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DOMINION OF CANADA

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE

FISCAL YEAR ENDING MARCH 31, 1930

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To General His Excellency the Right Honourable Viscount Willingdon, G.C.S.I., G.C.M.G., G.C.I.E., G.B.E., 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, 1930.

W. A. GORDON,
Minister of Mines.

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REPORT
OF THE
DEPARTMENT OF MINES

FOR THE FISCAL YEAR ENDING MARCH 31, 1930

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

SIR,—In accordance with the requirements of Parliament, I have the honour to submit the Annual Report of the Department of Mines for the year ending March 31, 1930.

Continued expansion in mining and metallurgical activities throughout the Dominion has been the keynote of the period covered by this report. This has been featured mainly in underground and surface development at the mines, in the erection of mills, smelters, and refineries, and in additions to existing structures and equipment, all of which point to increased stability and permanency of future operations. Also, the calendar year 1929 saw a new high record attained in Canadian mineral production, in value as well as in quantity of output.

The growth of the mining industry has again been reflected in increased departmental activities. Field and laboratory investigations have been extended to secure the greatest benefit for the industry from the facilities available, and the work of increasing existing facilities to render greater and urgently needed service has been continued. It is gratifying to note that both Dominion and provincial authorities are fully alive to the increasing industrial importance of mining and its associated arts, and that a larger amount of scientific and technical research is being devoted each year to their improvement.

The operations of the various branches of the department are reviewed below in detail by the heads of each branch and division. Present conditions in the industrial field are such that the greater part of the work being done is of urgent economic value, for which pressing demands exist. Nevertheless, other research investigations are carried on as time and circumstances permit, particularly when there is some likelihood of the application of scientific developments to Canadian conditions turning to the benefit of Canadian industry.

Increased activities in geological and topographical mapping and related work undertaken by the Geological Survey engaged the attention of fifty-two field parties working in widely separated parts of the Dominion. One party commenced the geographical and geological mapping of an area on the west coast of Hudson bay, immediately south of Rankin inlet, known to contain mineral deposits. Special investigations included the completion of the geological mapping of the Turner Valley oil and gas area of Alberta; a survey of the underground water supply for Regina, and the study of mapping of the surface deposits, including soils, of certain areas in southern Manitoba and Saskatchewan. Field and office work in anthropology and biology was continued by the National Museum of Canada.

The application of geophysics to the study of geological problems and, more particularly, to the investigation of ore deposits, is a matter of considerable interest to those engaged in the development of Canada's mineral resources. The Geological Survey this year continued the field study commenced in 1928 of the various methods and appliances now in commercial use for those purposes. Valuable, though highly technical, data have been derived from this investigation, the object of which is to ascertain the applicability and limitations of the various processes employed.

Research was continued by the Mines Branch into the more efficient treatment and utilization of the numerous metallic and non-metallic minerals of commercial importance. Investigations of modern methods of mining and milling and of the mineral technology of the more important ores have been made with a view to making this information available to the industries concerned. In the field of metallurgy the Mines Branch continued to contribute to the development and practical conservation of the Dominion's mineral resources through the improvement of methods for recovering more of the mineral content of ores, with attendant lessening of the cost of recovery. Special investigatory work on the utilization of Canadian iron ores was initiated and will be continued.

In the new Fuel Research Laboratories satisfactory progress has been made with the installation of equipment, and preliminary tests have begun. The work now being done includes tests on the burning of pulverized fuels, the examination of oil-shales, natural gas, and crude oils, the testing of coals, and the carbonization of coal with attendant recovery of by-products. Special studies have been made in the ceramics laboratories for the purpose of improving certain processes now in use in the clay-working industry, and for the elimination of unscientific and wasteful practices. Investigations have also been made on materials used in road construction. In addition to these technical studies, increased attention is being given to economic conditions and problems affecting the mineral industries generally.

The department wishes to acknowledge the co-operation of Dominion and provincial Government departments, of the development branches of the railway companies, banks, chambers of commerce, and of other Canadian organizations interested in the development of our natural resources. The general type of investigation undertaken by the department differs distinctly from those conducted by other organizations, and the danger of overlapping is almost entirely eliminated. Where similar work is carried on—as is the case with some of the universities, provincial governments, and the National Research Council—every effort is made to co-ordinate the work of the department with that of these various bodies. Close co-operation was also maintained with 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.

The results of all major investigations conducted by the department are made available to the public in the form of summary reports, special bulletins, maps, and memoirs. Much information of scientific, technical, and current interest related to the work of the department is also disseminated through the public and technical press, and by means of addresses. A selection of these papers and addresses is listed on pages 6 to 9. The winter series of Museum lectures, a standing feature of the educational work in Ottawa, was continued throughout the season of 1929-30. The official mining newsletter series prepared in the department for distribution from the High Commissioner's Office in London is now in its seventh year. Through this fortnightly service some four hundred selected newspapers, mining, banking, and investment houses in the United Kingdom and on the Continent, are informed of current develop-

ments in Canadian mining and metallurgical operations. The titles of the articles dispatched during the year will be found following the list of papers and addresses mentioned above.

The Deputy Minister, in addition to his administrative duties, served as chairman or member of the following official bodies: Council of the North West Territories; Dominion Fuel Board; Canadian Committee of the World Power Conference; Advisory Committee on Mining Regulations; National Research Council and several of its associate committees; Turner Valley Waste Gas Committee; Bituminous Sands Administrative Committee; and Advisory Committee on Minerals of the Imperial Institute. In February, 1930, the Deputy Minister sailed for South Africa to represent the Government of Canada at the Third (Triennial) Empire Mining and Metallurgical Congress.

Investigations into the utilization of the extensive deposits of bituminous sands of northern Alberta have been carried on for some years by the department and by the Research Council of Alberta. These investigations have been conducted along different lines, but the field in each case has been widening, and for this reason it was found desirable to secure the co-ordination of all research work on these potentially valuable resources. With this end in view the Honourable Charles Stewart, Minister of Mines, and the Honourable J. E. Brownlee, Premier of Alberta, arranged for the creation of a Bituminous Sands Administrative Committee, the membership of which is composed of the Deputy Minister of Mines, the President of the Research Council of Alberta, and the President of the National Research Council. All research on these resources is now controlled by the committee.

The Committee on the Conservation and Utilization of Waste Gas in Turner valley was created by the Dominion and Alberta Governments in the summer of 1929 to report upon the situation that had arisen in Turner Valley gas and oil field, Alberta. The inquiries instituted by the committee covered a wide field, and included studies of current practice in widely separated oil fields, industrial developments associated with gas fields, and current chemical processes in which are utilized gases similar to those being wasted in Turner valley. The committee recommended the formulation of new regulations to control all phases of the gas-producing industry, and the administration of the same by one body representing both Dominion and provincial authorities.

For the purpose of considering the means that might be taken to improve conditions in the coal mining industry in British Columbia, a conference was held in Victoria on October 1, 1929, at which the Deputy Minister of Mines and officers of the department met the Honourable W. A. McKenzie, officials of the British Columbia Department of Mines, and representatives of the coal mining industry of the province. The possibilities of the utilization of coal by destructive distillation at high and low temperatures, and the combustion of coal in pulverized form were discussed, and it was arranged that a sufficient supply of British Columbia coals should be made available in Ottawa for experimental work in the Fuel Research laboratories of the department. Investigative work was continued by the Mines Branch and the Geological Survey on the Cape Breton coal resources. The machinery set up for the administration of the Order in Council governing test movements of coals mined in eastern Canada has been made to apply to test movements of western Canadian coals. It is hoped that these various experiments will prove beneficial to the coal mining industry generally.

Finally revised figures of production for 1929 mark another step in the progress of Canada's mineral industries. For the fourth year in succession a new high record output was reached with a total production value estimated at nearly \$311,000,000, an advance of nearly \$36,000,000 or 13 per cent over the total output value for 1928. During the year important gains were made in

many different fields, new records being established in the production of copper, gold, nickel, and zinc among the metals, and of asbestos, petroleum, and salt among the non-metallics. In the more significant fields of mining exploration and development, upon which the output of the future to a great extent depends, very satisfactory progress was also made.

The high metal prices that have prevailed during recent years provided the impetus to intensive mining developments not only in Canada but in all mining countries. Reduced industrial activities and increasingly large stocks of metals on hand have resulted in a general slackening in the rate of production. The world depression that has seized commerce and industry since the beginning of 1930 will most likely be reflected this year in diminished activity in some branches of Canadian mining and in reduced output values for mining and metallurgical products generally, with that of gold excepted. The fall in the prices of copper, lead, and zinc, commodities to which the Dominion owes a large percentage of its increased mineral production in recent years, will be a principal contributory factor to any eventual decline, although it is probable that the 1930 production of these metals will exceed in quantity that of 1929.

These indications, considered in conjunction with the increase in mining, milling, smelting, and refining facilities already referred to, point to the increasing industrial stability of the Canadian mining industry and to its ability to operate and to advance in face of adverse market conditions. From its former status as a producer of raw mineral material the Dominion is gradually developing into a manufacturer of the finished mineral product, metallic and non-metallic. The present exceptional position of world industry veils to some extent the real situation which over a period of time becomes more than ever apparent. The world's need for minerals continues to increase with almost astonishing rapidity, and with the gradual exhaustion of Old World resources it is inevitable that the demand for Canada's mineral products will become greater, more varied, and more insistent.

Dominion Fuel Board

The Dominion Fuel Board held twelve meetings during the year and many subjects appeared on the agenda.

In its studies of the fuel situation, the board, in addition to continuing a systematic program of investigation that had been previously initiated, enlarged considerably the sources from which its information is drawn. Connexions with the coal-mining industry and the coal trade were extended and co-operation in the exchange of information between the board and coal marketing associations was advanced. Through such connexions the board obtained a great deal of data on the coal situation that are not otherwise available.

During the year, the second of the seasonal movements of Alberta coal to Ontario under the test freight rate of \$6.75 a ton, as authorized by Order in Council of March 16, 1928 (P.C. 439), was carried out. The board, in order to ascertain the results so far obtained in marketing the coal in Ontario, made a survey over representative areas and consuming centres of the province.

Administration of Order in Council of March 30, 1928 (P.C. 539), so far as it relates to inland rail shipments of water-borne coal from the Maritime Provinces, was an important part of the board's work. This work included inspection of applications from the coal companies for shipments under the provisions of the Order in Council, and payments made to the railways.

During the year eighty-two applications under Order in Council P.C. 539 were dealt with by the board. These applications referred to the movement of nearly 750,000 tons of coal.

In the summer of 1929 the secretary of the board visited the leading cities of Manitoba and Saskatchewan to study fuel costs to consumers, extent of coal markets, and competitive conditions as between Canadian and imported coals.

Administration of the Domestic Fuel Act (1927) during the past year included the final inspection by the board of the coking plant of the Nova Scotia Light and Power Company, Limited, at Halifax.

An application to participate under the benefits of the Domestic Fuel Act was received from the Quebec Power Company of Quebec. This application was accepted, preliminary inspection carried out, and an agreement entered into by the Minister with the applicant.

The Mineral Resources Division of the Department of Mines again conducted for the Fuel Board the annual survey of domestic fuel consumption in Ontario, Quebec, and Manitoba, and in the year under review extended the survey to cover the Maritime Provinces. The board continued its program of distributing printed cards and pamphlets showing proper methods of burning coke and other fuels displacing American anthracite.

A pamphlet on the subject of humidity in house heating was published by the board during the year. The public demand for this pamphlet quickly exhausted the first edition of 25,000 copies and a second edition of 50,000 copies was necessitated. Another pamphlet which the board had prepared during the year deals with the cost and convenience of house heating with various fuels, including fuel oil and city gas.

The board received many inquiries from representatives of Canadian and British interests who were investigating questions relating to coal markets or to the establishing of new sources of fuel supply. Inquiries from the public for information respecting fuels and the fuel situation were also dealt with. In response to requests from the newspapers and technical journals publicity articles on the fuel situation were prepared under the board's direction.

As in former years, generous co-operation was given to the board by the National Development Bureau and the Dominion Water Power and Reclamation Service, Department of the Interior, the Dominion Bureau of Statistics, Department of Trade and Commerce, the Mines Branch and the Geological Survey, Department of Mines, and by many of the coal interests throughout Canada.

Your obedient servant,

CHARLES CAMSELL,
Deputy Minister.

OTTAWA, ONT., April 7, 1930.

List of Papers and Addresses

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

General

- The Mining Industry in Canada, by Hon. Charles Stewart. Canadian Mining Journal, Fiftieth Anniversary Number, August, 1929.
- Mining Progress in Canada, by the Hon. Charles Stewart. Times Trade and Engineering Supplement, November 30, 1929.
- Canada's Mining Industries, by Hon. Charles Stewart. Beaver—Canada First, Toronto, June 20, 1929. Mail and Empire, Toronto, July 2, 1929.
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- Canada's Mining Industries, by Charles Camsell. Financial Times Fourth Canadian Resources Supplement, June 3, 1929.
- Canada's Mining Industries, by Charles Camsell. Financial Times Fifth Canadian Resources Supplement, November 18, 1929.
- Changing Aspects of Canada's Mining Industry, by Charles Camsell. Canadian Club, Vancouver, B.C., October 4, 1929.
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- The Mining Industry in 1929, by L. L. Bolton. Montreal Gazette Financial and Industrial Review 1929, January, 1930.
- Use of the Airplane in Mining, by Charles Camsell. Institute of Politics, Williamstown, Mass., August 19, 1929.
- How Airplanes Are Used by the Modern Prospector, by Charles Camsell. School of Mines and Metallurgy, Rolla, Missouri, April 17, 1929.
- The Nation's Business—Aiding the Development of Canada's Mining Industry, by Charles Camsell. Radio broadcast CNRO, Ottawa, November 28, 1929.
- The Dominion Department of Mines, by Charles Camsell. Canadian Mining Journal, Fiftieth Anniversary Number, August, 1929.
- Functions of the Department of Mines, by L. L. Bolton. Lion's Club, Ottawa, October 29, 1929.
- The Department of Mines and Its Relation to the Mining Industry, by A. Buisson. Vancouver Branch, Canadian Institute of Mining and Metallurgy, July, 1929.
- The National Museum of Canada, by Charles Camsell. Radio broadcast CNRO, Ottawa, February 12, 1930.
- Field Work of the Geological Survey, 1929, by W. H. Collins. Canadian Mining Journal, June 7, 1929.
- Investigations of the Mines Branch, 1929, by John McLeish. Canadian Mining Journal, July 26, 1929.

Geology, Mining, and Mineral Resources

- Economic Geology of Canada, 1928, by P. J. Moran. Canada Year Book, Ottawa.
- Sketch of the History of Canadian Mining, by H. C. Cooke. Mining Magazine, August, 1929.
- Determination of Age-relations in Folded Rocks, by T. L. Tanton. Geological Magazine, vol. LXVII, 1930.
- Geology of Coal, by B. R. MacKay. Cornwall, March 25, 1930.
- Geological Guides in the Search for Ore Bodies, by J. F. Wright. Professional Institute Bulletin, Ottawa, March, 1930.
- Some Heavy Detrital Minerals in Canadian Sediments, by F. J. Fraser. Canadian Field Naturalist, September, 1929.
- Sedimentation in a Glacial Lake, by E. M. Kindle. Journal of Geology, January-February, 1930.
- Mining Industry in Yukon during 1929, by W. E. Cockfield. Canadian Mining Journal, February 14, 1930.
- Portland Canal Region—Activities during 1928, by V. L. Eardley-Wilmot. Canadian Mining Journal, June 14 and 21, 1929.
- Silver Producing Mines of British Columbia, by V. L. Eardley-Wilmot. Canadian Mining Journal, February 7, 1930.

- Big Bend District, B.C., by H. C. Gunning. Chamber of Commerce and Canadian Mining Institute, Vancouver, B.C., May 28, 1929.
- Quatsino-Nimkish Area, B.C., by H. C. Gunning. Chamber of Commerce and Canadian Mining Institute, Vancouver, B.C., October 8, 1929.
- Nimkish Lake Copper Deposits, by H. C. Gunning. Canadian Institute of Mining and Metallurgy, Vancouver, December, 1929.
- Mineral Possibilities of Northern Vancouver Island, by H. C. Gunning. Annual Meeting, Canadian Institute of Mining and Metallurgy, Toronto, March, 1930.
- Northern British Columbia, by F. A. Kerr. Financial News of Western Canada, September 20, 1929.
- Development and Mineral Resources of Northern British Columbia, by F. A. Kerr. Canadian Mining and Metallurgical Bulletin, July, 1929. British Columbia Miner, July, 1929.
- Recent Developments in Northern British Columbia, by F. A. Kerr, Vancouver Branch, Canadian Institute of Mining and Metallurgy, Vancouver Board of Trade, November 5, 1929.
- Significance of Recent Discoveries in Northwestern British Columbia, by F. A. Kerr. Canadian Mining Journal, March 7, 1930.
- Developments in the Stikine and Iskut Rivers Area, by F. A. Kerr. Wrangell Commercial Club, October 14, 1929.
- River Navigation and the Prospector, by F. A. Kerr. Canadian Mining Journal, February 7, 1930.
- Geological Story of Jasper National Park, by E. M. Kindle. National Parks of Canada, Department of the Interior, 1929.
- Stratigraphy and Structure of Bituminous Coalfields in Vicinity of Jasper Park, Alberta, by B. R. MacKay. Western Meeting, Canadian Institute of Mining and Metallurgy, October, 1929.
- Geology and Copper-zinc Deposits of Cold Lake Area, Manitoba, by J. F. Wright. Canadian Mining and Metallurgical Bulletin, April, 1929.
- Survey of Main Mineral Resources, by A. H. A. Robinson. Times Trade and Engineering Supplement, November 30, 1929.
- The Mineral Resources of Canada, by A. H. A. Robinson. Halifax Herald, January, 1930.
- Metal Mining in Canada, by A. H. A. Robinson. Engineering and Mining Journal, January 9, 1930. Engineering and Mining World, January, 1930.
- Base Metal Production in Canada, by A. H. A. Robinson. Annual financial number *Mail and Empire*, Toronto, January 3, 1930.
- Gold Resources of Canada, by H. C. Cooke and W. A. Johnston. Gold Resources of the World, Transactions XVth Geological Congress, 1929.
- The Wilberforce Radium Occurrence, by H. S. Spence. Annual Meeting, Canadian Institute of Mining and Metallurgy, Toronto, March, 1930.
- Zinc in Canada, by Charles Camsell. Zinc Institute, St. Louis, April 17, 1929.
- Non-metallic Minerals, by L. H. Cole. Boys' Camp, Golden Lake, August 3, 1929.
- Bituminous Sands of Northern Alberta, by S. C. Ellis. Chamber of Commerce, Edmonton, January 27, 1930; University of Alberta, February 11, 1930.
- Canada's Diatomite Deposits, by V. L. Eardley-Wilmot. Technical periodicals, Canada and United States.
- Feldspar Used for Glass Manufacture in Canada, by H. S. Spence. Mining and Metallurgy, February, 1930.
- Story of Gypsum in Canada, by L. H. Cole. Annual Convention, Canada Gypsum and Alabastine, Limited, Hamilton, January 8, 1930. Annual Meeting, Canadian Institute of Mining and Metallurgy, Toronto, March, 1930.
- Limestone in Industry, by M. F. Goudge. Annual Meeting, Canadian Institute of Mining and Metallurgy, Toronto, March, 1930.
- Mica, by H. S. Spence. Mineral Industry for 1928.
- Waste Natural Gas in Turner Valley, Alberta, by A. W. G. Wilson. Canadian Press, March 8, 1930.
- Phosphate Developments in British Columbia, by H. S. Spence. Mining and Metallurgy, February, 1930.
- Recent Developments of the Sodium Sulphate Deposits of Western Canada, by L. H. Cole. Mining and Metallurgy, February, 1930.

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- Status of Low Temperature Carbonization in Europe, by B. F. Haanel. Annual Convention of the Canadian Gas Association, Ottawa, June 13-14, 1929.
- Status of Coal Classification in Canada, by R. E. Gilmore. American Institute of Mining and Metallurgy, New York, February, 1930.
- Comparison of Cost and Convenience of House Heating with Various Fuels, by E. S. Malloch. Pamphlet, Dominion Fuel Board.

- The Fuel Research Laboratories at Ottawa and the Scope of their Investigations, by B. F. Haanel. Canadian Mining and Metallurgical Bulletin, October, 1929.
- The Coal Mining Industry of Canada, by F. G. Neate. Times Trade and Engineering Supplement, November 30, 1929.
- Conditions in the Western Coal Mining Industry, by F. G. Neate. Edmonton Bulletin, October, 1929.
- Markets Reached by Canadian Coals, by M. D. McCloskey. Topographical Surveyors Society, Ottawa, November, 1929.
- Prospects of Nova Scotia's Coal Markets, by M. D. McCloskey. Halifax Herald, January, 1930.
- Papers on Activities of Dominion Fuel Board, by F. G. Neate. Regina Star, August, 1929. Manitoba Free Press, November, 1929. Edmonton Bulletin, September, 1929.
- The Dominion Fuel Board, by M. D. McCloskey. Montreal Gazette, November, 1929.

Ore Dressing and Metallurgy

- Fifty Years of Development in Ore Dressing, by C. S. Parsons. Canadian Mining Journal, August, 1929.
- Canadian Flotation Practice, by C. S. Parsons. McGill University, Montreal, November, 1929.
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- Application of Electro-thermal Methods to Iron and Steel Production in Canada, by T. W. Hardy. Sault Daily Star, Sault Ste. Marie, August, 1929.
- Concentration Tests on the Wilberforce Radium-bearing Ores, by R. K. Carnochan. Annual Meeting, Canadian Institute of Mining and Metallurgy, Toronto, March, 1930.

Ceramics and Road Materials

- Ceramic Research, by Howells Fréchette. Professional Institute Bulletin, Ottawa, September, 1929.
- Ceramic Research in the Mines Branch, by Howells Fréchette. Clay Products News and Ceramic Record, February, 1930.
- Research Work by the Ceramics Division, by Howells Fréchette. Clay Products News and Ceramic Record, July, 1929.
- Chemistry in Ceramics, by L. P. Collin. Society of Chemical Industry, Ottawa, December 19, 1929.
- Clayworking in Canada, by Howells Fréchette. Clay Products News and Ceramic Record, January, 1930.
- Canada Possesses Many Types of Clay, by Howells Fréchette. Natural Resources, Canada, March, 1930.
- New Method of Treating Clays to Overcome Drying Defects, by J. G. Phillips. Western Canada Contractor and Builder, June, 1929. Concrete and Quarry, February, 1930.
- Transverse Strength of Ball Clays, by L. P. Collin. American Ceramic Society, Toronto, February 18, 1930.
- Causes and Prevention of Scumming and Efflorescence, by J. W. Craig. Western Canada Brick and Clay Products Association, Moose Jaw, December 13, 1929.
- Refractories of Moulding Sands, by J. F. McMahon. American Foundrymen's Association, Chicago, April 9, 1929.
- An Improved Mercury Volumeter, by J. F. McMahon. American Ceramic Society, Toronto, February 18, 1930.
- Road Materials in the Maritimes, by Howells Fréchette. Canadian Engineer, October, 1929. Contract Record, October 30, 1929.
- Road Material Situation in the Maritime Provinces, by Howells Fréchette. Good Roads Association, Charlottetown, September 18, 1929.

Physiography and Topography

- Studies of the Physiography of the Canadian Shield: I. Mature Valleys of the Labrador Peninsula, by H. C. Cooke. Transactions, Royal Society of Canada, vol. 23, sec. IV.

Palæontology

- The Rôle of Fossils in Geology, by E. M. Kindle. Professional Institute Bulletin, Ottawa, January, 1930.
- Succession of Fossil Faunas in the Eastern Part of Jasper Park, by E. M. Kindle. American Journal of Science, vol. XVIII, N.S., 1929.
- Notes on Dinosaur Collecting in North America, by E. M. Kindle. Canadian Mining Journal, November 22, 1929.
- A Mississippian Fauna from Windsor, N.S., by W. A. Bell. Proceedings of the Academy of Natural Sciences of Philadelphia, vol. LXXXI, 1929.
- Trees One Hundred Million Years Old, by W. A. Bell. Forest and Outdoors, March, 1929.
- Preliminary Study of the Faunas of the Upper Triassic Schooler Creek Formation of Western Peace River, B.C., by F. H. McLearn. Royal Society of Canada, Ottawa, May 21, 1929.
- Canadian Dinosaurs, by C. M. Sternberg. Moose Jaw, September 9; Medicine Hat, September 10; Lethbridge, September 16; High River, September 17; Red Deer, September 18; Port Arthur, September 20; Fort William, September 20, 1929.
- New Records of Mastodons and Mammoths in Canada, by C. M. Sternberg. Canadian Field Naturalist, vol. XLIV, No. 3, 1930.

Mining Newsletter Series

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

- Oil and Gas Developments in Western Canada, by G. S. Hume.
- Cadmium in Canada, by A. Buisson.
- Mineral Possibilities of Northern British Columbia, by F. A. Kerr.
- The Present and Future of Zinc in Canada, by A. H. A. Robinson.
- Field Work, Geological Survey, 1929, by W. Malcolm.
- The Oil Fields of Western Canada, by A. Buisson.
- Tin Discovery in British Columbia, by V. Dolmage.
- The Nickel Situation in Canada, by A. Buisson.
- Possibilities of the Peat Litter Industry, by A. Anrep.
- The Tin Situation in Canada, by A. Buisson.
- The Bismuth Situation in Canada, by A. Buisson.
- The Chibougamau District, Quebec, by C. Tolman.
- The Copper Situation in Canada, by A. Buisson.
- Increasing Output from Canadian Metal Mines, by W. Malcolm.
- Lead and Zinc Situation in Canada, by A. Buisson.
- Mining Developments in Yukon Territory, by W. E. Cockfield.
- Possible Canadian Production of Radium Ore, by H. S. Spence.
- The Rouyn District of Quebec, by H. C. Cooke.
- Prospecting Activities in Northern Saskatchewan, by J. R. Marshall.
- Silver Producing Mines of British Columbia, by V. L. Eardley-Wilmot.
- The Mineral Industry of Canada, by W. Malcolm.
- Great Slave Lake Has Interesting Geological Features, by C. H. Stockwell.
- Sulphur Independence for Canada, by W. B. Timm.
- Recent Developments in Northwestern British Columbia, by F. A. Kerr.
- Mineral Exploration West of Hudson Bay, by L. J. Weeks.
- Mining Note—Diatomite, by V. L. Eardley-Wilmot.
- Increased Lead-Zinc Output for British Columbia, by W. B. Timm.
- Mining Developments on Northern Vancouver Island, by H. C. Gunning.
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- Growing Interest in Canada's Feldspar Resources, by H. S. Spence.

GEOLOGICAL SURVEY

W. H. Collins, Director

CHANGES IN STAFF

There were two resignations during the fiscal year, both from the Geological Division. On October 4, 1929, Victor Dolmage resigned to enter the commercial field as a consulting geologist. Since his appointment to the Survey staff on November 20, 1917, Dr. Dolmage had worked in British Columbia and had acquired a valuable knowledge of the geology and mineral resources of the Cordilleran region. He had also been in charge of the branch office of the Survey at Vancouver since May 12, 1923. J. B. Mawdsley resigned on November 15, 1929, to take charge of the Department of Geology in the University of Saskatchewan. Dr. Mawdsley had been on the Survey staff for seven years, during which he did exceptionally fine geological work in the Precambrian region of western Quebec, especially in the Rouyn mineral field. By these resignations the Survey has lost two effective and experienced geologists.

Three assistant geologists were appointed: G. W. H. Norman on June 13, 1929, H. S. Bostock on December 20, 1929, and R. B. McConnell on March 27, 1930.

The Draughting Division is composed largely of experienced map draughtsmen from Great Britain, who were trained in government and commercial map-publishing institutions there, suitably trained men being difficult to obtain in Canada. Of late years this source of supply has failed, and the Survey, with the concurrence of the Civil Service Commission, has undertaken to train recruits for itself. This plan was put in effect on September 20, 1927, by the employment of two student map draughtsmen. At the end of the present fiscal year four of these apprentices are in training, and so far the plan has exceeded expectations.

FIELD WORK

The following table of the number of field parties sent out each year since 1920 affords a rough idea of the increasing amount of work done:

Year	Number of parties	Year	Number of parties
1920.....	39	1925.....	54
1921.....	43	1926.....	53
1922.....	39	1927.....	50
1923.....	40	1928.....	53
1924.....	47	1929.....	56

The corresponding cost of the Geological Survey is shown in a table in the Annual Report for 1927-28.

The work done by the fifty-six parties sent out in 1929 is explained briefly in succeeding sections of this report. One new feature of this program is that two of the parties mentioned were engaged upon geophysical investigations. The application of physics to the study of geological problems in Canada is, in some respects, not new or novel, for the dip-needle and the magnetometer have been used here for many years, and quite successfully, in locating deposits of iron ore and other magnetic substances. Within the last twenty years, however, a great deal of attention has been given in other countries to the investi-

gation of ore deposits and other geological features by means of their physical behaviour—electrical, gravitational, radioactive, and mechanical (transmission of vibrations). Many ingenious methods have been devised.

These new geophysical methods have been introduced into Canada within the last ten years. They have not yet been used extensively, and in perhaps a majority of trials they have been disappointing. This condition, however, is probably transient. Geophysical methods appear to be going through a difficult but normal transition from an experimental stage to that of a recognized applied science. The methods and apparatus have been devised by physicists and, necessarily as yet, used by physicists because no one else understands them. Physicists, accustomed to the simple and controllable conditions obtainable in the laboratory, have not understood well, and have perhaps underestimated, the complex geological conditions encountered in field trials. Methods have not always been adapted to the particular geological conditions, and wrong interpretations have been made. A good deal of secrecy and ignorance attends the new science in the present stage. For their financial advantage the companies engaged in geophysical investigations protect their inventions by patents and secrecy. Their clients are correspondingly unable to judge for themselves regarding the merits of geophysical work and are prone to extremes of opinion. It is to be remembered, too, that this branch of geophysics is a very young science, that most of the apparatus and methods are still imperfect, and that standards for practice and equipment have not yet been established. But these disadvantages will disappear if applied geophysics continue to prove as useful as present experience leads one to expect.

It appears quite clear that geophysical investigations should be directed and interpreted by persons with an adequate knowledge of the geological sciences. Almost every field investigation will present its own peculiar geological conditions that will determine which geophysical method or methods are most suitable and how they should be applied, and the geophysical data obtained will be of little value until they are translated into geological terms. It is probable that much of the geophysical apparatus will ultimately become so perfected and simplified that it can be used by the geologist or geologically trained engineer without the assistance of the physicist. In the past the physicist has provided the geologist with more than one new appliance and new technique, such as the polarizing microscope, and there seems no reason whatever to doubt that, in the same way, geophysical methods and apparatus will ultimately become another valuable adjunct for the geologist, and geophysics become as much a part of the curriculum for geologists and engineers as is petrography. Application of other principles and invention and improvement of apparatus will, of course, remain functions of the physicist.

Viewing geophysical work from this standpoint, the Geological Survey commenced the study of the new methods—electrical, gravitational, and vibrational—in 1928. Professor Lachlan Gilchrist, of the Department of Physics, University of Toronto, and Dr. J. B. Mawdsley undertook in collaboration with a number of geophysical companies to ascertain the capabilities and limitations of the various electrical principles then being employed in Canada. This investigation was undertaken for the immediate purpose of affording mining men some impartial information regarding where geophysical methods might be used and what results might be expected. A report upon it is now in press. Study was also commenced upon gravimetric (torsion balance) methods in co-operation with the Dominion Observatory, Department of the Interior. Mr. A. H. Miller, of the Observatory staff, was sent to Europe during the summer to study the apparatus and methods in use there, preparatory to actual experimentation with these methods in Canada. In this connexion it is desired to express the cordial thanks of the Geological Survey and of the Dominion Observatory to Sir John Flett, Director of the Geological Survey of Great Britain; to Dr. Paul

Krusch, Director of the Geological Survey of Germany; the directors of the observatories in both these countries and many others in Europe; also to the officials of the geophysical prospecting companies above named for assistance rendered.

In 1929 the investigation of electrical and magnetic methods was continued by a Geological Survey party comprising Professor Gilchrist, Dr. Mawdsley, Dr. A. S. Eve, of the Department of Physics, McGill University, and his colleague, Dr. A. D. Keys, in collaboration with a party from the United States Bureau of Mines, under Dr. W. T. Lee. Professor Eve and Dr. Keys had been engaged in this work for the United States Bureau of Mines for two seasons and undertook work for the Survey with the advantage of this previous experience. The combined party tested a variety of electrical methods at the Mammoth cave, Kentucky; at the Falconbridge mine, Sudbury; and again at the Abana mine, Rouyn district.

Mr. Miller commenced to apply the information obtained in Europe the previous season by undertaking torsion-balance and magnetometer surveys of known examples of the chief types of geological structures to which the gravimetric method is applicable. These types of structures are faults, bodies of abnormal density, and folds. The Gloucester fault near Ottawa was surveyed.

Work will be continued in 1930.

OFFICE WORK

Under this head it is desired to refer specially to the output of geological and topographical maps during the fiscal year. A list of these maps is given in the section relating to the Draughting Division. About twice as many were published as usual. Credit for this is due, within the Survey, to Mr. Alexander Dickison and Mr. C. O. Senecal, of the Draughting Division, Mr. W. H. Boyd, of the Topographical Division, Mr. G. A. Young, of the Geological Division, and Mr. G. G. Clarke, of the Photographic Division, and to the members of those divisions. It is also due in an important measure to the Surveys Branch of the Department of National Defence and to the Topographical Surveys Branch of the Department of the Interior for the use of base maps made by those organizations, and to the Department of Public Printing and Stationery for expeditious publication work of excellent quality.

GEOLOGICAL DIVISION

Yukon

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

W. E. Cockfield, assisted by E. J. Lees, commenced the topographical and geological mapping of Laberge quadrangle (latitudes 61° to 62° , longitudes 134° to 136°), southern Yukon. Silver-lead, placer gold, and, possibly, copper-bearing deposits, occur within the map-area. The work when completed will result in the publication of a geological and topographical map, on a scale of 4 miles to 1 inch.

During the field season Mr. Cockfield visited several of the active mining camps of Yukon and will report upon them in Summary Report 1929, Part A. An effort will be made to continue annually this review of mineral developments on Yukon.

British Columbia

F. A. Kerr completed the topographical and geological survey, begun in 1926, of the more accessible territory bordering Stikine and Iskut rivers and lying mainly within three quadrangles contained by latitudes $56^{\circ} 30'$ and $58^{\circ} 00'$,

and longitudes 131° and 132° . The region is traversed by the east margin of the Coast Range batholith and, therefore, is of prospective importance as a mineral-bearing district. A preliminary account of the work accomplished in 1929 will appear in Summary Report 1929, Part A. The three map-sheets on a scale of 2 miles to 1 inch are being prepared for publication. Mr. Kerr also visited the section on Taku river adjacent to the International Boundary where important mineral discoveries have recently been made. A report on this section will appear in Summary Report 1929, Part A.

George Hanson continued the study of the geology and mineral resources of Alice Arm mineral area. Various types of mineral deposits bearing silver, silver lead, zinc, copper, and molybdenite are present and are the subject of renewed interest. The geological work being prosecuted is mainly confined to two map-areas bounded by latitudes $55^{\circ} 30'$ and $55^{\circ} 45'$ and longitudes 129° and 130° , of which geological and topographical maps on a scale of 1 mile to 1 inch will be issued when field work is completed.

A. H. Lang, under the direction of George Hanson, geologically and topographically mapped an area of about 100 square miles in the vicinity of Owen lake. The resulting map and a report dealing with the geology and mineral resources of the area will appear in Summary Report 1929, Part A.

H. C. Gunning geologically explored an area of about 700 square miles in northern Vancouver island, extending west from Nimpkish lake to Quatsino sound. Copper-bearing and lead-zinc deposits of merit occur within the area. One large copper deposit is now approaching the production stage. A geological map, on a scale of 2 miles to 1 inch, and a report on the geology and mineral resources will appear in Summary Report 1929, Part A.

C. E. Cairnes commenced the study and mapping of the geology of the Trinity quadrangle bounded by latitudes $50^{\circ} 15'$ and $50^{\circ} 30'$ and longitudes $118^{\circ} 30'$ and $119^{\circ} 00'$. This area was chosen as being representative of the geologically, comparatively unknown country stretching westward from Upper Arrow lake towards Kamloops. Mr. Cairnes also examined in detail the gold occurrences within a belt of country crossing Coquihalla river about 10 miles northwest of Hope. Much interest has been displayed in these gold-bearing deposits and a full report concerning them will appear in Summary Report 1929, Part A.

H. S. Bostock continued geological mapping and study of three quadrangles in Hedley district lying between latitudes $49^{\circ} 00'$ and $49^{\circ} 30'$ and longitudes $119^{\circ} 30'$ and $120^{\circ} 30'$. The work when completed will be issued in the form of a report accompanied by three geological maps on a scale of 1 mile to 1 inch. The results of a detailed study of the Nickel Plate mine at Hedley will appear in Summary Report 1929, Part A.

J. F. Walker continued geological mapping and investigation of the mineral resources of the Salmo quadrangle (latitudes $49^{\circ} 00'$ to $49^{\circ} 15'$, and longitudes $117^{\circ} 00'$ to $117^{\circ} 30'$). A preliminary report on a number of the gold-bearing properties within this map-area will appear in Summary Report 1929, Part A.

Alberta

B. R. MacKay investigated and mapped, geologically and in some cases also topographically, various coal-bearing areas in the vicinity of and northwest of Brûlé. This work included examinations of a considerable area around Pochontas, of an area in the Prairie Creek section, of other areas in Hay River basin, and a reconnaissance of Smoky River coal area. The results obtained will be incorporated in a memoir treating of the coal fields of the district extending northwesterly from Brazeau to Hay rivers.

J. F. Caley, under the direction of C. S. Evans, made a geological reconnaissance of a part of Wapiti River basin. An account of the results obtained will appear in Summary Report 1929, Part A.

G. S. Hume completed the geological mapping of Turner Valley quadrangle (latitudes $50^{\circ} 30'$ to $50^{\circ} 45'$, longitudes $114^{\circ} 00'$ to $114^{\circ} 30'$), of the east half of Bragg Creek quadrangle (latitudes $50^{\circ} 45'$ to $51^{\circ} 00'$, longitudes $114^{\circ} 30'$ to $115^{\circ} 00'$), and of two townships bordering Turner Valley map-area on the north. The field work disclosed a structural feature that extends from Highwood to Elbow rivers, and is of great importance to those engaging in the search for oil and gas. An account of this structure and other important features of the general district will appear in Summary Report 1929, Part B. To meet the immediate needs of the many who are interested in Turner Valley district, arrangements are being completed that will permit the supplying, at a moderate charge, of hand-coloured geological maps, on a scale of 1 mile to 1 inch, of the various areas mentioned above.

Saskatchewan

F. H. McLearn continued the study and mapping of the geology of the southern part of an area embracing most of southern Saskatchewan (latitudes 49° to 52° , longitudes 102° to 109°). An account of some of the results obtained will appear in Summary Report 1929, Part B.

P. S. Warren continued the study and mapping of the geology of a large area in southern Saskatchewan south of latitude 52° . When this work and that being conducted by Mr. McLearn in the district to the south, are completed the results will be incorporated in a map (Regina sheet) on a scale of 8 miles to 1 inch, and a report dealing with southern Saskatchewan. A report by Mr. Warren, giving an account of the area investigated by him, will appear in Summary Report 1929, Part B.

W. A. Johnston and R. T. D. Wickenden commenced the investigation of the surface geology, including the soils, of southern Saskatchewan within the limits of the proposed Regina map-sheet (latitudes 49° to 52° , longitudes 102° to 109°).

H. E. Simpson and W. A. Johnston investigated the underground water supply for Regina. The work resulted in the locating of what seems likely to prove an adequate additional source of water for the city. A report by Mr. Simpson on the results obtained will appear in Summary Report 1929, Part B.

J. R. Marshall with J. Satterly commenced the geological study of, and mapping of, Pelican Narrows quadrangle (latitudes 55° to 56° , longitudes 102° to 104°). This area lies within the area of Precambrian rocks known as the Canadian Shield, to which so much attention is being given by the mining public. The work, when completed, will result in the publication of a geological map on a scale of 4 miles to 1 inch.

S. H. Ross made a geographical and geological survey of a limited area in the vicinity of Rottenstone lake, northern Saskatchewan, where mineral deposits of prospective importance have been discovered.

Manitoba

W. A. Johnston completed the study and mapping of the surface deposits—including soils—of the greater part of southern Manitoba contained within the limits of the Winnipeg map-sheet (latitudes 49° to 52° , longitudes 95° to 102°). A map, called the Winnipeg sheet, on a scale of 8 miles to 1 inch, covering this district and presenting the results of field work, is in course of preparation.

S. R. Kirk continued the study and mapping of the geology of southern Manitoba and adjacent parts of Saskatchewan lying within the limits of the Winnipeg map-sheet. A report on the results of the investigation of the Cretaceous strata will appear in Summary Report 1929, Part B.

J. F. Wright studied and mapped in detail a part of the gold-bearing Beresford-Rice Lakes district. He also geologically mapped extensions of the areas previously mapped in Oiseau River district and visited various localities in southeastern Manitoba where tin-bearing deposits have been found. An account of some of the more important gold-bearing deposits and of the tin-bearing occurrences will appear in Summary Report 1929, Part B.

E. Antevs studied the glacial and other surface deposits in areas bordering the Hudson Bay railway.

North West Territories

C. H. Stockwell geologically mapped for publication on a scale of 4 miles to 1 inch, part of a quadrangle (latitudes 62° to 63° , longitudes 110° to 112°) embracing an eastern part of Great Slave lake. Lead-zinc deposits occur in the region and the study of the general geology of the area promises to yield results of much value. A preliminary account of the results obtained will appear in Summary Report 1929, Part B.

L. J. Weeks commenced the geographical and geological mapping, for publication on a scale of 4 miles to 1 inch, of a quadrangle (latitudes 62° to 63° , longitudes 92° to 94°) extending southward from Rankin inlet on the west coast of Hudson bay. A brief report on general conditions within the field will be included in Summary Report 1929, Part B. Mineral deposits have been found, and when the territory becomes more easily accessible it will probably be actively prospected.

Ontario

T. L. Tanton continued the geological and geographical survey of the Shebandowan quadrangle (latitudes $48^{\circ} 30'$ to $48^{\circ} 45'$, longitudes $90^{\circ} 00'$ to $90^{\circ} 30'$). Various types of mineral deposits occur within the map-area and it was expected that the study of the geology of the district would yield results of importance.

H. M. Bannerman continued the geological and geographical survey of the Rush Lake quadrangle (latitudes $47^{\circ} 45'$ to $48^{\circ} 00'$, longitudes $82^{\circ} 00'$ to $82^{\circ} 30'$), in Woman River basin. He also examined various lead-zinc, copper, and copper-gold deposits in Cunningham, Chester, Keith, and Heenan townships. A report on the mineral deposits examined in these townships and within Rush Lake quadrangle will appear in Summary Report 1929, Part C.

T. T. Quirke continued the geological study and mapping of a quadrangle (latitudes $45^{\circ} 15'$ to $45^{\circ} 30'$, longitudes $79^{\circ} 30'$ to $80^{\circ} 00'$) east of Parry Sound. The geological investigations being carried out are yielding results of much scientific interest, as well as practical value.

M. E. Wilson completed the geological mapping of the Westport quadrangle (latitudes $44^{\circ} 30'$ to $44^{\circ} 45'$, longitudes $76^{\circ} 00'$ to $76^{\circ} 30'$), and commenced the geological study and mapping of the Perth quadrangle (latitudes $44^{\circ} 45'$ to $45^{\circ} 00'$, longitudes $76^{\circ} 00'$ to $76^{\circ} 30'$). The publication scale of the map-sheets is to be 1 mile to 1 inch. The systematic mapping of the geology of this part of the province permits a better valuation of the various types of metallic and non-metallic mineral deposits so characteristic of the region.

Miss A. E. Wilson revised and completed the geological mapping of the southern part of the Thurso quadrangle (latitudes $45^{\circ} 30'$ to $45^{\circ} 45'$, longitudes $75^{\circ} 00'$ to $75^{\circ} 30'$) and completed the geological mapping of the Cornwall

quadrangle (latitudes $45^{\circ} 00'$ to $45^{\circ} 15'$, longitudes $74^{\circ} 30'$ to $75^{\circ} 00'$). The work in the two quadrangles has afforded new information regarding the structure and stratigraphy of the Ordovician strata.

D. C. Maddox and Miss A. E. Wilson commenced the revision of the geology of the Ottawa (city) quadrangle. This work, it is proposed, is to be carried to completion incidentally to regular field work elsewhere.

Quebec

H. C. Cooke revised the geological mapping of the Kinojevis and Clericy quadrangles (latitudes $48^{\circ} 00'$ to $48^{\circ} 30'$, longitudes $78^{\circ} 30'$ to $79^{\circ} 00'$) and part of the Opasatika quadrangle (latitudes $48^{\circ} 00'$ to $48^{\circ} 15'$, longitudes $79^{\circ} 00'$ to $79^{\circ} 30'$). The three map-sheets, on a scale of 1 mile to 1 inch, represent an important part of Rouyn mineral district, western Quebec.

R. Thomson geographically and geologically mapped the northeastern part of the Thurso quadrangle (latitudes $45^{\circ} 30'$ to $45^{\circ} 45'$, longitudes $75^{\circ} 00'$ to $75^{\circ} 30'$). This completes the field work necessary to permit publication of a geological map-sheet, on a scale of 1 mile to 1 inch, of this mineral-bearing district.

H. W. McGerrigle, under supervision of T. H. Clark, completed the geological study and mapping of the Lacolle quadrangle (latitudes $45^{\circ} 00'$ to $45^{\circ} 15'$, longitudes $73^{\circ} 00'$ to $73^{\circ} 30'$). Publication scale of the map-sheet is to be 1 mile to 1 inch. This work is one item of the detailed investigation of the geology of southeastern Quebec.

C. Tolman explored geographically and geologically a district southwest of Chibougamau lake, chiefly along Obatogamau river between latitudes $49^{\circ} 30'$ to $50^{\circ} 00'$, and longitudes $74^{\circ} 00'$ to $75^{\circ} 30'$. The district is part of an extensive region whose mineral-bearing possibilities are of public interest. An account of geological results obtained will appear in Summary Report 1929, Part C.

G. W. Crickmay, under the supervision of F. J. Alcock, commenced the study and mapping of the geology of that part of Matapedia River valley and tributary areas lying within two quadrangles bounded by longitudes $67^{\circ} 00'$ and $67^{\circ} 30'$, and latitudes $48^{\circ} 00'$ and $48^{\circ} 30'$.

C. H. Kindle, under the supervision and with the assistance of E. M. Kindle, continued the geographical and geological mapping of the more accessible territory bordering Chaleur bay from the vicinity of Port Daniel east to Percé. The field work when completed will permit the issuing of a series of standard map-sheets on a scale of 1 mile to 1 inch.

New Brunswick

F. J. Alcock commenced and nearly completed the geographical and geological mapping of the territory bordering Chaleur bay from southeast of Campbellton to east of Bathurst. The districts geologically surveyed lie within the limits of three standard map-sheets which it is proposed to publish on a scale of 1 mile to 1 inch. Mr. Alcock also examined a number of mineral occurrences elsewhere within the province.

Nova Scotia

E. R. Faribault continued the geological mapping of the Digby quadrangle (latitudes $44^{\circ} 30'$ to $44^{\circ} 45'$, longitudes $65^{\circ} 30'$ to $66^{\circ} 00'$) and commenced similar work in the Belliveau quadrangle. He also visited various mineral occurrences in western Nova Scotia.

W. A. Bell commenced the revision of the geological mapping, for publication on a scale of 1 mile to 1 inch, of the Sydney quadrangle (latitudes $46^{\circ} 00'$

to $46^{\circ} 15'$, longitudes $60^{\circ} 00'$ to $60^{\circ} 30'$) which includes a considerable part of the Sydney coal field. He also spent a short time in the Pictou coal field collecting supplementary information needed to complete the investigation of this field.

G. W. H. Norman completed the geographical and geological mapping of the Ainslie quadrangle (latitudes $46^{\circ} 00'$ to $46^{\circ} 15'$, longitudes $61^{\circ} 00'$ to $61^{\circ} 30'$) for publication on a scale of 1 mile to 1 inch. He also made a detailed survey of the Mabou coal field which lies within the quadrangle.

General

A. S. Eve, L. Gilchrist, and D. A. Keys, physicists, and J. B. Mawdsley, geologist, continued an investigation of electrical geophysical methods of prospecting. This work was undertaken in 1928 by Mr. Gilchrist and Mr. Mawdsley for the purpose of comparing at some well-known ore deposit the capabilities and limitations of the various electrical principles in commercial use, much uncertainty and difference of opinion about these methods having arisen among mining men. The Abana mine, in Rouyn district, was selected, and four geophysical companies co-operated, namely the Schlumberger, Radiore, Swedish-American, and Alderson-MacKay. This comparison test was concluded in 1929 and the balance of the season was devoted to further independent investigation of the possibilities of electrical methods. Professor Eve and Mr. Keys had been engaged for two years previously by the United States Bureau of Mines on work of the same kind and brought valuable information and experience to the investigations in Canada. The field work of 1929 was also done in collaboration with a party from the United States Bureau of Mines under Dr. W. T. Lee. Attention was devoted principally to a study of the penetration underground of radio waves, a principle upon which one of the geophysical methods of searching for ore deposits is based. This was carried out at the Mammoth cave, in Kentucky, where uniquely favourable conditions for experimentation exist. The double party then moved to Sudbury, where various methods were tested on Falconbridge metal-copper ore deposit, which is also specially suited for the purpose.

A. H. Miller commenced an investigation of gravimetric and magnetic methods. He had, during the preceding summer, visited Europe to become acquainted with what is being done there with these methods, especially in England and Germany. The next step was to apply the methods to known examples of the main types of geological features to which gravimetric methods are applicable in order to obtain some measure of the effects of such features before undertaking an investigation of unknown features. Work was commenced upon the Gloucester fault, near Ottawa.

TOPOGRAPHICAL DIVISION

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

British Columbia

R. Bartlett completed topographical mapping of an area comprising about 200 square miles in the vicinity of Alice Arm, constituting part of two 1-mile quadrangles bounded by latitudes $55^{\circ} 15'$ to $55^{\circ} 45'$ and longitudes 129° to $129^{\circ} 30'$. Map scale, 1 inch to 1 mile. Contour interval 100 feet.

S. M. Steeves continued topographical mapping of the Salmo sheet, latitudes $49^{\circ} 00'$ to $49^{\circ} 15'$, longitudes $117^{\circ} 00'$ to $117^{\circ} 30'$. Map scale, 1 inch to 1 mile. Contour interval 100 feet. Owing to bad smoke conditions from forest fires, it was not possible to complete the field work necessary for the whole sheet; about 122 square miles remain to be done.

J. V. Butterworth commenced the topographical mapping of the east half of the Cranbrook sheet, latitudes $49^{\circ} 30'$ to $49^{\circ} 45'$, longitudes $115^{\circ} 30'$ to $116^{\circ} 00'$. Map scale, 1 inch to 1 mile. Contour interval 100 feet. The west half of this sheet was completed in 1925 by A. C. T. Sheppard. More field work is required to complete the east half.

Alberta

D. A. Nichols completed the topographical mapping of the east half of the Wildcat Hills sheet, latitudes $51^{\circ} 15'$ to $51^{\circ} 30'$, longitudes $114^{\circ} 30'$ to $115^{\circ} 00'$. Map scale, 1 inch to 1 mile. Contour interval 25 feet.

W. H. Miller commenced the topographical mapping of the Brûlé sheet, latitudes $53^{\circ} 15'$ to $53^{\circ} 30'$, longitudes $117^{\circ} 30'$ to $118^{\circ} 00'$. Map scale, 1 inch to 1 mile. Contour interval 100 feet. About one-half of the sheet remains to be done.

R. C. McDonald completed the triangulation control for the Brûlé sheet and commenced the topographical mapping of the Nordegg sheet, latitudes $52^{\circ} 15'$ to $52^{\circ} 30'$, longitudes $116^{\circ} 00'$ to $116^{\circ} 30'$. Map scale, 1 inch to 1 mile. Contour interval 100 feet.

A. C. T. Sheppard visited the parties, with the exception of the party under D. A. Nichols, working in British Columbia and Alberta, for the purposes of inspection and advising on any matters relating to field work.

Ontario

A. G. Haultain completed the control surveys for the Chelmsford sheet, latitudes $46^{\circ} 30'$ to $46^{\circ} 45'$, longitudes $81^{\circ} 00'$ to $81^{\circ} 30'$. Map scale, 1 inch to 1 mile. Details of drainage, etc., in this area will be filled in from vertical aerial photographs.

Quebec

A. C. Tuttle carried on geographical surveys in the Chibougamau sheet, latitudes $49^{\circ} 45'$ to $50^{\circ} 00'$, longitudes $74^{\circ} 00'$ to $74^{\circ} 30'$.

H. N. Spence completed some additional control surveys in the Opasatika sheet, latitudes $48^{\circ} 00'$ to $48^{\circ} 15'$, longitudes $79^{\circ} 00'$ to $79^{\circ} 30'$.

New Brunswick

J. W. Spence completed the topographical mapping of the Moncton sheet, latitudes $46^{\circ} 00'$ to $46^{\circ} 15'$, longitudes $64^{\circ} 30'$ to $65^{\circ} 00'$. Map scale, 1 inch to 1 mile. Contour interval 50 feet.

H. N. Spence completed certain control surveys in the Bathurst sheet, latitudes $47^{\circ} 30'$ to $47^{\circ} 45'$, longitudes $65^{\circ} 30'$ to $66^{\circ} 00'$; in the Belledune sheet, latitudes $47^{\circ} 45'$ to $48^{\circ} 00'$, longitudes $65^{\circ} 30'$ to $66^{\circ} 00'$; and in the Charlo sheet, latitudes $47^{\circ} 45'$ to $48^{\circ} 00'$, longitudes $66^{\circ} 00'$ to $66^{\circ} 30'$.

Nova Scotia

J. A. Macdonald completed the control surveys for the Church Point sheet, latitudes $44^{\circ} 15'$ to $44^{\circ} 30'$, longitudes $66^{\circ} 00'$ to $66^{\circ} 30'$; and for the Port Mouton sheet, latitudes $43^{\circ} 45'$ to $44^{\circ} 00'$, longitudes $64^{\circ} 30'$ to $65^{\circ} 00'$. Details of drainage, etc., on these sheets will be filled in from vertical aerial photographs.

K. G. Chipman visited the parties working in New Brunswick and Nova Scotia for the purposes of inspection and advising on any matters relating to field work.

OFFICE WORK

The control and computing section, under S. C. McLean, which was organized for the purpose of computing and adjusting the triangulation and

traverse control carried out by the various field parties, has accomplished a great amount of work, and materially assisted in speeding up the whole work of the division by relieving the topographical engineers of a considerable amount of routine work, thereby enabling these engineers to put more time on the actual work of mapping.

During the year this section carried out and completed the duplicate computations, checking, and adjusting of one net of secondary triangulation, three nets of tertiary triangulation, and 1,000 miles of traverse. In addition to this, considerable back work was completed, and the correlation, adjustment, and filing of a mass of information for general use was commenced.

D. A. Nichols continued his work in physiography and in assembling the nucleus of a geographical section for the National Museum.

MINERALOGICAL DIVISION

Eugene Poitevin, Chief of the Division, reports:

One of the prime functions of the Division of Mineralogy is to investigate the physical and chemical properties, mode of occurrence, genesis, associations, and economic applications of Canadian minerals. It is the duty of the mineralogists to examine and report upon the nature and commercial value of ores, minerals, and rocks submitted by prospectors, property owners, and the public generally.

FIELD WORK

At various times during the year, and especially in the summer, Mr. Poitevin has been carrying on some detailed geological and mineralogical work at the asbestos mines in the vicinity of Thetford, Que.

R. J. C. Fabry, rock analyst of the division, towards the end of August spent ten days in the field under the direction of Mr. M. E. Wilson. The object of this field work was to have him become acquainted with the field methods of the Geological Survey.

A. T. McKinnon left Ottawa on June 3 to return on August 23. During that time he visited numerous mineral localities in Ontario, Quebec, New Brunswick, and Nova Scotia, collecting minerals for museum and educational purposes.

LABORATORY WORK

More than three thousand rock and mineral specimens were received from various outside sources. These were identified and reported on as to their possible commercial value. During the fiscal year just ended more than twenty-five hundred reports were issued by Eugene Poitevin and H. V. Ellsworth. These do not include numerous verbal reports given to the visiting public.

Eugene Poitevin and R. J. C. Fabry have completed their study of the lithium minerals from the pegmatites of the Silver Leaf property in southern Manitoba.

Eugene Poitevin has, in addition, completed the study of a new mineral, robertsonite, from British Columbia, and has also completed the revised study of the ptilolite group of minerals.

H. V. Ellsworth assisted in the determination of minerals sent in for identification and report as to commercial possibilities. He, also, spent considerable time in consultations and personal interviews with prospectors and others. A good deal of work was involved in connexion with the preparation for publication of his report on rare element minerals. During the absence of Mr. Poitevin on field duty he took charge of the work of the Division of Mineralogy. In addition, during the year he made a study of a deposit of cobalt nickel minerals occurring on Calumet island, of cenosite, a very rare yttrium mineral, and of a Canadian

occurrence of gadolinite. He also co-operated with the Ore Dressing Division, Mines Branch, in the concentration of a large shipment of uranium ores by the Ontario Radium Corporation and made about one hundred and thirty electroscopic determinations of the uranium content of the ores and concentration products. In addition he made many electroscopic and other special tests for rare elements in minerals sent in by prospectors.

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

- Thomsonite from Johnston asbestos mine, Thetford, Coleraine township, Megantic county, Que.
- Stannite, Snowflake mine, Albert Canyon, B.C.
- Robertsonite, Penticton, B.C.
- Aphrodite, Jacob asbestos mine, Thetford Mines, Que.
- Pink diopside, Montreal chrome pit, Coleraine township, Megantic county, Que.
- Green diopside, Orford, Brompton Lake, Que.
- Two samples of vesuvianite—one from American chrome pit, one from Southwark asbestos pit, Coleraine township, Megantic county, Que.
- Four rocks of granite type, from T. T. Quirke.
- White serpentine, Megantic Lambly mine, Ireland township, Megantic county, Que.
- Chlorite, Montreal chrome pit, Coleraine township, Megantic county, Que.
- Fine asbestos, King asbestos mine, Que.
- Coarse asbestos, Vimy Ridge asbestos mine, Que.

He also completed other qualitative analyses connected with the routine of the division.

MUSEUM WORK

Owing to the limited staff and the pressure of more urgent work, it has been impossible to give this important branch of the division the attention it deserves. However, several museum cases were added to the National Museum; a travelling collection for the Geological Survey has been assembled; museum cases at 227 Sparks street were re-arranged, and a large number of specimens were classified in filing cabinets. A large number of very fine specimens were added to the collections by purchase and donation. An itemized list of these is given in the Annual Report of the National Museum.

EDUCATIONAL COLLECTIONS

The number of collections distributed to educational institutions has been maintained.

This year more than 7,500 minerals and 138 bags of specimens have been distributed, as follows:

Province	Standard	Grade 2	Grade 3	Miscellaneous	Minerals, prospectors	Rocks, prospectors	Mineral chips
British Columbia.....	1	0	1	0	4	0	0
Alberta.....	0	0	1	0	1	0	0
Saskatchewan.....	0	0	0	1	5	0	0
Manitoba.....	0	1	1	2	3	0	0
Ontario.....	9	5	46	13	45	6	1
Quebec.....	3	0	5	5	17	1	1
New Brunswick.....	0	0	3	1	4	0	1
Nova Scotia.....	1	0	0	0	1	0	0
Foreign.....	0	1	1	8	24	0	0
	14	7	58	30	104	7	3

Total number of collections distributed = 221.

These collections were assembled by Mr. A. T. McKinnon and required almost 20 tons of rocks and minerals for their preparation.

PALÆONTOLOGICAL DIVISION

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

FIELD WORK

W. A. Bell commenced detailed mapping of Sydney coal field north and west of the published Sydney map No. 1767. A fuller reference to this and other field work by officers of this division is made in the section relating to the Geological Division.

E. M. Kindle was engaged in determining formation and systemic boundary lines in Gaspé peninsula. Work done was limited chiefly to the Percé to Port Daniel map-area near the eastern end of the peninsula, and to the Escuminac-Maria map-area bordering Chaleur bay. Mapping in Percé area has been carried on by C. H. Kindle under the supervision of E. M. Kindle.

F. H. McLearn continued geological mapping of the area in southern Saskatchewan between latitudes 49° - 52° and longitudes 102° - 109° , begun in 1927. Districts now completed within this area are: (a) Twelvemile Lake-Willowbunch; (b) Fir Mountain; (c) Wood Creek; (d) Keoghs; (e) Rocky Creek, of interest for its dinosaur remains.

Miss A. E. Wilson spent the first part of the summer in mapping the southern section of the Thurso sheet, in which the Palæozoic rocks occur. The field work on the geological map of Cornwall area was completed during the latter part of the summer.

C. M. Sternberg was engaged in collecting fossil plants and invertebrates in southern Saskatchewan.

OFFICE WORK

A large share of the office work of the division has been devoted to the unusually large collections of fossils sent in to be used as the basis of reports determining stratigraphic sequence in areas that are being mapped.

W. A. Bell supplied the following reports: (a) Report on fossil plants from Alberta, submitted by Mr. B. R. MacKay; (b) Report on fossil plants from British Columbia, submitted by Mr. C. E. Cairnes; (c) Report on fossil plants from Alberta, submitted by Mr. C. S. Evans; (d) Report on collections of fossil plants from Campbellton, N.B., and from Gaspé, submitted by Mr. E. M. Kindle; (e) Partial report on fossil plants from Saskatchewan, submitted by Mr. F. H. McLearn, placed in hands of Dr. E. W. Berry along with bulk of collection; (f) Report on stratigraphy of oil and gas-bearing formations in the Maritime Provinces, for Economic Geology series "Report on Oil and Gas in eastern Canada," by Mr. G. S. Hume. In addition to reports on fossil plants for other field officers he was engaged in preparation of a memoir on the Pictou coal field.

E. M. Kindle has prepared reports on a number of collections submitted for the purpose of dating the formations represented. Some work has also been done on sea bottom sediments collected by cable repair ships in the area south and southeast of Newfoundland.

The office work of F. H. McLearn included: reports on collections of Mesozoic fossils submitted by field officers of the Geological Survey; continuation of a preliminary study of the faunas of the Upper Triassic Schooler Creek formation of the western part of Peace river and the preparation of a preliminary paper on this subject; a continuation of the study of Jurassic faunas of Skidegate inlet, a second contribution on which is now nearing completion; the plotting and assembling of notes on field work in southern Saskatchewan and the writing of a report on southern Saskatchewan for the Summary Report of the Geological Survey.

Miss A. E. Wilson continued work on the type catalogue. Considerable time was spent in reporting on the collections of Ordovician and Silurian fossils submitted by field officers. Work was completed on the report of the Cornwall area, including the fossils.

C. M. Sternberg has continued preparatory work on vertebrate collections and has submitted manuscripts on certain dinosaur collections.

Miss M. A. Fritz of the Department of Geology, Toronto University, completed sorting and indexing the old collections of invertebrate fossils which have been in storage, making it possible to locate any lots that may be required for reference.

COLLECTIONS

Reference to collections received and Museum exhibits has been made in the Annual Report of the National Museum.

BORINGS DIVISION

D. C. Maddox, Acting Chief of the Borings Division, reports:

The routine work of collecting information and samples from wells drilled for oil and gas and for water, from all parts of the Dominion, was continued during 1929. The filing of records, the organized storage of samples, and the work of sample examination were continued. During 1929 all samples were gone over and listed and tables showing their location were prepared.

The number of wells from which samples have been obtained is now about 800. Due to the enormous increase in the number of samples received, which was slightly over twice the number received in 1928—in itself a record to that date—the question of storage became acute. The present congestion may necessitate some system by which a limited number of samples may have to be rejected after examination and bottling and the passing of a certain time interval thereafter.

Three student assistants were employed during the summer months to help cope with the great number of samples coming in. One student assistant spent a few weeks in the Toronto office of Colonel Harkness, Gas Commissioner for Ontario, plotting on maps of the Borings Division the positions of oil and gas wells in Ontario. The positions of several thousand of such wells were plotted and the writer wishes to express his thanks to Colonel Harkness for the facilities provided for this work and for the help and advice given.

A limited amount of research work was done in the laboratory of the Borings Division, chiefly in separating heavy minerals contained in the sediments, and the mounting of them for future reference. About two hundred slides of this material were made during 1929 by M. Mahoney and F. J. Fraser, bringing the total to about six hundred. Time has not yet permitted many detailed reports to be made on the slides, but they will form a basis for future work. During the spring and autumn Mr. Fraser continued the work conducted in previous years on the sediments of southern Saskatchewan, brought in by Mr. F. H. McLearn. This work involves the determination of the heavy mineral content and the mechanical analysis of the sediments and may prove of value to the division in the future as providing data from which key horizons may be located. A certain amount of work was also done on the mechanical analysis of oil sands, examination of water, etc.

R. T. D. Wickenden continued the work begun in 1928 on western Cretaceous foraminifera, and the Borings Division co-operated with him in the matter of supplying samples of sediments obtained from wells. D. C. Maddox spent two weeks in field work with Mr. M. E. Wilson in Perth area, to study methods of outcrop mapping. In co-operation with Miss A. E. Wilson a certain amount of time was devoted to the location and examination of excavations in Ottawa district.

Assistance from the following sources is gratefully acknowledged.

The office of the Supervisory Mining Engineer of the Department of the Interior under Mr. C. C. Ross, which supplied borings samples and much valuable information as to the exact position of wells in the Prairie Provinces; and the yield of oil, gas, and water, and other items of interest in connexion with them.

Colonel R. B. Harkness, Gas Commissioner for Ontario, for information as to oil and gas wells drilled in Ontario and for the supplying of samples from wells of unusual interest.

Provincial Department of Health and the many Federal Government organizations—especially the Department of Agriculture—and many drillers of wells, for information as to water wells and water supply.

Dr. J. A. L. Henderson of the New Brunswick Gas and Oilfields Company, who continued co-operation in the supplying of information and samples from wells put down by that company.

Mr. John Ness of the Imperial Oil Company for information as to wells put down in Minudie district, N.S.

The chief points of interest from the individual provinces follow.

Nova Scotia. The only drilling for oil and gas was the putting down of a few test holes in Minudie district, Cumberland county, by the Imperial Oil Company.

Prince Edward Island. No drilling for oil and gas reported since the abandonment of the two wells put down by the Doherty interests in 1927.

New Brunswick. Drilling for oil and gas seems to have been confined to the New Brunswick Gas and Oilfields, Limited, in the area to the south of Moncton. Samples from some of the wells put down, including some from the wells in which salt was obtained, were received.

Province of Quebec. Considerable interest was shown in the oil and gas possibilities of the area between Montreal and Quebec. This area is underlain by Palæozoic rocks of Cambrian and Ordovician age and small flows of gas have in the past been obtained in this area both from the base of the drift, from the Trenton limestone, and from some of the shales that overlie the limestone, but no commercial production has been obtained to date and no samples or records were received by the Borings Division during 1929. Twenty-eight samples from a well put down some years ago at the Cap Rouge Experimental Station were examined and bottled.

Ontario. A number of samples from oil and gas wells were examined and bottled in order to provide type sections of the areas in which the wells were put down, or to obtain information as to certain stratigraphic conditions at depth. The number of samples so examined was 3,519, distributed as follows.

*Coste No. 7.....	Lot 17, con. 7.....	Dover, East, tp.....	Kent co.....	369
Delaware Development Co.	" 23, " 22.....	Caradoc tp.....	Middlesex co.....	231
*Suburban Gas Co.....	" 30, " 8.....	Nassagaweya tp.....	Halton co.....	209
Puslinch well.....	" 7, " 4.....	Puslinch tp.....	Wellington co.....	186
Bollert No. 1.....	" 7, " 6.....	" " " ".....	" " " ".....	406
St. Mary's Cement.....	" 21, " 17.....	Blanshard tp.....	Perth co.....	297
Dominion Nat. Gas Co. No. 2.....	.....	.....	Norfolk co.....	199
Beachville.....	.....	Oxford tp.....	Oxford co.....	285
Manitoulin No. 1.....	Lot 4, con. 14.....	Assiginack tp.....	Manitoulin co.....	45
Roslyn No. 1.....	" 5, " 10.....	Tilbury, West, tp.....	Essex co.....	348
Johnson and Hyatt.....	" 23, " S.R.....	Bosanquet tp.....	Lambton co.....	221
Henderson well.....	" 11, " 3.....	Vaughan tp.....	York co.....	283
*Colborne well.....	" 23, " 1.....	Cramahe tp.....	Northumberland co.....	123
Union Nat. Gas Co.....	" 24, " 5.....	Dawn tp.....	Lambton co.....	224
*Kincardine Salt Co.....	.....	.....	Bruce co.....	93

The asterisk opposite the name of the well indicates that the condensed log is published in the Summary Report, Part C. The total number of samples from all sources examined was 4,096.

Prairie Provinces. The success of drilling operations in Turner Valley field and in Red Coulee and other fields seems to have stimulated the search for oil and gas to an unprecedented extent. The number of samples received was greatly in excess of the figure for 1928. The more intensive development of proved fields and the drilling of wells in areas not yet tested for oil or gas or tested only to limited depths resulted in a great number of wells being drilled in areas both in the foothills and the prairie regions. Turner Valley field continued to be the main centre of interest and its production was approximately doubled in 1929. Much development work was done in Wainwright and Ribstone fields, however, and the discovery of oil in Red Coulee area in southern Alberta has stimulated further drilling in that area. The total number of samples received was 28,988, representing a section nearly 55 miles thick.

British Columbia. Sage Creek area continued to be the centre of interest. The Crow's Nest Oil Company's well, which has been drilled intermittently for several years, was further deepened as was the B.C. Oil Company's No. 2 well. Recent developments in the oil and gas occurrences in the area would seem to indicate that further drilling will probably be undertaken. The oil and gas possibilities of other points in British Columbia are receiving the attention of operators, but no drilling of a conclusive nature was undertaken in 1929. Samples from the following wells were examined and bottled: the Crow's Nest Oil Company; the B.C. Oil and Gas Company's No. 2; the Okanagan Oil and Gas Company; the Armstrong Oil Company; and a well put down for water, in Telkwa district, by Mr. C. G. Scott.

The total number of samples received from all parts was 36,024, representing a section about 68½ miles thick, these being distributed as under. Of these 16,803 were bottled for future reference.

	Records	Samples
British Columbia.....	3	78
Prairie Provinces, oil and gas.....	228	28,783
" " water.....	93	205
Ontario, oil and gas.....	125	2,985
" " water.....	43	268
New Brunswick.....	16	3,619
Quebec.....	10	96
Nova Scotia.....	1	
Prince Edward Island.....		
Total.....	519	36,034

DRAUGHTING AND REPRODUCING DIVISION

C.-Omer Senécal, Geographer, and A. Dickison, Chief of the Draughting and Reproducing Division, jointly report:

Maps Published April 1, 1929, to March 31, 1930

Series A	Publication number	Title	Remarks
218A	2169	BRITISH COLUMBIA AND YUKON Atlin sheet; scale, 1 inch to 8 miles.....	Geology.
199A	2143	BRITISH COLUMBIA Britannia Beach sheet, New Westminster district; scale, 1 inch to 1 mile.....	Geology. For memoir by H. T. James.

Maps Published April 1, 1929, to March 31, 1930—Continued

Series A	Publication number	Title	Remarks
BRITISH COLUMBIA—Continued			
—	2180	Ore deposits of the Britannia shear zone, New Westminster district; scale, 1 inch to 200 feet....	Geology. For memoir by H. T. James.
215A	2166	Stewart sheet (west half), Cassiar district; scale, 1 inch to 1 mile.....	Geology. For memoir by G. Hanson.
216A	2167	Bear River sheet (west half), Cassiar district; scale, 1 inch to 1 mile.....	Geology. For memoir by G. Hanson.
217A	2168	Bear River sheet (west half), Cassiar district; scale, 1 inch to 1 mile.....	Topography.
232A	2192	Portion of Slocan and Upper Arrow Lakes area, Kootenay district; scale, 1 inch to 2 miles.....	Geology. For report by C. E. Cairnes, Summary Report, part A, 1928.
235A	2196	Lardeau area, Kootenay district; scale, 1 inch to 4 miles.....	Geology. For memoir by M. F. Bancroft, J. F. Walker, and H. C. Gunning.
236A	2198	Kootenay Lake area, Kootenay district; scale, 1 inch to 4 miles.....	Geology. For report by J. F. Walker, Summary Report, part A, 1928.
237A	2200	Big Bend area, Columbia river; scale, 1 inch to 4 miles.....	Geology. For report by H. C. Gunning, Summary Report, part A, 1928.
ALBERTA			
208A	2157	Mountain Park sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Geology. For memoir by B. R. MacKay.
209A	2158	Cadomin sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Geology. For memoir by B. R. MacKay.
225A	2183	Brûlé Mines area; scale, 1 inch to 1,000 feet.....	Geology. For report by B. R. MacKay, Summary Report, part B, 1928.
226A	2184	Lovett sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Topography.
228A	2186	Cardinal River sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Topography.
229A	2187	Turner Valley sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Topography.
SASKATCHEWAN AND MANITOBA			
233A	2194	Reindeer Lake area; scale, 1 inch to 6 miles.....	Geology. For report by C. H. Stockwell, Summary Report, part B, 1928.
MANITOBA			
234A	2195	Kississing Lake area; scale, 1 inch to 2 miles.....	Geology. For report by J. F. Wright, Summary Report, part B, 1928.
—	2199	Figure 3. Sherritt-Gordon deposit, Kississing Lake area; scale, 1 inch to 800 feet.....	Geology. For report by J. F. Wright, Summary Report, part B, 1928.
ONTARIO			
155A 197A	1553 1939	Lake Huron sheet; scale, 1 inch to 8 miles..... Fort William and Port Arthur sheet, Thunder Bay district; scale, 1 inch to 1 mile.....	Geology. Second edition. Geology (surface deposits). For memoir by T. L. Tanton.

Maps Published April 1, 1929, to March 31, 1930—Continued

Series A	Publication number	Title	Remarks
ONTARIO—Continued			
220A	2173	Panache sheet, Sudbury and Manitoulin districts; scale, 1 inch to 1 mile.....	Geology. For memoir by T. T. Quirke and W. H. Collins.
221A	2174	Collins Inlet sheet, Manitoulin and Sudbury districts; scale, 1 inch to 1 mile.....	Geology. For memoir by T. T. Quirke and W. H. Collins.
239A	2205	Key Harbour sheet, Parry Sound and Sudbury districts; scale, 1 inch to 1 mile.....	Geology. For memoir by T. T. Quirke.
244A	2219	Panache sheet, Sudbury and Manitoulin districts; scale, 1 inch to 1 mile.....	Geography.
245A	2220	Collins Inlet sheet, Manitoulin and Sudbury districts; scale, 1 inch to 1 mile.....	Geography.
246A	2221	Key Harbour sheet, Parry Sound and Sudbury districts; scale, 1 inch to 1 mile.....	Geography.
247A	2222	Delamere sheet, Sudbury and Parry Sound districts; scale, 1 inch to 1 mile.....	Geography.
QUEBEC			
210A	2129	Part of Lemieux township, Gaspé county; scale, 1 inch to $\frac{1}{2}$ mile.....	Geology. Reprint. For Economic Geology Series, No. 8: "Zinc and Lead Deposits of Canada", by F. J. Alcock.
224A	2179	Dubuisson sheet, Abitibi county; scale, 1 inch to 1 mile.....	Geology.
240A	2208	Opasatika sheet, Témiscamie county; scale, 1 inch to 1 mile.....	Geology.
NOVA SCOTIA			
—	2153	Mahone Bay sheet, No. 88, Lunenburg county; scale, 1 inch to 1 mile.....	Geology.
—	2154	Bridgewater sheet, No. 89, Lunenburg county; scale, 1 inch to 1 mile.....	Geology.
EASTERN CANADA			
—	2213	Sheet 1. Profiles of peat bogs in eastern Canada..	Geology. For memoir by V. Auer.
—	2214	Sheet 2. Profiles of peat bogs in eastern Canada..	Geology. For memoir by V. Auer.
—	2215	Sheet 3. Sections of peat bogs in eastern Canada..	Geology. For memoir by V. Auer.

Maps in Hands of King's Printer, March 31, 1930

Series A	Publication number	Title	Remarks
ONTARIO			
238A	2204	Delamere sheet, Sudbury and Parry Sound districts, scale, 1 inch to 1 mile.....	Geology. For memoir by T. T. Quirke.
QUEBEC			
242A	2212	Escuminac sheet, Bonaventure county; scale, 1 inch to 1 mile.....	Geography.
NOVA SCOTIA			
241A	2211	Digby sheet, Digby and Annapolis counties; scale, 1 inch to 1 mile.....	Geography.

Other Map-Work in Varying Stages of Progress

—	Title	Remarks
BRITISH COLUMBIA		
1	Quatsino-Nimpkish area, north Vancouver island; scale, 1 inch to 2 miles.....	Geology. For report by H. C. Gunning, Summary Report, part A, 1929.
2	Summit of Nickel Plate mountain (near Hedley), Similkameen district; scale, 1 inch to 500 feet.....	Geology. For report by H. S. Bostock, Summary Report, part A, 1929.
3	Topley sheet, Coast district; scale, 1 inch to 1 mile...	Geology.
4	Stikine area, Cassiar district, 56° 30'–57° 00', 131° 00'–132° 00'; scale, 1 inch to 2 miles.....	Geology.
5	Stikine area, Cassiar district, 57° 00'–57° 30', 131° 00'–132° 00'; scale, 1 inch to 2 miles.....	Geology.
6	Stikine area, Cassiar district, 57° 30'–58° 00', 131° 00'–132° 00'; scale, 1 inch to 2 miles.....	Geology.
7	Copper Mountain mining area, Similkameen district; scale, 1 inch to 1,000 feet.....	Geology. For memoir by V. Dolmage.
ALBERTA		
1	Lovett sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Geology. For memoir by B. R. MacKay.
2	Cardinal River sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Geology. For memoir by B. R. MacKay.
3	Turner Valley sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Geology.
4	Bragg Creek sheet (east half), west of fifth meridian; scale, 1 inch to 1 mile.....	Topography.
5	Bragg Creek sheet (east half), west of fifth meridian; scale, 1 inch to 1 mile.....	Geology.
6	Jumpingpound sheet (west of fifth meridian); scale, 1 inch to 1 mile.....	Topography.
7	Thoreau Creek area (west of sixth meridian); scale, 1 inch to 1,000 feet.....	Geology. For memoir by B. R. MacKay.
8	Cadomin-Luscar coal basin; scale, 1 inch to 2,000 feet..	Geology. For memoir by B. R. MacKay.
MANITOBA		
1	Winnipeg sheet; scale, 1 inch to 8 miles.....	Geology (surface deposits).
ONTARIO		
1	Espanola sheet, Sudbury district; scale, 1 inch to 1 mile	Geology.
2	Shebandowan sheet, Thunder Bay district; scale, 1 inch to 1 mile.....	Geology.
QUEBEC		
1	Rouyn Mineral area, Abitibi and Témiscamingue counties; scale, 1 inch to 4 miles.....	Geology. For memoir by H. C. Cooke, W. F. James, and J. B. Mawdsley.
NEW BRUNSWICK		
1	New Brunswick sheet; scale, 1 inch to 8 miles.....	Geology.
2	Hillsborough sheet, Albert and Westmorland counties; scale, 1 inch to 1 mile.....	Topography.
NOVA SCOTIA		
1	Bridgetown sheet, Annapolis county; scale, 1 inch to 1 mile.....	Topography.
2	Ainslie sheet, Inverness county; scale, 1 inch to 1 mile.	Topography.

In addition to the foregoing, ninety-four map and related figure drawings were prepared for reproduction by zinc-cut process, for illustrating of reports, memoirs, and bulletins; a series of twelve figure drawings was also prepared for reproduction by photolithography, for memoir on "The Niagara Falls Survey of 1927," by W. H. Boyd; other draughting and associated work necessary for staff and public use amounted to one hundred and sixteen items. Duties in connexion with the Geographic Board of Canada have, as usual, been attended to.

PHOTOGRAPHIC DIVISION

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

The following work has been done in this division during the fiscal year:

Contact prints, 4 x 5 to 36 x 48.....	15,235
Bromide enlargements, 4 x 5 to 40 x 72.....	972
Exposures developed, 3½ x 4½ to 6½ x 8½.....	4,763
Dry plate negatives, 4 x 5 to 11 x 14.....	548
Wet plate negatives, 8 x 10 to 24 x 30.....	204
Zinc plates, 11 x 14 to 24 x 36.....	23
Photostat copies, 7 x 11 to 11 x 14.....	66
Lantern slides, 3½ x 4.....	1,625
Photos and maps mounted.....	3,052
Total	26,488

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Chief of the Division, reports:

The work of the division consists in answering inquiries for information regarding the geology and mineral resources of Canada. This information is imparted verbally to those making application in person, and is given to others in the form of correspondence, memoranda, and published reports and maps. A considerable part of the technical correspondence of the Geological Survey is dealt with.

Articles were prepared during the year for publication in the British press and the Canada Year Book. These articles dealt with subjects such as the importance and status of the mineral industry of Canada, and the progress made. Numerous short articles were prepared for the use of the press. In this way the readers of the newspapers and mining and scientific journals were kept informed of the nature of the publications issued from time to time by the Survey.

The publications of the Geological Survey and of the National Museum of Canada are distributed by this division. During the year, 48,766 publications, exclusive of the French editions, were distributed. Of these, 15,055 were sent to addresses on the regular mailing lists, and 33,711 were distributed in compliance with written and personal requests for named publications, or requests for general or specific information.

LIBRARY

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

Additions to the Library during the year include:

Books purchased	650
Volumes received as gifts or exchanges	963
Pamphlets	361
Maps	443
Periodicals subscribed for	202
Periodicals and serial publications by gift and exchange.....	498

Six hundred and ninety-three books were bound and 256 maps mounted. The catalogue was increased by 3,452 cards, and the work of keeping the files complete by correspondence was continued.

The recorded loans amounted to 8,234 books and maps, in addition to those used by the many readers who consulted the library in person. Inter-library loans were made to Canadian and United States universities, to Government departments in Ottawa, and in the various provinces.

Notable progress has been made during the year in bringing the collection of photographs up to date and in cataloguing and preparing lantern slides for loan purposes. The total number of maps catalogued during the year was 554.

The filing of the Gray Herbarium Botanical Index, which was purchased in 1928, has gone steadily forward, and is kept up to date as new sets of the cards are received. This unique and important index is regarded as the most valuable aid to botanical research on the continent, and since its installation in the Library has been frequently consulted, not only by botanists in Ottawa, but, by correspondence, throughout Canada.

Additional space for expansion has been provided in the gallery of the Library, formerly occupied by the Royal Society library.

The Library has been fortunate in acquiring from Mr. Johansen several hundred volumes, separates, and parts of publications needed to complete important series of European learned societies, the collections being especially rich in Scandinavian material. Among these may be mentioned Drygalski's *Greenland Expedition, 1897*; *Danmarks Fauna, vols. 1-33, 1907-1927*; *Zoologische Anzeiger, vols. 1-13, 1879-1890*; *Revue Zoologique par la Société Cuverienne, vols. 4-11, 1841-48*; *Ergebnisse der Hamburger Magalhaenschen Sammelreise, vols. 1-3, 1896-1907*, and many valuable *Handlingar* of the Royal Society of Stockholm. Other important purchases are: *Journal fur Ornithologie, vols. 1-date*; Austria K. K. *Geologische Reichsanstalt Verhandlungen, 1892-1911*; *Société Neuchateloise des Science Naturelles, bulletins 4-16, 1858-1888* and Brehm's *Tierleben* in 10 volumes. The Explorers' Club of New York presented to the Library their unique facsimile publication of the *Scoresby Log-books, Concerning the Arctic Voyages of Captain William Scoresby*; The *Missouri Botanical Garden* brought up to date our set of their *Annals*; and the *Heidelberg Academie der Wissenschaften* presented a complete set of their *Sitzungsberichte* and *Abhandlungen*.

BRITISH COLUMBIA OFFICE

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

The activities of the British Columbia Office show little falling off. During the year 4,200 visitors registered at the office and 450 inquiries were answered by letter, also a large number by telephone; 1,874 reports and 2,699 maps were distributed; and a large number of specimens of rocks and minerals were examined and reported on. Seventeen public lectures on geological and mining subjects were given by the staff during the year. Examination of the drill cores for the proposed Canadian Pacific Railway, False Creek Yard, tunnel under the city was also undertaken.

The staff of the office was changed during the year; W. E. Cockfield, as Officer in Charge, replacing V. Dolmage, who resigned, and J. F. Walker replacing F. A. Kerr, who was transferred to Ottawa. The staff is now composed of W. E. Cockfield and J. F. Walker, geologists, and A. J. C. Nettell, assistant engineer.

NATIONAL MUSEUM OF CANADA

W. H. Collins, Acting Director

Satisfactory progress was made in the work of the National Museum of Canada during the year 1929, in the collecting of material for purposes of scientific study and exhibition, in systematic scientific research, in the public display material in the Museum halls, and in general educational activities.

Anthropological investigations were carried on among the Tsimshian Indians of Nass River region, the Kwakiutl and Nootka tribes of Vancouver island, the Indians in the vicinity of Norman on Mackenzie river and of Peace River district, and the Ojibway of Georgian bay. Excavations were made of Indian village sites on the north shore of the St. Lawrence. A study of the mammalian life of southern British Columbia was continued, and observations on the fauna of the Arctic were made by a member of the Museum staff who accompanied the Canadian Government Expedition on the Canadian Government steamship *Beothic*. Botanical surveys were made in Wood Buffalo park, in the valley of Restigouche river, and in southwestern New Brunswick. In all cases material was collected for research and for exhibition purposes.

For geological, mineralogical, and palæontological exhibits the National Museum is dependent on the Geological Survey, with which there is most sympathetic co-operation. To the members of the Geological Survey staff who have made collections for the Museum and who have contributed generously of their time and energy in the preparation of exhibits, sincere appreciation is here expressed.

For co-operation in the preparation of exhibits the Museum is indebted to the Forestry Branch, Department of the Interior, and to the Entomological Branch, Department of Agriculture.

During the year the equipment was increased by the purchase of thirty steel table cases, and it is the wish of the Museum officials to continue adding to the supply of cases and other equipment and material even at the risk of being accused of overcrowding.

The Acting Director of the Museum here expresses his gratitude to the Canadian National Parks Branch and the North West Territories Branch, Department of the Interior, to the Department of Indian Affairs, the Royal Canadian Mounted Police, and other Government departments for valuable assistance and friendly co-operation. He also wishes to express to many individuals and organizations, both Canadian and foreign, his most cordial appreciation for donations and exchanges and for assistance rendered in connexion with scientific investigations.

ANTHROPOLOGICAL DIVISION

D. Jenness, Chief of the Anthropological Division, reports:

FIELD WORK

D. Jenness left for Java on March 31 to attend the Fourth Pacific Science Congress as one of the two delegates representing the Dominion of Canada and carried the official invitation of the Canadian Government that the Congress

should hold its next session in the year 1932 in Canada. He returned to Ottawa early in July, and left almost immediately to conduct some ethnological researches among the Ojibwa Indians of Georgian bay. During a two month's stay on the Indian reserve at Parry island he gathered much new and valuable information concerning their social life and religious beliefs before they were greatly influenced by contact with European civilization.

C. M. Barbeau completed during the summer field season his survey, commenced over ten years ago, of the Tsimshian tribes of northern British Columbia. This year he devoted his attention particularly to the social organization, language, and æsthetic arts of the Nass River group. He also collected some specimens for the National Museum, and some totem poles for the Royal Ontario Museum of Archæology.

Harlan I. Smith went to Vancouver island in May to collect ethnological and archæological material, and to take moving pictures of the various Indian tribes. His field work added 363 specimens to the Museum's collections, and 6,000 feet of motion picture film, in addition to a large number of still pictures. On Hornby island he discovered and photographed many petroglyphs that had not been previously recorded.

W. J. Wintemberg made an archæological investigation of the west coast of Newfoundland, from June to early September, and discovered there, rather unexpectedly, the remains of many Eskimo settlements predating the discovery of the island by Europeans. The specimens he collected from these sites indicate that the inhabitants were an offshoot of an early group of tribes whose real centre may have been in Hudson bay, but whose civilization possessed many peculiar features not as yet fully determined.

J. C. Boileau Grant, Professor of Anatomy in the University of Manitoba, continued his anthropometric survey of the northern tribes of Canada, working this year along the valley of Peace river among the Cree and Beaver Indians. It is expected that he will supplement this year's survey with a similar study during the coming year, of the related Indians of Great Slave lake, and work up the combined results of the two field trips into a comprehensive report that will cover all the Indian tribes of this area.

C. B. Osgood, who went down Mackenzie river to Norman in the summer of 1928 to make an ethnological study of the Hare Indians, passed a very successful winter with that tribe on Great Bear lake, and obtained a large number of notes on their mode of life, their customs and religious beliefs, which he is now working up into a consecutive report. He had an opportunity during the spring to study the Mountain Indians who live to the west of Norman, and will incorporate in his report an account of this tribe also. He procured for the Museum fifty phonograph records of Hare Indian songs, and fifty-six specimens of their clothing, tools, and household furniture.

OFFICE WORK

Since his return from the field Mr. Jenness has been working up his field notes on the Ojibwa Indians for publication as a museum bulletin, and continuing his text-book on the Indians of Canada, which is now nearing completion. Mr. Barbeau has in hand a selection of Indian songs from Nass and Skeena rivers, and Mr. Wintemberg has just completed a detailed report on the Roebuck village site, in Ontario, which he excavated some years ago. Mr. Smith was occupied during the winter in arranging the moving picture films which he has secured during the past few years; he has now completed six reels illustrating different Indian tribes in British Columbia.

The division published two scientific reports during the past fiscal year: "Some Shell-heaps in Nova Scotia," by Harlan I. Smith and W. J. Wintemberg; and "Anthropometry of the Cree and Ojibwa Indians of Northeastern Manitoba," by Dr. J. C. B. Grant. Three other reports are either in press or in the hands of the editors, viz.: "Totem-poles of the Gitksan," by C. M. Barbeau; "Anthropometry of Cree and Chipewyan Indians of Lake Athabaska," by J. C. Boileau Grant; and "Sacred Stories of the Sweet Grass Cree," by L. Bloomfield.

There was an unusual number of requests during the year for the loan of exhibition material. Early in the spring a small exhibit of fire-lighting apparatus was installed at the Y.M.C.A., Ottawa, for a boys' hobby show, and another of Canadian handicraft material in the Chateau Laurier for the Art Association of Ottawa. In September a high school at Windsor, Ontario, asked for and received the loan of a small selection of Indian specimens. In October, at the request of the Department of Trade and Commerce, Ottawa, a valuable collection of specimens was forwarded to the Imperial Institute, London, England, where they will be on display for several months; and from October to January the Canadian National railways received from the division, on loan, five collections of specimens illustrating Indian games, music, weapons, embroidery, and art, for exhibition in their ticket offices throughout Canada, and in certain cities of the United States.

Three archæologists from the United States visited the Museum during the summer. Mr. N. C. Nelson, of the American Museum of Natural History, New York, made a rapid survey of its archæological collections; Dr. Warren K. Moorehead, of Andover, Mass., spent several days studying its collection of stone axes and adzes; and Mr. H. B. Collins, of the Smithsonian Institute, Washington, came to examine large collections from Alaska.

MUSEUM WORK

The large exhibition cases installed last year in the east exhibition hall were equipped this year with diaphragms, and the entire north row filled with attractive specimens from the plains and plateau tribes of Canada. The division is assembling a series of synoptic exhibits of Indian basketry, musical instruments, etc., for installation in the large cases on the south side of the same hall, preceded by a special introductory exhibit of some of the palæolithic material from Europe collected by Dr. H. M. Ami. During the winter Dr. Ami placed in the division's care an excellent replica of two clay bisons recently discovered in a palæolithic cave in France; these are being installed in a special case near the entrance of the hall, pending their arrangement as the central feature of a habitat group depicting the artistic achievements of early man about the close of the Ice age.

A large number of table cases were acquired during the year and placed around the walls of the east exhibition hall. The division plans to arrange a series of archæological exhibits in these table cases as soon as their interiors are equipped with heavy beaverboard foundations.

Accessions to Museum

The anthropological collections of the Museum were augmented during the year, mainly through its staff, as follows:

	Specimens
Ethnological	517
Archæological	1,200
Osteological	3

BIOLOGICAL DIVISION

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

FIELD WORK

R. M. Anderson attended the Eleventh Annual Meeting of the American Society of Mammalogists held April 10 to 13, 1929, in the Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

Mr. Anderson also planned and carried out an extensive campaign of field work in southern British Columbia during the season of 1929, in continuation of a biological reconnaissance of the region in the vicinity of the International Boundary line between the province of British Columbia and the states of Washington, Idaho, and Montana. The data and specimens collected are expected to be used as a basis for a later faunal report on the mammals of the International Boundary region of southern British Columbia from the strait of Georgia to the Alberta boundary.

This project was begun in the spring of 1927—and carried on by C. H. Young, senior collector-preparator on the Museum staff, assisted by H. M. Laing, of Comox, B.C. They made extensive collections in the low, humid Pacific coast belt and continued over the Hope-Princeton summit to the eastern slope of Cascade mountains. In 1928 Mr. Laing continued the work, beginning at Sterling creek (elevation 1,700 feet) on the east slope of Cascade mountains near Hedley, B.C., carrying the survey as far east as Westbridge in Kettle River valley (elevation 2,075 feet), going back later in the autumn for investigations on Juniper mountain, south fork of Ashnola creek (elevation 4,500 feet).

In 1929, Mr. Laing was again engaged and began work on May 4 in the arid belt of southern Okanagan valley covering the area from Osoyoos lake to Rossland.

R. M. Anderson left Ottawa on June 27 and reached Rossland on July 2, remaining with the party until the close of the season.

On August 6, the party left Rossland and proceeded to Creston. Camp was situated on flat lands west of Kootenay river, where the party remained until August 23. Extensive forest fires prevented exploration of Boundary creek and Summit lake and ultimately compelled retreat from Creston district.

On August 23, the party established camp on a little stream about one mile from Moyie river. Small mammal life was not abundant as a large part of the valley was burned-over land and the hillsides were too dry. A small collection was made here.

Through the courtesy of Mr. H. B. Murray, of the Canadian Pacific railway, camp was established, August 31, on Meadow creek (elevation 3,500 feet) about 3 miles from the British Columbia-Idaho-Montana corner. Work was carried on from this camp until October 3. Considerable collecting was done on American creek, Flatiron mountain, and on Cold creek. Mr. Hall, student assistant, spent over a week near the head of Cold creek at about 4,500 feet elevation. Short trips were made to tops of neighbouring mountains up to about 6,000 feet.

After completing the field work at Yahk, Mr. Anderson continued to Vancouver and interviewed the Game Commissioner of the province, Mr. A. Bryan Williams, from whom he obtained information on some of the big game species. Mr. Anderson also examined the Kenneth Race collection of mammals and birds of British Columbia. At Victoria he spent some time at the Provincial Museum and made notes on the British Columbia mammals in the collection. On the return trip he stopped off at Okanagan Landing, B.C., and examined the large collections of Major Allan Brooks and of J. A. Munro, also

checked up mammal notes with Major Brooks, and made preliminary arrangements for a series of coloured drawings, of big game and fur-bearing mammals of Canada, for a work on the Mammals of Canada which Mr. Anderson is preparing for the department. Twenty-four plates of mammals were completed by Major Brooks later in the year. After returning to Ottawa, Mr. Anderson attended the 47th Annual Meeting of the American Ornithologists' Union, held at Philadelphia, October 21 to 25. While there he spent some time carefully examining and making notes on a rather large number of British Columbia mammals in the collections of the Academy of Natural Sciences, which include several types of mammals collected and described from southern British Columbia by the late Samuel N. Rhoads of Philadelphia, and interesting Canadian material from other collectors.

P. A. Taverner, ornithologist, accompanied the Canadian Arctic Expedition of 1929 as naturalist on S.S. *Beothic* to Greenland, the eastern islands of the Canadian Arctic archipelago, Hudson strait, and into Hudson bay to Chesterfield inlet. The *Beothic* left North Sydney, N.S., July 20, with Mr. George P. Mackenzie, Officer in Charge, making its first call at Godhavn, Greenland, on July 27. The ship then proceeded to Dundas Harbour, Devon island, and from thence to cape Sparbo, on the north coast of Devon island, where a well-known herd of musk-oxen is still found, and where many excellent still and motion pictures of musk-oxen were secured. From Sparbo the ship proceeded to Craig harbour, Ellesmere island, and thence to Buchanan bay, where supplies for the Bache Peninsula post were landed at cape Rutherford. Turning south stops were made at Etah and Nerke Settlement, North Greenland; Dundas Harbour, Devon island; Ponds inlet, Clyde river, Pangnirtung, and Lake Harbour, all on Baffin island. The boat then proceeded into Hudson bay to Chesterfield inlet to land provisions and coal for the Royal Canadian Mounted Police detachment, and building material for the medical officer to be stationed there. On the return the *Beothic* stopped at Carys Swan Nest on Coats island; Lake Harbour, Baffin island; Acadia cove, Resolution island, where a direction-finding station is being established by the Department of Marine; touched at Port Burwell on the south entrance to Hudson strait, and cruising down the Labrador coast, reached North Sydney again on September 3, after travelling 7,800 miles.

Joseph Rochon, osteological preparator, left Ottawa on July 16 and proceeded to Trout lake and lake Pourri, Labelle county, Quebec, returning August 25 with 107 specimens of small mammals. During the rest of the year his time was mostly spent in macerating, cleaning, and preparing skulls and skeletons of mammals and birds.

Clyde L. Patch, chief taxidermist and herpetologist, D. Blakely, taxidermist, and Claude E. Johnson, artist, did some field work in Ottawa district, principally collecting local material to fill out the collections and obtaining accessories for habitat group work.

PUBLICATIONS

R. M. Anderson continued work as general editor of scientific reports of Canadian Arctic Expedition, 1913-18. No new parts were issued during the year, but preparations are being made to close up some of the unfinished volumes, and some progress has been made in preparing some of the completed volumes of the series.

At the request of Professor Julian Huxley, Departmental Editor of Section Biology and Zoology, Mr. Anderson wrote the article on "Fur-bearing Animals (Land)" which was published in 13th Edition of the *Encyclopaedia Britannica*, issued in 1929. He has also completed one section of the manuscript for a museum bulletin on "Methods of Collecting and Preserving Animals for Study." The line drawings for illustration have been prepared by Claude E. Johnson, artist

of the Division of Biology. Some progress has been made on the "Check-List of Canadian Mammals" and a large amount of data has been accumulated adding to its completeness. A good start has also been made in the preparation of an illustrated book on "Mammals of Canada," planned to include analytical keys for determination of species, adequate descriptions of every form of mammal known to occur in Canada, distribution maps, bibliographical data, and general accounts of life histories and habits of the most important species. Several book reviews and mammal notes were published in *The Canadian Field-Naturalist*, Ottawa, of which Mr. Anderson is Associate Editor in Mammalogy.

The introduction was by Mr. Laing, pages 64-71. "Notes on Birds Collected and Observed in Chitina River Region, Alaska" gives field notes on eighty-five species by Mr. Laing, with systematic notes by Mr. Taverner, pages 72-95. "Notes on Mammals of Upper Chitina River Region, Alaska," gives field notes on seventeen species by Mr. Laing and systematic notes by Mr. Anderson, pages 96-107.

Mr. Taverner also prepared an article on "Some Zoological Aspects of the Canadian Arctic Expedition of 1928," which was published in *The Canadian Field-Naturalist*, vol. XLIV, 2, February, 1930, pages 25-27. Mr. Taverner also completed the manuscript and drawings for a bulletin on "Water Birds, Game Birds, and Hawks of Canada."

During the year an edition of 3,000 copies of sixty picture postcards of birds was issued about December 18. The coloured illustrations were made from plates of "Birds of Western Canada," some from "Birds of Eastern Canada," and some from new paintings by Major Allan Brooks. Each card contains one coloured illustration, accompanied by descriptive text, and the cards are supplied in sets, in carton, for sale at \$1, and also loose, for sale at two for 5 cents.

A valuable paper on "Freshwater Mollusca from Central Ontario," by Frank Collins Baker and Alvin Robert Cahn, based on recent collections made in Ontario and on other material in different collections, has been received for publication. The authors have generously offered to give the National Museum of Canada duplicate specimens of the species collected on the expedition, as well as cotypes of new forms which are described. This report is a contribution of interest both in the field of recent zoology and of invertebrate palaeontology.

MUSEUM WORK

The Forestry Branch, Department of the Interior, has made a beginning of exhibition of certain forest products, and has filled one large case with two exhibits: (1) The manufacture of wood pulp, illustrating the groundwork, sulphate, sulphite, and soda processes; (2) some products of wood pulp, including rayon thread and weaves, wallpaper, twine, rope, fibreware, wall-boards, and artificial wood. Part of the material for four large tree exhibits has been shipped in, but not yet installed.

The Curator of Insects in the Museum, Mr. Arthur Gibson, Dominion Entomologist, has aided in the installation of a case of silk products, the bulk of the material being supplied by the General Silk Corporation.

As a result of field work by members of the staff, considerable additions have been made to the study collections, and much material obtained suitable for subsequent mounting. The scientific officers of the staff have devoted such time as other duties permitted, to determining, classifying, and making systematic notes on specimens examined.

The work of identifying and systematically arranging the collections in zoology and botany which are coming in, and making the data obtained from field notes, correspondence with specialists and local naturalists, and study of specimens available for reference is an important feature, and the results are embodied from time to time in Museum reports and bulletins and in

technical scientific periodicals. The officers of the Division of Biology are prepared to identify and return Canadian specimens of mammals, birds, reptiles, or amphibians, which are sent in a fair state of preservation and with sufficient data in regard to locality, date of collecting, and sex if possible. Where possible the Museum would be pleased to have duplicate specimens sent for deposit in the National collection. The Chief Botanist will only attempt to determine plants when properly pressed, showing roots, stem, leaves, and if possible flowers or fruit, and it is requested that one or two duplicates of each form be sent for dissection and for permanent preservation in the National Herbarium.

The National Parks of Canada, Department of the Interior, through the Commissioner, Mr. J. B. Harkin, has kindly continued to send in many specimens of large game or predatory fur-bearing mammals from the various national parks, the North West Territories and Yukon Branch, Department of the Interior, through Mr. O. S. Finnie, director, and the members of various detachments of the Royal Canadian Mounted Police, through the Commissioner, Colonel Cortlandt Starnes, have continued to send in valuable materials from the Far North, which are very acceptable to the Museum. As the area of the Dominion of Canada is so large, and the Museum staff limited, the only hope of obtaining needed material from many districts is by donations and interested friends and public-spirited sportsmen and travellers.

The Hudson's Bay Company, the largest establishment engaged in the fur business in the British Empire, has for some time been interested in having studies made of the periodical fluctuations in the numbers of wild animals in the districts where the company operates trading posts. There is in many cases confusion in regard to data based on inadequate and inaccurate determinations of species of the smaller mammals which are not so well-known and which occupy different ecological niches. To check up this data it was considered necessary to have collections of small mammals made at different points and properly identified. Mr. C. V. Sale, Governor of the Hudson's Bay Company, authorized Chief Factor Charles H. French, Fur Trade Commissioner of the Company at Winnipeg, to co-operate with R. M. Anderson in the matter in the spring of 1929. Forty small sets of collecting equipment, including tools, small traps, preservatives, labels, and mimeographed instructions for preserving mammals for scientific purposes for the National Museum of Canada, were accordingly prepared at Ottawa and shipped by direction of the Fur Trade Commissioner's office to the District Managers' offices at Montreal, Winnipeg, Saskatoon, North Bay, Edmonton, and Vancouver, and from thence distributed to forty different posts of the Hudson's Bay Company.

These forty posts were selected as being in suitable positions to give a cross-section through a great part of northern Canada and with the co-operation of the intelligent managers in charge of many of the posts and their facilities for obtaining material from Eskimos, Indians, and white trappers, it is hoped that much scientific data will be obtained to the advantage of both the Hudson's Bay Company and the National Museum. As the posts are in most cases remote and difficult of access, results are hardly expected until one winter after the shipment of equipment and instructions. However, small lots of mice were received in the autumn of 1929 from Ile-a-la-Croise, Saskatchewan, and two species of lemmings from Lake Harbour, Baffin island, and more are expected during the summer of 1930.

Accessions to Museum

Accessions to the zoological collections:

Mammals received and catalogued	846
Birds received and catalogued	293
Amphibians and reptiles received and catalogued.....	96

NATIONAL HERBARIUM

M. O. Malte, Chief Botanist, National Herbarium, with Mr. W. R. Watson, as student assistant, made a botanical survey of St. Andrews and vicinity, New Brunswick. More than 600 species and varieties of flowering plants and ferns were collected.

H. M. Raup, assisted by Mrs. Raup, continued investigations on the flora of Wood Buffalo park, Alberta.

J. Rousseau made a botanical exploration of the districts of St. Urbain and Matapedia, Quebec, collecting about 500 flowering plants and ferns, aggregating approximately 3,000 herbarium sheets.

M. O. Malte continued work on Arctic botany in co-operation with Professor C. H. Ostenfeld, Copenhagen, Denmark, who spent about one month at the National Museum determining collections and preparing manuscript for a "Flora of Arctic Canada".

Through the co-operation of the Forestry Branch, Department of the Interior, samples of five trunks of different trees were secured for exhibit in the Museum.

Plants distributed:

Prof. C. H. Ostenfeld, Copenhagen, Denmark 47

Plants received outside of collections made by staff:

Gray Herbarium, Cambridge, Mass. 28

Prof. M. L. Fernald, Cambridge, Mass. 12

MINES BRANCH

John McLeish, Director

The annual value of the mineral production in Canada continues to increase rapidly, having grown from \$86,000,000 in 1907 to \$189,000,000 in 1917, and \$247,000,000 in 1927. In 1929 the production had risen to \$307,000,000, or the production per capita in 1907 was \$13.75; in 1917 it was \$23.18; in 1927, \$25.97, and in 1929 it reached a maximum of \$31.35. The rapidly accelerating growth of this industry has been due not alone to the finding of new mineral deposits, but must be ascribed in considerable measure to the improvements that are constantly being made in the metallurgical treatment of ores, and to new uses developed for numerous products of the mine.

To this development the Mines Branch, Department of Mines, can properly claim to have made a substantial contribution through the collection and dissemination of information respecting Canadian mineral resources, and especially through the test and research work being carried on in its ore dressing and metallurgical laboratories, its fuel research laboratories, and its laboratories for ceramic and road material investigations.

The organization of the branch has been increased from year to year in an effort to meet the constantly increasing demand for its work, although the problems the branch is called upon to investigate appear to be increasing at a much greater rate than the available staff to undertake them.

The total number of employees at the end of March, 1930, was 188, of whom 46 were temporary; and included 62 administrative officers, engineers, and chemists; 13 technical clerks and draughtsmen; 24 clerks and stenographers; 19 laboratory assistants in several grades, and 70 mechanics, labourers, and messengers.

The Director devoted the major part of his time to departmental administrative duties, in addition to which he attended the regular meetings of the Dominion Fuel Board, and acted as chairman of several sub-committees of this board. He attended, as a member, several meetings of the Advisory Committee on Mining Regulations, and meetings of several Associate Committees of the National Research Council, as well as numerous meetings of the Government Advisory Committee on the Civil Service Superannuation Act.

In May he attended the second annual meeting of the Nova Scotia Provincial Advisory Board on Fuel Investigations.

Early in October he attended a conference of Dominion and Provincial officials with representatives of the coal mining industry of British Columbia, at which it was arranged that the Mines Branch should undertake a series of large-scale experiments on the burning of British Columbia coals in the powdered form. At Edmonton, in the province of Alberta, arrangements were made for the formation of a joint committee representing the Mines Branch and the Alberta Research Council to advise on the distribution for action of Alberta coal investigation problems. Visits were also paid to coal fields on Vancouver island and in the Crowsnest Pass districts of British Columbia and Alberta.

He attended the annual western meeting of the Canadian Institute of Mining and Metallurgy in Edmonton in October of 1929, and the annual meeting of the Institute in Toronto in March of 1930.

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

MINERAL RESOURCES DIVISION

In submitting his review of the year's work, A. W. G. Wilson, Chief of the Division, stresses the fact that a very important feature of the work of the technical officers of this division is the dissemination of information through correspondence and personal conference.

Each technical officer is a specialist on certain selected minerals, their commercial products, and industrial applications. He devotes a large part of his office time to dealing with requests for information, and to acting in a consulting capacity to engineers, capitalists, prospectors, and others who call at the offices of the Mines Branch in Ottawa for advice and assistance. It is believed that this service is contributing greatly toward the development of new industries in Canada and to the improving of operating conditions, though it very seriously interferes with the completion of reports and with the early publication of the results of the more systematic investigations which appear from time to time as monographs or bulletins.

Mr. Wilson was nominated, in May of this year, as one of the representatives of the Dominion Government on a committee, under the chairmanship of Mr. Charles Camsell, appointed to investigate conditions of natural gas production and wastage in Turner valley, Alberta. Meetings were held in western Canada in May, in June, and in September, and a final meeting in Ottawa in January. Work on this committee, including the organization of its investigations and the preparation of its final reports, occupied a large part of Mr. Wilson's time during the year. The committee's investigations included an exhaustive report on the "Economic Possibilities of the Production of Chemical Products from Waste Natural Gas in the Turner Valley, Alberta", which was prepared by Industrial Processes Development, Limited, and a report on "Clay and Shale Resources of Turner Valley and Nearby Districts", by Dr. W. G. Worcester, of the University of Saskatchewan, through the Ceramics Division of the Mines Branch.

H. S. Spence completed the field work in connexion with his study of the mica industry during the early part of the year, when he visited mica mines and mills, and mica trimming establishments in the United States. His report on mica was issued early in March, 1930. The field season was devoted largely to completing the examination of feldspar deposits and mines in Ontario and Quebec. Feldspar mines and mills in the United States were also visited to gather data for a report on this mineral and on the producing and consuming industries. Examinations were made in Ontario and Quebec; Maine, New Hampshire, and New York states. The field work is completed, with the exception of some minor details, and the revised monograph is well under way. Concurrently with his work on feldspar, Mr. Spence studied the occurrences of rare-earth and radioactive minerals in Canada, to ascertain whether these minerals occur in commercial quantities. The most important occurrence studied is that of a radium-bearing uraninite near Willberforce, Ontario. This deposit forms the subject of a special article which will be published in "Investigations of Mineral Resources, 1929."

L. H. Cole completed the manuscripts of his revised reports on gypsum and on salt, and both volumes are in process of publication. Through the courtesy of the New Brunswick Gas and Oilfields, Limited, Mr. Cole had the opportunity of sampling in detail a core obtained from a salt deposit at Gautreau, N.B. This core penetrated 980 feet of rock salt; it was divided into suitable sections for sampling, and the samples were examined in the chemical laboratories for bromine, iodine, and potash. Mr. Cole devoted most of the field season to a study of deposits of anhydrite in Canada. The field work, which is now com-

pleted, included visits to localities in Ontario, Nova Scotia, and New Brunswick. At the close of the season a trip was made to United States points to ascertain what progress had been made in the utilization of this mineral. On the conclusion of the field work a number of laboratory studies were planned, and this work is still in progress.

S. C. Ells devoted most of the field season to the development of a new quarry site for the production of bituminous sands. This site is located on the Clearwater reserve, nearly opposite the present end of steel of the Alberta Great Waterways railway. About 6,000 tons of sands were exposed by removing the overburden, docks were built, and loading towers and cable were installed. The Research Council of Alberta has erected a separation plant, designed to use Dr. K. A. Clark's process of separating bitumens from sand, beside the quarry site, and it is proposed to operate this plant during the summer of 1930. Late in the year Mr. Ells visited asphalt mixing plants at several points in Texas, preparatory to undertaking the construction of a mixing machine at Edmonton during the winter. This new machine is now nearly complete and it is planned to carry on some experimental work with the machine during the season of 1930.

M. F. Goudge continued his work on the systematic survey of the limestone resources of Canada. The general areal survey of important occurrences in Canada has been completed, except for some minor detailed examinations that may be required. Studies of the technology of limestone quarrying, lime burning, and of the industrial uses of limes and limestones are now in progress. Preliminary reports dealing with the limestone resources of each province, except British Columbia, have been published during the progress of the investigation; a report on the lime and limestone industries in British Columbia is in course of preparation.

A. H. A. Robinson was engaged primarily upon the compilation of a report on lode mining for gold ores in Canada. He also has reported on current progress in the mining of ores of base metals in central and eastern Canada. A good deal of Mr. Robinson's time has been devoted to the preparation of reviews of the Canadian Mineral Industry for the technical press.

V. L. Eardley-Wilmot was engaged in the compilation of a report on current progress in the mining of silver-bearing ores in Canada. About four months were spent in visits to mines throughout British Columbia. A considerable part of Mr. Eardley-Wilmot's time in the office has been devoted to work in connexion with investigations of abrasives and the abrasive industry, including the preparation of an annual review for Mineral Industry.

Arthur Buisson, mineral technologist in charge of the Records Section of this division, spent about two months visiting the principal mining centres in northern Ontario, western Quebec, northern Manitoba, and southern British Columbia. This season's work was in continuation of a practice initiated some years ago to procure for the records first-hand information about current developments and local conditions in the various mining districts of the country. Mr. Buisson has prepared for distribution to the press a number of short articles based on this field work.

C. H. Freeman continued his general work of checking the production of sands and gravels for various purposes. Most of his time for field work was spent on the investigation of moulding sand occurrences in Quebec, south of St. Lawrence river, and in Ontario, west of Toronto. About one hundred and twenty-six large-scale samples of sands suitable for use as moulding sands were collected. These samples are now being studied in the laboratories.

E. H. Wait was employed in studying current conditions in the mining industry in the provinces of New Brunswick and Nova Scotia.

John Casey, statistician attached to this division, conducted the third survey of fuels for domestic heating, covering the Maritime Provinces, Quebec,

Ontario, and Manitoba. Information was collected respecting the source of supplies and the quantities consumed of the following sources of heat: coals and cokes, charcoals, briquettes, gases, both natural and artificial, fuel oil, electric energy, and such other fuels as are used for domestic purposes. The survey covered the operations of over 5,600 distributors of domestic-purpose fuels in four hundred and fifty municipalities. Although the survey, as a whole, was conducted by circular letters and correspondence, it was also necessary to follow up written inquiries by personal visits to many distributors.

ORE DRESSING AND METALLURGICAL DIVISION

W. B. Timm, Chief of the Division, reports a 50 per cent increase in the amount of investigative work on ore treatment as compared with the previous year. This large increase in the demand for assistance was due to greater activity in the mining industry and to the confidence of the industry in the usefulness of the work being performed.

Under the direction of W. B. Timm, H. C. Mabee and V. A. Minnes cooperated with the architects of the Department of Public Works on the preparation of plans and specifications for a new building which will contain chemical and physical testing laboratories and provide the very urgently required office space for the staff of the division.

The new pyrometallurgical laboratory building to house the electric smelting furnaces and other equipment required for the operation of the newly organized Iron and Steel Section has been completed and part of the apparatus installed. The preliminary research work on the utilization of low-grade iron ores can now proceed.

CO-OPERATIVE ARRANGEMENTS

The co-operative arrangement entered into with the Base Metal Extraction Company, Limited, a British organization, was continued and further work was done on the treatment of low-grade base metal copper, lead, and zinc ores. The company hope to establish a smelter in eastern Canada for the treatment of such ores. During the year they obtained the Canadian rights on the Waelz process, a method of recovering zinc and lead from smelter residues and from low-grade ores and refractory concentrates. A small test plant was erected in our laboratories and work of a highly important nature was done on the refractory concentrates from the Treadwell-Yukon mine near Sudbury. The results of this work were particularly satisfactory in as much as an economical method for the treatment of the ore was indicated and plans are now being made in anticipation of favourable development at the mine for the erection of a smelter using this process.

The co-operative arrangement with the Cassel Cyanide Company, a branch of the Canadian Industries, Limited, is still existent. The company maintain a research fellow in our laboratories. Advantage is taken of the laboratory equipment to determine the suitability of their various products for the treatment and recovery of metals from Canadian complex ores.

During the year two new co-operative arrangements were made. One with the American Cyanamid Company, Niagara Falls, Ont., under which they placed a flotation research engineer in our laboratories to work, under Mines Branch supervision, on the use of cyanide and special flotation re-agents developed by that company for the selective flotation of Canadian complex ores.

The other new co-operative arrangement was with the Ross-Playfair interests of Montreal, who own the Canadian rights on the Musso sponge iron process for the semi-direct production of steel from iron ores. This Montreal financial group, wishing to try out this process—which may be specially adaptable to Canadian ores—have been granted permission to install in our new

pyrometallurgical laboratory building, at their own expense, a semi-commercial scale unit required to demonstrate the process. The Mines Branch will make available all the facilities of its laboratories and of its metallurgical staff. This investigation of the Musso process will constitute a part of the general Mines Branch investigatory problem of the utilization of Canadian iron ores and the replacement of imported steel scrap for the manufacture of alloy and high-grade steels in Canada. The plant is at present under construction and when in operation, which it is hoped will be by the middle of the summer, will be capable of producing from 4 to 6 tons of sponge iron a day, which will be converted into steels of all grades. These steels will be thoroughly tested by the Mines Branch for quality. The plant at the completion of the demonstration will become the property of the Mines Branch and if the process is successful the investigation will be continued to include iron ores from all parts of Canada.

At the request of Dr. J. Neil Greenwood, Professor of Metallurgy in the University of Melbourne, Melbourne, Australia, Mr. C. B. O'Malley, then recently appointed as lecturer on ore dressing in the university, was granted permission to spend five months, from May to September, in our Ore Dressing Laboratories, where he was enabled to become acquainted with Canadian and American milling practice. Mr. O'Malley at the same time was given an opportunity of studying, and making personal contact with, our Canadian mining industry.

These co-operative arrangements are an evidence of the practical value of the service being rendered the mining industry by the laboratories.

FIELD STUDIES

The policy of allowing the officers to keep in contact with those engaged in the mining industry was continued.

W. B. Timm spent two months in the field securing information on the progress in ore dressing and metallurgical practice and in renewing personal contact. He visited the mining centres of British Columbia and in particular the new developments at Field, where the Base Metal Mining Corporation is operating. He also inspected the new developments of the Sherritt-Gordon and Hudson Bay Mining and Smelting Companies in northern Manitoba.

C. S. Parsons, accompanied by C. B. O'Malley, visited the Coxheath and Stirling mines in Cape Breton, Nova Scotia, and a few of the gold properties. They also made a trip through the mining fields of northern Ontario and Quebec. Mr. Parsons spent one month in Malartic township, Quebec, working on milling problems.

T. W. Hardy visited the iron and steel plants in Ontario and Nova Scotia, securing information regarding certain of their problems in metallurgical practice. He also visited certain steel centres in the United States and discussed with the leading experts in the industry the latest developments in direct reduction of iron ores as applied to the problem of the utilization of the Canadian low-grade iron ores. Mr. Hardy also devoted a large part of his time to assisting the Advisory Tariff Board on matters pertaining to iron and steel products.

R. J. Traill accompanied by W. B. Timm visited the new Tainton electrolytic zinc plant at Kellogg, Idaho, to study the operation of this new process with the object in view of determining its adaptability to Canadian ores and conditions. They also visited the Trail smelter in British Columbia to investigate the new developments of the Consolidated Mining and Smelting Company, particularly in connexion with the recovery of the by-products, such as cadmium and bismuth, from the electrolytic zinc plant. The new process for the recovery of zinc from the lead slags was also studied, and the plans for the production of fertilizer as a means of eliminating the smelter fume problem.

R. A. Rogers, working with L. H. Cole of the Mineral Resources Division, in connexion with a study of the Canadian gypsum and anhydrite industry, visited gypsum plants in West Virginia, Virginia, and Connecticut, U.S.A.

W. B. Timm was appointed to represent the Department of Mines at the Third (Triennial) Empire Mining and Metallurgical Congress being held in South Africa during the months of April and May. He left for England in February to join the Congress.

LABORATORY INVESTIGATIONS

In the Ore Dressing Section for metallic ores, C. S. Parsons in charge, assisted by A. K. Anderson and J. S. Godard, conducted the following investigations:

Gold ore.....	(a) Jackson Manion mine, Woman Lake, Ont.
	(b) British Canadian mine, Mine Centre, Ont.
	(c) McMillan Gold mine, Mongowin tp., Ont.
	(d) Perrier Syndicate, Nelson, B.C.
	(e) Gem Lake mines, Gem lake, east-central Man.
	(f) Sylvanite Mines, Ltd., Kirkland Lake, Ont.
	(g) Evangeline gold mine, Liscomb mill, N.S.
	(h) Belledate-Goudreau mine, Goudreau, Ont.
	(i) St. Anthony mine, Savant Lake, Ont.
	(j) Malartic mine, Fournier tp., Ont.
	(k) Goudreau-Lochalsh district, Ont.
	(l) Granada-Rouyn mine, Rouyn district, Que.
	(m) Beardmore mine, Jellicoe, Ont.
Copper-gold ore.....	(a) Green Stabell mine, Dubuisson, Abitibi, Quebec.
	(b) Central Manitoba mine, Wadhope, Man.
Copper-nickel	(a) Engineers Holding Co., Michipicoten, Ont.
	(b) Falconbridge mine, Sudbury, Ont.
Copper ore.....	(a) Patterson copper mines, Boston Creek, Ont.
	(b) Windsor mine, La Sarre, Que.
	(c) Coxheath mine, N.S.
	(d) McGinn claims, Baldwin, Sudbury, Ont.
	(e) Aldermac mine, Rouyn, Que.
Copper-zinc	(a) Sherritt-Gordon mine, Man.
Copper-lead-barytes	(a) Giant mine, Spillamacheen, B.C.
Copper-lead-zinc ore.....	(a) Errington mine, Bradley, Ont.
Lead-zinc ore.....	(a) Towagamac Exploration Co., Geneva, Ont.
	(b) Haslat Duck Lake mine, Schreiber, Ont.
Lead-silver ore.....	(a) Mallard Lake mine, Kirkland Lake, Ont.
Iron ore.....	(a) Kaministikwia, Ont.
	(b) Bristol mine, Que.
	(c) Mine Centre, Ont.
Silver ore.....	(a) Castle-Trethewey mine, Bestel, Ont.
Tin	(a) Snowflake mine, Albert Canyon, B.C.

In the Ore Dressing Section for non-metallics, R. K. Carnochan in charge, assisted by R. A. Rogers, conducted the following investigations on non-metallic minerals:

Non-metallics—	(a) Asbestos, Ville Marie, Que.
	(b) Silica sands, Guigues tp., Que.
	(c) Mica, Gatineau district, Que.
	(d) Radium, Cardiff tp., Haliburton, Ont.
	(e) Gypsum from various Canadian occurrences.

In the Hydrometallurgical and Electrochemical Section, R. J. Traill in charge, assisted by W. R. McClelland and J. D. Johnston, conducted the following investigations:

- (a) Canadian titaniferous magnetites as a source of iron and vanadium.
- (b) Hydrometallurgical and electrochemical processes for the recovery of zinc from Canadian ores, concentrates, and residues.
- (c) Co-operative investigations with the Base Metal Extraction Company in the treatment of complex lead-zinc-copper ores by the Waelz process.

The Pyrometallurgical (iron and steel) Section, T. W. Hardy in charge, undertook some experimental work in connexion with sponge iron investigation. The installation of the Musso sponge iron and semi-direct steel process plant, already referred to under co-operative arrangements, was in progress under the direction of H. A. McLeod and C. E. Parsons, representing the Ross-Playfair interests.

H. C. Mabee, chief chemist in charge of the chemical laboratories of the division, reports that the number of samples for chemical analysis from the various investigations exceeded those of any previous year by over 50 per cent. B. P. Coyne, R. A. Rogers, and H. L. Beer performed the analytical, and L. Lutes the assay, work.

Mr. Mabee actively co-operated with the Base Metal Extraction Company in the investigation of the Waelz process for the recovery of zinc and lead from complex ores.

FUELS AND FUEL TESTING DIVISION

B. F. Haanel, Chief of Division, reports that the investigational and routine work is continuing to increase rapidly. The installation of small-scale experimental equipment is approaching completion; the pulverized fuel boiler installation is completed and tests on British Columbia coals are under way. With the exception of the semi-commercial by-product coke oven, the installation of large-scale equipment, including the pulverized fuel steam boiler just mentioned, the large gas engine, and the wet and dry coal cleaning equipment, is now complete. The installation of the small-scale pressure experimental hydrogenation laboratory has been completed and the preliminary tests have been begun on samples of Canadian coals. The chemical and physical survey of the Phalen seam in Nova Scotia—field work on which was begun in the summer of 1928—is still under way. Peat manufacturing operations at the Alfred peat plant were terminated in the autumn of 1928, but during the summer of 1929 some 1,500 tons of peat humus was harvested and piled at the railway siding, and several hundred tons of peat fuel and peat humus were sold; during the autumn of 1929 the plant was closed indefinitely.

The technical staff of the division was increased by the appointment of T. E. Warren and E. A. Smith as Research Engineers, the former for full time and the latter for the university vacation period only. R. J. Young was appointed Assistant Chemist.

INVESTIGATIONS AND EXAMINATIONS MADE BY THE CHIEF OF THE DIVISION AND TECHNICAL ENGINEERS

In addition to planning and directing the work of the division, Mr. Haanel attended the regular meetings of the Dominion Fuel Board, and the meeting of the Nova Scotia Advisory Board of Fuel Investigation. He held several conferences with officials of the British Empire Steel Corporation at Montreal, in connexion with the experimental work being carried on by that company in co-operation with the division, on low temperature carbonization. Mr. Haanel also attended the conference held with the British Columbia government relating to the investigation of British Columbia coals, and spent considerable time visiting collieries in Crowsnest pass and on Vancouver island. While in the west he attended the annual meeting of the Canadian Institute of Mining and Metallurgy held at Edmonton, Alberta. Mr. Haanel also attended the annual meeting of the American Society of Heating and Ventilating Engineers, held at Philadelphia; and visited the Todd Shipyards Corporation and the Foster Wheeler Corporation, for the purpose of conferring with those concerns on powdered fuel steam-raising installations for marine purposes. A portion of his time was spent, as previously, in connexion with concluding the work being carried on at Alfred, Ontario, in the manufacture of peat.

R. E. Gilmore, Superintendent of the Fuel Research Laboratories, was occupied chiefly with the details pertaining to moving into the new laboratory building and the installation of equipment therein. In addition to his regular supervisory duties, he assisted in planning the work of the division and in the preparation of the annual report "Investigations of Fuels and Fuel Testing." He made a special report on the outcrop sample of Blacksmith Rapids lignite submitted by the Ontario Department of Mines, and during the year visited collieries in Nova Scotia, Alberta, and British Columbia. He was occupied, also, with the work of both the Canadian and American coal classification committees, and prepared a paper on the status of coal classification in Canada.

E. S. Malloch and C. E. Baltzer, in addition to their routine duties, supervised the setting up and preliminary operation of the pulverized fuel-fired boiler, prior to making a start on the investigation into the amenability of Canadian coals to pulverization and firing in that state under a steam boiler. Ten tests in all were made in this investigation, three of a routine nature and one on each of seven different coals from British Columbia. Mr. Baltzer witnessed a series of burning tests on four different fuels in the boiler plant of Westminster Hospital, London, Ontario, for the purpose of determining the most suitable fuel for use in that institution. This investigation was made at the request of the Department of Pensions and National Health.

R. A. Strong and E. J. Burrough of the Carbonization Section, inspected a series of tests on a 20-ton lot of Nova Scotia coal at the experimental plant of the Illingworth (low temperature) Carbonization Company at Pontypridd, South Wales. Mr. Strong made inspections of gas plants at Halifax and Quebec city in connexion with their applications to come under the provisions of the Domestic Fuel Act, and, assisted by Mr. Burrough, continued the small laboratory scale high and low temperature carbonization survey of Canadian coals. Mr. Strong, also, was a member of the delegation investigating the problems relating to the mining and utilization of coal in the western provinces.

A. A. Swinnerton and G. P. Connell continued laboratory work pertaining to oil-shales and bituminous sands. Mr. Swinnerton conducted further oil-shale field work in Pictou area, Nova Scotia, and visited oil-shale retorting operations at Rosevale, New Brunswick, and New Glasgow, Nova Scotia. He also visited the experimental oil-shale plant of the U.S. Bureau of Mines at Rulison, Colorado, and made a departmental report on the experiments and operations there. Mr. Connell's services were utilized in connexion with bituminous sands paving operations by the Canadian National railways at Jasper park, Alberta. Messrs. Swinnerton and Connell also assisted in the analyses survey of Canadian crude petroleum oils.

P. V. Rosewarne and H. M. Chantler did the field and laboratory work of the Oils and Natural Gas Section. Mr. Rosewarne, assisted by R. J. Offord, conducted an analyses survey for hydrocarbon and helium content of natural gases from different parts of the country, with special reference to Turner Valley field in Alberta. In this work the proffered laboratory facilities of the Institute of Technology in Calgary were used for setting up and operating a special gas analysis apparatus, and the hearty co-operation of the officials of the Institute, of the Dominion Department of the Interior (Office of Supervisory Mining Engineer) in Calgary, as well as the operators in Turner Valley field is herewith acknowledged. A co-operative arrangement was entered into by the Mines Branch with the Alberta Government "Committee on Inquiry into Fuel and Lubricating Oils," of which Major H. G. L. Strange is chairman, under which an analysis survey of motor fuels used in Alberta was initiated under the supervision of Mr. Rosewarne. Check work was also undertaken for this committee on lubricating oil analysis and Mr. Rosewarne's services as a consultant placed at their disposal. Mr. Chantler accompanied Mr. Rosewarne on a visit to oil refineries and producing fields in western Ontario and studied

the analyses of crude oils as part of a crude oil survey. Mr. Rosewarne also visited crude oil producing and refining operations in Oklahoma, including the Experiment Station of the U.S. Bureau of Mines at Bartlesville, and the Bureau's experimental helium plant at Amarillo, Texas.

J. H. H. Nicolls and C. B. Mohr were mostly occupied in the analytical work of the Solid Fuels Analyses Section; the former examined the indexing and compiling of the results pertaining to the Canadian coals and other solid fuels, and the latter took immediate charge of the proximate analyses and calorific value work according to standard laboratory procedure. Mr. Nicolls, with the assistance of E. Swartzman, investigated certain methods of analysis requiring revision, conducted further coking index experiments, and continued his coal classification studies with special reference to Canadian coals.

T. E. Warren and E. A. Smith conducted special laboratory investigations on hydrogenation and low temperature carbonization, respectively. Mr. Warren was specially occupied with the setting up and preliminary operation of a high pressure bomb and accessory equipment, and Mr. Smith conducted a series of test runs on Canadian coals and peat according to different standard low temperature carbonization methods, with the development of a non-expensive standard laboratory method in view.

Chemical Laboratory Work

The routine chemical laboratory work was conducted in two sections, namely, the Solid Fuels Analyses Section and the Oils and Natural Gas Section.

The services of R. J. Young as Assistant Chemist were concerned mainly with gas analysis work pertaining to tests in the pulverized fuel fired experimental boiler, and to carbonization and retorting tests on coals and oil-shales.

During the year a total of 1,165 samples of solid, liquid, and gaseous fuels were examined. Of these 769, that is, approximately 68 per cent, pertained to investigations conducted within the division, whereas the remaining 32 per cent originated outside the division. Of the total samples submitted from outside, 43 were from other divisions of the Mines Branch, 102 from the Geological Survey, 88 from the Department of Pensions and National Health, 69 from provincial government departments, and 94 from public institutions, commercial firms, and private individuals. The following is a classification of the various kinds of fuels analysed:

Solid fuels; total samples examined		754
Coals (various kinds)	681	
Cokes and chars	41	
Peat and miscellaneous	32	
Liquid fuels; total samples examined		200
Gasoline	96	
Lubricating oils	27	
Crude oils	64	
Other petroleum, oils, and miscellaneous	13	
Gases from coals, oil-shales, etc.		91
Oil-shales		36
Bituminous sands		42
Natural gas		42
Total		1,165

CERAMICS AND ROAD MATERIALS DIVISION

Howells Fréchette, Chief of the Division, reports continued increase in calls of clay products manufacturers for technical assistance in the utilization of Canadian clays and in the various steps of processing.

During the year increased kiln capacity was required. This was furnished by the building of a second down-draught gas kiln capable of developing a temperature of about 1,500 degrees C.

The usual annual report on "Investigations in Ceramics and Road Materials" was not issued for the year 1928. The material that would have appeared in this will be incorporated into a report covering the two years 1928 and 1929. The report in manuscript on the road materials investigation of Prince Edward Island for 1928 was transmitted as soon as it was completed to the Minister of Public Works of Prince Edward Island, and other information was made available to interested persons, so that very little inconvenience has been occasioned by delaying the printing of the report on the work of the year.

CERAMICS

As was mentioned in last year's report, the investigation on the treatment of tender-drying clays of the Prairie Provinces to overcome drying defects was extended to include clays from other parts of the Dominion. Following the very successful results obtained in correcting drying defects in the manufacture of brick at a plant in Alberta, a request for assistance in relieving serious troubles experienced in the drying of structural hollow tile was received from the Montreal Terra Cotta Company. Although the general cause of the trouble at this plant was found to be similar to that at the Alberta plant, the character of the two clays differed in several respects and local factors had to be considered, therefore this case was attacked as a separate problem. Chemical treatment of the clay was again found to be effective and well within the limits of economic cost. Following laboratory investigation by J. G. Phillips, plant trials, using sodium chloride as a coagulant, were run, and gave satisfactory results. A definite treatment was formulated and was at once adopted as regular plant procedure. This resulted in shortening the drying time, greatly reducing drying breakage, increasing the production capacity of the plant, and improving the quality of the ware.

During the summer further work was done by Mr. Phillips on the pre-heating of clays to improve their drying properties. Several trial runs were made with a small rotary kiln at a brick plant in Alberta to learn the effect of bulk treatment.

Continued work by L. P. Collin is in progress on the compounding of ceramic bodies for electrical heating devices. In the early part of this investigation caustic magnesia was used in the mixtures and was found to reduce the plasticity and the green-bond strength of the ball clay to a marked degree and to cause the firing shrinkage of the bodies to be unduly high. The substitution of dead-burned magnesite for the caustic magnesia is now being tried out. Improvement has been noted in the working properties of the mixtures. Burning trials are to be made in the near future to determine whether the shrinkage will be decreased, and the effects of the substitution on the physical properties of the finished product.

A large part of Mr. Collin's time has been devoted to the investigation for the production of grey brick. Experiments were made in the laboratory to find a suitable grey slip which could be sprayed on the faces of the brick. Satisfactory results were obtained, but tests made at the Citadel Brick Company's plant at Boischatel, Que., gave results quite different from those obtained in the laboratory. After trials with many mixture adjustments good grey colours were obtained, but the degree of vitrification was not thoroughly satisfactory and further adjustment of fluxes will be necessary.

Mr. Collin conducted an investigation on the bonding strength of ball clays in the green state. It had been found that the tentative standard test for transverse strength as adopted by the American Ceramic Society was unsuitable for the western Canada ball clays. Transverse tests were made on nineteen Canadian, four English, and seven United States ball clays in accordance with

the tentative standard method and also with a different method to demonstrate the unsuitability of the tentative method and to show the more correct results obtainable by this second method.

At the beginning of a general investigation of the fireclay resources and refractories industry of Canada, J. F. McMahon spent two and one-half months in Nova Scotia and New Brunswick, gathering samples and data. Incidental to this work in the Maritime Provinces he sampled a number of clay deposits and studied local conditions with a view to reporting upon the opportunities offered for the establishment of a floor and roofing-tile industry close to tide-water. The testing of these samples has revealed some very satisfactory raw material.

At the request of the Turner Valley Waste Gas Committee, an investigation was undertaken of the clay resources of Turner valley and adjacent territory to determine the character of the clays that might constitute sources of supply of raw material for possible clay-working industries that could utilize the available natural gas for fuel. Professor W. G. Worcester, of the University of Saskatchewan, was engaged to carry out this investigation and has submitted a report to the committee. Eighty-two samples were collected and were later subjected to standard tests.

During the year one hundred and nine samples of clays and shales were tested. Tests were made on three samples of bentonitic material, five samples of mineral pigment, two samples of volcanic ash, one sample of pyrophyllite, and one sample of sericite. Determinations of strength were made on three samples of brick and tile.

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

ROAD MATERIALS

R. H. Picher made a survey of the road gravel resources and collected samples for testing in the area lying between Waltham and Quebec to the north of Ottawa and St. Lawrence rivers, and also in a portion of the Eastern Townships of Quebec.

In addition to the testing of one hundred and forty-seven samples gathered in the field, seven samples were tested for the Highway Department of Nova Scotia and eight from other sources.

Several samples of gumbo soils were obtained from Alberta and were subjected to a series of experiments by Mr. Phillips to learn whether chemical treatment with coagulants would so alter their characteristics as to materially improve them as road building materials. In many sections in the Prairie Provinces where stone and gravel cannot be obtained locally, the roads made on the gumbo soils are almost impassable in wet weather due to the stickiness of this material and the rutting due to its inability to carry loads when wet.

Treatment with lime in the laboratory was found to improve it greatly but whether the improvement is sufficient to warrant the cost can be determined only by the treatment of trial stretches on travelled roads. A decision has not yet been reached whether this will be undertaken.

CHEMISTRY DIVISION

F. G. Wait, Chief of Division, reports:

From April 1, 1929, to March 31, 1930, fifteen hundred and sixty-five specimens have been reported on.

The work of the different members of the chemical staff has been as follows:

H. A. Leverin investigated a new process for manufacturing peat fuel. He collected data regarding the development of the sponge iron process in Europe, through correspondence with investigators and translation of publications. He made a number of analyses of minerals—including a number of brines and rock salts.

E. A. Thompson made complete analyses of thirty samples of feldspar. Several others were analysed for potash content only. He also made complete analyses of two samples of water and of several samples of limestones, of dolomites, of clay, and of diatomite, as well as of several samples of miscellaneous materials. He also made microscopic examinations of several minerals and made a large number of mineral identifications.

A. Sadler had charge of the furnace assays. He tested seven samples for radioactivity, and examined six samples of earth as to their suitability for use as fullers' earth. He made complete analysis of twenty-seven sands, fourteen clays, and partial analysis of a large number of specimens.

J. Moran's principal work has been the analysis of the air sampled in the coal mines of western Canada. One hundred and eighty-six such samples have been analysed and reported. He designed and constructed a special apparatus for the analysis of natural gas samples and also one for the determination of small quantities of carbon monoxide. He has also carried out experiments to determine the efficiency of new re-agents for the estimation of carbon monoxide. An investigation was made into the nature of the electric charge on various insecticides and field experiments bearing on the same carried out in conjunction with the Department of Agriculture. He also made partial analyses of several limestones.

C. L. O'Brian analysed a large number of limestones and dolomites collected by officers of the Mineral Resources Division and of the Geological Survey.

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

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

The report of the Assay Office for the calendar year ending December 31, 1929, shows the net value of gold bullion deposited during the year amounted to \$1,032,128.51, as compared with \$1,673,926.65 during the previous year.

The value of gold bullion deposited from British Columbia sources was \$853,409.12, being a decrease of \$65,308.94.

Gold bullion from Yukon territory amounted to \$120,825.77, a decrease of \$572,939.63 from the previous year. This decrease is due to gold from Yukon territory, which formerly was marketed at this office, being shipped during the season just ended to the United States in order to benefit by the premium on United States funds, which prevailed practically throughout the year.

Deposits at this office from all other sources totalled in value \$57,893.62, a decrease over the previous year of \$3,549.57.

The purchase and disposal of the gold bullion deposits during the year 1929 required a total of 1,348 meltings and 1,348 assays, quadruplicate assays being made in each instance. This includes the melting into large bars of the smaller deposits after purchase and of the assaying of same before shipment.

The aggregate weight of all deposits before melting was 69,985.84 troy ounces, and after melting 61,279.85 troy ounces, included in which were ninety deposits containing a large proportion of lead requiring to be cupelled in a large muffle furnace. The total weight of these deposits before melting was 28,523.59 troy ounces and after melting and cupelling 21,645.40 troy ounces, showing a loss by melting and cupellation of 24.114 per cent. The average loss in melting all other bullion deposited, viz., 41,462.25 troy ounces before melting and 39,634.45 troy ounces after melting, was 4.408 per cent.

The loss in weight by assaying (base and parted silver) was 30.28 troy ounces, making the weight of bullion after melting and assaying 61,240.57 troy ounces, the average fineness of same being 814 $\frac{3}{4}$ gold and 113 silver.

The net value of the gold and silver contained in deposits was \$1,032,128.51, and was received from the following sources:

Bars, nuggets, dust, and amalgam	Number of deposits	Before melting and assaying (troy ounces)	After melting and assaying (troy ounces)	Net value
British Columbia.....	429	54,844.08	46,932.21	\$ 853,409 12
Yukon territory.....	154	7,970.97	7,877.84	120,825 77
Alaska.....	1	31.71	31.36	572 70
Washington.....				
Alberta.....	2	7.09	6.11	112 46
California.....	1	162.59	162.57	2,723 52
Dental and jewellery scrap.....	705	6,969.40	6,239.48	54,484 94
	1,292	69,985.84	61,249.57	\$1,032,128 51

DRAUGHTING DIVISION

H. E. Baine, Chief Draughtsman, reports:

Maps Published During the Fiscal Year Ending March 31, 1930

- Map No. 703. Principal Amber Mica Mines and Occurrences in the Province of Quebec; scale, 3.95 miles to 1 inch.
- Map No. 704. Principal Amber Mica Mines and Occurrences in the Province of Ontario; scale, 3.95 miles to 1 inch.
- Map No. 715. Gypsum Occurrences in Canada.
- Map No. 717. Saline Springs and Salt Areas in Canada.
- Map No. 718. Michigan-Ontario Salt Basin.
- Map No. 709. Asbestos Region, Quebec (not published).

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

Five hundred and twenty-two negatives, black and white and blue prints were made from the blue-print machine.

Twelve hundred and thirty-nine negatives, and black and white prints were made from the photostat machine.

Two hundred and twenty-five halftone blocks and zinc cuts were sent out, received, and filed during the year.

DISTRIBUTION OF PUBLICATIONS

During the fiscal year ending March 31, 1930, the distribution of Mines Branch reports, bulletins, memorandum series, press bulletins, maps, list of mine operators, etc., amounted to 40,392 copies.

LIBRARY

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

Accessions to the Library, 1929

Books (by purchase)	314
Books (by gift)	116
Books (by transfer from other Government libraries)	109
Books (complete unbound volumes)	293
Books added to the circulating division of Library	819
Canadian Government documents (by exchange and gift)	1,840
British and Foreign Government documents (by exchange and gift)	1,105
Scientific societies bulletins, proceedings, and transactions (by exchange and gift)	1,344
Trades catalogues (by gift)	271

Thirty-seven bound volumes and three hundred and ninety-eight unbound volumes and pamphlets were received as a gift from the Library of the late J. G. S. Hudson.

Nine hundred and sixteen books were bound for the Library during the year.

Additional shelving was installed and further re-adjustments were made to accommodate the annual increase, which has this year exceeded the increase of any previous year.

EXPLOSIVES DIVISION

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

Staff

The division suffered the loss, by death, of Mr. Joseph G. S. Hudson, who had served as Inspector of Explosives since its inception in 1919. Keenly interested in its operation, the value of his work was enhanced by a personality which, in the task of introducing new regulations, did much to enlist the goodwill and co-operation of those affected thereby.

He was succeeded by Mr. M. C. Fletcher, formerly chemist in the division.

Factories

The Mexco Company's factory at Parry Sound was finally closed at the end of 1929, and the small firework factory of Dominico Ruffo at Cornwall, Ontario, did not resume operations.

The production of explosives for the year 1929 showed an increase of about 12½ per cent.

No serious accident occurred in licensed factories during the year ending March 31, 1930. An employee of the Macdonald Metal Products Company caused the explosion of a small quantity of dried composition on a stamp plate, as used in transferring drops of composition on to a sheet in the manufacture of caps for toy pistols, which he was improperly cleaning with a nail. The burns he received entailed seven days' absence from work.

The spontaneous ignition of carbonaceous material in a soda dry house in the factory at James Island, B.C., resulted in damage to the building, but only in very minor burns to an employee.

A small fire, quickly extinguished, in a building used for the manufacture of railway fuses at Brownsburg, the spontaneous combustion of an oily rag in an empty can in a 'dope' house (for non-explosive ingredients), and the ignition of woodwork in a nitric acid house, caused by the passage of nitro cake down a chute, did not cause damage of any consequence.

Magazines

There were 288 magazines under licence on March 31, 1930, and 231 licences for temporary magazines had been issued during the year—in all, an increase of 47 over the number for the previous year. Thefts of explosives, aggregating 289 pounds of high explosives and 1,000 detonators, were reported from five magazines that had been forcibly entered. There is also to record an unsuccessful attempt on a magazine, and the recovery of eleven pounds of dynamite stolen from another.

Explosives Condemned

High explosives, 1,906 pounds, black blasting powder, 150 pounds, distributed over twenty-one magazines or unlicensed premises, were condemned on inspection and destroyed.

In addition, there were several instances of the finding of small quantities of explosives cached in the bush, or left and forgotten elsewhere, which were destroyed. In some cases, these were found by the Royal Canadian Mounted Police, in others, reported to the police by the finders, and it is a hopeful sign that, in a few instances, the finders were children who wisely did not themselves tamper with the explosives.

Prosecutions

Of the two undecided cases referred to in the last report, one, relating to the unlawful keeping of explosives in unlicensed premises, resulted in a conviction, a fine being imposed; and the other, relating to the keeping of explosives found in a disused quarry, was dismissed on appeal, responsibility not being established as against the defendant. Proceedings were taken in seven other cases, and convictions obtained.

In one case the offence lay in having a larger quantity of explosives in a magazine than was prescribed by the licence. The other six cases referred to violations of the regulations by work parties or private users of explosives. They were all instances of negligent keeping of explosives, under conditions such as to invite accidents or to facilitate pilfering.

Importations

Six hundred and three permits and forty-three special permits, for the importation of explosives, were issued during the year. No difficulty is experienced in regard to the importations of explosives other than fireworks. The great variety of fireworks on the market necessitates careful checking of those varieties it is proposed to import, to ensure that they have been authorized, but, after this precaution, it is seldom that any from the United States or Europe have to be refused admission at port of entry. In the case of Chinese fireworks, the rejections, which in the past have been very considerable, show a marked reduction, amounting during the year to about 2 per cent.

Authorization of Explosives

Samples of twenty-three explosives were examined and authorized. Eighty-five varieties of fireworks were also submitted, of which sixty were authorized.

Accidents

A summary of accidents with explosives, which occurred during the year 1929, is given in the annual report for the division. Accidents in the use of explosives, and from other miscellaneous causes, such as playing with explosives, accounted for the death of sixty-five persons and injury to two hundred and one others—a slight increase over the figures for the previous year, respectively sixty-four and one hundred and ninety-two. The consumption of explosives had increased in a greater degree. The accidents arising from playing with detonators and other explosives accounted for two deaths and fifty-one persons injured, as compared with seven deaths and eighty injured in the preceding year—an improvement which gives ground for the hope that the warnings given to children in schools, and the constant activity of the Royal Canadian Mounted Police in checking careless practice in the keeping of explosives, are materially helping towards the prevention of this class of accident.

General

The inspections of stores and other places where small quantities of explosives are kept, have not shown other than minor irregularities, readily rectified in the case of regular dealers. Instances of more serious irregularities and general carelessness are met with in regard to explosives kept by private users, or for use in small contract work. Some of these resulted in prosecutions, as already indicated. Inspectors of the division made 679 inspections of unlicensed premises, and about 2,400 were made by members of the Royal Canadian Mounted Police whose watchfulness, in all parts of the Dominion, brings a steady insistence on the observance of good and lawful practice in the keeping of explosives.

EDITORIAL DIVISION

F. Nicolas, Editor-in-Chief

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

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

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 distributed¹ during that period:

DEPARTMENT OF MINES

Report
No.

English Publications

- 2217 *Report of the Department of Mines for the Fiscal Year ending March 31, 1929*: 58 pages; 1 figure; 3,000 copies; published February 1, 1930.

French Translations

- 2203 *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars, 1928*: 67 pages; 1 plate; 1 figure; 1,250 copies; published November 12, 1929.
2231 *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars, 1929*: 62 pages; 1 figure; 1,250 copies; published March 31, 1930.

GEOLOGICAL SURVEY

English Publications

- Information for Officers of the Geological Survey and National Museum*: 34 pages; 3 figures; 500 copies; published April 4, 1929.
2176 *Memoir 155. Horton-Windsor District, N.S.*—by W. A. Bell: 268 pages; 36 plates; 14 figures; 1 map; 2,500 copies; published November 9, 1929.
2181 *Memoir 156. Gold Fields of Nova Scotia*—by Wyatt Malcolm: 253 pages; 40 plates; 10 figures; 4 maps; 1,500 copies; published September 27, 1929.
2191 *Memoir 157. Preliminary Report on Woman and Ridout Map-areas, Sudbury District, Ont.*—by R. C. Emmons and Ellis Thomson: 30 pages; 2 maps; 2,500 copies; published August 16, 1929.
2193 *Memoir 158. Britannia Beach Map-area, B.C.*—by H. T. James: 139 pages; 4 plates; 12 figures; 2 maps; 2,500 copies; published October 8, 1929.
2197 *Memoir 159. Bear River and Stewart Map-areas, Cassiar District, B.C.*—by George Hanson: 84 pages; 5 plates; 14 figures; 2 maps; 2,500 copies; published October 29, 1929.
2202 *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1928, Part A*: 210 pages; 4 plates; 11 figures; 4 maps; 3,000 copies; published October 10, 1929.
2206 *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1928, Part B*: 131 pages; 5 plates; 2 figures; 1 map; 3,000 copies; published October 7, 1929.

French Translations

- 2188 *Série de la Géologie appliquée n° 1. Géologie et Minéraux industriels du Canada*—by G. A. Young: 276 pages; 38 plates; 1,450 copies; published February 11, 1930.

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

- 2201 *Rapport sommaire de la Commission géologique, Ministère des Mines, pour l'année civile 1927, Partie C* (extraits): 54 pages; 2 maps; 1,250 copies; published November 30, 1929.

NATIONAL MUSEUM OF CANADA

English Publications

- Bulletin 47. Anthropological Series 9. *Some Shell Heaps in Nova Scotia*—by H. I. Smith and W. J. Wintemberg: 192 pages; 32 plates; 1 figure; 1,000 copies; published October 24, 1929.
- Bulletin 53. Biological Series 15. *A Faunal Investigation of Southern Baffin Island*—by J. D. Soper: 143 pages; 7 plates; 1 figure; 1,000 copies; published April 24, 1929.
- Bulletin 54. Geological Series 49. *Contributions to Canadian Palaeontology*—by F. H. McLearn and C. M. Sternberg: 80 pages; 22 plates; 1,000 copies; published September 5, 1929.
- Bulletin 55. Biological Series 16. *A Generic Revision of North American Agrotid Moths*—by J. H. McDunnough: 78 pages; 53 figures; 1,000 copies; published April 23, 1929.
- Bulletin 56. *Annual Report for 1927*: 107 pages; 2 plates; 3,500 copies; published October 11, 1929.
- Separate: *Notes on the Beothuk Indians of Newfoundland*—by D. Jenness: 3 pages; 2 plates; 100 copies; published November 4, 1929.
- Separate: *Preliminary Report on Field Work in 1927*—by W. J. Wintemberg: 2 pages; 100 copies; published October 22, 1929.
- Separate: *Kitchen-Middens of the Pacific Coast of Canada*—by H. I. Smith: 5 pages; 100 copies; published November 4, 1929.
- Separate: *Materia Medica of the Bella Coola and Neighbouring Tribes of British Columbia*—by H. I. Smith: 22 pages; 100 copies; published November 4, 1929.
- Separate: *Birds and Mammals of the Mount Logan Expedition, 1925*—by H. M. Laing, R. M. Anderson, and P. A. Taverner: 39 pages; 100 copies; published November 8, 1929.
- Bulletin 57. *A Transverse Polyconic Projection for General Maps of Canada*—by C. O. Senecal: 17 pages; 3 figures; 2,000 copies; published August 17, 1929.
- Bulletin 58. Geological Series 50. *Mesozoic Palaeontology of Blairmore Region, Alberta*—by S. S. Buckman, E. W. Berry, and F. H. McLearn: 144 pages; 19 plates; 1 figure; 1,000 copies; published October 28, 1929.
- Bulletin 59. Anthropological Series 13. *Anthropometry of the Cree and Saulteaux Indians in Northeastern Manitoba*—by J. C. Boileau Grant: 73 pages; 5 plates; 4 figures; 1,000 copies; published October 25, 1929.
- Bulletin 62. *Annual Report for 1928*: 37 pages; 1 figure; 2,500 copies; published December 26, 1929.
- Separate: *A study of the Canadian Races of Rock Ptarmigan (*Lagopus rupestris*)*—by P. A. Taverner: 10 pages; 300 copies; published December 28, 1929.

French Translations

- Bulletin 50. *Rapport annuel 1926* (extraits): 76 pages; 10 plates; 1 figure; 1,250 copies; published March 21, 1930.

MINES BRANCH

English Publications

Report
No.

- 695 *Investigations in Ore Dressing and Metallurgy, 1927*: 186 pages; 6 plates; 1 figure; 4,000 copies; published June 26, 1929.
- 696 *Investigations of Fuels and Fuel Testing, 1927*: 107 pages; 10 plates; 9 figures; 4,000 copies, published November 26, 1929.
- Separate: Part I—*Solid Fuels*: 70 pages; 10 plates; 3 figures; 500 copies; published September 18, 1929.
- Separate: Part II—*Liquid Fuels*: 37 pages; 6 figures; 500 copies; published September 18, 1929.
- 697 *Investigations in Ceramics and Road Materials, 1927*: 80 pages; 3,500 copies; published October 2, 1929.
- Separate: *The Testing of Non-Bituminous Road Materials*—by R. H. Picher: 13 pages; 1,000 copies; published November 7, 1929.
- 698 *Industrial Fuel and Power Statistics of Ontario, 1925*—by E. S. Malloch and C. E. Baltzer: 23 pages; 12 figures; 4,000 copies; published April 19, 1929.
- 701 *Mica*—by H. S. Spence: 142 pages; 21 plates; 10 figures; 2 maps; 1 chart; 4,000 copies; published March 3, 1930.

- 705 *Comparative Tests on Various Fuels when Burned in a Domestic Hot-Water Boiler*—by E. S. Malloch and C. E. Baltzer: 92 pages; 5 plates; 6 figures; 6 charts; 4,000 copies; published September 23, 1929.
- Core Drilling Bituminous Sands of Northern Alberta*—by S. C. Ellis. (Advance section of *Investigations of Mineral Resources and the Mining Industry, 1928*): 26 pages; 4 plates; 1 figure; 500 copies; published August 12, 1929.

Lists of Mines and Mine Operators in Canada:

- Coal: 2,000 copies; published April 25, 1929.
- Manufacturers of Clay Products: 1,000 copies; published April 25, 1929.
- Stone Quarry Operators: 1,000 copies; published April 25, 1929.
- Silver: 1,000 copies; published June 29, 1929.
- Graphite: 1,000 copies; published July 9, 1929.
- Sand and Gravel Deposits: 1,500 copies; published July 17, 1929.
- Copper, Copper-Zinc, and Nickel-Copper: 1,000 copies; published August 8, 1929.
- Sand-Lime Brick Plants: 1,000 copies; published August 9, 1929.
- Mica: 1,000 copies; published August 14, 1929.
- Gypsum: 1,000 copies; published August 15, 1929.
- Feldspar: 1,000 copies; published August 15, 1929.
- Magnesium Sulphate (Epsomite), etc.: 1,000 copies; published August 19, 1929.
- Abrasives: 1,000 copies; published August 23, 1929.
- Silver-Lead-Zinc: 1,000 copies; published August 29, 1929.
- Milling Plants: 1,000 copies; published September 7, 1929.
- Metallurgical Works: 1,000 copies; published September 9, 1929.
- Natural Gas and Petroleum Wells: 1,500 copies; published October 11, 1929.
- Gold: 1,000 copies; published November 15, 1929.

DOMINION FUEL BOARD

Report
No.

English Publications

- 8 *Why You Should Insulate Your Home* (Third edition)—by G. D. Mallory: 15 pages; 7 drawings; 25,000 copies; published May 27, 1929.
- 12 *Humidity in House Heating*—by E. S. Martindale: 38 pages; 13 drawings; 26,200 copies; published October 17, 1929.
- Reprint: 50,000 copies; published March 14, 1930.
- 14 *Comparison of the Cost and Convenience of House Heating with Various Fuels*—by E. S. Malloch: 8 pages; 1 figure; 5,000 copies; published September 30, 1929.

French Translations

- 11 *Deuxième rapport des travaux de la Commission fédérale du Combustible, 1923-1928*: 60 pages; 5 plates; 1 figure; 5,000 copies; published June 18, 1929.
- 13 *L'humidité dans les maisons chauffées*—by E. S. Martindale: 40 pages; 13 figures; 5,000 copies; published March 12, 1930.

EXPLOSIVES DIVISION

English Publications

- 25 *Annual Report of the Explosives Division for the Calendar Year 1928*: 19 pages; 2,000 copies; published May 8, 1929.

French Translations

- 26 *Rapport annuel de la Division des Explosifs pour l'année civile 1928*: 20 pages; 1,000 copies; published September 26, 1929.

DISTRIBUTION OF FRENCH PUBLICATIONS

The French publications of the Department of Mines, including those of the Geological Survey, the Mines Branch, and the Explosives Division, are distributed by the Editorial Division. During the fiscal year 1929-30, 8,619 copies were distributed in Canada and foreign countries, as follows: 4,274 copies to addresses on the mailing lists, through the Printing Bureau Distribution Office, and 4,345 copies in compliance with written or personal requests, from the office of the Editorial Division. 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

ACCOUNTANT'S STATEMENT

P. R. Marshall

The funds available for the work and expenditure of the Department of Mines for the fiscal year ending March 31, 1930, were:

	Grant	Expenditure	
		Amount	Total
	\$ cts.	\$ cts.	\$ cts.
DEPARTMENT—			
Amount voted by Parliament.....	118,329 00		
Civil Government salaries.....		71,541 61	
Grant to Imperial Institute.....		12,848 00	
Civil Government contingencies.....		11,918 84	
Expenses of the Explosives Division.....		9,607 08	
Grant to Canadian Institute of Mining and Metallurgy.....		3,000 00	
Miscellaneous gratuities.....		570 00	
Balance unexpended and lapsed.....			109,485 53
			8,843 47
GEOLOGICAL SURVEY—			
Amounts voted by Parliament.....	705,325 00		
Civil Government salaries.....		307,563 34	
Explorations, surveys, and investigations.....		199,600 29	
Wages.....		77,587 59	
Publication of reports and maps.....		42,482 76	
Museum equipment.....		14,587 26	
Sundry printing and stationery.....		12,433 49	
Instruments and repairs.....		6,349 90	
Library.....		5,796 90	
Mineralogical Division.....		4,699 63	
Specimens for Museum.....		3,000 00	
Miscellaneous.....		2,293 47	
Advertising.....		1,336 12	
Postages, telegrams, and telephones.....		1,140 28	
Photographic supplies.....		981 46	
Balance unexpended and lapsed.....			679,902 49
			25,422 51
MINES BRANCH—			
Amounts voted by Parliament.....	826,610 00		
Civil Government salaries.....		200,476 34	
Wages.....		153,198 21	
Expenses of ore dressing and metallurgical laboratories.....		61,821 16	
Subvention on Canadian coals.....		55,693 90	
Investigation of mineral resources and deposits.....		50,371 22	
Expenses of fuel testing plant and laboratory.....		30,304 36	
Printing and stationery.....		28,728 18	
Expenses of Dominion Fuel Board.....		8,230 51	
Operation of peat plant, Alfred, Ont.....		4,258 18	
Miscellaneous.....		2,899 83	
Chemical laboratory.....		2,117 39	
Compensation to J. H. Fortune.....		400 00	
Transportation charges on ore shipments.....		214 54	
Advances to be accounted for in 1930-31.....		2,899 57	
Balance unexpended and lapsed.....			601,613 39
			224,996 61
DOMINION OF CANADA ASSAY OFFICE—			
Amount voted by Parliament.....	27,140 00		
Earnings.....	46 50		
Salaries of staff.....		20,130 00	
Assayers supplies.....		995 06	
Miscellaneous.....		763 98	
Premium on bonds.....		462 50	
Electric burglar alarm service.....		360 00	
Balance unexpended and lapsed.....			22,711 54
			4,474 96
	1,677,450 50		1,677,450 50

DEPARTMENT OF MINES

Summary

	Grant	Expenditure	Grant not used
	\$ cts.	\$ cts.	\$ cts.
Civil Government salaries.....	633,445 00	579,581 29	53,863 71
Department.....	39,849 00	37,373 92	2,475 08
Geological Survey.....	373,000 00	372,339 15	660 85
Mines Branch.....	603,400 00	401,137 05	202,262 95
Dominion of Canada Assay Office.....	\$ 27,140 00		
	46 50		
	27,186 50	22,711 54	4,474 96
Miscellaneous gratuities.....	570 00	570 00	
	1,677,450 50	1,413,712 95	263,737 55

Casual Revenue

Sales of equipment, explosives permits, publications, etc.....	\$ 5,273 20
Sales of peat.....	4,214 09
Profit on gold bullion.....	1,295 63
Miscellaneous.....	608 69
	\$11,391 61

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