presented in a report in Summary Report 1932, Part D.

Northwest Territories

D. F. Kidd continued geological mapping and investigation of Great Bear Lake region. The country bordering the east side of the lake and island for distances up to 40 miles has now been explored. A report on the region, containing an account of the mineral occurrences, is published in Summary Report 1932, Part C. This report also contains a description of coal deposits on the west side of the lake, at Etacho Point.

C. H. Stockwell explored a part of the region north of Great Slave Lake. He ascended Yellowknife River, crossed to the upper waters of Coppermine River and, following a series of lakes and rivers, reached Great Slave Lake at the mouth of Barnston River. Large areas of rocks were discovered that are not unfavourable to mineral deposits. Mr. Stockwell also examined an occurrence of niccolite near François River on the north shore of Great Slave Lake. An account of the season's work, as well as a brief summation of previous work on Great Slave Lake, is contained in Summary Report 1932, Part C.

L. J. Weeks continued the geological and geographical exploration of a region bordering the west side of Hudson Bay. He ascended Maguse River and crossed over to Ferguson River. This work is reported upon in Summary Report 1932, Part C.

TOPOGRAPHICAL DIVISION

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

FIELD WORK

Yukon

R. Bartlett continued exploratory mapping of the Quiet Lake quadrangle, latitudes 61° to 62°, longitudes 132° to 134°. This area adjoins on the north the Teslin 4-mile quadrangle mapped by Mr. Bartlett in 1931. Both areas were mapped by photo-topography for publication on a scale of 1 inch to 4 miles, contour interval 500 feet. Triangulation control was carried from Whitehorse

connecting the Whitehorse, Laberge, Teslin, and Quiet Lake map-sheets. Connexion was made to the astronomical position established by the Geodetic Survey at Hootalinkwa. Observations for magnetic declination were made throughout the season.

W. H. Miller began exploratory mapping of the Carmacks quadrangle, latitudes 62° to 63°, longitudes 136° to 138°. The field work was done by photo-topographical reconnaissance methods for publication on a scale of 1 inch to 4 miles, contour interval 500 feet. Geographical positions in the area were controlled by triangulation including astronomical positions already established by the Geodetic Survey. Connexion to the triangulation control of the Laberge sheet was made. Observations for magnetic declination were made throughout the area.

British Columbia

J. A. Macdonald mapped in detail the coal mining area at Michel. This detailed mapping is on the same scale and is of the same grade of work as carried on in other years for the coal mining areas at Hillcrest Mines, and other towns in Alberta. This work was done by a combination of plane-table traverse and photo-topographical methods. Scale 1 inch to 800 feet. Contour interval 25 feet.

Mr. Macdonald spent about two weeks on further work found necessary to complete the Crowsnest 1-inch to 1-mile sheet of 1931, latitudes 49° 30′ to 49° 45′, longitudes 114° 30′ to 115° 00′.

A. C. Tuttle carried out exploratory mapping in Manson Creek area, latitudes 55° to 56°, longitudes 124° to 126°, and in Fort Grahame area, latitudes 56° to 57°, longitudes 124° to 126°. The methods employed were photo-topographical. Publication scale 1 inch to 4 miles, contour interval 500 feet. Observations for magnetic declination were made throughout the season. Triangulation control was connected to the nets of the Pacific Great Eastern Railway survey, and the British Columbia Department of Lands. Elevations in the area were based on those established by the British Columbia Department of Lands along the 124th Meridian.

A. C. T. Sheppard visited the party of Mr. Tuttle for the purpose of advising on matters relating to the field work.

Northwest Territories

R. C. McDonald established by astronomical observations the geographical positions of a number of points along the west coast of Hudson Bay between Cape Eskimo and Chesterfield Inlet. These are for control of a map-sheet at 1 inch to 8 miles between latitudes 61° and 64° and longitudes 90° and 98°. A detailed survey was made of the shoreline for 2 miles or more on each side of the points so established in order to connect them more accurately with the plotting of geographical features of the country from the oblique air photographs. This plotting is being done by the Topographical Surveys Branch, Department of the Interior. Observations for magnetic declination were made throughout the area.

Quebec

J. W. Spence carried on with the detailed mapping of an area in the vicinity of Noranda started in 1931. This area includes the Horne, the Amulet, and the Waite-Montgomery mines, and is being prepared on the scale of 1 inch to 800 feet with contour interval of 10 feet.

New Brunswick

H. N. Spence carried out control for mapping from vertical air photographs of two 1-inch to 1-mile sheets in an area in the interior of New Brunswick, including the headwaters of Tobique, Miramichi, Nipisiguit, and Upsalquitch rivers. This area is embraced in latitudes 47° 00′ to 47° 30′, longitudes 66° 30′ to 67° 00′. Various methods were used in order to establish the location of points that could be identified on the aerial photographs.

Nova Scotia

H. N. Spence carried out the transit and tape control surveys necessary for the completion of the east half of the Oxford sheet, latitudes 47° 30′ to 45° 45′, longitudes 63° 30′ to 63° 45′.

OFFICE WORK

D. A. Nichols continued his work in physiography and related subjects. The collection of physiographic illustrations has been enlarged. There is a large and increasing demand for information on physiographic subjects. Progress has been made during the year on the large Museum model of Canada. Twenty-nine sections 10° by 10° have been contoured and twenty-one of these built and cast in plaster. Nine of these have been adjusted on a temporary frame. Revision of the Geological Map of Canada on a scale of 1 inch to 100 miles has been undertaken and is now about 75 per cent compiled.

MINERALOGICAL DIVISION

Eugene Poitevin, Chief of the Division, reports:

FIELD WORK

A. T. McKinnon spent almost two months in eastern Canada collecting 14½ tons of minerals and rocks for distribution as standardized collections to prospectors, educational institutions, etc.

LABORATORY

About three thousand specimens of minerals and rocks from prospectors, mining companies, and members of the staff were examined by E. Poitevin and H. V. Ellsworth. About four hundred reports on this work were prepared, not including verbal reports and others given to the many visitors to the laboratory.

Mr. Poitevin also completed the mineralogical study of a collection of zeolites occurring in the serpentine belt of Megantic County, Quebec, and of several varieties of serpentine from the same district. Reports on these are to be incorporated in a memoir which is being prepared. He also studied topaz-bearing rocks from near Welsford, New Brunswick, the results of which are incorporated in Summary Report 1932, Part D.

H. V. Ellsworth continued special investigations of rare-element minerals and possible sources of vanadium in Canada, this work including many determinations on minerals sent in by prospectors. During the year his report on the "Rare Element Minerals of Canada" was published as No. 11 of the Economic Geology Series. His work on vanadium brought to light an occurrence of vanadiferous rock in British Columbia containing over 2 per cent V_2O_5, an account of which, in collaboration with H. S. Gunning, is published in Summary Report 1932, Part A II.

R. J. C. Fabry completed the analyses of a large number of rocks and minerals.

There was a marked increase in the number of qualitative tests for the commoner elements carried out on specimens submitted to the division for identification.

MUSEUM

Several special mineral exhibits were prepared, the most important one being for the Central Canada Exhibition at Ottawa. Another was prepared for the meeting of the Dominion Land Surveyors at Ottawa. Towards the end of the fiscal year work was resumed in numbering and cataloguing the minerals of the systematic collection. A large number of mineral specimens were added to the mineralogical collections by collecting, donation, and purchase. An itemized list of these is given in the Annual Report of the National Museum.

EDUCATIONAL COLLECTIONS

During the fiscal year ending March 31, 1933, collections were distributed as follows:

Province	Standard	Grade 3	Grade 4	Special grade 4	Miscellaneous	Mineral chips	Prospectors	
							Minerals	Rocks
British Columbia	.....	.....	.....	.....	2	.....	30	19
Alberta	.....	.....	.....	.....	5	.....	71	68
Saskatchewan	.....	.....	.....	.....	4	.....	14	4
Manitoba	.....	.....	.....	.....	3	.....	4	.....
Ontario	1	50	.....	.....	17	2	43	25
Quebec	1	2	50[1]	300[1]	8	.....	10	1
New Brunswick	.....	.....	.....	.....	2	1	.....	.....
Nova Scotia	.....	.....	.....	.....	2	.....	.....	.....
Prince Edward Island	.....	.....	.....	.....	1	.....	.....	.....
Foreign	1	.....	.....	.....	4	.....	5	1
No. of collections	3	52	50	300	48	3	177	118
Specimens	438	2,080	2,000	12,000	1,335	135	3,464	2,808

Three "Mineral Chip" collections consisting of 135 bags.
[1]Prepared specially for the Quebec Bureau of Mines.

PALÆONTOLOGICAL DIVISION

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

FIELD WORK

Reference to the field work of L. S. Russell and A. E. Wilson will be found in the section relating to the Geological Division.

OFFICE WORK

A statement concerning the map work by members of the division is given under the Geological Division. The palæontological work has included the preparation of brief reports on fossils collected by members of the staff for the purpose of orienting formations studied in the general geological section. Reports of this character have also been prepared for the Quebec Bureau of Mines. These special reports for the use of field geologists have been supplied by F. H. McLearn, W. A. Bell, A. E. Wilson, L. S. Russell, C. M. Sternberg, and E. M. Kindle. Various short reports also have been furnished to persons not professionally engaged in geological work.

F. H. McLearn has prepared a paper on Problems of the Lower Cretaceous of the Canadian Interior. The section on the Cephalopoda of the Bibliographic Index of North American Devonian Fossils by E. M. Kindle and A. K. Miller has been completed. A report on Sedimentation and Erosion at Point Pelee has been prepared by E. M. Kindle.

PREPARATORY WORK

Preparatory work on a skeleton of *Ornithomimus* from Alberta has been nearly completed. Progress has been made in the preparation of an armoured dinosaur. A cement duplicate of a large dinosaur track has been placed in the grounds of the Museum for a bird bath. A card index to the invertebrate collections is being prepared and the Whiteaves collection of Recent shells has been made accessible.

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.

An important part of the work of the division has been, as in previous years, the examination of samples from well borings made in search of oil, gas, and water and the supplying of information to the operators as to the character of the samples and geological interpretation of the well sections. Information was supplied to many inquirers regarding the possibilities of underground water supplies at various places, and the occurrences of placer gold, peat moss, clays, sands, and gravels.

D. C. Maddox, in addition to his field studies of artesian water areas in Saskatchewan, examined samples from wells in Saskatchewan and in Quebec.

R. T. D. Wickenden continued his studies of deep well samples in the Prairie Provinces, particularly with reference to the occurrence of microfossils and the correlation of formations by this means. One result of the work has been the discovery that Jurassic marine and non-marine formations occur in southern Manitoba but not in the sections shown by wells north of Dauphin. Study of the well sections has also shown that there are several sands that were not known from exposures.

F. J. Fraser, assisted by M. Mahoney, examined 1,500 samples from wells in Quebec where considerable deep drilling is being carried on in search for natural gas. Mr. Fraser continued the work on the mechanical and mineral analyses of rock samples from southern Saskatchewan collected by F. H. McLearn and examined a number of well samples from other parts of Canada. In order to assist operators in search of oil and gas in Ontario, a study of well samples was made by C. S. Evans.

Samples from oil and gas wells, received during the year, numbered 7,799. Of these 3,381 were from Alberta and were received through the courtesy of the Department of Lands and Mines of the province. There were 22 from Saskatchewan, 234 from Manitoba, 36 from Ontario, 1,500 from Quebec, and 2,617 from New Brunswick.

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 Commonwealth Petroleum Company, Limited, Calgary, Alberta; officials of the New Brunswick Oil and Gas Company, Limited, Moncton, New Brunswick; and many others.

DRAUGHTING AND REPRODUCING DIVISION

A. Dickison, Chief of the Division, reports:

Maps Published April 1, 1932, to March 31, 1933

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.
278A	2286	Prince Rupert sheet; scale, 1 inch to 8 miles.....	Geology.
——	2046	Barkerville area, Cariboo district; scale, 1 inch to 1 mile.	Geology (Reprint).
		ONTARIO	
266A	2270	Kenora sheet; scale, 1 inch to 8 miles.....	Geology.
290A	2321	Rush Lake sheet, Sudbury district; scale, 1 inch to 1 mile.	Geology.
		QUEBEC	
281A	2295	Duparquet sheet, Abitibi and Témiscamingue Counties; scale, 1 inch to 1 mile.	Geology.
284A	2310	Desmeloizes sheet, Abitibi County; scale, 1 inch to 1 mile.	Geology.
		NOVA SCOTIA	
282A	2302	Lake Ainslie sheet, Inverness County; scale, 1 inch to 1 mile.	Geology.
		CANADA	
270A	2274	Aborigines of Canada; linguistic families and tribal locations; scale, 1 inch to 197·3 miles.	Ethnology. For National Museum use.

Maps in Hands of King's Printer, March 31, 1933

Series A	Publication number	Title	Remarks
		NORTHWEST TERRITORIES	
296A	2328	Great Bear Lake (McTavish Arm), between Richardson Island and Hornby Bay; scale, 1 inch to 4 miles.	Geology. For report by D. F. Kidd, Summary Report, part C, 1932.
		BRITISH COLUMBIA	
295A	2327	Brisco-Dogtooth area, Kootenay district; scale, 1 inch to 4 miles.	Geology. For report by C. S. Evans, Summary Report, part A, 1932.
		ONTARIO	
155A	1553	Lake Huron sheet; scale, 1 inch to 8 miles.....	Geology (Third edition).

Other Map-Work in Varying Stages of Progress

—	Title	Remarks
	CANADA	
1	Dominion of Canada; scale, 1 inch to 100 miles	Geology.
	YUKON TERRITORY	
1	Laberge sheet, 61° to 62°, 134° to 136°; scale, 1 inch to 4 miles.	Geology.
	BRITISH COLUMBIA	
1	Salmo sheet, Kootenay district, 49° to 49°15′, 117° to 117°30′; scale, 1 inch to 1 mile	Topography.
2	Cranbrook sheet, Kootenay district, 49°30′ to 49°45′, 115°30′ to 116°; scale, 1 inch to 1 mile	Topography.
3	Stikine area, Cassiar district, 56°30′ to 57°, 131° to 132°; scale, 1 inch to 2 miles	Geology.
4	Stikine area, Cassiar district, 57° to 57°30′, 131° to 132°; scale, 1 inch to 2 miles	Geology.
5	Stikine area, Cassiar district, 57°30′ to 58°, 131° to 132°; scale, 1 inch to 2 miles	Geology.
6	Copper Mountain mining area, Similkameen district; scale, 1 inch to 1,000 feet	Geology. For memoir by V. Dolmage.
	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	Espanola sheet, Sudbury district, 46° 15′ to 46°30′, 81°30′ to 82°; scale, 1 inch to 1 mile	Geology.
2	Copper Cliff sheet, Sudbury district, 46°15′ to 46°30′, 81° to 81°30′; scale, 1 inch to 1 mile	Geology.
	QUEBEC	
1	Escuminac sheet, Bonaventure county, 48° to 48′15°, 66° to 66°30′; scale, 1 inch to 1 mile	Geology.
2	Palmarolle sheet, Abitibi county, 48°30′ to 48°45′, 79° to 79°30′; scale, 1 inch to 1 mile	Geology.
3	Taschereau sheet, Abitibi county, 48°30′ to 48°45′, 78°30′ to 79°; scale, 1 inch to 1 mile	Geology.
	QUEBEC AND NEW BRUNSWICK	
1	Chaleur Bay area, 47°30′ to 48°30′, 64°30′ to 66°45′; scale, 1 inch to 4 miles	Geology.
	NEW BRUNSWICK	
1	Benjamin River sheet, Restigouche County, 47°45′ to 48°, 66° to 66°30′; scale, 1 inch to 1 mile	Geology.
2	Belledune sheet, Gloucester and Restigouche Counties, 47°45′ to 48°, 65°30′ to 66°; scale, 1 inch to 1 mile	Geology.
3	Bathurst sheet, Gloucester County, 47°30′ to 47°45′, 65°30′ to 66°; scale, 1 inch to 1 mile	Geology.

In addition to the foregoing, one hundred and twenty-two 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 eight items. The duties of an executive member of the Geographic Board of Canada were also performed during the year.

PHOTOGRAPHIC DIVISION

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

The following work was done during the fiscal year:

Contact prints, 4 x 5 to 36 x 48	13,277
Bromide enlargements, 4 x 5 to 40 x 72	1,181
Exposures developed, 3¼ x 4¼ to 6½ x 8½	3,154
Dry plate negatives, 4 x 5 to 11 x 14	575
Wet plate negatives, 8 x 10 to 24 x 30	245
Zinc plates, 11 x 14 to 24 x 30	9
Photostat copies, 7 x 11 to 11 x 14	347
Lantern slides, 3¼ x 4	769
Photos and maps mounted	1,349
Total	20,906

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Assistant Director, reports:

During the year 51,155 publications of the Geological Survey and National Museum, exclusive of French editions, were distributed. Of these, 14,822 were sent to addresses on the regular mailing lists, and 36,333 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:

A recent conservative estimate of the contents of the library places the number of volumes at 68,288, not including the pamphlets. Additions during the year include:

Books purchased	58
Bound periodicals (by purchase)	214
Volumes received as gifts or exchange	790
Pamphlets	534
Maps	632
Periodicals subscribed for	223
Periodicals and serials by gift and exchange (separate files)	623

During the year 2,483 volumes were catalogued and 9,634 cards added to the catalogue, more than double the number for last year.

New lantern slides catalogued 155, and cards filed 252.

New maps and charts catalogued 291.

BRITISH COLUMBIA OFFICE

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

The use made by the public of the facilities offered by the British Columbia office showed a considerable increase during the year and is indicative of the interest in the mining industry of the province. A total of 3,750 visitors registered at the office and 320 inquiries were handled by mail, as well as a large number of telephone inquiries. Reports distributed totalled 2,790 and 586 separate maps were issued.

NATIONAL MUSEUM OF CANADA

W. H. Collins, Acting Director

Continuance of the financial stringency prevented resumption of field work during the summer of 1932, and the activities of the Museum staff were limited to office and laboratory work.

The Acting Director wishes to express his cordial appreciation of the fine spirit and co-operation manifested by other Government departments and would mention in particular the National Parks Branch, the Dominion Lands Administration, Department of the Interior, the Royal Canadian Mounted Police, and the Department of Public Works. He also wishes to express to many individuals and institutions, both Canadian and foreign, his gratitude for donations and exchanges and for assistance rendered in connexion with scientific investigations.

Miss T. L. Klotz resigned from the position of Herbarium Assistant on November 15, 1932.

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.

Statements of the progress of the work of the Anthropological and Biological Divisions follow.

ANTHROPOLOGICAL DIVISION

D. Jenness reorganized the program for the Anthropological Section of the Fifth Pacific Science Congress, now scheduled to meet in June, 1933; and he acted also as a member of an Interdepartmental Reindeer Committee. He published in the University of Toronto Quarterly an economic paper on "The Population Possibilities of Canada". During the year he completed three scientific reports for the National Museum, one on Eskimo Grammar, one on the Sekani Indians of British Columbia, and a third on the Ojibwa Indians of Georgian Bay.

C. M. Barbeau proceeded with the preparation of his monograph on the Eagle Phratry of the Tsimsyans, Its Southward Migration.

A volume of fifty French-Canadian folk songs with historical annotations was completed in the spring of 1932.

Mr. Barbeau's services were lent for several weeks to the Quebec Government in connexion with the zoological garden of Charlesbourg, and he helped in the elaboration of plans for the conservation of handicrafts and traditional resources of French Canada.

Harlan I. Smith continued his work on the archæology of Canada. He continued, with some success, his efforts to induce the artists and manufacturers of Canada to reproduce museum specimens as distinctive Canadian manufactures and souvenirs embodying as they do the earliest art of Canada, which represents Canada's earliest mythology.

W. J. Wintemberg wrote a part of his report on the culture of the Sidey-Mackay village site, Simcoe County, Ontario, and did considerable work on his report on the ancient site at Tadoussac, Quebec.

Douglas Leechman made a study of caries in the series of Indian and Eskimo teeth in the Museum collection. He made good progress in the preparation of an Eskimo habitat group and the interior of an igloo, and prepared several collections for exhibition outside, mainly of Canadian handicrafts.

There were few additions to the anthropological collections during the year owing to there having been no field work. Specimens received during the year totalled 273, as follows:

Ethnology	22
Archæology	241
Osteology	2
Portraits and drawings	8

BIOLOGICAL DIVISION

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

FIELD WORK

Field work was confined to collection near Ottawa of a few specimens and a considerable amount of accessories for preparation of habitat groups. C. H. Young also collected and mounted about 900 specimens of *Microlepidoptera*, many of which proved to be new forms.

R. M. Anderson and P. A. Taverner served as members of the inter-departmental Advisory Committee on Wild Life Protection, and attended the semi-annual Conference of Federal and Provincial Game Officials held in Ottawa, April 14 to 16, 1932, and the 50th Annual Meeting of the American Ornithologists' Union held at Laval University, Quebec, October 18 to 21, 1932. Mr. Anderson also served as honorary advisory zoologist for the Gatineau-Lièvre-Nation division of the province of Quebec Association for the Protection of Fish and Game.

OFFICE WORK AND PUBLICATIONS

An up-to-date "Check-list of Canadian Mammals" has been virtually completed in card catalogue form, with modern nomenclature and revised geographical distribution of species containing much unpublished data. Work has also been continued on a bulletin on "Animal Life and Life Zones of Southern British Columbia," covering four seasons' field work of museum parties (1927-1930) along the International Boundary. Progress has been made on a more comprehensive descriptive and illustrated bulletin on the "Mammals of Canada."

P. A. Taverner completed the work of revising and consolidating his two popular earlier bulletins "The Birds of Eastern Canada" and "The Birds of Western Canada," which are now out of print, into one complete volume "The Birds of Canada." In collaboration with Dr. George Miksch Sutton of Cornell University, Mr. Taverner has prepared an annotated faunal list of the birds of Churchill, Manitoba, covering the work of P. A. Taverner, A. C. Lloyd, and V. E. Gould for the National Museum of Canada in 1930, Dr. Sutton for the Carnegie Museum, Pittsburgh, and other collectors in 1931 and 1932.

MUSEUM WORK

C. L. Patch, chief taxidermist and herpetologist, has mounted and installed a number of mammals and birds in the biological exhibition halls. Thirty-seven new mammals and birds were collected and mounted for the school loan collection, and 104 specimens remounted on new bases. Three hundred and sixty-four loans were made to schools for use in nature study and art work. For the study collections 247 birds were prepared.

Much intensive research work has been done on the reserve study collections, and several important groups have been systematically worked over, in connexion with loan specimens. At the end of the year the catalogued specimens of birds in the National Museum of Canada numbered 25,179, of mammals 11,750, and of reptiles and amphibians 4,478.

Various specimens have been obtained on loan from the Royal Ontario Museum of Zoology, Toronto; Provincial Museum, Regina, Saskatchewan;

California Academy of Sciences, San Francisco; American Museum of Natural History, New York City; Academy of Natural Sciences, Philadelphia; Grant Coteau Museum of Canadian Club, Shaunavon, Saskatchewan; Experimental Fisheries Station (Atlantic), Halifax, Nova Scotia; also from Major Allan Brooks, Okanagan Landing, British Columbia; Mr. C. H. Douglas Clarke, Toronto; Mr. Stuart Criddle, Treesbank, Manitoba; Mr. Eli Davis, London, Ontario; Mr. Kenneth Racey, Vancouver, British Columbia; Mr. W. E. Saunders, London, Ontario.

NATIONAL HERBARIUM

M. O. Malte made considerable progress in the report on the Flora of Arctic Canada. Many of the so-called critical genera were thoroughly studied and worked up, a task that was made possible by loans of Arctic plants from the Gray Herbarium, Cambridge, Mass.; The New York Botanical Garden, New York, N.Y.; The Danish Arctic Biological Station, Disco, Greenland; and the Botanical Division of the Government Museum, Stockholm, Sweden. No field work was undertaken. The number of plants received on account of exchange was 721. A list of the donors is given in the Annual Report of the Museum.

MINES BRANCH

John McLeish, Director

The necessity for reduction in national expenditure during the past three years has halted the expansion of the investigational and experimental test work which has grown up with, and indeed has been a very important contributing factor to, the rapid expansion during the past ten years of the Canadian mining industry.

Field investigations of mineral resources were considerably curtailed during the year, the officers ordinarily engaged therein devoting their attention in greater degree to the completion of reports on work already undertaken and towards the compilation of technical and trade information on industrial minerals and products for Government conference use.

The Dominion of Canada Assay Office at Vancouver, B.C., organized by the Superintendent of Mines, Department of the Interior, in 1901, and since 1908 operated under the administration of the Mines Branch, was, on January 1, 1933, transferred to the Department of Finance.

The demand and search for gold have been stimulated to an unprecedented degree by economic conditions of recent years. Canadian gold production has greatly increased owing to intensive prospecting, efficient management, and the highly developed scientific testing facilities afforded by the Ore Dressing Laboratories of the Department of Mines.

These laboratories not only make their direct contribution towards Canada's gold output, but test work on base metal ores and on non-metallics is laying the foundation for industrial development on a technically efficient and economically sound basis.

The Fuel Testing Laboratories have continued technical studies of Canadian coals. These investigations are demonstrating the suitability of Canadian coals for use in equipment and in localities where, hitherto, imported coal has been preferred. As a result, and with the assistance granted by the Government toward transportation, the market for Canadian coals has been greatly widened.

The engineers of the Ceramic Laboratories have contributed toward the more efficient operation of clay product plants in Canada, and the investigations under way are demonstrating the possibilities for the greater use of Canadian raw materials in the making of clay and refractory products.

During the year the Director, in addition to departmental administration duties, served as a member of the Dominion Fuel Board, the Advisory Committee on Mining Regulations, several Associate Committees of the National Research Council, and on the Government Advisory Committee on the Civil Service Superannuation Act. Toward the end of April he was authorized to accept appointment by the Alberta Government on the Turner Valley Gas Conservation Board. Advantage was taken of the opportunity, while in the West, of conferring with the officials of the Mines Department at Victoria and Edmonton respecting the work of the Mines Branch, and with officials of gas and coke companies at Vancouver and Winnipeg respecting test work to be undertaken by officers of the Mines Branch.

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

MINERAL RESOURCES DIVISION

The holding of the Imperial Conference in Canada in 1932 necessitated the preparation of exhaustive reports dealing with Canada's mineral industry and with mineral products necessarily obtained from abroad. The division was first required to prepare replies to a series of questionnaires distributed by the central Minerals Committee of the Imperial Economic Conference in London. This required the nearly continuous work of a staff of ten persons, including three technical officers, for about ten weeks.

More complete and elaborate data were then prepared for the use of the Canadian representatives at the Conference. A complete review of the present status of the Canadian mining industries was prepared covering 68 separate products, stating for each item the present status of the industry, statistics of production over a term of years, notes on reserves where possible, British import data, and, in the case of the more important products, a review of the United States situation, or of the world situation, as appeared desirable.

A series of statistical statements believed to be the most complete studies yet made of the Canadian mining industry, was prepared under the following general titles:

(1) Ore and Mineral Production, calendar years 1913-1930.
(2) Summary of Canadian Metals, Production, Imports, Exports, Supply, and Recorded (local) Consumption, 1927-1930.
(3) Inter-trade in Minerals, Metals, and Their Products; United States-Canada, calendar years 1927-1930.
(4) Inter-trade in Metals, Minerals, and Their Products; United States-United Kingdom (except Irish Free State), calendar years 1927-1930.
(5) Inter-trade in Metals, Minerals, and Their Products; United States-British Empire Units, calendar years 1927-1930.

At the beginning of the year there was completed and issued in mimeograph form a comprehensive review under fifty-six separate subject headings of the Canadian Mineral Industry during 1931. During the year there were completed and published reports on: Gold in Canada; Feldspar; Anhydrite in Canada; and the Annual Report on Investigations of the Mineral Resources and the Mining Industry 1931, containing eight reports on investigations that had been in progress during that and the preceding year; lists were prepared and published of operators of milling plants, metallurgical works, gold mines, coal mines, and coke works.

In addition to administrative duties the Chief of the Division, A. W. G. Wilson, supervised the preparation of the data required for the Imperial Conference, wrote many of the memoranda on different products, and was appointed an adviser at the Conference. Mr. Wilson also served as a member of the subcommittee of the Research Council on Asbestos. During the field season inspection trips were made to many areas or operating metallurgical plants in Ontario, Quebec, and British Columbia.

H. S. Spence was engaged for the greater part of the year in work connected with the recent discoveries of radium-bearing minerals and silver at Great Bear Lake, N.W.T. A report on his field investigations of these deposits in 1931 was prepared and published. An article dealing with the character of the Great Bear Lake pitchblende, illustrated by a unique series of radiographs, was prepared and published in the Canadian Mining Journal for November. Two months' field work in September-November included progress inspections of mining operations for radium and other rare-element minerals in central Ontario, for feldspar in Ontario and Quebec, and for talc and soapstone in the Eastern Townships, Quebec, as well as the examination of a number of barite prospects in Perth district, Ont. Visits were also made to fertilizer and other plants in Ontario and Quebec and to the new radium refinery at Port Hope, Ontario.

L. H. Cole assisted in the preparation of data for the Imperial Economic Conference. About two months were devoted to field work in Ontario and Quebec in connexion with the investigation on granites and other crystalline rocks as building stones, and for the purpose of checking in the field recent developments in gypsum and salt production.

S. C. Ells continued his studies of asphalt resources and the allied industries. During the field season representative manufacturers of commodities in whose production asphaltic materials are used were visited and consulted both in eastern and western Canada; and the principal oil refineries in the western provinces were visited and an inspection was made of the situation at McMurray. During the course of the field work preliminary arrangements were made for an extensive series of commercial tests of various asphaltic products that can be made from separated bitumens from northern Alberta.

M. F. Goudge continued his study of the limestone industries. A report on "Canadian Limestones for Building Purposes" was completed and considerable progress was made on the manuscript of the general report on Limestones of Canada. Much information on this subject was furnished to interested engineers through correspondence and personal interviews. Further progress was also made in demonstrating the suitability of certain Canadian limestones for the manufacture of rock wool. A report upon this subject was included in the Annual Report on Investigations of Mineral Resources, 1931.

A. H. A. Robinson prepared a condensed report on "Gold in Canada" which was published late in July—the whole edition of 4,000 copies being exhausted at the end of the year. Material was prepared for a revised edition of the general report on "The Mineral Industries of Canada," the last edition of which was published in 1925. In the latter part of November two weeks were spent on field work collecting data relating to new mining developments in Ontario and Manitoba.

V. L. Eardley-Wilmot continued his studies on diatomite, spending about six weeks on field work in Ontario and in British Columbia. He also made laboratory examinations of samples obtained from field collections or submitted by inquirers.

John Casey, statistician, prepared an elaborate series of statistical tabulations for the Imperial Economic Conference (*see* titles in introduction of this report). The sixth annual survey of domestic-use fuels marketed in Quebec, Ontario, and Manitoba was conducted as usual; a survey of fuel oil for all purposes throughout Canada during the year 1931 was also made. During the year a new list of "Coal Mines in Canada," was compiled and issued; statistical reports were compiled for the Dominion Fuel Board. Several special reports were also prepared, two of which may be mentioned; one dealt with the recorded output of the Onondaga gas field in Ontario, for the Natural Gas Commissioner of Ontario, and the other was an historical summary showing production of metals in the province of Quebec, for the Director of the Bureau of Mines, Quebec.

A. Buisson spent about six weeks visiting leading mining operations in Quebec and Ontario, for the purpose of procuring authentic information about local conditions and the progress being made in the mining industry.

C. H. Freeman continued an investigation of natural bonded moulding sands of Canada. Laboratory tests were made on samples collected in the field during the previous years and on several submitted by inquirers. A report upon the investigation is in course of preparation.

ORE DRESSING AND METALLURGICAL DIVISION

W. B. Timm, Chief of Division, reports that sixty-four investigations were completed in the Ore Dressing and Metallurgical Laboratories and reported on. This number was the greatest for any one year since laboratory facilities were provided for the investigation of treatment methods for Canadian ores. Of the forty conducted in the ore dressing laboratories for metallic ores, thirty-two, or one-half of the total, were on gold ores from newly developed properties. Fourteen investigations were conducted on non-metallic minerals. The investigation of methods for the treatment of the Great Bear Lake pitchblende for the extraction of radium was completed. Four investigations on iron ores and five special investigations for the Aeronautical Division of the Department of National Defence and for the Steel Companies were conducted in the metallurgical laboratories.

Based on the results obtained from these investigations new milling plants have been built, are under way, or contemplated, and changes made to existing plants to effect economies of operation, and increased recoveries. The treatment plant for the Great Bear Lake pitchblende and radium refinery at Port Hope, Ontario, commenced operations in January, 1933. The steel plants are extending their operations along new lines, manufacturing new and higher grade products.

Advantage of the laboratory facilities was taken by consulting engineers and the metallurgists from operating companies to carry out investigations on their ore treatment problems. Consulting engineers and metallurgists engaged on the design, construction, and operation of new milling plants, and on the operating problems of existing plants were given the benefit of the experience and knowledge of the staff of the division, gained in conducting the investigative work.

FIELD STUDIES

C. S. Parsons spent two months investigating the methods employed by the placer miners, in British Columbia and Alberta, for the recovery of gold from placer gravels.

A. K. Anderson spent four weeks in the gold mining districts of western Quebec and northeastern Ontario, visiting the milling plants and concentrators.

T. W. Hardy spent a week 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, the following investigations were conducted by C. S. Parsons, A. K. Anderson, W. D. Johnston, and W. S. Jenkins:

Recovery of gold from the ore of the Ashley property, Matachewan district, Ont.
The concentration of chromite from Obonga Lake, Ont.
The concentration of chromite from Lake Shebandowan, Ont.
Experimental tests on gold-bearing sulphides from placer deposits in Cariboo district, B.C.
Experimental tests on gold ore from the Rand mineral claims, Sanca, B.C.
Recovery of gold from the ore of the De Santis Gold Mining Company, Limited, Timmins, Ont.
Experimental tests for receiving of gold from blanket concentrates from Granada Gold Mines, Limited, Rouyn, Que.
Concentration of scheelite ore from Indian Path Mines, Lunenburg, N.S.
The recovery of gold from the ore of the St. Germaine-Gale property, Dubuisson area, Que.
Recovery of pyrite from coal washery waste of the Dominion Coal Company, Sydney, N.S.
Experimental tests on gold ore from the McKellar-Longworth property, Schreiber, Ont.
Flotation concentration of Siscoe gold ore, Siscoe Gold Mines, Limited, Siscoe, Que.
Recovery of gold from Bussieres property, Quebec, of Treadwell-Yukon Mines, Limited.

Experimental tests on gold ore from the Alexandria Mines, Limited, Phillips Arm, B.C.
Experimental tests on gold-silver-lead-zinc ore from the Alice Lake group of mineral claims near Quatsino Sound, Vancouver Island, B.C.
Experimental tests on gold ore from Herb Lake, Man.
Recovery of gold from arsenical ore of the Cameron Island mine, Shoal Lake, Lake of the Woods, Ont.
Concentration of cobalt ore from Werner Lake, Red Lake mining division, Ont.
Recovery of gold from the ore of the Cariboo Gold Quartz Mining Company, Limited, Barkerville, B.C.
Cyanidation of flotation concentrate from Bralorne Mines, Limited, Bridge River district, B.C.
Recovery of gold from the ore of the Beattie Gold Mines, Limited, Duparquet Township, Abitibi County, Que.
Recovery of gold from black sand concentrates from North Bend, B.C.
Magnetic concentration of iron sands from Black Bay, Port Arthur, Ont.
Recovery of gold, silver, lead, and zinc from the ore of the Yankee Girl mines, Ymir, B.C.
Experimental tests on gold ore from mining claims K-3645, Island 102P, Lake of the Woods district, Ont.
Experimental tests on gold-silver-lead-zinc ore from the Bey Mines, Limited, Northbrook, Ont.
Concentration of copper and gold in the Greene-Stabell ore, Dubuisson Township, Abitibi, Que.
Recovery of gold from the ore and mill tailings of the Horseshoe Mines, Limited, Kenora, Ont.
Experimental tests on gold ore from the Highland Enterprise Company's claims, Barren Lake, Falcon Lake district, Man.
Recovery of gold from black sand concentrate from Rock Creek placer deposits, B.C.
The recovery of gold from the ore of Ventures, Limited, Island Lake property, Man.
Experimental tests on three samples of gold ore from Cedar Island, Shoal Lake, Lake of the Woods, Ont.
The concentration of Surf Point, Porcher Island, gold ore.
Experimental tests on arsenical gold ore from Whitewater, Taku River area, B.C.
The concentration of the disseminated copper-nickel ore of the Falconbridge Nickel Mines, Limited, Falconbridge, Ont.
Experimental tests on gold ore from Beaufor Gold Mines, Limited, Pascalis Township, Abitibi County, Que.
Experimental tests on gold ore from the Sullivan Consolidated Mines, Limited, Dubuisson Township, Abitibi County, Que.
Experimental tests on gold ore from Mackey Point Syndicate, Michipicoten district, Ont.
Experimental tests on gold-silver-copper-lead-zinc ore from Teddy Glacier mine, Cambourne, B.C.
Magnetic separation of vanadium-bearing titaniferous magnetite from Mine Centre, Ont.

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

The concentration of garnet from River Valley, Ont.
The preparation of diatomite, Martin Siding, Ont.
The separation of gypsum and dolomite from Amaranth, Man.
The testing of quartz from Larouche, Chicoutimi County, Que.
The crushing and washing of sandstone from St. Canute, Que.
The crushing and washing of sandstone from Gatineau Point, Que.
Experimental tests on Madoc talc for the separation of dolomite.
Experimental tests on barite from Strathborne, N.S.
The concentration of cyanite from Death Rapids, Big Bend district, B.C.
Experimental tests on quartz and china clay from Lac Remi, Que.
The testing of gypsum from Ottawa Brook, N.S.
The testing of anhydrite from Baddeck Bay, N.S.
The testing of a prepared anhydrite plaster (Pioneer plaster).
The testing of gypsum from Windsor, N.S.

In the hydrometallurgical and electrochemical section, R. J. Traill investigated "Methods of treating Great Bear Lake pitchblende for the extraction of radium." W. R. McClelland conducted the work of the radium measuring laboratory in connexion with this investigation and made a study of the precautions to be taken for workers in treating radium ores.

In the section of ferrous metallurgy, T. W. Hardy and H. H. Bleakney conducted the following investigations:

The production of sponge iron from Texada Island (B.C.) iron ore.
The production of sponge iron from Moose Mountain (Ont.) concentrate.
The laboratory concentration of a high sulphur magnetite from Texada Island, B.C.
Sintering tests on a high sulphur magnetite from Texada Island, B.C.

For the Aeronautical Division of the Department of National Defence and for the steel companies, special investigations were as follows:

The structure and compressive strength of some samples of cold drawn tubing used in aircraft construction.
The comparative properties and constitution of some samples of aluminium alloy used in airscrews and the investigation of a propeller blade which failed in service.
McQuaid-Ehn and other tests on certain samples of hollow drill steel.
The possibility of controlling coarse carbide formation in cast chromium-molybdenum rolls of high carbon content.

In the Chemical Section of the division, H. C. Mabee, chief chemist, reports 3,329 samples were received in connexion with the investigative work of the division, on which over 10,000 chemical determinations were made.

In the Mineragraphic Laboratory, where facilities are provided for the microscopic examination and spectrographic analysis of ores and mill products, 411 polished, and 30 thin, sections were prepared and examined and 156 spectrographic analyses made. M. H. Haycock issued sixty reports, giving the results of his findings to those conducting the investigations in ore treatment, which were embodied in the reports of investigations.

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 conducted were: beneficiation of eastern and western Canadian coals by sizing and washing; observations on storage of Nova Scotia coals at Montreal; plant scale coking tests on Nova Scotia and British coals in the ovens of the Ottawa gas plant; plant scale coking tests on several British Columbia coals in the new chamber ovens of the British Columbia Electric Railway Company at Vancouver. Other research work was carried on throughout the year and during the summer months field investigations were carried out in the Turner Valley gas field. All the chemical work in connexion with the Explosives Division was also carried out in the Fuel Research Laboratories.

The erection of a commercial briquetting plant was completed and a large-scale coal washing plant installed.

Additional to planning and directing the work of the division, Mr. Haanel attended the regular meetings of the Dominion Fuel Board. He also held several conferences with officials of the Dominion Steel and Coal Corporation and the Montreal Coke and Manufacturing Company, Montreal, in connexion with the investigations on Nova Scotia coals carried out in the Fuel Research Laboratories. Mr. Haanel, accompanied by R. A. Strong, visited the principal collieries in British Columbia and held conferences with the Minister of Mines and other officials of the British Columbia Government at Victoria, and with officials of the British Columbia Electric Railway Company relative to the carrying out of large-scale tests on various British Columbia coals.

Professors Smith and Frost, who were actively engaged during the previous summer months on research work at the Fuel Research Laboratories, were not re-engaged this year. They, however, co-operated with the staff of this division in their respective universities on research problems pertaining to Canadian fuels.

R. E. Gilmore, Superintendent of Fuel Research Laboratories, assisted in planning the work of the division and in the preparation of "Investigations of Fuels and Fuel Testing for 1930 and 1931". He represented the division in the work of both the Canadian and American Coal Classification Committees, the objective of which is the establishment of an international system of classification satisfactory for the coals of North America. Such a classification is for all coals from anthracite to lignite, and is "to be based upon such

chemical and physical characteristics as will make the plan most readily adaptable to industrial and commercial use on a national scale". Mr. Gilmore also took an active part in the standardization of methods for testing coals; this work was being done in co-operation with the D-5 Committee of the American Society for Testing Materials, of which he is the Mines Branch member. In this connexion, two projects worthy of mention are the development of standard laboratory methods on "friability" of coal to show comparative handling qualities, and on "grindability" to indicate the comparative pulverizing characteristics of coal.

R. A. Strong, assisted by E. J. Burrough and E. Swartzman, of the Carbonization Section, continued tests on carbonization, washing, storage, and briquetting of coals. The work on carbonization pertained to testing in commercial gas and coke plants and to laboratory investigation on coal to determine their suitability for coke and gas production. Three tests were conducted at the plant of the Ottawa Gas Company, one on Nova Scotia coal and the remaining two on British coals. Tests were also made in the newly built coke plant of the British Columbia Electric Railway Company at Vancouver on British Columbia coals. The laboratory tests relative to the coking properties of coal were made for the purpose of determining suitable British coals for coke and gas manufacture to displace coals imported from the United States. These coals were tested by a new method developed during the year, which aims at predicting coke quality by coking small quantities of coal. The possibility of improvement in the quality of bituminous coal mined in Canada was studied, and washing curves were prepared for all the coals previously tested in the coke oven, and reported during the previous fiscal year. In addition, a special study was made of the various seams mined at Michel by the Crow's Nest Pass Coal Company, prior to the installation of a pneumatic coal-cleaning table. The success that attended the storage tests conducted on 35,000 tons of washed Princess coal at the plant of the Montreal Coke and Manufacturing Company led to further tests on washed Waterford coal. Several thousand tons of this coal were prepared in a manner similar to that used for Princess, and a test was made in the same manner. No heating developed in the pile during the storage season and it has now been demonstrated that either coal is suitable from this standpoint for use by this company. The briquetting installation was completed and tests were made on charcoal breeze and petroleum coke breeze for two large commercial organizations, and preliminary experimental work was started on the problem of producing a suitable briquette from Welsh coal fines. Results of co-operative investigations were furnished to the companies directly interested.

E. S. Malloch, assisted by C. E. Baltzer and J. R. Kirkconnell, carried on the work of the Mechanical Engineering Section, which consisted of the general routine of the section, and preparation of memoranda in connexion with the economic use of Canadian fuels in power plants and in domestic heating equipment. In addition, thirteen final reports were prepared on pulverized fuel fired boiler trials made on thirteen coals, viz., two from British Columbia and eleven from Alberta. Nine domestic furnace burning tests were made on coke fuels made from Nova Scotia and English coals at the plant of the Ottawa Gas Company and two reports were prepared on the results of these tests. Two short field investigations were made in connexion with the use of Canadian coal on domestic and power boiler stokers of the underfeed type. During the year considerable progress was made with an investigation regarding the grindability or pulverizability of coal. A new method for rating coals in this respect was developed by C. E. Baltzer, assisted by H. P. Hudson. A report descriptive of this work has now been published.

A. A. Swinnerton and G. P. Connell continued work on the alteration by heat treatment of bitumen from bituminous sands, and of Ontario lignite. Mr. Swinnerton assisted in co-operative tests at the Montreal East refinery of the Imperial Oil Company on the weathering properties of refined asphalt from Alberta bitumen, and subsequently supervised the construction of a small still at the Fuel Research Laboratories for preparing samples of refined asphalt. In this still, from the Alberta bitumen, were made a series of samples of oxidized asphalt with varying melting points, which were forwarded to different commercial firms to test the possibilities for the industrial application of the product. Mr. Connell made a systematic study of the reaction of the different woody, peaty, and fusian constituents of Ontario lignite to oxidation in an endeavour to determine relative storage properties. He also conducted low-temperature carbonization assays on these constituents as well as on other Canadian coals.

P. V. Rosewarne was in charge of the Oil and Natural Gas Section of the Fuel Research Laboratories, assisted by H. McD. Chantler, W. P. Campbell, and R. J. Offord. A survey of the gasoline used in Canada during the summer months was made and a report prepared for publication. This report included the results of a comprehensive laboratory analysis, and a discussion of the practical value and significance of the tests. An investigation was made of the total product of some wells in Turner Valley, Alberta, and a report on the subject was prepared. Over thirty samples of natural gas were collected from producing wells in Ontario and much valuable information obtained concerning that field. Considerable time was devoted to co-operation with the National Research Council in their associate committees on natural gas and on helium. An investigation was undertaken concerning permissible limits of acidity in explosives, but has not yet been completed. Work was continued on the analysis and testing of explosives submitted by the Explosives Division, on testing motor fuels and lubricating oils, on the fractionation of natural gas, and on testing natural gas for helium.

J. H. H. Nicolls and C. B. Mohr attended to the analytical work of the Solid Fuels Analysis Section. Mr. Nicolls continued his study of coal classification matters as affecting Canadian coals. He also conducted a large number of friability tests involved in the development of a standard laboratory method for testing the friability of coals.

T. E. Warren continued high pressure hydrogenation tests on low temperature tar from Nova Scotia coal, and on mixtures of tar and powdered coal, for their direct conversion into motor fuel. In his large laboratory-scale installation, equipped for continuous operation, he has shown the possibilities of obtaining, by the use of a catalyst, yields of from 80 to 100 per cent by volume of motor fuel, without the formation of coke. Certain changes are being made in the reaction chamber, and equipment is being added for the purpose of giving a more efficient recirculation of the hydrogen.

Routine Chemical Laboratory Work. During the year a total of 1,880 samples of solid, liquid, and gaseous fuels, and explosives, were examined. Of these, 1,033 or 55 per cent, pertained to investigations of the division, the remaining 45 per cent originating outside the division. On the same basis 6·4 per cent of the total examined was from other divisions of the Department of Mines, 3·6 per cent from the Department of Pensions and National Health, 3·3 per cent from the Departments of Marine and National Defence, and 1·3 per cent from other departments. From public institutions were received 2·9 per cent of the total and the corresponding percentages from commercial firms and private individuals were 23·9 per cent and 3·6 per cent, respectively.

The following is a more detailed classification, in which the kinds of fuel examined are shown:

—	—	—	—	Per cent of total examined
1	Samples pertaining to:			
	Fuel testing investigations—			
	Solid fuels; total number samples		737	39·2
	Coals (various kinds)	587		
	Cokes and chars	42		
	Peat and miscellaneous	98		
	Liquid fuels; total number samples		187	10·0
	Gasoline and other motor fuels	127		
	Lubricating oils	8		
	Crude oils	46		
	Other petroleums, oils, and miscellaneous	6		
	Gases from coals, oil-shales, etc		62	3·3
	Natural gas		47	2·5
2	Samples from other divisions of the Department of Mines—			
	Geological Survey—coals		23	1·2
	Explosives Division (dynamites, fireworks, etc.)		91	4·8
	Other Mines Branch divisions		7	0·4
3	Samples from outside the department—			
	Dept. Pensions and National Health, coal		67	3·6
	Depts. Marine and National Defence, coal and oils		63	3·3
	Other Government departments, coals, etc		13	0·7
	Provincial Governments—coals, etc		11	0·6
	Public institutions		55	2·9
	Commercial firms—coals, oils, and natural gas		449	23·9
	Private individuals—coals, oils, and natural gas		68	3·6
	Total		1,880	100·0

CERAMICS AND ROAD MATERIALS DIVISION

Howells Fréchette, Chief of the Division, reports that many ceramic industries have been assisted through advice given on technical matters by members of the staff.

Information and advice have been furnished to the Department of Labour in connexion with the establishment of a clay-working plant at a relief labour camp.

CERAMICS

For the greater part of the year L. P. Collin was occupied with the investigation on the physical properties of Canadian bricks. During the field work about 7,500 bricks were selected for testing from brick plants in Quebec and Ontario and full data were gathered as to the processing through which these bricks had passed. About 1,500 bricks have been tested for transverse strength and 1,100 for compression strength. Two thousand five hundred determinations of toughness and hardness have been made. Equipment has been installed for determining absorption data and weathering resistance, based on repeated freezing and thawing. Mr. Collin completed investigational work on ceramic bodies for pebble-mill balls and liners. Bodies comparing favourably with those on foreign markets were developed.

The investigation of the Canadian refractories industry and resources occupied much of J. F. McMahon's time. He spent five weeks visiting manufacturers of refractories in Ontario and Quebec and also some typical plants using refractories.

Mr. McMahon conducted a series of tests on various types of insulating brick to ascertain the effect of high temperatures upon them.

An investigation has been commenced by J. G. Phillips to find a means of increasing the density of building brick manufactured from certain Canadian shales. This will include study of the effects of: (*a*) variation in grain size; (*b*) the addition of electrolytes; and (*c*) de-airing or removing air from the tempered shale. The possibility of attaining desired density through the action of added flux will also be investigated.

Mr. Phillips paid particular attention to microscopical examination of ceramic raw materials and products, and to the testing of clays, shales, and other ceramic raw materials. Fired ceramic bodies were studied and the presence of cordierite identified. In refractory bricks the development of cristobalite and mullite was observed. The presence of anhydrite and its mode of occurrence in a sample of a commercial grade of salt were determined and an unusual form of silica was identified as composing a sample from a deposit in western Ontario which is being investigated by the Mineral Resources Division.

The following testing has been done by Mr. Phillips or under his direct supervision:

One hundred and ninety-two samples of clay from southern Saskatchewan, collected by F. H. McLearn of the Geological Survey, were subjected to test to obtain indications of their possible commercial use.

Similar tests were conducted on fourteen samples of clay from Alberta, collected by L. S. Russell, also of the Geological Survey.

Eighty samples of clays and shales, 5 samples of quartzite and quartz, 4 samples of diatomite, and one sample each of talc and soapstone, submitted by the general public, were tested and reported upon.

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

ROAD MATERIALS

R. H. Picher was engaged for about six weeks in certain parts of Nova Scotia and New Brunswick investigating gravels suitable for road making. Another period of six weeks was spent investigating road ballast and concrete gravels and sands in southern Ontario south of the Ottawa-Sarnia highway and in studying the gravel deposits of St. Clair River in their relationship to the gravel requirements of the adjacent counties.

In addition to the testing of sixty-five samples collected in the field, eleven samples of rock and gravel from other sources were tested to determine their qualities as road and ballast materials.

CHEMISTRY DIVISION

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

From April 1, 1932, to March 31, 1933, 1,296 specimens have been reported on.

Complete analyses of 87 samples of diatomaceous earth, 2 alloys, 33 brines and salts, 1 water, 4 coal ash, 5 magnetites, 1 sample of uranium for standard purposes, 2 type metals, 1 quartzite, 57 manganese ores, 2 bentonites, 1 dolomite, 8 bauxites, 2 sands, 1 soapstone, 1 marl, 1 asbestine, 2 iron ores, 1 graphite rock, 4 waters, 1 manganous concretion, 29 limestones, 12 mineral wools, 1 rock powder, 8 irons, and 25 sulphurs and sulphates in limestone and mineral specimens were made.

Partial analyses were made on 5 samples of rock mud, 28 limestones, 1 rock salt, and 1 precipitated silica (Trail, B.C.).

Three hundred and sixty-one furnace assays were made. Twelve quantitative determinations were made for arsenic, 16 copper, 6 platinum, 1 potassium, 6 beryllium, 2 uranium, 2 tin, and 2 mercury.

Specific gravity determinations were made on 18 diatomites, and 1 bentonite was examined for its physical properties, also 1 specific gravity on incised slate.

A considerable amount of time was spent on diatomaceous earth investigation to find a method of distinguishing the diatomite silica.

The various methods for determining less than 0·005 per cent manganese in diatomaceous earth were checked and a satisfactory method for making this determination was evolved. Also settling tests were made on bentonite using some 20 different electrolytes.

During the year translations were made of technical literature from Scandinavian, Dutch, and German languages.

The investigation of samples relating to the Ottawa sewer explosion of 1931 was completed, twenty special samples being analysed for the Ottawa Gas Company. Analyses of 286 samples of mine air, largely special samples, mainly for British Columbia, were made. In addition to an investigation into chemical problems relating to spontaneous combustion in the Allan mine, N.S., an investigation was made on samples of exhaust gases from Diesel engines for the information of the Inspector of Mines for the province of British Columbia.

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

G. N. Ford, Manager of the Dominion of Canada Assay Office, reports for the year ending December 31, 1932, as follows:

The total amount disbursed for purchase of gold bullion during the year was $142,898.15, as compared with average annual disbursement for the preceding ten years of $1,869,419.18. The reason for the reduction was that prior to December 12, 1932, this office did not pay premium, which resulted in the bulk of the gold being shipped to the Royal Canadian Mint, Ottawa, or exported under licence.

The gold and silver making up the deposits received at the Assay Office came from the following sources:

Bars, nuggets, dust, and amalgam	Number of deposits	Weight		Premium paid	Disbursements
		Before melting	After melting and assaying		
		Ozs.	Ozs.	$ cts.	$ cts.
British Columbia	710	3,833·03	3,571·56	848 83	848 83 61,159 48
Yukon Territory	10	138·47	131·09	.....	2,256 12
Miscellaneous	44	266·73	247·28	.....	4,522 86
Dental and jewellery scrap	841	7,626·63	7,220·30	.....	74,110 86
	1,605	11,864·86	11,170·23	848 83	142,898 15

DRAUGHTING DIVISION

H. E. Baine, Chief Draughtsman

The following work was performed by the Draughting Division during the fiscal year ending March 31, 1933:

Preparing two hundred and forty-five maps, mechanical drawings, charts, and flow-sheets for reproduction.

Preparing seven charts for the Dominion Fuel Board.

Two thousand four hundred and ten negatives and prints were made from the Rectigraph machine.

Three hundred and forty-six negatives, black and white, and blue prints were made from the blue-print machine.

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

One hundred and thirty photos were received and filed.

DISTRIBUTION OF PUBLICATIONS

During the fiscal year ending March 31, 1933, the distribution of Mines Branch reports, bulletins, memorandum series, maps, lists of mines, operators, etc., amounted to 58,331 copies.

Mimeographed work comprised some 130,000 pages and 22,500 notification cards were issued.

LIBRARY

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

Accessions to the Library, 1932

Books (by purchase)	238
Books (by gift)	77
Books (by transfer)	18
Books (complete unbound volumes)	326
Books and bulletins added to the circulating divisions	111
Canadian Government documents (by exchange and gift)	1,843
British and Foreign Government documents (by exchange and gift)	1,152
Scientific societies' bulletins, proceedings, and transactions (by exchange and gift)	1,438
Trades catalogues (by gift)	368
Periodicals and continuations subscribed for	275
Annuals, continuations, and periodicals (by gift)	501

Two hundred and fifty-eight volumes were bound.

EXPLOSIVES DIVISION

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

Factories

No change was made during the year in the list of factories licensed to manufacture explosives. One factory, normally in operation for only a short period annually for the manufacture of fulminate of mercury, did not open. One small fireworks factory and one licensed for the manufacture of toy pistol caps were in operation for limited periods. The other seven, three for the manufacture of blasting explosives, one for that of sporting ammunition, detonators, and other supplies, one for safety fuse, and two fireworks factories, operated throughout the year, but, in most cases, on reduced time in view of the decrease in demand both for blasting explosives and for fireworks.

One accident, whereby two men were killed, occurred at the factory of the Canadian Industries, Limited, at Beloeil, Que., on March 30, 1933, when an explosion in the black powder press house demolished that building, and caused explosion also in the corning mill house, which likewise was completely wrecked. The two victims of the disaster were in the press house where, it is computed, they were engaged in cleaning up the building after a charge had been put through. Unfortunately no evidence was obtainable that would indicate specifically what they were doing at the time and that might have thrown light on the probable cause of the explosion. No one outside the building was injured. The corning mill was in operation and, it being controlled from a distance, no one was involved in the explosion in that building.

Of other accidents in licensed factories only one caused injury to personnel, an employee of the Macdonald Metal Products Company sustaining burns, not of a serious nature, from the ignition of some cap composition adhering to a bucket he was cleaning.

Inspectors of the division made thirty-two visits of inspection to factories, and one supplementary inspection of a small fireworks factory was made by a deputy inspector of the Royal Canadian Mounted Police.

Magazines

The magazines under licence, on March 31, 1932, numbered 335, and on March 31, 1933, 327. In addition, 189 licences were issued during the year covering the operation of temporary magazines.

Thefts from magazines have again been frequent: 21 magazines were broken into, three of them on two occasions, and explosives totalling 5,500 pounds of dynamite, 19,000 detonators, and 24 quarts of nitroglycerine stolen. Of the major thefts one lot of 400 pounds and one of 800 pounds of dynamite were recovered. Both strong, permanent magazines and temporary magazines, as used on construction work and at road camps, suffered from these depredations.

Routine inspections bring to notice explosives commencing to deteriorate but usable and so sentenced for early use, also explosives not fit for use. Among the latter were 1,400 pounds damaged by water, and 400 pounds of an obsolete explosive, which were destroyed. In addition, 4,450 pounds of dynamite, 175 pounds of gunpowder and 100 detonators, distributed over eighteen magazines, were condemned and destroyed.

Inspectors of the division made 434 inspections of magazines, and a further 245 were made by deputy inspectors of the Royal Canadian Mounted Police. A few reports on certain outlying magazines were also rendered by the courtesy of the Commissioner of the British Columbia Provincial Police.

Unlicensed Premises

The inspection of dealers' stores in which small quantities of explosives as well as small arm ammunition may be kept, calls for a considerable amount of routine work, and the locating of work parties using small quantities of explosives is effected, principally, by the vigilance of the scattered detachments of the Royal Canadian Mounted Police. Inspections numbering 758, of unlicensed premises of all kinds, were made by inspectors of the division, and over 2,100 additional by deputy inspectors of the Royal Canadian Mounted Police. The increases in the personnel of that force, and its wider distribution, consequent on its taking over the duties of provincial police in several provinces, have greatly facilitated the task of conducting a uniform inspection in all parts of the country at a minimum of expense.

Eighty pounds of dynamite were stolen from three places, including one case, 50 pounds, stolen from a truck conveying explosives. In addition, extensive thefts, totalling 900 pounds, were made from temporary stores established along a line of railway when dealing with the clearance of landslides.

Prosecutions

Prosecution was entered in two cases; one in respect to violation of the conveyance regulations, dynamite and detonators having been loaded on a truck together, and one against a person who, without a licence, kept explosives in excess of the quantity allowed in unlicensed places. Fines were imposed in both cases.

Importations

Permits numbering 350 and 38 special permits were issued for the importation of explosives. With a few exceptions these related to the importation of explosive material required for use in explosives factories and for other manufacturing purposes, and included also considerable shipments of Chinese and other manufactured fireworks.

Authorization of Explosives

Eight explosives were added to the Authorized List, and changes in formulæ of twenty-eight others authorized after examination. Four explosives submitted for authorization were rejected, and four authorized explosives, having become obsolete, were withdrawn from the list. Eleven new varieties of fireworks were authorized.

Accidents

Accidents in the use of explosives during the year 1932 caused the loss of twenty-two lives and injury to one hundred and forty-four persons, and accidents arising from playing with explosives and miscellaneous causes, otherwise than in the use of explosives, accounted for eight deaths and injuries to fifty persons. These figures approximate closely to those of the year preceding. A record of the accidents, with the causes to which they are attributed, is given in the Annual Report of the Division. It is observable that accidents are much more common in the course of general construction work, road work, and the like, than in operations in mines and quarries. This may reasonably be attributed to the closer supervision usually exercised in mining operations in conformity with the provincial mining regulations.

EDITORIAL DIVISION

F. Nicolas, Editor-in-Chief

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

At the end of the fiscal year there were in the hands of the King's Printer five English reports of the Geological Survey, four English reports and two French translations of the Mines Branch, and one English report of the Explosives Division. Several other publications have also been translated, namely: reports on Mica, Artificial Abrasives, Fluorspar, Zinc and Lead in Canada, and Prospecting in Canada, the printing of which has been postponed for the present.

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:

DEPARTMENT OF MINES

Report No.

English Publications

2315. *Report of the Department of Mines for the Fiscal Year ending March 31, 1932:* 50 pages; 2,000 copies; published October 13, 1932.
Canada, The Department of Mines, Its Organization, The Service It Performs: 16 pages; 1 chart; 1,000 copies; published February 24, 1933.

French Translation

2307. *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars, 1931:* 39 pages; 800 copies; published June 20, 1932.

General Index

2260. *General Index to Geological Survey Reports 1917-1926*—by Frank Nicolas: 666 pages; 1,500 copies; published August 24, 1932.

GEOLOGICAL SURVEY

English Publications

2294. Economic Geology Series No. 9. *Oil and Gas in Eastern Canada*—by G. S. Hume: 187 pages; 1 plate; 20 figures; 3,000 copies; published April 18, 1932.
2300. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1931, Part B:* 84 pages; 9 figures; 2,500 copies; published April 13, 1932.
2305. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1931, Part A:* 120 pages; 1 plate; 8 figures; 3,000 copies; published May 12, 1932.
2306. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1931, Part D:* 58 pages; 1 figure; 2,500 copies; published April 22, 1932.
2308. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1931, Part C:* 93 pages; 1 figure; 2,500 copies; published June 13, 1932.
2309. Economic Geology Series No. 10. *Gold Occurrences of Canada, Summary Account*—by H. C. Cooke and W. A. Johnston: 61 pages; 9 figures; 3,000 copies; published June 10, 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

2313. Memoir 170. *Studies of Geophysical Methods, 1930*—by A. S. Eve, D. A. Keys, L. Gilchrist, A. H. Miller: 118 pages; 51 figures; 2,500 copies; published January 12, 1933.

2314. Economic Geology Series No. 11. *Rare-Element Minerals of Canada*—by H. V. Ellsworth: 272 pages; 1 plate; 8 figures; 2,500 copies; published December 27, 1932.

2317. Economic Geology Series No. 12. *Manganese Deposits of Canada*—by G. Hanson: 120 pages; 4 figures; 2,000 copies; published December 9, 1932.

List of Publications of the Geological Survey and National Museum of Canada: 17 pages; 1,000 copies; published July 6, 1932.

Catalogue of Motion Picture Films: 9 pages; 1 figure; 1,500 copies; published January 11, 1933.

French Translations

2299. *Rapport sommaire de la Commission géologique, Ministère des Mines pour l'année civile 1930, Partie D* (extraits): 67 pages; 4 figures; 1,250 copies; published September 13, 1932.

2320. *Rapport sommaire de la Commission géologique, Ministère des Mines pour l'année civile 1931, Partie D* (extraits): 31 pages; 1,250 copies; published November 29, 1932.

2322. Memoir 166. *Géologie et gisements minéraux de la région de Rouyn-Harricanaw*—by H. C. Cooke, W. F. James, and J. B. Mawdsley: 333 pages; 3 plates; 28 figures; 1 map; 1,500 copies; published March 31, 1933.

NATIONAL MUSEUM OF CANADA

English Publications

2304. Bulletin 65. *Indians of Canada*—by D. Jenness: 446 pages; 115 plates; 7 coloured plates; 9 figures; 1 map; 1,500 copies; published August 10, 1932.

Bulletin 68. *Annual Report for 1930:* 89 pages; 11 plates; 9 figures; 2,000 copies; published April 19, 1932.

Separate. *The So-called Agropyron caninum (L.) Beauv. of North America*—by M. O. Malte: 22 pages; 5 plates; 400 copies; published April 7, 1932.

Separate. *Dinosaur Tracks from Peace River, British Columbia*—by C. M. Sternberg: 28 pages; 5 plates; 9 figures; 300 copies; published April 2, 1932.

Separate. *A New Subspecies of Willow Ptarmigan from the Arctic Islands of America* and *A New Hybrid Grouse*—by P. A. Taverner: 3 pages; 1 plate; 300 copies; published April 2, 1932.

Bulletin 69. *Methods of Collecting and Preserving Vertebrate Animals*—by R. M. Anderson: 141 pages; 46 figures; 2,500 copies; published November 23, 1932.

Bulletin 70. *Annual Report for 1931:* 119 pages; 5 plates; 2,000 copies; published December 21, 1932.

Separate. *Three Iroquois Wampum Records*—by D. Jenness: 4 pages; 1 plate; 300 copies; published January 24, 1933.

Separate. *The Ethnography of the Great Bear Lake Indians*—by C. B. Osgood: 62 pages; 3 plates; 1 figure; 300 copies; published January 24, 1933.

Separate. *Five New Mammals from British Columbia*—by R. M. Anderson: 20 pages; 1 plate; 300 copies; published January 25, 1933.

MINES BRANCH

English Publications

724. *Investigations in Ore Dressing and Metallurgy, 1930:* 215 pages; 1 plate; 3,300 copies; published April 26, 1932.

727. *Investigations in Mineral Resources and the Mining Industry, 1931:* 153 pages; 36 plates; 7 figures; 3,300 copies; published December 21, 1932.

Separate. *Pitchblende and Silver Discoveries at Great Bear Lake, Northwest Territories:* 48 pages; 11 plates; 2 figures; 500 copies; published December 23, 1932.

MINES BRANCH—*Concluded*

Report No.

English Publications—Concluded

728. *Investigations in Ore Dressing and Metallurgy, 1931:* 183 pages; 2 plates; 4 figures; 3,300 copies; published February 3, 1933.
Classification of Coals Using Specific Volatile Index (Advance Section of Investigations in Fuels and Fuel Testing, 1930-31): 15 pages; 4 figures; 500 copies; published February 28, 1933.
729. *Clay and Shale Resources of Turner Valley and Nearby Districts*—by W. G. Worcester: 118 pages; 8 plates; 29 figures; 3,500 copies; published April 28, 1932.
730. *Gold in Canada*—by A. H. A. Robinson: 92 pages; 8 figures; 4,000 copies; published August 3, 1932.
731. *Feldspar in Canada*—by H. S. Spence: 145 pages; 13 plates; 23 figures; 3,300 copies published December 2, 1932.
Hydrogenation of Alberta Bitumen and Effect of Pressure on the Pyrolysis of Methane (Advance Sections of Investigations in Fuels and Fuel Testing, 1930-31): 21 pages; 2 plates; 12 figures; 500 copies; published June 20, 1932.
732. *Anhydrite: Its Occurrence, Properties, and Utilization*—by L. H. Cole and R. A. Rogers: 89 pages; 5 plates; 9 figures; 3,300 copies; published March 8, 1933.

Lists of Mines and Mine Operators in Canada:
Gold: 3,500 copies; published July 15, 1932.
Milling Plants: 1,500 copies; published September 30, 1932.
Gold (Reprint): 1,000 copies; published January 4, 1933.
Producers of Coke: 500 copies; published February 14, 1933.
Metallurgical Works, January, 1933: 1,500 copies; published March 14, 1933.
Coal Mines: 1,500 copies; published March 15, 1933.

EXPLOSIVES DIVISION

English Publications

31. *Annual Report of the Explosives Division for the Calendar Year 1931:* 22 pages; 1,800 copies; published April 27, 1932.

French Translation

32. *Rapport annuel de la Division des Explosifs pour l'année civile 1931:* 24 pages; 300 copies; published June 6, 1932.

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 1932-33, 3,675 copies were distributed in Canada and foreign countries, as follows: 1,401 copies to addresses on the mailing lists, through the Printing Bureau Distribution Office, and 2,274 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.

ACCOUNTING DIVISION

STATEMENT

Representative of the Treasury, E. A. Sawyer

The funds available for the work and the expenditure of the Department of Mines for the fiscal year ending March 31, 1933, were:

—	Grant	Expenditure	Grant not used
	$ cts.	$ cts.	$ cts.
CIVIL GOVERNMENT—			
Salaries—			
Department	76,806 00	76,236 07	569 93
Mines Branch	194,490 00	194,368 06	121 94
Geological Survey	269,928 00	267,043 59	2,884 41
	541,224 00	537,647 72	3,576 28
Contingencies	15,000 00	9,507 93	5,492 07
DEPARTMENT—			
Explosives Division	10,000 00	7,031 00	2,969 00
MINES BRANCH—			
For investigation of mineral resources, etc	238,500 00		
Salaries and wages		142,992 40	
Ore Dressing and Metallurgical Division		25,447 51	
Fuels and Fuel Testing Division		20,626 93	
Mineral Resources Division		7,243 81	
Ceramics and Road Materials Division		7,259 29	
Chemical Division		1,886 12	
Mechanical Section		3,076 08	
Administrative Division		627 76	
Dominion Fuel Board		4,516 87	
		213,676 77	24,823 23
For publications, English and French, etc	35,000 00		
Publication of reports, maps, etc		15,011 96	
Salaries and wages		4,158 00	
Printing, stationery, typewriters, etc		2,369 46	
Library		3,944 12	
Miscellaneous		1,495 22	
		26,978 76	8,021 24
DOMINION OF CANADA ASSAY OFFICE—			
For maintenance of Assay Office, Vancouver	16,00 000		
Salaries		11,343 57	
Assayers' supplies		17 83	
Premium on bonds		250 00	
Electric burglar alarm service		120 00	
Stationery and printing		87 05	
Miscellaneous		182 65	
		12,001 10	3,998 90
Expenditure to December 31, 1932, only (Assay Office transferred to Department of Finance on January 1, 1933).			
GEOLOGICAL SURVEY—			
For explorations, surveys, and investigations, etc	142,500 00		
Explorations, surveys, and investigations		91,577 91	
Salaries and wages		31,881 54	
Equipment and supplies		6,498 19	
Miscellaneous		1,127 49	
Photographic work		417 76	
		131,502 89	10,997 11

STATEMENT—*Continued*

—	Grant	Expenditure	Grant not used
	$ cts.	$ cts.	$ cts.
GEOLOGICAL SURVEY—*Concluded*			
For publication of English and French editions, etc.	52,000 00		
Printing reports, etc.		22,867 35	
Engraving services		12,608 71	
Printing of maps, etc.		7,688 37	
Salaries and wages		4,698 00	
		47,862 43	4,137 57
For maintenance of offices and museum, etc.	42,500 00		
Salaries and wages		21,775 63	
Stationery, printing, typewriters, etc.		8,686 38	
Library		4,511 97	
Instruments and repairs		307 55	
Miscellaneous		3,788 51	
Photographic Division		1,242 74	
Chemicals and drugs		303 23	
Postage		801 82	
B.C. Office		244 91	
		41,662 74	837 26
For museum equipment	8,000 00		
Salaries and wages		3,426 27	
New equipment and material		1,990 62	
Maintenance		1,184 48	
		6,601 37	1,398 63
For purchase of specimens	1,000 00	996 22	3 78

Summary

Civil Government salaries	541,224 00	537,647 72	3,576 28
Civil Government contingencies	15,000 00	9,507 93	5,492 07
Department	10,000 00	7,031 00	2,969 00
Mines Branch	273,500 00	240,655 53	32,844 47
Dominion of Canada Assay Office (to December 31, 1932, only)	16,000 00	12,001 10	3,998 90
Geological Survey	246,000 00	228,625 65	17,374 35
	1,101,724 00	1,035,468 93	66,255 07

Grants and Miscellaneous Statutory Expenditure

MISCELLANEOUS—			
For payments in connexion with movements of coal, etc.	1,750,000 00		
Subventions		1,188,221 64	
Salaries and wages		7,398 00	
Miscellaneous administrative expenses		3,393 87	
		1,199,013 51	550,986 49
Grant to Imperial Institute	9,733 33	8,490 00	1,243 33
MISCELLANEOUS (STATUTES)—			
Domestic Fuel Act (1927) payments		20,804 81	
Salary Deduction Act (1932)		1,855 33	

STATEMENT—*Concluded*

DETAILS OF REVENUE

Revenue for the Department of Mines for the Fiscal Year Ending March 31, 1933

Casual Revenue

	$ cts.	$ cts.	$ cts.
DEPARTMENT—			
Sale of explosives permits, etc.	1,631 93		
Sale of equipment	150 00		
		1,781 93	
GEOLOGICAL SURVEY—			
Sale of publications	2,735 27		
Sale of minerals	1,597 41		
Sale of equipment	878 70		
Sale of relief models	218 50		
Miscellaneous revenue	208 70		
		5,638 58	
MINES BRANCH—			
Assays and analysis	829 15		
Sale of equipment	278 40		
Sale of publications	164 75		
Sale of publications (Dominion Fuel Board)	42 00		
Miscellaneous revenue	100 12		
		1,414 42	
DOMINION OF CANADA ASSAY OFFICE (To December 31, 1932, only)—			
Profit on bullion	1,335 29		
Sale of residue	602 63		
Assays and analysis	8 00	1,945 92	10,780 85
FINES AND FORFEITURES—			
Explosives Division		10 00	10 00
PREMIUM, DISCOUNT, AND EXCHANGE—			
Exchange on U.S. Money Orders, etc., Geological Survey	46 24		
Exchange on U.S. Money Orders, etc., Mines Branch	22 55		
Exchange on U.S. Money Orders, etc., Dominion Fuel Board	3 10	71 89	71 89
			10,862 74

Casual Revenue

MISCELLANEOUS—	
Dominion Fuel Board—	
Subvention Refunds	2,027 44