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DOMINION OF CANADA

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE

FISCAL YEAR ENDING MARCH 31, 1936

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REPORT

OF THE

DEPARTMENT OF MINES

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*To His Excellency the Right Honourable Baron Tweedsmuir of Elsfield,
G.C.M.G., C.H., 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, 1936.

T. A. CRERAR,
Minister of Mines.

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REPORT
OF THE
DEPARTMENT OF MINES

FOR THE FISCAL YEAR ENDING MARCH 31, 1936

To the Hon. T. A. CREEAR, M.P.,
Minister of Mines,
Ottawa.

SIR,—In accordance with the requirements of Parliament, I have the honour to submit the Annual Report of the Department of Mines for the fiscal year ending March 31, 1936.

Mining continued to hold a pre-eminent position among Canadian industries during the year, with public interest directed upon it by reason of its fine record of progress and its many outstanding achievements.

By virtually equalling its 1929 peak record the industry again gave evidence of its vigorous and stimulating leadership. The impressive gains recorded in the value of base metal exports; the increase in the value of gold production; and the less notable, but significant headway made by the non-metallic group of minerals, demonstrate the widespread nature of the improvement. With practically every branch of the industry reporting notable gains in the first quarter of 1936, the outlook at the close of the fiscal year appeared particularly bright.

The record of the gold industry was noteworthy, a significant feature being the remarkable degree of success that attended a re-survey of old properties and of older areas in the search for new sources of gold. The long-established producers are soundly entrenched in respect to ore reserves; the younger producers in most cases are exceeding all early expectations; and a well-maintained price for gold is serving to accelerate the search for the metal. Having full regard for the many factors involved, the outlook for the gold mines is most encouraging. It should be borne in mind, of course, that as industrial conditions continue to improve there is a slow but steady rise in the prices of commodities and services, which tends to offset the advantages gained by the rise in the gold price. Counteracting this tendency are the lower production costs obtained as a result of greater efficiencies in mine and mill operations.

Higher average prices for the metals copper, lead, and zinc played an important part in the increased value of exports of the base metals, and as production of the metals set a new record, there was a decided improvement in the earnings of the producing companies. Early in the fiscal year there were hopes that exploratory work would be actively resumed. These hopes did not materialize, but business sentiment was undoubtedly becoming more favourable to the renewal of such operations.

The decline of more than 100,000 tons in the world copper inventory during the year and the improved statistical positions of lead and zinc are favourable omens in respect to the base metal outlook. A disturbing factor is the politico-economic tension that exists, principally in European and Asiatic countries. Available reports from the principal countries importing Canadian base metals strongly indicate, however, that industrial conditions are continuing to improve, and this should eventually make itself felt in metal prices. Predictions that the price of copper will reach 10 cents a pound before the close of 1936 appear reasonable in view of the month-to-month decline in the stocks of the metal on

hand. For the same reason some improvement may be expected in the price of lead, but the zinc situation, unfortunately, is not so favourable.

Decidedly encouraging were the gains recorded in the outputs of the principal non-metallic minerals during the last quarter of the fiscal year. Particularly is this true of asbestos, clay products, and cement, three minerals that were severely affected by the depression. It is of interest to note that much of this improvement is traceable to the heavy construction programs being carried out by leading Canadian metal mining enterprises, with one company planning an expenditure of close to \$12,000,000 in 1936. As the value of non-metallics production in one year exceeded \$156,000,000, the outlook for the group is most hopeful.

Canada's mineral industry has played a conspicuous rôle in her industrial development, and appears destined to make a still greater contribution to the general prosperity of the country. Its dividend disbursements have increased from approximately \$12,000,000 in 1920 to \$58,000,000 in 1935, with expectations that 1936 disbursements will reach \$75,000,000. The industry's purchasing power in the form of expenditures for supplies and equipment, and for salaries and wages, now exceeds \$150,000,000 a year. Its exceptional prosperity during a period of industrial upheaval and readjustment has materially enhanced the economic status of the Dominion, and has been largely responsible for placing Canada in her present enviable position in respect to world trade.

Because of the rapid growth of mining in Canada, and because of the significance of the growth to the economic welfare of the Dominion, the Government's efforts toward encouraging and assisting the industry have been materially extended. Research and investigative work in the fields of geology, mineral technology, and mineral economics continue as the central feature of its service to the industry, but considerably more attention than in former years is being given toward developing among Canadians an appreciation of the importance of mining and increasing the interest of local and outside capital in Canadian mineral development.

An instance of this is the series of radio talks on Canada's mineral industry, given by the Honourable, the Minister of Mines, over a national network of the Canadian Radio Commission at weekly intervals, commencing Friday, January 31, 1936. By the close of the fiscal year nine of the series of twelve talks had been delivered and the thousands of requests for copies of the addresses received both from Canada and elsewhere may be regarded as evidence of the interest they have aroused.

As part of the Government's efforts toward encouraging outside capital, a series of eight articles, two of which appeared during the fiscal year, were prepared for publication in the *Manchester Guardian Commercial*. Endeavours of this nature to promote the cause of mineral development are becoming an increasingly important phase of the Department's activities. Somewhat similar in character was the work done in preparation for the Dominion-Provincial Conference, held early in December 1935, and at which matters pertaining to mining were an important topic of discussion.

With the steady improvement recorded by practically every branch of the mineral industry, the demands for research and investigative work were much heavier during the year than in the previous fiscal year. It should be noted that, particularly since the gold price rise, there has been a greater recognition among prospectors and exploration companies of the value of geological guidance in their work. Also mine operators and executives have become more appreciative of the value of test work on ores in relation to efficient mill design.

The activities for the year are reviewed by the heads of the various branches and divisions. They were featured by the enlarged program of geological field work in which employment was afforded for more than one thousand people. The purpose of the work and the results obtained are summarized elsewhere. A condensed statement of the results was issued to the press shortly after the

return of the parties from the field, and before the fiscal year had closed fifteen preliminary reports and provisional maps had been issued, and several others were nearing completion. This is in accordance with the present policy of the department, whereby either a preliminary or final report is issued on each geological project before the field work of the following year is under way. The policy operates to the decided advantage of those making extensive use of the maps and reports, and appears amply justified in view of the many private and public expressions of approval.

The Mines Branch reports a substantial increase over the preceding year in the number of ore dressing and metallurgical investigations, the increase being attributed mainly to the record volume of work on gold ores. In this work ore treatment processes were devised for the majority of the new gold milling plants that entered production during the year, a service to the industry that has proved a powerful factor in the efficient operation of milling plants. There was no appreciable increase in the number of tests on base metal ores. Such work originates largely from exploratory efforts throughout the country, and there has not been sufficient incentive for an active resumption of these efforts. The increase in the tests on non-metallic ores is largely a reflection of the notable improvement made by the principal minerals of the group in the closing months of the year.

Laboratory and field work on fuels was largely in the nature of an extension of tests and investigative work essential to the more extensive and more efficient use of the fuel resources of the Dominion. Investigative work carried out on the friability of coal, and having for its object the determination of a method whereby coals for any particular purpose may be readily selected, is of practical interest to distributors and consumers.

Tests were continued in the ceramics laboratories on the physical properties of Canadian brick. Test work was undertaken on the use of clay as a plasticizer in masonry mortars, and on samples of refractory clays from northern Ontario. Laboratory work was done on samples of sodium uranate produced in Canada as a by-product of radium extraction to determine a process whereby the quality of the material could be improved to meet competition from foreign sources. As a result of these studies recommendations for overcoming the trouble have been made to the producing company.

In view of the keen interest manifested by pulp and paper, and by soap, manufacturers, mention should be made of the systematic study under way during the year of the industrial waters of Canada. The investigation was commenced in 1933 and will require at least three years to complete.

The resumption of field activities on a scale comparable with the pre-depression years featured the activities of the National Museum. The program included five anthropological projects, three biological, one mineralogical, and one palæontological. As part of its educational work the Museum loaned or sold an unusually large quantity of mineral and rock specimens to prospectors and to schools.

Exclusive of French editions, 102,329 publications were distributed during the year, an increase of 8,788 over the previous year. Distribution of French publications totalled 7,106 copies. These figures are exclusive of the several thousand copies of each of the nine radio talks by the Minister, which were dispatched to mailing lists in every country likely to be interested in Canadian mineral development.

Through its publicity work the department continued its endeavours to keep the public informed as to its activities, and as to important developments in the industry, and to promote a healthy and widespread interest in mining.

Evidence of this widening interest, it may be noted, is furnished by the marked increase over the previous year in the number of oral and written inquiries recorded by the department, relative to various phases of mineral development. Contact was maintained with the High Commissioner's Office in

London, through the department's fortnightly mining newsletter service, now in its thirteenth year. Full advantage was taken of the facilities of this office in the department's efforts to widen the interest of British capital in Canadian mining.

Grateful acknowledgment is made of the splendid co-operation received from the mineral industry; from other departments of the Dominion Government; from the various provincial departments; from development branches of the two large railways; from the High Commissioner's Office in London; from such organizations as the Imperial Institute (London), the British Department of Scientific Research, and the United States Bureau of Mines and Geological Survey; and from the Canadian Institute of Mining and Metallurgy, and similar institutes in other countries.

The Deputy Minister, in addition to his departmental activities, served as Chairman of the Dominion Fuel Board, the principal activities of which appear elsewhere; Chairman of the Interdepartmental Committee on Air Surveys and Base Maps; and Member of the National Research Council of Canada, of the International Niagara Board, and of the Canadian Committee, World Power Conference.

In August he made a 4,000-mile aerial trip through northwestern Canada, with the threefold purpose of inspecting several geological field parties; investigating a number of matters on behalf of the Council of the Northwest Territories, of which he has been a member for some fifteen years; and observing and photographing from the air a large area of unknown country in northern British Columbia and southeastern Yukon.

Dominion Fuel Board

Seven meetings of the Dominion Fuel Board were held during the fiscal year in addition to several sub-committee meetings.

The major part of the board's work, as of recent years, was the administration of various Orders in Council authorizing assistance to the Canadian coal industry and the supervision of payments to coke plants operating under the Domestic Fuel Act (1927).

During the last fiscal year approximately 2,249,398 net tons of Canadian coal were moved under assistance by the Dominion Government at a total cost of \$2,068,932 or an average cost of 92 cents a net ton, as compared with the movement of 2,282,157 tons during the preceding fiscal year at a total cost of \$2,041,081 or an average cost of 89 cents a net ton.

The market for Nova Scotia coal in central and southern Ontario has continued to expand. Approximately one-half of the coal moved from Nova Scotia under assisted rates was sold for distribution in this area with a consequent slight increase in the cost per ton of the assistance granted.

Although the amount of coal moved under assisted rates was slightly less than in the preceding fiscal year, the routine administrative work in connexion with this movement, as measured by the number of applications for assistance considered and granted, increased by almost 15 per cent. The necessary audits of railway and other accounts were maintained on the same thorough basis as the previous year.

The board through their resident inspector in Winnipeg maintained a check on the distribution of the coal shipped into the Winnipeg market under assisted rates.

The coke plants, operating under the Domestic Fuel Act (1927), located at Halifax, Quebec, and Vancouver, were all inspected during the year. These annual inspections are carried out, first, to ensure that the operations of the plants are in conformity with the agreements under the said Act, and secondly, to allow of setting the amount of benefit payable to the company in question after thorough inspection of the plant and of the certified books of the company.

The disallowance of the N.R.A. by the Supreme Court of the United States did not lead to as much disorganization in the coal trade as was expected, but did furnish sufficient reason for the close and exhaustive check maintained by the staff of the board on the competitive situation between Canadian and foreign coals. In the early part of 1936, the Chairman and Secretary of the board visited Washington and discussed matters with officials of the Bituminous Coal Commission which had been set up to administer the provisions contained in the Guffey Bill for the regulation of the bituminous coal industry. The board would especially like to place on record here their grateful acknowledgment of the assistance and co-operation rendered by the various authorities in the United States operating both under the old N.R.A. code provisions and also under the new Bituminous Coal Commission.

As in past years, many studies and investigations were carried out on the problems presented by the fuel situation in Canada and reports were prepared for the information of the board, the Government, and other interested parties.

The annual survey of the operating costs and revenues of Canadian coal mines was again completed. This has been the fourth year in which this survey has been carried out. The results were published in a chart form that showed not only the cost and revenue details for the past year, but the variation in these details for each district during the last four years. This presentation of the facts in a comparative form has increased the usefulness of this work, already recognized as being of great assistance to the coal operator in maintaining control over his production costs.

For the information of the general public, a chart in graphical form was prepared and published showing the production, imports, exports, and distribution of coal in Canada by provinces for the calendar years 1925-1934. The chart included numerical tables, also by provinces, giving details on the movements of coal over the same period.

In the past year, a certain amount of anthracite coal from French Indo-China has been sold in Canada and it is probable that sales of such coal may continue. A memorandum on the coal industry of this French Asiatic colony was prepared by the staff for the information of the board and of any other interested parties.

The independent coal producers of Nova Scotia held a meeting at Halifax to discuss the subject of the assistance granted on all-rail coal movements to Quebec and Ontario and this meeting was attended by the Vice-Chairman and Secretary of the Board. The difficulties in the administration of this section of the Order in Council were thoroughly discussed and the operators' views obtained.

A study of the competitive conditions covering the movement and sale of British coal and coke to Canada was carried out by the Secretary of the Board. During this study information was gathered on many other subjects. These subjects included: export and shipping of coals from England and Continental Europe to Canada, distribution of coals in Europe, Governmental restrictions, trade cartels and combinations, marketing schemes.

A continued demand has been apparent for the board's bulletins, particularly those dealing with insulation and humidity.

The board acknowledge with thanks the sincere co-operation received from Government departments, from members of the Canadian coal mining industry, and from the many interests concerned with the movement, marketing, and use of Canadian coal, and with fuel problems generally.

Your obedient servant,

CHARLES CAMSELL,
Deputy Minister.

OTTAWA, ONT., July 2, 1936

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 - (7) The Industrial Metals in Canada's Mining Industry. March 13, 1936.
 - (8) Metal Mining in British Columbia and Yukon. March 20, 1936.
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- Fauna of the Upper Milk River Beds, Southern Alberta, by L. S. Russell. *Transactions, Royal Society of Canada*, 1935.
- The Systematic Position of *Trachodon*, by C. M. Sternberg. *Palæontological Society, New York, U.S.A.*, December 27, 1935.
- A Second Multituberculate from the Belly River Formation of Alberta, by L. S. Russell. *Palæontological Society, New York, U.S.A.*, December 28, 1935.
- Life-sized Dinosaur Model in Calgary Park, by C. M. Sternberg. *Palæontological Society, New York, U.S.A.*, December 28, 1935.
- Formation Names in the Mackenzie River Valley, by E. M. Kindle. *Science*, January 1936.

Mining Newsletter Series

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

- Canada's Mica Industry Shows Marked Progress.
- Silver Price Rise Brightens Canadian Situation.
- Milling Practice for Small Gold Mills.
- Canada's Gold Industry Continues to Expand.
- Million Dollar Geological Field Program Well Under Way.
- Canada's Mineral Industry Established New Dividend Record in 1934.
- Large Mining Companies Take Lead in Financing Development Operations.
- Mines Branch Laboratory and Field Program, 1935.
- Titanium in Canada.
- Activities in Various Mineral Areas Throughout Canada Reviewed.
- Gold Industry in Nova Scotia Making Encouraging Headway.
- Favourable Prospecting Areas Mapped.
- Canadian Semi-precious and Ornamental Stones.
- Mineral Developments in Chibougamau-Waswanipi Area, Quebec.
- Copper Situation in Canada.
- Natural Gas and Petroleum in Southwestern Ontario.
- A New Canadian Mineral Industry.
- Survey of Canada's Mineral Record in 1935.
- Yellowknife River Area, Northwest Territories.
- Record Attendance at 1935 Annual Meeting.
- Canada's Mica Industry Shows Marked Progress.
- Canada's Mineral Industry Established New Dividend Record in 1934.
- Gold Industry in Nova Scotia Making Encouraging Headway.
- Canadian Semi-precious and Ornamental Stones.
- Copper Situation in Canada.
- A New Canadian Mineral Industry.
- Cadmium.
- Thirty-seventh Annual Meeting of the Canadian Institute of Mining and Metallurgy.

BUREAU OF ECONOMIC GEOLOGY*F. C. C. Lynch, Director***GEOLOGICAL SURVEY**

The chief duty of the Bureau of Economic Geology is to secure all information that will enable prospecting and mining to be carried on with as little waste of time and expenditure as possible. Progress towards this end depends upon the growth of detailed geological knowledge, and recognition of this fact by the Geological Survey yearly makes less difficult the task of the prospector and fortifies at the same time the claims that much additional wealth remains to be won. The Geological Survey explores and maps known and potential mineral-bearing regions and ascertains the nature, extent, and mineral possibilities of the rocks. From the results of this work, the prospector learns where, and where not, to conduct his search; he is thereby directed to areas where his energy is most likely to be rewarded. Close co-operation is maintained by the Geological Survey with Provincial and Federal departments in order that field investigation and the geological knowledge thereby acquired may be properly co-ordinated to the greatest benefit of the mining industry.

The range of the prospector's activities has been greatly extended by reason of the airplane, and, as a consequence, an urgent demand for topographic and geologic maps has arisen. The facilities of the bureau have been strained to cope with this demand, but thanks also to the use of the airplane in aerial surveying and the modern science of map-making, the prospector has had the satisfaction of obtaining maps of a number of areas that were formerly almost inaccessible.

The fiscal year just concluded was, in a sense, epochal in the history of the Geological Survey; in no other year has the field work been so extensive. This resulted from the million dollars voted by Parliament as an additional means of assistance to prospecting. In planning the enlarged Geological Survey program, first consideration was given to ensuring that progress in the mining industry would continue uninterrupted. And though expenditure on the field work was made with an eye to future rather than immediate employment in mining, it nevertheless afforded employment during the past summer to as many as 1,000 people, including a large number of geological and mining students attending Canadian universities. The projects undertaken by the Survey numbered 65; they covered areas from Nova Scotia to Yukon, and necessitated 188 field parties. Last year there were only 24 field parties.

The work centred mainly around the finding of unprospected territory favourable for the occurrence of gold, but much attention was given to petroleum and natural gas areas in Alberta, Saskatchewan, and Ontario; to asbestos deposits in Quebec; and to the task of obtaining data that might be helpful in solving the problem of scarcity of water for domestic and agricultural purposes in the southern prairie region of western Canada.

In order to make the results of the field work available to the prospector at the earliest possible date, the policy has been adopted of issuing preliminary reports and maps shortly after the geologists return from the field. These take the place of the Summary Reports formerly issued collectively once a year. From those already made available on last summer's work, important discoveries are expected. This expectation is supported by such published results or facts as: the successful tracing of the narrow belt of greenstones in Cadillac township, Quebec, where, as a consequence, the prospector and miner are very active; the oil and gas permits recently applied for to prospect recommended areas on the

Battleview and Eagle Hills anticlines in Alberta and Saskatchewan, respectively; the 3,000 square miles of territory shown to be favourable for the occurrence of precious metals in Yellowknife River area, Northwest Territories; and large areas of favourable ground to which the prospector is directed in Ontario and Quebec.

The Topographical Division not only compiles base maps from the results of its own field surveys, but also undertakes the compilation of a large number of other base maps required for geological purposes. The successful carrying out of all this work is the result of the very close co-operation that exists between the three main divisions of the Geological Survey, viz: Geological, Topographical, and Map Draughting and Reproducing Divisions.

The number of maps published was 39, and at the close of the year 2 were in the printer's hand and 66 in varied stages of progress; these figures compare with 20, 9, and 33, respectively, in the previous year. The distribution office sent out 64,057 maps and reports, exclusive of French editions, against 47,995 last year.

The Mineralogical Division had the busiest year of its existence; 4,500 minerals and rocks were sent in to be examined and reported upon, and 2,110 educational collections containing 78,004 specimens were assembled and distributed. The work on silicosis and asbestosis was continued, also that dealing with radioactive and other rare-element minerals and with gold tellurides. More than 75 per cent of the time of the mineralogists was occupied in meeting the inquiries of the general public.

The staff of the Pleistocene Geology, Water Supply, and Borings Division was engaged, as usual, mainly in examination of samples from well borings; 30,697 samples from oil and gas wells were received during the year, and 261 samples of underground water were analysed.

The public continued to make use to a large extent of the facilities of the British Columbia office. Registration showed that the office had 5,287 visitors and distributed 3,890 reports and 1,085 maps.

Two geologists, D. F. Kidd and H. C. Horwood, resigned from the Bureau during the year, the former to engage in private practice, the latter to take a position as geologist in the Ontario Department of Mines. R. B. Yorston, principal map draughtsman, and Miss M. M. Lister, special typist, were superannuated.

GEOLOGICAL DIVISION

G. A. Young, Chief Geologist, reports:

Yukon

H. S. Bostock began the geological mapping of the Ogilvie map-area. A review of the mining industry of the Yukon in 1935, as prepared by him, has been published as Memoir 193.

J. R. Johnston mapped geologically and topographically a section of country in Pelly River region.

E. J. Lees mapped the geology of a part of the Teslin-Quiet Lake area. A preliminary mimeographed report, with map, "Prospecting Possibilities of Teslin-Quiet Lake-Big Salmon Area, Yukon," by H. S. Bostock, has been issued.

Northwest Territories

F. Jolliffe carried out geological mapping in Yellowknife River area. A mimeographed report accompanied by a preliminary geological map has been issued.

British Columbia

X M. F. Bancroft investigated the gold-bearing deposits of the west coast of Vancouver island from Alberni canal to Esperanza inlet.

✓ C. E. Cairnes completed the geological mapping of Cadwallader Creek and Gun Lake map-areas, Bridge River district.

X W. E. Cockfield studied the mineral deposits of Nelson area. A report covering the work done in this area (Memoir 191) is now in press.

X N. F. G. Davis studied the geology of Camp McKinney area.

X G. Hanson investigated the geology and mineral resources of an area extending east from Dease lake and from Tanzilla-Stikine divide north to McDame creek.

✓ M. S. Hedley investigated the geology and mineral resources of Tahtsa-Morice Lakes area.

✓ H. C. Horwood explored geologically the region immediately west of Fraser river and south of Nahatlatch river. A mimeographed report, "The South Part of Fraser River-Harrison Lake Region," and another "The Nahatlatch Region," each accompanied by a map, have been issued. In addition, he has completed "Geology and Mineral Deposits at the Mine of B.C. Nickel Mines, Limited, Yale District, B.C.," Memoir 190, accompanied by a map, which has been published.

✓ E. D. Kindle examined the mineral properties in the area tributary to the Canadian National railways from Terrace east. A mimeographed report "Mineral Resources of Terrace Area, Coast District, British Columbia," accompanied by preliminary map, has been issued.

X A. H. Lang studied the geology of Keithley map-area, Cariboo district. A mimeographed report, "Keithley Creek Map-area," accompanied by a preliminary geological map, has been issued.

X H. M. A. Rice completed the study of the geology and mineral resources of Cranbrook map-area. A mimeographed report, "Tertiary Gravels in Cranbrook Area," has been issued.

X H. V. Warren studied the geology of David Creek map-area, Similkameen.

Alberta

X L. S. Russell studied the geology, including the oil and gas possibilities, of a portion of southeastern Alberta. A mimeographed preliminary report, "Oil and Gas Possibilities along Milk River, Southeastern Alberta," by him, and another by W. C. Howells, "Foremost-Skiff Area, Alberta," have been issued.

X G. S. Hume in connexion with his work in western Saskatchewan studied the geology and underground water resources of an area in northeast-central Alberta. A mimeographed report, "Battleview Anticline, Wainwright Area, Alberta," with map, has been issued.

X B. R. MacKay, assisted by D. C. Maddox, investigated the underground water resources of part of southeastern Alberta.

Saskatchewan

X F. J. Alcock investigated the geology of an area lying between lake Athabaska and the northern boundary of the province, giving particular attention to the region around Goldfields where development work is being carried out on a number of properties.

S. C. Ells explored an area drained by the headwaters of Clearwater and Firebag rivers.

X G. S. Hume studied the geology and underground water resources of an area in western Saskatchewan lying between latitudes 52 degrees and 54 degrees. A mimeographed report, "Eagle Hills Anticline, Battleford Area, Saskatchewan," accompanied by a preliminary geological map, has been issued.

B. R. MacKay, assisted by D. C. Maddox, investigated the underground water resources of southern Saskatchewan. A series of preliminary geological reports, each accompanied by a map, is now being issued.

D. M. E. McLarty mapped geologically the Lac la Ronge map-area.

R. T. D. Wickenden studied the geology of an area in eastern Saskatchewan between latitudes 52 degrees and 53 degrees and extending as far west as longitude 108 degrees. A mimeographed report, "Oil and Gas Possibilities of Hudson Bay Junction Area, Saskatchewan," with preliminary map by R. T. D. Wickenden and F. H. McLearn, has been issued.

F. H. McLearn studied geologically an area near Hudson Bay Junction. His results have been incorporated in the above-mentioned report.

Manitoba

R. T. D. Wickenden studied the geology of an area in western Manitoba between latitudes 52 degrees and 53 degrees and extending as far east as longitude 101 degrees.

D. L. Downie completed the geological mapping of Granville Lake map-area. *VKD*

F. A. Kerr continued the geological mapping of Flinflon map-area, begun in 1933 by J. F. Wright and C. H. Stockwell. *+ VKD*

A. W. Johnston explored geologically a large area in Manitoba lying north of latitude 58 degrees. A mimeographed report, "Geological Exploration of Seal River, Northern Manitoba," accompanied by a preliminary geological map of Seal river, has been issued. *Ash "Johnston" 2500!*

R. C. McMurchy mapped geologically part of the country surrounding Gods lake.

C. H. Stockwell investigated the mineral resources of Wekusko Lake area.

Ontario

W. H. Collins continued his study of the geology of Sudbury area.

C. S. Evans investigated the occurrence of gas and oil in southwestern Ontario.

B. C. Freeman studied the mineral occurrences of Renfrew district. A report, "Mineral Deposits in Renfrew County and Vicinity," Memoir 195, is now in press.

T. C. Holmes mapped geologically the district embracing the headwaters of Aux Sables river.

N. B. Keevil mapped geologically the area drained by the headwaters of Montreal river.

W. B. Mather investigated geologically the Nungesser Lake area south of Berens river.

T. L. Tanton studied the geology of Pigeon River area southwest of Fort William. A mimeographed report, "Copper-Nickel Mineral Occurrences in Pigeon River Area," has been issued.

M. Y. Williams studied the geology of Manitoulin island.

W. I. Wright geologically mapped a district embracing the headwaters of Papaonga river, Kenora district. A preliminary geological map of the area has been issued.

Alice E. Wilson completed the geological mapping of Ottawa map-area.

L. J. Weeks commenced the geological mapping of Hearst-Kapuskasing area.

Quebec

H. C. Cooke completed the geological mapping of Disraeli map-area and of the eastern half of Warwick map-area, southern Quebec.

F. T. Denis investigated geologically Desboues map-area.

✓ H. C. Gunning, assisted by J. W. Ambrose, continued detailed geological mapping of the Cadillac belt of Cadillac and Malartic townships. A preliminary mimeographed report, "Cadillac Belt from Pandora to Pan Canadian, Quebec," with map, has been issued in English and French.

✓ J. F. Henderson mapped geologically Ville-Marie and Guillet (Mud) Lake area. A preliminary mimeographed report, "Guillet (Mud) Lake Area, Témiscamingue county, Quebec," with map, has been issued in English and French.

✓ C. S. Lord investigated the mineral occurrences of Lake Megantic district.

✓ G. W. H. Norman completed the geological mapping of Opawica-Chibougamau area and commenced the mapping of Waswanipi region. A preliminary mimeographed report, "Opawica-Chibougamau Map-Area, Northern Quebec," and another, "Waswanipi Map-Area, Northern Quebec," both with maps, have been issued in English and French.

✓ C. Tolman mapped geologically a part of Dorchester county.

✓ M. E. Wilson completed the detailed investigation of an area taking in Noranda and vicinity. The results include five geological sheets and three special maps.

New Brunswick

✓ J. F. Caley mapped geologically an area along St. John river from Woodstock northward.

✓ A. H. Miller carried out, by means of the torsion balance, investigations of geological structure in Stony Creek and other areas of the Moncton field.

✓ S. C. Perry commenced the geological mapping of St. George area, in the south part of Charlotte county.

✓ B. Rose mapped geologically Plaster Rock area. He also supervised the investigations of other geological parties working in New Brunswick.

✓ E. W. Shaw made a geological map of a part of the basin of Little Southwest Miramichi river.

Nova Scotia

✓ P. F. Armstrong carried out geological mapping in Lunenburg and Queens counties and investigated the active gold properties of Nova Scotia.

u W. A. Bell revised the geology of Springhill map-area.

TOPOGRAPHICAL DIVISION

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

STAFF

In order to meet the requirements of the Bureau of Economic Geology and ensure that the increase in volume of work could be carried out more efficiently and expeditiously, it was necessary to allocate special duties and responsibilities to the senior officers of the Topographical Division. This allocation of duties has been effective throughout the year and is as follows:

S. C. McLean: co-ordination of triangulation and control surveys; computations and field survey records.

K. G. Chipman: office administration and executive assistant to Chief Topographical Engineer.

A. C. T. Sheppard: co-ordination western mapping, general base map compilations, projections.

A. G. Haultain: co-ordination eastern mapping, air survey compilations.

D. A. Nichols: physiography; information, illustrations etc., modelling, geographic exhibits.

Under the enlarged Geological Survey program, 1935, the work of the Topographical Division was greatly increased, necessitating additional staff for both field and office. The increased field staff was recruited from men previously engaged in our topographical or related work.

FIELD WORK

Yukon

C. H. Smith completed the field work for the topographical mapping of the Ogilvie sheet, latitudes 63° to 64° , longitudes 138° to 140° . This work was done by photo-topographical reconnaissance methods for publication on a scale of 1 inch to 4 miles, contour interval 500 feet. The triangulation control was tied to the astronomic pier at Dawson.

British Columbia

W. H. Miller had supervision of three sheets along the Canadian National railways between Prince George and Smithers. These sheets were:

Giscome, latitude 54° to 55° , longitude 122° to 124° ; J. A. Macdonald in charge.

Fort Fraser, latitude 54° to 55° , longitude 124° to 126° ; H. A. S. West in charge.

Smithers, latitude 54° to 55° , longitude 126° to 128° ; S. M. Steeves in charge.

These three sheets are for publication on a scale of 1 inch to 4 miles, with 500-foot contours. Field work was by photo-topographical reconnaissance methods supplemented by the use of the range finder or by plane-table intersection where feasible. Previous mapping in these areas by the British Columbia Department of Lands was incorporated in the results, where possible. Control was from the triangulation net of the Geodetic Survey of Canada with connexion to the net of the British Columbia Department of Lands.

R. Bartlett and A. C. Tuttle were engaged in the topographical mapping of McDame-Tanzilla area. The boundaries of the area were latitudes from the watershed between Tanzilla and Stikine rivers north to $59^{\circ} 30'$, longitude 129° to 130° . This work is for publication on a scale of 1 inch to 4 miles, with contour interval of 500 feet, and was done by photo-topographical reconnaissance methods. Control was extended from the triangulation net of the British Columbia Department of Lands, and elevations are based on the same triangulation net.

R. C. McDonald carried out the field work for mapping of the Hope sheet, latitude 49° to 50° , longitude 120° to 122° , and the Ashcroft sheet, latitude 50° to 51° , longitude 120° to 122° . This work is for publication on a scale of 1 inch to 4 miles, contour interval 500 feet, and was done by photo-topographical reconnaissance methods. Control was extended from the Geodetic Survey triangulation net and triangulation by the British Columbia Department of Lands was incorporated. Elevations were from bench marks by the Geodetic Survey along the main lines of the Canadian Pacific and Canadian National railways. Connexions were made in the field between the triangulation system and monuments of the Dominion Lands System of Surveys. Previous topographical mapping within the area, carried out by the Geological Survey, the International Boundary Survey, the Department of the Interior, and the British Columbia Department of Lands, was incorporated into the work where possible.

A. C. T. Sheppard visited the parties of W. H. Miller, R. C. McDonald, J. A. Macdonald, S. M. Steeves, and H. A. S. West for the purpose of advising on matters relating to the field work.

Alberta

J. W. Spence carried out the topographical mapping of the Fallen Timber sheet, latitude $51^{\circ} 30'$ to $51^{\circ} 45'$, longitude $114^{\circ} 30'$ to $115^{\circ} 00'$, and the west half of the Bearberry sheet, latitude $51^{\circ} 45'$ to $52^{\circ} 00'$, longitude $114^{\circ} 45'$ to $115^{\circ} 00'$. Both sheets are for publication on a scale of 1 inch to 1 mile, contour interval 50 feet, and were done by plane-table methods. Both horizontal and vertical control were extended from previous work by the Geological Survey.

F. P. DuVernet, mapped in detail an area in the vicinity of Steeveville. The field scale was 1 inch to 2,000 feet, and contour interval 25 feet. Horizontal control was from the Dominion Lands System of Surveys and elevations from Geodetic Survey bench marks along the Canadian Pacific railway.

J. W. Spence visited this party during the season in order to advise on field problems.

A. C. T. Sheppard visited the parties of Messrs. Spence and DuVernet for the purpose of advising on matters relating to the field work.

Quebec

S. C. McLean carried out control for mapping from vertical air photographs of an area in Timiskaming district. This area included the western part of the Ville-Marie sheet, latitude $47^{\circ} 15'$ to $47^{\circ} 30'$, longitude $79^{\circ} 00'$ to $79^{\circ} 30'$, and the Guillet Lake sheet, latitude $47^{\circ} 15'$ to $47^{\circ} 30'$, longitude $78^{\circ} 30'$ to $79^{\circ} 00'$. This mapping is for publication at 1 inch to 1 mile.

H. N. Spence mapped, on a scale of 1 inch to 400 feet, an area in Malartic township and environs. Close co-operation was maintained with the geological party in the area, hubs being established for control of geological traverses and plane-table sheets supplied in the field on which to show all geological information.

A. G. Haultain visited the party of Mr. Spence for the purpose of advising on matters relating to field work.

New Brunswick

J. V. Butterworth carried out control for the horizontal and vertical plotting of vertical air photographs in the following areas:

Salmon River, latitude $45^{\circ} 15'$ to $45^{\circ} 45'$, longitude 65° to $65^{\circ} 30'$.

Plaster Rock, latitude $46^{\circ} 45'$ to $47^{\circ} 00'$, longitude $67^{\circ} 00'$ to $67^{\circ} 30'$.

Tuadook Lake (west half), latitude $46^{\circ} 45'$ to $47^{\circ} 00'$, longitude $66^{\circ} 45'$ to 67° .

All work is for publication on a scale of 1 inch to 1 mile; relief to be shown by approximate contours or form lines.

R. J. Parlee completed the topography of the Petitcodiac area, latitude $45^{\circ} 45'$ to 46° , longitude $65^{\circ} 00'$ to $65^{\circ} 30'$, the control for which was mapped in 1933. This work is for publication on a scale of 1 inch to 1 mile with contour interval of 50 feet.

A. G. Haultain visited the parties of Messrs. Butterworth and Parlee for the purpose of advising on matters relating to the field work.

Northwest Territories

D. A. Nichols spent three months in the field with the Eastern Arctic Expedition, sponsored by the Lands, Northwest Territories, and Yukon Branch, Department of the Interior.

Physiographic studies were made of the regions visited, with special investigations of the raised strand-lines, with a view to obtaining further information regarding the rising of the north coast of the continent.

Fossils, minerals, and rock specimens were collected for the National Museum and for other purposes, and air and water temperatures were obtained as well as other information of general scientific interest.

OFFICE WORK

In connexion with the enlarged Geological Survey program, the Topographical Division has completed the compilation of sixty-eight base maps. These have already been transferred to the Draughting and Reproducing Division for final preparation and publication. In addition to all the regular work of map compilation, the division completed the drawings for eighteen maps for blue-print reproduction to accompany the preliminary geological reports.

The division also undertakes much of the preparation of base map copy for geologists' use in the field office.

D. A. Nichols continued work in connexion with the field investigations on the "Rising of the North Coast of the Continent." Clay and sand samples collected during the season were analysed and prepared for examination for marine fossil evidence, and the results tabulated. Views and motion pictures of the expedition were prepared for lecture purposes.

Physiographic correspondence was answered and maps prepared. Further work was carried on in connexion with the model of Canada, and additions and corrections were made from new field data. R. E. Ouimet, who is constructing the model, spent considerable time assisting in assembling exhibits for the Central Canada Exhibition.

The Chief of the Division, in his capacity as Chairman of the Geographic Board, attended to the duties connected therewith.

MINERALOGICAL DIVISION

✓ Eugene Poitevin, Chief of the Division, reports:

The greater part of the time of the staff of the division was occupied in meeting the increased demands from the public for information.

H. V. Ellsworth and R. J. C. Fabry arranged an exhibit of minerals for the Central Canada Exhibition.

✓ J. R. Marshall spent two months in Ontario, Quebec, and the Maritime Provinces collecting minerals and rocks required for the preparation of prospectors' and educational collections.

LABORATORY

The number of minerals and rocks sent in by prospectors, departmental officers, and others interested in the mining industry was greater than last year. A total of 4,500 specimens were received from various parts of Canada and examined and reported upon by Eugene Poitevin and H. V. Ellsworth, mineralogists. About 450 memoranda were furnished in connexion with them.

✓ Eugene Poitevin continued his investigation of mineral residues obtained from human lungs, particularly those relating to mining and industrial exposures. This year, he has studied thirty-two lungs making a total of fifty-five that he has examined so far and on which preliminary reports have already been furnished to the Health Department at Toronto. In connexion with the work on silicosis and asbestosis the closest co-operation was maintained with the Ontario Department of Health, the Banting Institute, and the Quebec Department of Health.

✓ H. V. Ellsworth gave special attention to the testing of radioactive and other rare-element minerals and did further work on tellurides associated with gold ores. During the year, other departments have made considerable use of the spectroscopic facilities afforded by the division.

PALÆONTOLOGICAL DIVISION

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

FIELD WORK

Reference to details of geological mapping by members of the division appears under the section relating to the Geological Division.

E. M. Kindle was occupied first in the northeastern part of Gaspé peninsula, in Quebec, with stratigraphic and faunal studies of the Devonian and earlier sediments. Later in the summer he studied the Knoydart formation in north-eastern Nova Scotia, and extended the known occurrence of lacustrine manganese concretions and other lake bottom deposits of manganese oxide over a considerable area in eastern Nova Scotia.

C. M. Sternberg spent a short time in Red Deer River valley, Alberta, in locating some of the major discoveries of dinosaur skeletons on a contoured map of the dinosaur-bearing beds, which is in preparation. Collecting a Mosasaur in Riding Mountain region, Manitoba, and assisting the Calgary Zoological Society with the construction of a life size dinosaur model at Calgary occupied the remainder of Mr. Sternberg's field season.

OFFICE WORK

W. A. Bell was engaged early in July, previous to the beginning of the field season, in assisting G. A. Young in organizing field parties.

F. H. McLearn has, in collaboration with R. T. D. Wickenden, prepared a preliminary report on the oil and gas possibilities of Hudson Bay Junction area, Saskatchewan.

Alice E. Wilson has completed the Ottawa sheet geological map, and prepared a map and report on the geology of the city of Ottawa and vicinity for the use of the Borings Division.

E. M. Kindle has prepared a report on the geology of Pelee island, lake Erie, accompanied by a map showing gravel, sand, and other bottom sediments adjacent to the southwestern part of the island.

L. S. Russell has compiled the results of 1935 field work and prepared a report on oil and gas possibilities in a portion of southeastern Alberta.

Considerable time has been devoted to the study of fossil collections acquired primarily for determining the order of sequence and structure of the rocks by members of the staff in various parts of Canada, in areas being mapped.

MUSEUM

The laboratory of vertebrate palæontology has been removed to another building during the year. Progress has been made by Mr. Sternberg and his assistants with the preparation of the dinosaur material which is still awaiting space for exhibit.

PLEISTOCENE GEOLOGY, WATER SUPPLY, AND BORINGS DIVISION

W. A. Johnston, Geologist in Charge, reports:

Field work of D. C. Maddox and R. T. D. Wickenden is included under the Geological Division.

The examination of samples from well borings and the supplying of information as to the character of the samples continued to form an important part of the work of the division. Samples from a number of wells drilled for oil and gas in Saskatchewan were examined in co-operation with the Department of Natural Resources of that province, and from wells in the province of Quebec in

co-operation with the Quebec Bureau of Mines. Analyses of two hundred and sixty-one samples of underground water were made by F. J. Fraser, assisted by R. H. Bray, to determine the mineral character of the water. Of these analyses two hundred and forty-four were made in connexion with the ground water survey under the Geological Division, the other seventeen were samples of water from oil, gas, or water wells. Information was also supplied to a number of inquirers as to the possibilities of ground water supplies at various places. R. T. D. Wickenden represented W. A. Johnston as ground water expert with the Water Development Committees under the Prairie Farm Rehabilitation Act.

R. T. D. Wickenden continued his studies of well samples from the Prairie Provinces and was responsible for the examination of well samples from Saskatchewan and Manitoba. The samples from Alberta were examined by the Department of Lands and Mines of that province and have been re-studied in part by geologists from this department.

Samples from oil and gas wells received during the year numbered 30,697. Of these 18,695 were from oil and gas wells in Ontario and were received through the courtesy of Colonel R. B. Harkness of the Ontario Department of Mines. From Alberta 9,091 samples were received through the courtesy of the Department of Lands and Mines of the province, and there were 4 from British Columbia, 1,647 from Saskatchewan, 119 from Manitoba, 143 from Quebec, and 998 from New Brunswick.

DRAUGHTING AND REPRODUCING DIVISION

A. Dickison, Chief of the Division, reports:

Maps Published April 1, 1935, to March 31, 1936

Series A	Publication number	Title	Remarks
NORTHWEST TERRITORIES			
331A	—	Rae-Great Bear Lake area (South sheet), between Rae and Faber lake, district of Mackenzie; scale, 1 inch to 4 miles.....	Geology. For memoir by D. F. Kidd, and separate distribution.
332A	—	Rae-Great Bear Lake area (Centre sheet), between Faber lake and Hottah lake, district of Mackenzie; scale, 1 inch to 4 miles.....	Geology. For memoir by D. F. Kidd, and separate distribution.
333A	—	Rae-Great Bear Lake area (North sheet), between Hottah lake and Richardson island, district of Mackenzie; scale, 1 inch to 4 miles.....	Geology. For memoir by D. F. Kidd, and separate distribution.
BRITISH COLUMBIA			
309A	2365	Stikine River area (North sheet), Cassiar district; scale, 1 inch to 2 miles.....	Geology. For separate distribution.
310A	2366	Stikine River area (Centre sheet), Cassiar district; scale, 1 inch to 2 miles.....	Geology. For separate distribution.
311A	2367	Stikine River area (South sheet), Cassiar district; scale, 1 inch to 2 miles.....	Geology. For separate distribution.
—	2394	Barkerville Gold Belt (North portion), Cariboo district; scale, 1 inch to 1,000 feet.....	Geology. For memoir by G. Hanson.
—	2395	Barkerville Gold Belt (South portion), Cariboo district; scale, 1 inch to 1,000 feet.....	Geology. For memoir by G. Hanson.

Maps Published April 1, 1935, to March 31, 1936—Continued

Series A	Publication number	Title	Remarks
BRITISH COLUMBIA—Concluded			
316A	2376	Camp McKinney, Similkameen district; scale, 1 inch to 1 mile.....	Geology. For memoir by W. E. Cockfield.
—	2388	Part of Fairview Camp, Similkameen district; scale, 1 inch to 1,000 feet.....	Geology. For memoir by W. E. Cockfield.
—	2389	Dividend-Lakeview Property, Similkameen district; scale, 1 inch to 1,000 feet.....	Geology. For memoir by W. E. Cockfield.
—	2390	Vidette Lake area, Lillooet district; scale, 1 inch to 2,000 feet.....	Geology. For memoir by W. E. Cockfield.
—	2063	Chilko Lake and Vicinity, Coast and Lillooet districts; scale, 1 inch to 4 miles.....	Geology (reissue). For report by V. Dolmage, and separate distribution.
—	2104	Dease Lake area, Cassiar district; scale, 1 inch to 2 miles.....	Geology (reissue). For report by F. A. Kerr, and separate distribution.
ALBERTA			
322A	2382	Canmore area (North portion), west of fifth meridian; scale, 1 inch to 800 feet.....	Geology. For memoir by B. R. MacKay, and separate distribution.
323A	2383	Canmore area (South portion), west of fifth meridian; scale, 1 inch to 800 feet.....	Geology. For memoir by B. R. MacKay, and separate distribution.
—	2384	Sections supplementing Map 322A, Canmore area (North portion); scale, 1 inch to 800 feet.....	Geology. For memoir by B. R. MacKay, and separate distribution.
—	2385	Sections supplementing Map 323A, Canmore area (South portion); scale, 1 inch to 800 feet.....	Geology. For memoir by B. R. MacKay, and separate distribution.
325A	2400	Wildcat Hills sheet, Northwest quarter (west of fifth meridian); scale, 1 inch to $\frac{1}{2}$ mile.....	Geology. For memoir by G. S. Hume, and separate distribution.
326A	2401	Wildcat Hills sheet, Southwest quarter (west of fifth meridian); scale, 1 inch to $\frac{1}{2}$ mile.....	Geology. For memoir by G. S. Hume, and separate distribution.
SASKATCHEWAN			
317A	2377	Mudjatik-Haultain area (Northwest quarter); scale, 1 inch to 1 mile.....	Geology. For memoir by F. J. Alcock, and separate distribution.
318A	2378	Mudjatik-Haultain area (Northeast quarter); scale, 1 inch to 1 mile.....	Geology. For memoir by F. J. Alcock, and separate distribution.
319A	2379	Mudjatik-Haultain area (Southwest quarter); scale, 1 inch to 1 mile.....	Geology. For memoir by F. J. Alcock, and separate distribution.
320A	2380	Mudjatik-Haultain area (Southeast quarter); scale, 1 inch to 1 mile.....	Geology. For memoir by F. J. Alcock, and separate distribution.

Maps Published April 1, 1935, to March 31, 1936—*Concluded*

Series A	Publication number	Title	Remarks
MANITOBA			
X 211A	2160	Island Lake area; scale, 1 inch to 2 miles.....	Geology (reprint). For separate distribution.
X 321A	2381	Elbow-Morton area; scale, 1 inch to 2 miles.....	Geology. For memoir by C. H. Stockwell, and separate distribution.
—	—	Bell, Apex Nos. 1, 2, and 3, and Dan claims; scale, 1 inch to 500 feet.....	Geology. For memoir by C. H. Stockwell.
—	—	Gunwor group; scale, 1 inch to 200 feet.....	Geology. For memoir by C. H. Stockwell.
—	—	North Star, Gold Rock, Jupiter, and nearby claims; scale, 1 inch to 1,000 feet.....	Geology. For memoir by C. H. Stockwell.
—	—	North Star No. 1 and No. 2 claims; scale, 1 inch to 75 feet.....	Geology. For memoir by C. H. Stockwell.
—	—	Jupiter No. 2 claim; scale, 1 inch to 75 feet.....	Geology. For memoir by C. H. Stockwell.
ONTARIO			
o 155A	1553	Lake Huron sheet; scale, 1 inch to 8 miles.....	Geology (reprint of third edition). For separate distribution.
o 308A	2364	Lake Nipigon sheet; scale, 1 inch to 8 miles.....	Geology. For separate distribution.
X 334A	—	Mine Centre area, Rainy River district; scale, 1 inch to $\frac{1}{2}$ mile.....	Geology. For memoir by T. L. Tanton, and separate distribution.
QUEBEC			
o 304A	2356	Chibougamau sheet, Abitibi territory; scale, 1 inch to 1 mile.....	Geology (also reprint). For memoir by J. B. Mawdsley and G. W. H. Norman, and separate distribution.
o 327A	2403	Amos sheet, Abitibi county; scale, 1 inch to 1 mile..	Geology. For separate distribution.
o 328A	2404	Rouyn-Bell River area, Abitibi and Témiscamingue counties; scale, 1 inch to 4 miles.....	Geology. For memoir, and separate distribution.
—	—	Preliminary Map of the Cadillac Belt from Pandora to Pan Canadian; scale, 1 inch to 1,600 feet.....	Geology (also reprint). For advance distribution.
QUEBEC AND NEW BRUNSWICK			
o 330A	—	Chaleur Bay area; scale, 1 inch to 4 miles.....	Geology. For memoir by F. J. Alcock, and separate distribution.

Maps in Hands of King's Printer, March 31, 1936

Series A	Title	Remarks
YUKON		
340A	Carmacks sheet; scale, 1 inch to 4 miles.....	Geology. For memoir by H. S. Bostock, and separate distribution.
—	Tantalus Butte-Tatchun Lake area, illustrating probable chief structural features; scale, 1 inch to 2 miles.....	Geology. For memoir by H. S. Bostock.

Other Map-work in Varying Stages of Progress

	Title	Remarks
YUKON		
1	Laberge sheet; scale, 1 inch to 4 miles.....	Geology.
2	Teslin-Quiet Lake area; scale, 1 inch to 4 miles.....	Geology.
3	Ogilvie sheet; scale, 1 inch to 4 miles.....	Topography.
BRITISH COLUMBIA		
4	Keremeos sheet, Similkameen district; scale, 1 inch to 1 mile.....	Topography.
5	Gun Lake area (Bridge River), Lillooet district; scale, 1 inch to $\frac{1}{2}$ mile.	Topography.
6	Cadwallader Creek area (Bridge River), Lillooet district; scale, 1 inch to $\frac{1}{2}$ mile.....	Topography.
7	Smithers sheet (East half), Coast district; scale, 1 inch to 4 miles....	Topography.
8	Fort Fraser sheet (West half), Coast district; scale, 1 inch to 4 miles..	Topography.
9	Hope sheet (East half), Yale district; scale, 1 inch to 4 miles.....	Topography.
10	Willow River (East half), Cariboo district; scale, 1 inch to 1 mile.....	Geology.
11	Willow River (West half), Cariboo district; scale, 1 inch to 1 mile.....	Geology.
12	Tahtsa-Morice area, Coast district; scale, 1 inch to 4 miles.....	Geology.
13	Cranbrook sheet, Kootenay district; scale, 1 inch to 1 mile.....	Geology.
SASKATCHEWAN		
14	Goldfields area; scale, 1 inch to 1 mile.....	Geology.
15	Tazin Lake sheet; scale, 1 inch to 4 miles.....	Geology.
16	Fond-du-Lac sheet; scale, 1 inch to 4 miles.....	Geology.
17	Stony Rapids sheet (West half); scale, 1 inch to 4 miles.....	Geology.
18	Lac la-Ronge sheet (East half); scale, 1 inch to 4 miles.....	Geology.
19	Lac la-Ronge sheet (West half); scale, 1 inch to 4 miles.....	Geology.
MANITOBA		
20	Portion of Seal river; scale, 1 inch to 4 miles.....	Geology.
21	Seal River area; scale, 1 inch to 12 miles.....	Geology.
22	Granville Lake sheet (East half); scale, 1 inch to 4 miles.....	Geology.
23	Granville Lake sheet (West half); scale, 1 inch to 4 miles.....	Geology.
24	Herb Lake area (North sheet); scale, 1 inch to 1,000 feet.....	Geology.
25	Herb Lake area (Centre sheet); scale, 1 inch to 1,000 feet.....	Geology.
26	Herb Lake area (South sheet); scale, 1 inch to 1,000 feet.....	Geology.
ONTARIO		
27	Papaonga area, Kenora district; scale, 1 inch to 2 miles.....	Geology.
28	Pigeon River area (Sheet I), Thunder Bay district; scale, 1 inch to 1 mile.....	Geology.
29	Pigeon River area (Sheet II), Thunder Bay district; scale, 1 inch to 1 mile.....	Geology.
30	Pigeon River area (Sheet III), Thunder Bay district; scale, 1 inch to 1 mile.....	Geology.
31	Manitoulin island, Manitoulin district; scale, 1 inch to 4 miles.....	Geology.
32	Shebandowan sheet, Thunder Bay district; scale, 1 inch to 4 miles....	Geology.
33	Hearst-Kapuskasing area (East half), Cochrane and Algoma districts; scale, 1 inch to 4 miles.....	Geology.
34	Hearst-Kapuskasing area (West half), Cochrane and Algoma districts; scale, 1 inch to 4 miles.....	Geology.
35	Cow River area, Sudbury and Algoma districts; scale, 1 inch to 2 miles.	Geology.
ONTARIO AND QUEBEC		
36	Ottawa sheet (East half), Carleton and Hull counties; scale, 1 inch to 1 mile.....	Geology.
37	Ottawa sheet (West half), Carleton and Hull counties; scale, 1 inch to 1 mile.....	Geology.
QUEBEC		
38	Chibougamau sheet (East half), Abitibi territory; scale, 1 inch to 4 miles.....	Geology.
39	Chibougamau sheet (West half), Abitibi territory; scale, 1 inch to 4 miles.....	Geology.
40	Desboues sheet (East half), Abitibi county; scale, 1 inch to 1 mile.....	Geology.
41	Desboues sheet (West half), Abitibi county; scale, 1 inch to 1 mile.....	Geology.
42	Thetford sheet (East half), Megantic, Beauce, and Frontenac counties; scale, 1 inch to 1 mile.....	Geology.
43	Thetford sheet (West half), Megantic, Beauce, and Frontenac counties; scale, 1 inch to 1 mile.....	Geology.

Other Map-work in Varying Stages of Progress—Concluded

—	Title	Remarks
QUEBEC—Concluded		
44	Disraeli sheet (East half), Wolfe, Frontenac, and Megantic counties; scale, 1 inch to 1 mile.....	Geology.
45	Disraeli sheet (West half), Wolfe, Frontenac, and Megantic counties; scale, 1 inch to 1 mile.....	Geology.
46	Warwick sheet (East half), Wolfe and Arthabaska counties; scale, 1 inch to 1 mile.....	Geology.
47	Megantic sheet (West half), Frontenac county; scale, 1 inch to 1 mile..	Geology.
48	Escuminac sheet, Bonaventure county; scale, 1 inch to 1 mile.....	Geology.
NEW BRUNSWICK		
49	Serpentine Lake sheet, Victoria and Northumberland counties; scale, 1 inch to 1 mile.....	Topography.
50	Sevogle Rivers area, Northumberland county; scale, 1 inch to 2 miles.....	Geology.
51	Woodstock area, Carleton and York counties; scale, 1 inch to 2 miles..	Geology.
NOVA SCOTIA		
52	Springhill sheet, Cumberland county; scale, 1 inch to 1 mile.....	Geology.
53	Oxford sheet (East half), Cumberland and Colchester counties; scale, 1 inch to 1 mile.....	Geology.
54	Oxford sheet (West half), Cumberland and Colchester counties; scale, 1 inch to 1 mile.....	Geology.
55	Bras d'Or sheet, Cape Breton and Victoria counties; scale, 1 inch to 1 mile.....	Geology.
56	Sydney sheet (East half), Cape Breton county; scale, 1 inch to 1 mile..	Geology.
57	Sydney sheet (West half), Cape Breton county; scale, 1 inch to 1 mile..	Geology.
58	Glace Bay sheet, Cape Breton county; scale, 1 inch to 1 mile.....	Geology.
59	Liverpool sheet (East half), Queens and Lunenburg counties; scale, 1 inch to 1 mile.....	Geology.
60	Liverpool sheet (West half), Queens and Lunenburg counties; scale, 1 inch to 1 mile.....	Geology.
61	Malaga Lake sheet (East half), Queens and Lunenburg counties; scale, 1 inch to 1 mile.....	Geology.
62	Malaga Lake sheet (West half), Queens and Lunenburg counties; scale, 1 inch to 1 mile.....	Geology.
63	Sherbrooke Lake sheet (East half), Kings and Lunenburg counties; scale, 1 inch to 1 mile.....	Geology.
64	Sherbrooke Lake sheet (West half), Kings and Lunenburg counties; scale, 1 inch to 1 mile.....	Geology.
65	Kejimkujik Lake sheet (East half), Digby, Annapolis, and Queens counties; scale, 1 inch to 1 mile.....	Geology.
66	Kejimkujik Lake sheet (West half), Digby, Annapolis, and Queens counties; scale, 1 inch to 1 mile.....	Geology.

In addition to the foregoing, sixty-four map and other figure drawings were prepared for reproduction by zinc-cut process, for illustrating reports, papers, and memoirs. Other draughting and related work necessary for staff and public use amounted to one hundred and eighty-three items.

The duties of an executive member of the Geographic Board of Canada were also performed during the year.

PHOTOGRAPHIC DIVISION

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

The following tabulation shows the work done during the fiscal year:

Contact prints, 4 by 5 to 36 by 48	15,466
Bromide enlargements, 4 by 5 to 40 by 72.....	1,893
Exposures developed, 1 by 1½ to 5 by 7.....	6,027
Dry plate negatives, 4 by 5 to 20 by 24.....	438
Wet plate negatives, 8 by 10 to 24 by 30.....	228
Zinc plates etched, 11 by 14 to 24 by 30.....	6
Photostat copies, 7 by 11 to 11 by 14.....	181
Lantern slides, 3¼ by 4.....	1,158
Photos and maps mounted.....	1,491
Total.....	26,888

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Chief of the Division, reports:

During the year 64,057 publications of the Geological Survey and National Museum, exclusive of French editions, were distributed. Of these 13,677 were sent to addresses on the regular mailing lists, and 50,380 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:

Accessions to the library include:

Books (by purchase)	348
Books (by gift)	364
Books (complete unbound volumes)	538
Pamphlets	220
Maps	649
Canadian Government documents (by exchange and gift)	634
British and foreign Government documents (by exchange and gift)	1,189
Scientific societies' bulletins, proceedings, and transactions (by exchange and gift)	2,246
Periodicals and continuations subscribed for	334

Two hundred and eighty-four volumes were bound and a large number of valuable works urgently in need of binding were temporarily placed in pamphlet boxes or folio covers. The recorded loans were 5,700. Inter-library loans amounted to 323 volumes and 113 were borrowed from other libraries. Cards added to the catalogue numbered 6,330, of which 147 were bibliographical entries and 43 biographical. The analysing of important monographs and other significant papers in periodicals added 799 new titles to the catalogue. Pamphlets catalogued amounted to 118, lantern slides 289, maps 166.

The number of new exchanges established was 111, an increase of 27 over the previous year. Of these 19 represented geological societies, 12 new geological survey series, 17 biological, 11 anthropological, 9 zoological, 3 botanical, 7 geographical, and 6 devoted to mining or mineralogy. The Société Française de Mineralogie and the Société Zoologique de France resumed exchange of publications after a lapse of several years, completing our series of their bulletins and memoirs to date.

Other outstanding gifts were: Societas Zoologica-Botanica Fennica Vanamo *Annales*, vols. 1 to 6, 1923-1928; Leipzig. Städtisches Museum für Völkerkunde, *Veröffentlichen*, 14 vols., 1916-1933; Montevideo Sociedad de Biología, *Archivos*, 4 vols., 1929-1933; Woods Hole Oceanographic Institute, Collected reprints; Carnegie Institution of Washington and the British Museum of Natural History, their 1935 volumes in natural history; Turton's Marine Shells of Port Alfred, presented by the Librarian of Parliament; The Order of Good Cheer, by Dr. J. Murray Gibbon; *Le Merveilleuse Aventure de Jacques Cartier and Au Coeur de Quebec*, by C. Marius Barbeau; also valuable books and pamphlets presented by Mr. Jenness and Mr. Harlan Smith of the Anthropological Division.

BRITISH COLUMBIA OFFICE

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

Continued use by the public of the facilities offered by this office showed that its usefulness is appreciated. The number of visitors registering totalled 5,287, which is indicative of the wide interest in the mining industry. In addition, a large number of inquiries were handled by mail and telephone. Reports issued totalled 3,890 and 1,085 separate maps were issued. A very large number

of rock and mineral specimens were received for determination. In this connexion it is of interest to note the large number of specimens for microscopic determination which are received from mining companies.

GEOGRAPHIC BOARD OF CANADA

J. H. Corry, Secretary, reports:

A number of changes in the personnel of the board have occurred during the past year: Mr. L. V. Rorke, Surveyor General and Provincial Representative for the Province of Ontario, retired on superannuation, and was succeeded by Mr. Charles H. Fullerton, now Surveyor General for Ontario; Hon. W. J. MacMillan, Provincial Representative for Prince Edward Island, resigned, and was succeeded by the Hon. Walter M. Lea; Mr. Lea died in January last and was succeeded by the Hon. Bradford W. LePage; Mr. Colin G. Groff, Acting Librarian, Provincial Representative for the Province of Alberta, retired from the service of the Provincial Government on November 30, 1935; up to the present time no Provincial Representative has been nominated by the Alberta Government.

The present personnel of the board is as follows: W. H. Boyd, Chairman, Chief Topographical Engineer, Geological Survey, Department of Mines; F. H. Peters, Surveyor General, Topographical and Air Survey Bureau, Department of the Interior; A. Dickison, Chief, Draughting and Reproducing Division, Geological Survey, Department of Mines; Lt.-Col. E. L. M. Burns, General Staff Officer, Surveys, Department of National Defence; Captain F. Anderson, Chief Hydrographer, Canadian Hydrographic Service, Department of Marine; F. C. C. Lynch, Director, Bureau of Economic Geology, Geological Survey, Department of Mines; E. E. Gagnon, Bridge Engineer, Department of Railways and Canals; A. M. Narraway, Chief Aerial Surveys Engineer, Topographical and Air Survey Bureau, Department of the Interior; N. J. Ogilvie, Director, Geodetic Survey of Canada, Department of the Interior; G. A. Young, Chief Geologist, Geological Survey, Department of Mines; J. H. Corry, Secretary.

The Executive Committee is comprised of Messrs. Peters, Dickison, and Burns.

The Provincial Representatives are as follows: British Columbia—Major G. G. Aitken, Chief Geographer, Department of Lands, Victoria, B.C.; Manitoba—W. J. Healy, Provincial Librarian, Winnipeg, Manitoba; New Brunswick—Dr. A. S. MacFarlane, Chief Superintendent of Education, Fredericton, N.B.; Nova Scotia—Harry Piers, Curator and Librarian, Provincial Museum, Halifax, N.S.; Ontario—Charles H. Fullerton, Surveyor General, Surveys Branch, Department of Lands and Forests, Toronto, Ont.; Prince Edward Island—Hon. Bradford W. LePage, President of the Executive Council, Charlottetown, P.E.I.; Saskatchewan—W. W. Amos, Deputy Minister of Natural Resources, Regina, Sask.

During the past year the board has passed upon several thousands of names for thirty map sheets; in addition to the regular duties of the board inquiries and requests for information as to the correct designation, location, meaning, and history of geographical names have been received from the various departments of the Federal service and also from foreign sources. These inquiries have involved extensive research for the required information, which, when found, has been forwarded to the persons requesting it.

NATIONAL MUSEUM OF CANADA

W. H. Collins, Acting Director

The growth and expansion of the work of the National Museum of Canada continue to be retarded by overcrowding, and lack of space for exhibits, offices, and storage. Notwithstanding this, the museum organization is highly gratified by the substantial interest towards it that is being manifest by the public both in Canada and other countries. For a good many years individuals and industrial corporations, such as the Imperial Oil Company, the International Nickel Company of Canada, and the American Chemical Company, have responded generously to suggestions for the donation of exhibition materials. This year a munificent gift was received from Mr. Harry Snyder, of Chicago and Montreal, in the form of a group of wood bison and northern timber wolves that were collected by himself and prepared for exhibition at his expense by the James L. Clark Studios, of New York city. The donation as received by the National Museum represents an outlay by Mr. Snyder of many thousands of dollars. The group of animals, arranged in a most natural looking setting with painted landscape background, is now safely installed in the Museum. A fuller description of it may be found in the Annual Report of the National Museum of Canada for 1935.

Another practical example of the interest of the public was a gift by the International Nickel Company of Canada of a copy of its moving picture film "Heritage," which illustrates admirably the processes whereby nickel, copper, and other metals are recovered from the great ore deposits at Sudbury. Mr. F. D. Burkholder, furrier, of Ottawa, donated an exceptionally fine specimen of silver fox.

EDUCATIONAL WORK

The educational work of the Museum is perhaps the most important activity that a museum, and particularly a national museum, can perform, for it is the one whereby a museum can be made useful to persons living at a distance from it. Under existing circumstances educational work is being carried on in a greater proportion than usual.

Some additions to the growing collection of moving picture films were made during the year by donation, purchase, or preparation by members of the staff. Reference has already been made to the film, "Heritage," presented by the International Nickel Company of Canada. Another entitled "Cheenama, The Trail Maker" was photographed by H. I. Smith and Diamond Jenness, of the Museum staff, and another entitled "Handicrafts of French Canada" by C. M. Barbeau. These films, besides being used for lectures and other museum purposes are lent to schools, scientific societies, and other interested organizations. No charge is made for loans except cost of transportation.

The already extensive collection of photographs by officers of the National Museum and the Geological Survey were added to considerably during 1935. These are made available to the public, in the form of photographic prints and lantern slides, either by loan or by sale at about the cost of preparation.

An unusually large quantity of mineral and rock specimens were sold or given during 1935 to prospectors and to schools.

The annual series of museum lectures that are given in the Museum during the winter months were continued during 1935-36. The attendance was considerably larger than usual. Full details may be found in the Annual Report of the National Museum.

FIELD AND OFFICE WORK

The principal activities of the members of the staff that pertained to scientific investigations and collection of specimens are summarized in the following sections and paragraphs.

ANTHROPOLOGICAL DIVISION

C. M. Barbeau continued his studies of the early arts and handicrafts of Quebec. Old records such as those of the Ursulines Convent, the Hotel Dieu, and the Hôpital-General of Quebec, Notre-Dame church, Montreal, and the seigniories of Murray Bay and Mount Murray were carefully studied and yielded valuable historical material. The early traditions of Charlevoix and Chicoutimi were studied and recorded and an investigation was made of the traditional craft of pottery making in various parts of the province of Quebec.

Diamond Jenness collaborated with H. I. Smith in taking motion pictures of Indian life in Ontario. During the winter he made ethnological investigations among the Coast Salish Indians of Vancouver island and the neighbouring mainland. He also examined a number of kitchen-middens. In the office he continued work on a report on the Sarcee Indians of Alberta.

Douglas Leechman made excavations of Eskimo igloos on Button islands and on the southwest part of McLelan strait near Port Burwell at the entrance to Hudson strait. Measurements were made, photographs taken, and specimens were collected.

H. I. Smith continued the classification and arrangement of his files of information concerning the archæology of Canada. He spent four weeks in the field taking, in co-operation with D. Jenness, a moving picture of Ojibwa Indian life showing among other activities the making of a birch-bark canoe and the harvesting of wild rice.

W. J. Wintemberg, in collaboration with Dr. J. C. B. Grant of the University of Toronto, excavated a prehistoric Indian cemetery in Windsor, Ontario. The greater part of the summer was spent by Mr. Wintemberg in an intensive exploration of the double-walled Southwold earthworks about 10 miles from St. Thomas, Elgin county. Material collected proves that the site is prehistoric and was inhabited by Neutrals.

BIOLOGICAL DIVISION

R. C. Hosie, of the University of Toronto, had charge of a party near Batchawana bay, on the east side of lake Superior. Plants and animals were collected, with ecological notes which are being prepared at the University of Toronto for publication.

Hamilton M. Laing, of Comox, British Columbia, with two assistants, collected vertebrate animals on northern Vancouver island. The party began at Comox, on the east coast of the island, and worked at various points along the northeastern, northern, and northwestern coast as far as the southeast arm of Quatsino sound on the west side of the island.

Victor E. Gould, of Wolfville, Nova Scotia, with one assistant, collected mammals, birds, amphibians, and reptiles on Cape Breton island, beginning work at cape North and working down the west side to the strait of Canso, with some work carried back a few miles into the interior.

On March 31, 1936, the catalogued specimens of mammals in the National Museum of Canada numbered 14,113, an increase of 1,458 during the year; birds numbered 26,675, an increase of 789; amphibians and reptiles numbered 4,875, an increase of 91.

R. M. Anderson, Chief of the Division, continued work on a manual on the Mammals of Canada, and in revision of a Check-List of Canadian Mammals.

P. A. Taverner devoted most of his time to study of bird specimens and spent some time during the summer photographing wild flowers for lantern slide collections.

C. L. Patch, besides carrying on the usual laboratory work of mounting specimens of mammals and birds and finishing and making up of the large number of fresh and salted specimens that came in from the field parties, prepared a special biological and anthropological exhibit for the Central Canada Exhibition at Ottawa in August 1935.

The systematic work of the National Herbarium has been suspended since the death of Dr. M. O. Malte, the sole qualified botanist on the staff. However, a technical assistant has carried on the work of mounting, labelling, and filing specimens; 2,889 sheets were labelled and numbered during the year. The number of sheets officially registered and numbered in the herbarium totalled 132,100 on March 31, 1936.

PALÆONTOLOGY (GEOLOGICAL SURVEY)

Most of the activities of the Division of Palæontology were for the Geological Survey and are detailed under that heading. Among those relating to the Museum, C. M. Sternberg spent the summer collecting vertebrate fossils in the Prairie Provinces. He obtained a mosasaur skull in the Riding Mountain section of Manitoba. He assisted the Calgary Zoological Society to construct a life-size dinosaur model for inclusion in an outdoor museum of extinct animals. A. LaRocque collected fresh-water shells from lakes in Algonquin park, Ontario.

Details concerning laboratory and exhibition work are given in the Annual Report of the National Museum.

MINES BRANCH

John McLeish, Director

The Mines Branch has during the past four years continued to meet the increasing demand of the mining industry for technological assistance in the production, treatment, and marketing of metals and minerals, and of the general public for information respecting the mineral resources and the mining and metallurgical industry of Canada.

Changes in staff during the year included the resignation, in May 1935, of H. H. Bleakney, Assistant Metallurgical Engineer, and his replacement by the appointment of G. S. Farnham on February 15, 1936. A. H. Seaton, Laboratory Helper, died on January 15 and was replaced in March by the appointment of L. E. Bisson. J. R. Kirkconnell was promoted from the Fuel Research Laboratories to fill a vacancy in the Administrative Division. Eleven technical and clerical employees who had been on the temporary list for a number of years were given permanent status.

Field investigations of mineral resources and field studies of mining problems and ore treatment methods have been severely curtailed during the past four years.

In the general investigations of mineral resources, field studies were again limited to keeping a personal contact with the progress of a few of the more important sections of the industry during the year. Despite the restrictions in both funds and personnel, the staff of the Mineral Resources Division has continued to render valuable assistance in the collecting and disseminating of information respecting Canada's mineral resources and the possibilities of economic developments. This assistance has been rendered through published reports, the preparation of many memoranda of information in reply to inquiries, and equally numerous personal conferences with engineers and with representatives of capital seeking opportunities for investment. The progress made in the production of rock wool in Niagara district within the last two years is an outstanding example of the development of a new industry resulting from the investigative work carried on by this division of the Mines Branch.

Pressure of work in the Ore Dressing Laboratories is increasing each year. One hundred and thirty-eight major investigations were completed in 1935, as compared with one hundred and sixteen in 1934, and a total of one hundred and seventy during the three previous years. At the end of March 1936, the number of sample shipments under test or awaiting action was forty, or sufficient for four months' work.

Of the metallic ores tested, gold ores, or those in which gold was predominant in value, constituted the majority, being some ninety in number. Twenty-six samples were ores of other metals, many of them carrying several metals, including copper, gold, silver, nickel, lead, zinc, vanadium, tungsten, titanium, radium, and molybdenum.

Owing to resignations of staff, only a small amount of work was done in ferrous metallurgy. Non-metallic investigations comprised a number dealing with silica sand and clay, grinding pebbles, magnesite, nepheline syenite, chromite, lime, gypsum, etc.

In the Fuel Research Laboratories studies and laboratory research work have been continued on Canadian coals, natural gas, petroleum, and Alberta bitumen.

These investigations are furnishing knowledge that is of great assistance in extending the home market for Canadian coal and has resulted in the

greatly increased use of Canadian coal for coke and gas-making at Montreal, Winnipeg, and Vancouver.

In the Ceramic Laboratories one hundred and twenty-one samples of clays, shales, and associated raw materials were examined to determine their suitability for the manufacture of industrial products. General study and research work were continued on: physical properties of Canadian bricks; clay as a plasticizer in masonry mortars; refractory industry and resources of Canada; increasing the density of brick; petrographic studies in dolomite research; the refining of sodium uranate.

During the year the Director, in addition to departmental administrative duties, served as a member of the Dominion Fuel Board; the Advisory Committee on Mining Regulations; several Associate Committees of the National Research Council; and the Government Advisory Committee on the Civil Service Superannuation Act. In addition he attended the Annual Meeting of the Mining Society of Nova Scotia in Pictou, N.S., June 1935, and the Annual Western Meeting of the Canadian Institute of Mining and Metallurgy in Vancouver, November 1935. In company with W. B. Timm, Chief of the Division of Ore Dressing and Metallurgy, an inspection was made, in June, of gold milling operations in Nova Scotia. Conferences were held with officials of Provincial Bureaux of Mines, both in the east and in the west, in pursuance of the department's policy of close co-operation with the provinces in the work carried on by the Mines Branch.

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

MINERAL RESOURCES DIVISION

As in previous years, a comprehensive survey of the progress of the mineral industry in Canada during the previous calendar year (1934) was compiled by the staff of this division for publication; formerly these reviews were issued only in mimeograph form, but the demand for use by the Canadian press and for other purposes has grown so large that it has become necessary to print them for distribution either as separate leaflets or in book form. In all sixty-one separate products were reviewed. Reports were completed and published on: Petroleum Fuels in Canada, Deliveries for Consumption, Calendar Year 1933; The Canadian Mineral Industry in 1934; Limestones of Canada, their Occurrence and Characteristics, Part III, Quebec; Gold in Canada, 1935 (English edition); Les Calcaires du Canada, Gisements et Caractéristiques, Partie III, Québec; List of Milling Plants in Canada, Part II, Non-Metallics; List of Milling Plants in Canada, Part I, Metallic Ores, revised edition; List of Gold Mines in Canada (July 3, 1935); List of Producers of Coke in Canada. At the close of the year there were five reports in press: Petroleum Fuels in Canada, Deliveries for Consumption, Calendar Year 1934; Moulding Sands of Canada (English and French); The Canadian Mineral Industry in 1935; L'Or au Canada, 1935. In addition to the preparation of these reports for publication, members of the staff of the division made eight public addresses on different phases of the mineral industry, and sixteen articles were prepared and published in the technical press of Canada, in the United States, or in Great Britain; one article being reproduced in a South African mining journal.

A slight increase was noted in the number of inquiries on matters relating to the mining industry that were received and answered during the year. These inquiries include not only requests for information about mining incorporations, but also many individuals ask for information about minerals, mineral products and their use in industry, markets and marketing, methods of recovery, and value. Where possible inquiries are answered by letter, in many cases by the preparation of special memoranda, by compiling special lists referring to published articles, or by the dispatch of printed reports already issued by the Mines

Branch. Most of the inquiries originate in Canada, but many, especially those relating to specific mining properties, come from United States points; requests for technical data come from many parts of the British Empire and occasionally from foreign countries.

The Chief of the Division, A. W. G. Wilson, was occupied most of the year with the administrative duties of the division; his work also included the preparation of some special reports for the use of other departments, as well as the compilation of monthly progress reports and one annual report. He served on two associate committees of the National Research Council and one international sub-committee; there were also a number of consultations on technical matters with several other departments and with some industrialists. During the year about three months were spent, in company with L. H. Cole, on a trip to western Canada, where nearly all the producers of industrial minerals were interviewed and their operations inspected; visits were also made to the mining departments of all the western provinces to consult with their officials about problems of mutual interest, to arrange for the fullest possible co-operation, and to avoid duplication of effort.

H. S. Spence was engaged in investigations upon the various industrial (non-metallic) minerals in his charge, and also of radioactive and rare-element minerals. His field work included six weeks in the Great Bear Lake and Lake Athabaska fields, where he made a progress inspection of radium and silver developments; three weeks in British Columbia, Alberta, and Manitoba, investigating various industrial minerals; and three weeks in Ontario and Quebec, also on industrial minerals investigations. Visits were also made to a number of industrial plants in the United States.

L. H. Cole continued his work on granites and related crystalline rocks as used in structural work or for monuments; similar work is also in progress on sandstones and freestones. He also studied current developments in industries producing or utilizing gypsum, salt, and sodium sulphate. About two and a half weeks were spent, in company with J. H. McMahon of the Ceramics Division, on an investigation of the silica and fireclay deposits that occur on Mattagami river, 9 miles north of Smoky falls, Ontario; about 4 tons of materials were shipped to the laboratories at Ottawa for testing purposes; on the same trip a granite deposit in Quebec and an operating silica sand plant were visited. Between September and December an extended trip was made to the western provinces; many operating properties, chiefly those producing granites, silica, sodium sulphate, sodium carbonate, gypsum, and other industrial minerals, were visited in the western part of Ontario and in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia. Some progress was made in the assembling of data for use in reports and in the preparation of memoranda and reviews; he also co-operated in laboratory investigations in progress on materials collected during the season.

S. C. Ells continued his studies of the possibility of utilizing the asphalt resources of Alberta. During the field season his services were loaned to the Bureau of Economic Geology, and he was employed in the exploration of an unknown area in northeastern Alberta and the adjacent parts of northwestern Saskatchewan.

M. F. Goudge continued his studies of the limestone industries; his report on limestones of the province of Quebec was completed and issued during the year (in English and in French); considerable progress was also made in the preparation of a companion volume dealing with the limestones of Ontario. Correspondence on the subject of limestones and their various uses has grown to very large proportions and much information was furnished to correspondents and also to direct inquirers.

The rock wool industry, in which this officer did the pioneer work, has been progressing satisfactorily and a third plant has been started. Mr. Goudge has kept in close touch with the developments in this industry.

During the year sixty-three days were spent on field investigations relating to the limestone industries and their operations, most of the time being spent in Ontario and in the western provinces.

A. H. A. Robinson was engaged during most of the year in the preparation of the third edition of his report on gold in Canada, which was printed and distributed late in the year; he also compiled a number of special articles for press use. About seven weeks were spent in the field inspecting new developments in the gold mining areas of Nova Scotia, western Quebec, and Ontario.

V. L. Eardley-Wilmot continued his studies of abrasives and diatomites; he also began an investigation of the industries producing sands for blasting, mineral grits for shingles and stuccos, roofing slates, and mineral fillers, and of the various trades in which these materials are used; about fifteen weeks were devoted to field investigations associated with these subjects, chiefly in the study of trade requirements and of present sources of supply. A number of molybdenite occurrences in Ontario on which some development work was in progress were examined.

John Casey, statistician, continued the annual survey of fuel oil for all purposes used throughout Canada; a report on deliveries for consumption during the calendar year 1933 was issued, and the report for 1934 is now in press. A similar survey of bunker fuels used in Quebec, Ontario, and Manitoba was also conducted and a tabular statement for the year (1934) was prepared. Mr. Casey also visited all places in Quebec and Ontario where peat bogs were being worked. During the year a number of statistical tables were prepared to meet special requests for information; and a compilation was prepared of information for the ten graphs dealing with phases of mineral production.

A. Buisson continued his office work in the Records Section during most of the year. A large number of special reviews for press use were prepared; five Lists of Mine Operators were revised, four being submitted for publication; a number of special memoranda on various subjects relating to the mining industry were prepared; and a number of graphs visualizing production data were compiled, or extended from previous compilations.

C. H. Freeman was engaged chiefly in the examination of samples of moulding sands submitted by inquirers; some time was devoted to the final revision of his report on moulding sands. He also revised the List of Manufacturers of Clay Products in Canada.

E. H. Wait continued his work of compiling records of all mining companies organized in Canada; transcriptions of these records were furnished to very many inquirers in Canada and to some in the United States or elsewhere.

H. A. Leverin, of the Chemical Division, continued an investigation of industrial waters. Two months were spent on field work collecting surface water samples at the key station and civic water at water works from all towns and cities of 3,000 inhabitants and more. The territory covered includes the province of Quebec as far east as Rivière du Loup, and the province of Ontario south of Ottawa river and Georgian bay. Samples of 166 surface and civic waters were collected.

The purpose of the investigation is to determine the characteristics of all natural waters in Canada that are used by, or are available to, industry. A compilation has been made of the analytical results on waters collected in Ontario and Quebec, and a progress report thereon is in preparation.

ORE DRESSING AND METALLURGICAL DIVISION

W. B. Timm, Chief of Division, reports an increase over the preceding year in the number of investigations conducted on Canadian ores, non-metallic minerals, and metallurgical products in the laboratories of the division. One hundred and thirty-seven reports of investigations were issued, fifty-six of which were prepared for publication, the remainder being submitted only to those

directly interested. In addition, a large number of minor tests were conducted, reported on by letter. The majority of the investigations were on gold ores, or ores in which gold was the principal valuable mineral.

Many of the investigations that have been carried out in these laboratories in recent years have been followed by the erection of mills built in accordance with the results obtained, thus enabling properties to be brought successfully into production. Improvements have also been made in the metallurgical practices of operating plants, and mills are in course of erection or are under consideration for other properties.

The continued expansion of the gold mining industry, the increasing price and markets for the base metals, an expanding market for industrial minerals and metallurgical products generally, have been responsible for an increase in the applications for investigative work. The increase in the number of investigations performed and reported on has been due to the increased experience of the staff, the elimination of unnecessary tests by a thorough preliminary microscopic study of the ores, and to less time being devoted to the investigations than they sometimes warrant, owing to the number of ores awaiting investigation and the insistence of the operators for results. At the end of the calendar year, the investigation of fourteen metallic ores was in progress and seventeen metallic ores were on hand awaiting investigation. At the end of the fiscal year March 31, the investigation of twenty-one metallic ores was in progress and nineteen metallic ores were on hand awaiting investigation.

FIELD STUDIES

W. B. Timm spent three weeks in the field visiting the gold milling plants of Nova Scotia; six weeks in visiting the pitchblende-silver occurrences and concentrator at Great Bear lake, Northwest Territories, and the gold milling plants in British Columbia; three weeks in visiting the gold milling plants in northwestern Quebec and northeastern Ontario for the purpose of obtaining information on the latest developments in milling practices and discussing with the operators their problems. C. S. Parsons spent sixteen weeks visiting the gold milling plants and concentrators in northwestern Ontario, east-central Manitoba, British Columbia, and Cape Breton, Nova Scotia. R. J. Traill and W. R. McClelland each spent two days at the radium refinery at Port Hope, Ontario, discussing with the technical staff the problems of radium, silver, and uranium extraction, and the precautions being taken with respect to the health hazards of the employees. W. R. McClelland consulted with the officials of the Ontario Department of Health on the hazards to radium workers.

LABORATORY INVESTIGATIONS

Metallic Ores. Investigations were carried out by C. S. Parsons, R. J. Traill, A. K. Anderson, J. D. Johnston, W. R. McClelland, M. H. Haycock, and W. S. Jenkins on the examination and treatment of the following ores:

Gold ore from the Engineer mine, Atlin district, B.C. (609).

Gold ore from Duparquet Mining Company, Limited, Duparquet, Que. (610).

Gold ore from Atlin Pacific Mining Company, Limited, Bighorn creek, Atlin district, B.C. (611).

Lead-zinc-silver ore from the Mammoth mine, Silverton, B.C. (612).

Gold ore from Canadian Reserve Mines, Limited, Larder Lake, Ont. (613).

Gold ore and mill products from Paymaster Consolidated Mines, Limited, South Porcupine, Ont. (614).

Gold ore from Miller-Independence mine, Boston Creek, Ont. (615).

Gold ore from Vimy Gold Mines, Limited, Ramore, Ont. (616).

Gold ore from Thorneloe mine, Thorneloe township, Porcupine district, Ont. (617).

Copper-gold ore from Manitoba and Eastern Mines, Limited, Timagami, Ont. (618).

Gold ore from The Cole Gold Mines, Limited, Pipestone bay, Red Lake area, Patricia district, Ont. (619).

Gold-silver ore from Chapeau mine, Reward Mining Company, Limited, Slocan mining division, B.C. (620).

- Gold-copper ore from Wendigo mine, Lake of the Woods district, Ont. (621).
- Gold-copper ore from Moosha Gold Mines, Limited, Bousquet township, Abitibi county, Que. (622).
- Gold ore from Little Long Lac Gold Mines, Limited, Geraldton, Ont. (623).
- Gold ore from Wayside Consolidated Mines, Limited, Bridge River district, B.C. (624).
- Copper-pyrite ore from the Eustis mine of Consolidated Copper and Sulphur Company, Limited, Eustis, Que. (625).
- Gold ore from Gunnar Gold Mines, Limited, Beresford Lake, Man. (626).
- Gold ore from Bradian Mines, Limited, Bridge River district, Bralorne, B.C. (627).
- Gold-copper ore from Ashloo Gold Mining Syndicate, Vancouver mining district, Squamish, B.C. (628).
- Gold-silver ore from Bayonne Consolidated Gold Mines, Limited, Nelson mining division, B.C. (629).
- Copper-zinc ore from the Abana mine, Normetal Mining Corporation, Limited, Desmeloizes township, Abitibi county, Que. (630).
- Gold ore from Burwash Yellowknife Mines, Limited, Yellowknife river, Mackenzie district, N.W.T. (631).
- Arsenical-gold ore from Whitewater mine, Taku River district, Atlin mining division, B.C. (632).
- Gold ore from Shawkey Gold Mining Company, Limited, Dubuisson township, Abitibi county, Que. (633).
- Gold ore from Beattie Gold Mines, Limited, Duparquet township, Abitibi county, Que. (634).
- Gold ore from Pearce mine, Marmora township, Deloro, Ont. (635).
- Gold ore from McWilliams-Beardmore property, Thunder Bay district, Empire post office, Ont. (636).
- Gold ore from Darwin Gold Mines, Limited, Michipicoten district, Wawa, Ont. (637).
- Gold ore from Laurentian mine, Wabigoon Lake area, Kenora mining district, Ont. (638).
- Gold ore from Osoyoos Mines, Limited, Osoyoos, B.C. (639).
- Gold ore from Gold Fern Mines, Limited, Hall creek, Nelson mining division, B.C. (640).
- Gold ore from the "K" zone, Siscoe Gold Mines, Limited, Siscoe, Que. (641).
- Gold ore from Centre Star mine, Wesko Exploration and Development Company, Limited, Ymir, B.C. (642).
- Gold ore from Lacey Gold Mining Company, Limited, Chester Basin, N.S. (643).
- Silver-bearing mill tailings from Nipissing Mining Company, Limited, Cobalt, Ont. (644).
- Gold ore from Straw Lake Beach Gold Mines, Limited, Straw lake, Kenora mining district, Ont. (645).
- Gold ore from Kalamalka Gold Mines, Limited, Vernon, B.C. (646).
- Gold ore from Shiningtree Gold Mines, Limited, McMurchy township, Sudbury mining district, Ont. (647).
- Gold ore from Macjoe Sturgeon Gold Mines, Limited, Sturgeon River area, Thunder Bay district, Ont. (648).
- Gold ore from Sand River Gold Mining Company, Limited, Thunder Bay district, Ont. (649).
- Gold-bearing concentrates from McWatters Gold Mines, Limited, Rouyn township, Témiscamingue co., Que. (650).
- Gold ore from Taylor Windfall Gold Mining Company, Limited, Whitewater district, Clinton mining division, B.C. (651).
- Gold ore from Hardrock Gold Mines, Limited, Little Long Lac area, Thunder Bay district, Ont. (652).
- Gold ore from Relief Arlington Gold Mines, Limited, Erie, B.C. (653).
- Gold ore from Argosy Gold Mines, Limited, Casummit Lake, Patricia district, Ont. (654).
- Gold ore from Stadacona Rouyn Mines, Limited, Rouyn township, Témiscamingue county, Que. (655).
- Silver ore from Toric mine, Torbit Mining Company, Limited, Kitsault River section, Nass River mining division, B.C. (656).
- Gold- and silver-bearing lead-zinc ores from "Mamie" and "Silver Creek" groups of mineral claims, Hudson Bay mountain, Omineca mining division, B.C. (657).
- Gold- and silver-bearing lead-zinc ore from Omineca Gold Quartz Mines, Limited, Copper river, near Terrace, B.C. (658).
- Gold ore from Red Lake Gold Shores Mines, Limited, Red Lake area, Patricia district, Ont. (659).
- Gold ore from Laguna Gold Mines, Limited, Herb Lake, northern Manitoba. (660).
- Gold ore from Pamour Porcupine Gold Mines, Limited, Whitney township, Cochrane district, Porcupine mining division, Ont. (661).
- Gold ore from God's Lake Gold Mines, Limited, Gods Lake, Manitoba. (662).
- Gold ore from Seal Harbour Gold Mines, Limited, Guysborough county, Goldboro, N.S. (663).

In addition to the ores listed above, on which reports were published, experimental tests were conducted on the following and reports issued to those directly interested:

- Arsenical-gold concentrate from Casey Summit Gold Mines, Limited, Casummit Lake, Patricia district, Ont.
- Gold ore from the Sol d'or Gold Mines, Limited, Rainbow lake, Patricia district, Ont.
- Gold-bearing flotation tailing from Dentonia Mines, Limited, Greenwood, B.C.
- Gold-bearing tailings from Mikado mine, Lake of the Woods district, Ont.
- Gold-bearing tailings from Golden Star mine, Rainy River district, Ont.
- Gold-silver ore from Paladora property, Greenwood mining division, B.C.
- Gold ore from the Pluto Claim No. 1, Island Lake district, Man.
- Silver-copper flotation concentrate from Eldorado Gold Mines, Limited, Great Bear lake, N.W.T.
- Gold ore from Centennial mine, Michipicoten district, Ont.
- Gold ore from lots 9 and 10, range IV, Launay township, Abitibi county, Que.
- Gold-bearing flotation concentrate from Northern Empire Mines Company, Limited, Empire, Ont.
- Gold ore from Murray-Algoma Mining Company, Limited, Algoma district, Ont.
- Gold ore from McKenzie-Carscallen property, Carscallen township, Porcupine district, Ont.
- Copper-zinc ore from old mine dumps of Poulin Gold Mines, Limited, near Sherbrooke, Que.
- Gold-bearing concentrate from North Shore Gold Mines, Limited, Thunder Bay district, Schreiber, Ont.
- Zinc ore from McLean-McNicoll, Limited, Nipigon, Ont.
- Copper ore from Fortin property, Dufresnoy township, Abitibi county, Que.
- Gold ore from Mac-Aver Mines, Limited, Davis and Scadding townships, Sudbury district, Ont.
- Gold ore from Wendigo mine, Lake of the Woods district, Ont.
- Gold ore from Neville Canadian Gold Mines, Limited, McMurchy and Churchill townships, Shingtree area, Ont.
- Gold ore from Morton Lake district, Manitoba.
- Gold ore from O'Neill Thompson Gold Mines, Limited, Joannes township, Témiscamingue county, Que.
- Gold-bearing concentrate from Minto Gold Mines, Limited, Bridge River district, B.C.
- Arsenical gold ore from Thompson-Cadillac Mining Corporation, Limited, Cadillac township, Abitibi county, Que.
- Gold-bearing tailing from San Antonio Gold Mines, Limited, Bissett, Man.
- Gold-silver-lead ore from Allico mine, near Revelstoke, B.C.
- Lead-zinc ore from True Fissure mine, near Ferguson, B.C.
- Pyrite ore from Richard Ramore Gold Mines, Limited, Iroquois Falls, Ont.
- Gold ore from the Dwyer Elbow Lake property, Elbow lake, Man.
- Gold ore from lots 9, 10, and 11, concession IV, Launay township, Abitibi county, Que.
- Copper-lead-zinc ore from Poulin Gold Mines, Limited, Sherbrooke county, Que.
- Gold ore from Laurentian mine, Wabigoon Lake district, Kenora mining division, Ont.
- Gold ore from Shebango Gold Mines, Limited, Oba area, Algoma district, Ont.
- Gold ore from the Shaw Porcupine property, Shaw township, Porcupine district, Ont.
- Arsenical-gold ore from Dupont Mining Company, Limited, Cameron island, Lake of the Woods district, Ont.
- Arsenical-gold ore from north half lot 1, concession XI, Tudor township, Hastings county, Ont.
- Tungsten ore from Hardscrabble creek, Cariboo mining division, B.C.
- Gold ore from Elizabeth Gold Syndicate, Rainy River district, Ont.
- Gold ore from Hawkins Mining Syndicate, Oba area, Algoma district, Ont.
- Titanium ore (ilménite) from St. Urbain, Charlevoix county, Que.
- Molybdenite ore from the Indian Lake deposit, Masham township, Hull county, Que.

Reports were also submitted on the use of the Crocetol frothing reagents "A," "B," "C," and "X" manufactured by Shawinigan Chemicals, Limited, Shawinigan Falls, Que., and on the use of crude resin oil soap as a frothing reagent for Consolidated Paper Corporation, Limited, Three Rivers, Quebec.

R. J. Traill carried on investigations on the problems of the radium plant operation at Port Hope, Ont., in connexion with the extraction of radium, uranium, and silver from the ore and concentrates from the property of the Eldorado Gold Mines, Limited, Great Bear lake, N.W.T. In addition he conducted investigations on the following:

- Recovery of the gold and silver in the zinc plant residues of the Hudson Bay Mining and Smelting Company, Flinflon, Man.
- Metallization of the iron content in titaniferous magnetite from the St. Charles deposit, Chicoutimi county, Que.

Non-Metallic Minerals. R. K. Carnochan and R. A. Rogers carried out investigations on the following non-metallic minerals and industrial mineral products:

- Silica sand and clay from the deposit of General Refractory Products, Limited, Smoky falls, Ont. (664).
- Radium ore from Great Bear Lake Development Company, Limited, Mackenzie district, Hottah Lake area, N.W.T.
- Grinding tests on pebbles from Ceramic, Que., for the Development Branch, Canadian Pacific Railway Company, Limited, Montreal, Que.
- Flotation concentration of magnesite from the Marysville deposit near Cranbrook, B.C.
- Nepheline syenite from Canadian Nepheline, Limited, Stony lake, Methuen township, Peterborough county, Ont.
- Chromite from B.C. Chrome Company, Limited, Ashcroft, B.C.
- Plasticity and fineness tests on hydrated lime from St. John Lime Company, Limited, Brookfield, N.B.
- Gypsum from H. B. McCurdy, Sydney, N.S.
- Gypsum from Windsor Plaster Company, Limited, Windsor, N.S.
- Gypsum from Moose river, northern Ontario.

In addition, numerous minor tests were conducted on sandstone, silica sands, clays, graphite, titanite, asbestos, dolomite, mica, talc, garnet, sillimanite, etc.

Ferrous Metallurgy. H. H. Bleakney, who carried on the investigations in ferrous metallurgy after the resignation of T. W. Hardy in 1934, also resigned in the early part of 1935, and after May 31 the work was almost entirely curtailed, tests of a minor nature being performed by A. E. Larochelle, senior laboratory assistant. The investigations and test work conducted during the year were as follows:

- Metallization of high-grade concentrate of Texada island (B.C.), magnetite.
- The relative merits of sponge iron and steel scrap as a base for steel making.
- Suitability of Quebec chromites for the production of ferrochromium.
- Investigation of pinholes in the enamel of an enamelled cast iron product for Ferro-Enamelling Company, Limited, Ottawa.
- Examination of stainless steel tubing used in lighthouse vapour burners for Department of Marine, Ottawa.
- Endurance tests on weld and plate material for Dominion Bridge Company, Limited, Montreal, Que.
- Hardness tests on two jackbits for Gleeson-Martin, Limited, Ottawa, Ont.
- Izod tests on steel samples from Dominion Engineering Works, Limited, Montreal, Que.
- Izod tests on steel and brass bars from Dominion Engineering Works, Limited, Montreal, Que.
- Tensile and other tests on steel samples from the Naval Service, Department of National Defence, Ottawa.
- Compression tests on two sections of drawn seamless tubing for the Air Service, Department of National Defence, Ottawa.
- Observations on the selection of steel for sheet steel piling for Department of Public Works, Ottawa.

In the radium measuring laboratory, measurements for radioactivity were made with the Alpha electroscope on four samples of rocks and mill products as follows:

- Upper Lakeville, Halifax, N.S.
- Burridge, Bedford township, Frontenac county, Ont.
- Claim 21567, Margaret claim, Athabaska lake, Sask.
- Eldorado Gold Mines, Limited, Great Bear lake, N.W.T.

In the mineragraphic laboratory, 1,166 polished sections of ores and mill products and 27 thin sections of non-metallic minerals were prepared for microscopic examination as follows:

For examination for the Ore Dressing and Metallurgical Laboratories.....	1,034
For Geological Survey, Canada, Ottawa.....	90
For Noranda Mines, Limited, Noranda, Que.	18
For W. H. Patmore, Vancouver, B.C.	9
For Queen's University, Kingston, Ont.	5
For Nova Scotia Technical College, Halifax, N.S.	4
For James D. Campbell, Vancouver, B.C.	3
For Mineral Resources Division, Mines Branch, Ottawa	3
Total.....	1,166
Thin sections for Ore Dressing and Metallurgical Laboratories	27

M. H. Haycock completed and reported on 104 investigations on the microscopic examination of ores and mill products, 88 of which were in connexion with the test treatment, the results being embodied in the reports of investigations. In addition, 16 special studies of ores and mill products, submitted by industry, especially for microscopic examination, were reported. He also completed and reported on 38 spectrographic analyses, 31 of which were in connexion with the Mines Branch investigations and 7 for sources outside the department.

H. C. Mabee, Chief Chemist, reports that 14,644 chemical determinations were made on 4,935 samples received in the chemical laboratories of the division, an increase of 18 per cent over 1934 and of 45 per cent over the average for the previous five years. Of the samples received, 298 were field samples submitted by officers of the Geological Survey and 14 by officers of the Mineral Resources Division, Mines Branch. The remainder, 4,382 samples, originated from the investigations of the division. In addition, investigations were continued on the use of highly basic fluxes in the assay of siliceous gold ores, and on a pre-treatment method for the assay of mill pulp samples obtained during cyanide treatment of the ores. The purpose of these investigations was to determine the possibility of error that might occur in the application of the regular fire-assay methods usually employed. Physical and chemical tests were also made on a number of samples of hydrated limes and plasters.

FUELS AND FUEL TESTING DIVISION

B. F. Haanel, Chief of Division, reports:

Investigations conducted were domestic furnace burning tests on Canadian imported fuels used in Canada, tests on the washing, carbonization, and briquetting of coals, and a further large-scale storage test on Nova Scotia coal at Sydney, Nova Scotia. Laboratory research work on the classification, constitution, beneficiation, and hydrogenation of Canadian coals was carried on throughout the year. Samples of natural gas from a number of new wells situated in different parts of Canada were obtained and their composition, including helium content, determined. The annual gasoline survey comprising the collection and analysis of 179 samples of gasoline obtained from different cities in Canada was carried out as usual. In addition to the regular chemical work of the division all the chemical work in connexion with the Explosives Division was carried out by technical officers of the Fuel Research Laboratories.

Additional to planning and directing the work of the division, Mr. Haanel attended the regular meetings of the Dominion Fuel Board. During the month of May he attended a conference in New York, in company with Mr. A. T. Stuart, Director of the Electrolytic Gas Department of the Hydro Electric Power Commission of Ontario, the purpose of which was to obtain information concerning the manufacture of peat in Russia. In November, accompanied by R. A. Strong, he visited the various collieries in the Alberta and British Columbia Crowsnest Pass areas, and while in Victoria he had conferences with the Honourable Minister of Mines, the Deputy Minister of Mines, and the Provincial Mineralogist for British Columbia, and also with Col. C. W. Villiers of the Canadian Collieries (Dunsmuir), Limited. He also had a conference in Edmonton with representatives of the Cadomin Collieries, Alberta.

Professors E. A. Smith and G. B. Frost, who had been engaged previously during the summer months on research work at the Fuel Research Laboratories, continued, at their respective universities, to co-operate with the staff of this division on problems relating to Canadian fuels. The activities of the division are amplified below according to the sections under which the technical staff and work have been organized.

R. E. Gilmore, Superintendent of Fuel Research Laboratories, represented the division at meetings of coal classification committees of both Canada and the United States, and took an active part in the detailed work of these com-

mittees. Mr. Gilmore, as a Mines Branch member of the American Society of Testing Materials, acted as chairman of the subcommittee dealing with the development of standard laboratory methods for testing the friability of coal, and he also participated in the work of the "grindability" committee having to do with the comparative pulverizing characteristics of coals. A comprehensive report has been published comprising the friability tests conducted at the Fuel Research Laboratories, which report includes suggestions for a "tumbler test" method and a "drop shatter test" method for testing the comparative handling properties of coals.

Coal Classification and Analyses

The American "Sectional Committee on Classification of Coal" has established tentative specifications for classifying coals, according to both "Rank" and "Grade," the former being mainly for scientific use and the latter to serve the ordinary purchasing and selling of coals. By means of charts prepared at the Fuel Research Laboratories, the position in the classification scheme, of typical Canadian coals from the different mining areas, has been indicated and their relation shown to typical United States coals.

J. H. H. Nicolls, C. B. Mohr, G. P. Connell, and R. J. Young, comprised the senior staff of the Solid Fuels Analysis Section. The work of this section comprised the routine examination of over 1,200 samples of coal, coke, peat, and other solid fuels and involved proximate analyses for moisture, ash, volatile matter, and fixed carbon; ultimate analyses for carbon, hydrogen, nitrogen, and sulphur; calorific value (B.T.U. per pound), and fusion point of ash determinations. Other work conducted in conjunction with the activities of other sections comprised: screen analyses, apparent specific gravity, bulk density determinations, grindability, and special friability tests. The assay of coals according to a standard low-temperature carbonization method has also been added, as a regular part of the work of this section.

Purchase of Coal by Specification

A considerable part of the coal analysis work pertained to samples submitted by the Department of Pensions and National Health, the results of which analyses served in connexion with the coal purchases of that department according to specifications. The total amount of coal involved was over 16,000 tons, of which nearly half was of Canadian origin, and this was used in hospitals operated by the department in seven centres throughout the country.

Combustion Engineering Investigations

E. S. Malloch, assisted by C. E. Baltzer and J. R. Kirkconnell, carried on the work of the Mechanical Engineering Section which consisted of general routine and preparation of memoranda in connexion with the economic use of Canadian fuels in power plants and domestic and large scale heating equipment. A series of domestic furnace tests was made on Canadian and imported fuels used in Canada. These were as follows: (a) six on bituminous coals; (b) two on peat briquettes; (c) six on Welsh anthracite; (d) eight on various coke fuels; (e) one on Alberta coal; (f) one on briquettes; and (g) seven on Welsh buckwheat blower fuel. C. E. Baltzer, assisted by H. P. Hudson, made 93 routine grindability laboratory determinations on coal samples, and three trips were made by the former to hospitals of the Department of Pensions and National Health in connexion with power plant problems.

The routine of collecting outdoor temperatures in order to compute the heating load in Ottawa measured in degree days was continued and the data so computed were correlated with the gas consumption of four private residences heated by gas.

Peat Investigations

E. S. Malloch, H. A. Leverin of the Chemical Division, and W. L. Gordon, Accountant, of Toronto, were appointed as a special committee to investigate and report upon the Peco Peat Fuel Briquetting Process under development in Denmark and Ireland. Some five weeks were spent upon the investigation in April and May 1936.

Coal Beneficiation, Carbonization, and Briquetting

R. A. Strong, assisted by E. J. Burrough and E. Swartzman, of the Carbonization Section, continued tests on the washing, storage, carbonization, and briquetting of coals. Further progress was made on the study of the chemical and physical characteristics of the different sizes of bituminous coals as mined in Canada, the product from four extra collieries in Sydney area and two from Springhill area having been examined during the year. This investigation, which includes a study of the washing characteristics of the coals, is designed to determine the possibilities of improvement in quality by special preparation. The "Lehmann" mill, mentioned in the 1933 report, for separating coal into its petrographic constituents, was completed and preliminary tests made. A series of tests in this mill is planned for the coming year in connexion with a coal-coking program. The second experimental coke oven of 500 pounds capacity, mentioned in the 1934 report, was erected and a series of tests is planned for the new fiscal year. This unit was erected for conducting further studies on the coking reaction of coals and experimental tests on coal mixtures for the production of domestic coke at high, medium, and low temperatures. A method of briquetting coal by pressure and impact, without the use of binders, is being studied and the suitability of Canadian coals for this treatment will be reported on conclusion of the tests. Twelve reports were issued by this section during the year, covering the various tests conducted and field investigations undertaken.

Petroleum Oils, Bitumen, and Natural Gas

P. V. Rosewarne was in charge of the Oil and Gas Section and was assisted by H. McD. Chantler, W. P. Campbell, and R. J. Offord. The annual gasoline survey, comprising the collection and analysis of 179 samples from different cities in Canada, was made and a report prepared showing the quality of the gasoline being sold throughout the country. A survey of the quality of fuel oil and lubricating oil marketed in Ontario was also conducted. Samples of natural gas from a number of new wells in different parts of Canada were obtained and their composition including helium content determined. Technical officers of this section have been called upon frequently as consultants and advisers in regard to the interpretation and revision of specifications for gasolines, fuel oils, and lubricants, and to co-operate with the National Research Council on standard specifications of these petroleum products. A report on the properties of crude oils produced in Canada has been published.

A. A. Swinnerton continued work on bitumen from Alberta bituminous sands, with special attention to its amenability for the production of refined asphalt and associated products. In addition he assisted in the work of the oil laboratory with particular reference to distillations of, and the preparation of a report on, crude oils, and in the study of the reclamation of used motor oils.

Hydrogenation

T. E. Warren, assisted by K. W. Bowles, continued the experimental hydrogenation investigation. Two sets of apparatus have been constructed and were used throughout the year for the hydrogenation of coal. In the larger of these the raw coal and tar oil products, together with the hydrogen, are charged and the product withdrawn continuously. In the other a batch of raw material is

heated in a stream of hydrogen. The semi-continuous apparatus was first used in a preliminary program to establish a standard method of testing and later in comparative tests on several Canadian coals of different ranks. In the larger apparatus, known as the large laboratory scale continuous apparatus, a standard coal from Nova Scotia was used to determine the effect of changing the conditions of operation. Two coals, one from eastern Canada and the other from western Canada, have given oil yields nearly equal to that obtained from a standard English bituminous coal by Imperial Chemical Industries and further work is in progress to ascertain the amenability of other Canadian coals.

Testing and Examination of Explosives

P. V. Rosewarne and W. P. Campbell analysed explosives submitted by the Explosives Division.

Routine Chemical Laboratory Work

During the year a total of 1,896 samples of solid, liquid, and gaseous fuels, and explosives were examined. Of these, 1,437, that is, approximately 76 per cent, pertained to investigations of the division, the remaining 24 per cent originating outside the division. On the same basis, approximately 6 per cent of the total examined was from other divisions of the Department of Mines, 4 per cent from the Department of Pensions and National Health, 3 per cent from the Department of Marine and National Defence, and 5 per cent from other federal government departments. From provincial governments and public institutions were received less than 1 per cent of the total and the corresponding rough percentages from commercial firms and private individuals were 2 and 5 per cent respectively.

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

—	—	—	Per cent of total examined
(1)	Samples pertaining to:		
	Fuel testing investigations—		
	Solid fuels; total number samples.....	936	49.4
	Coals (various kinds).....	845	
	Cokes, chars, and other solid fuels.....	91	
	Liquid fuels; total number samples.....	437	23.1
	Gasoline and other motor fuels.....	347	
	Lubricating oils.....	24	
	Crude and miscellaneous oils.....	66	
	Gases from coals, tars, bitumen, etc.....	12	0.6
	Natural gas.....	52	2.7
(2)	Samples from other divisions of the Department of Mines:		
	Explosives Division (27 dynamites and 17 fireworks).....	96	5.1
	Other Mines Branch divisions.....	10	0.6
(3)	Samples from outside the Department:		
	Department of Pensions and National Health, coal.....	78	4.1
	Department of Marine and National Defence, coals, motor fuels, and lubricating oils.....	64	3.3
	Other Government departments, coals and oils.....	99	5.2
	Provincial governments and public institutions, coal and oils.....	12	0.6
	Commercial firms, coals, oils, and natural gas.....	62	3.3
	Private individuals, coals and oils.....	38	2.0
	Total.....	1,896	100.0

CERAMICS AND ROAD MATERIALS DIVISION

Howells Fréchette, Chief of the Division, reports not only a very active year in the investigational work in the laboratories and field, but an increasing demand upon the time of the staff for technical advice, in many cases involving much laboratory and office research.

In addition to his routine office duties and supervising the investigational work of the division, Mr. Fréchette served on the sub-committees on Paint Specifications, Standard Testing Sieves, and Refractories Specifications (Chairman) of the Canadian Government Purchasing Standards Committee. J. F. McMahon served on this last-named sub-committee and assisted materially in drawing up specifications for fireclay brick for stationary boiler service and high temperature cements. In connexion with this, methods of laboratory tests were developed by Mr. McMahon and twenty cements now on the market were tested.

The services of the division were called upon on numerous occasions by other departments of the Government. The use of the refrigeration equipment was placed at the disposal of the Engineer's Branch of the Department of Public Works for freezing tests on stone, and the Department of Agriculture for chilling tests on apples.

The facilities of the Ceramics Laboratories were made use of throughout the year by the National Research Council for the making, burning, and testing of bricks and other products in connexion with the Magnesitic Dolomite Research in which the Mines Branch has co-operated from the beginning.

Appreciation is expressed for information and assistance received from other departments of the Government.

A special exhibit of Canadian made ceramic products was assembled, and displayed in the National Museum of Canada throughout February and March. This exhibition was made possible by the generosity of a number of manufacturers who gave or loaned specimens of their products.

As a service to promote the technology of ceramics in industry in Canada, an active part was taken in the affairs of the Canadian Ceramic Society by Mr. Fréchette and the ceramic engineers of the division. Mr. McMahon, who was Chairman of the Enamel Division, was elected Vice-President of the Society.

Much information on a variety of subjects pertaining to clay resources, manufacturing problems, and ceramic products, was furnished to inquirers in direct consultation or through correspondence.

Ceramics

Physical Properties of Canadian Bricks. Mr. Collin continued the investigation on the physical properties of Canadian bricks. Hardness and toughness determinations were completed on the brick collected in Ontario, Quebec, and the Maritime Provinces. Tests were made on all of the 320 sets of brick samples to determine if there was any tendency to effloresce. In the few cases that showed efflorescence the degree was carefully noted. Full-sized bricks from all of these sets are being subjected to alternate cycles of freezing and thawing until failure occurs or a maximum of 100 cycles is obtained.

As many brick plants were closed or were operating for limited periods only, no attempt was made to collect samples from southwestern Ontario or the western provinces. This can be undertaken satisfactorily only when a more nearly normal condition has returned to the brick industry.

Clay as a Plasticizer in Masonry Mortars. A new market has been obtained for raw clay in some parts of the United States as the result of considerable experimental work on the suitability of clays and shales as plasticizers in masonry mortars. As this has been of considerable value to a number of manufacturers in the United States, it was felt that an investigation should be conducted to determine the suitability of certain Canadian clays for this purpose. L. P. Collin has tested a series of mortar mixture to determine the plasticity,

bonding properties, strength, and endurance when clays were used to replace hydrated lime in cement-lime mortars. The preliminary work has been completed and favourable results have been obtained. A paper covering the work done to date has been prepared for publication in the Journal of the Canadian Ceramic Society.

Refractory Industry and Resources of Canada. J. F. McMahon spent three weeks in northern Ontario studying the refractory clay occurrences on Mattagami river. Much of this time was devoted to the study of one particular deposit which is being developed with a view to production in the near future. Auger holes were put down and samples collected for laboratory testing.

Approximately sixty samples of clay from this area were tested in comparison with ten samples of imported clays.

Further work was done on problems connected with the destructive action of certain coal ash slags on boiler house refractories, and tests were made on a variety of types of firebrick to observe their suitability for use in the production of rock wool.

Increasing the Density of Brick. The laboratory work on this investigation was completed by J. G. Phillips during the year, the data compiled, and curves drawn for publication in a general report that will also cover the work done on tender-drying clays from time to time over a number of years.

Petrographic Work. J. G. Phillips carried out a large amount of petrographic work in connexion with the Magnesitic Dolomite Research to determine the thermal reactions that take place during heat treatment in the manufacture of basic refractories from Grenville magnesitic dolomite, and for the identification of the mineral phases present in the finished product. The results of this study were incorporated in a paper, "Basic Refractories in Industry" by J. W. Craig, presented at the annual meeting of the Canadian Institute of Mining and Metallurgy, March 1936.

Other petrographic work included the examination of a number of insulating brick, the identification of miscellaneous mineral samples, and a study of the mineral composition of samples of fireclays from northern Ontario.

Sodium Uranate. An investigation was commenced in December by Mr. Phillips to determine the factors that affect the colour imparted to glazes (particularly high lead glazes) by sodium uranate. It had been found that the sodium uranate at first produced in Canada gave a different orange colour from the Belgian chemical. This fact was having an adverse effect on the marketing of this new Canadian product. The laboratory work done has resulted in finding the cause of the trouble and a means for its correction. A visit was made to the plant where the sodium uranate is produced. The refining process was studied, and recommendations made for overcoming the trouble.

Tests of Clays, Shales, Etc. One hundred and ten samples of clays and shales, eleven samples of mineral pigments, and miscellaneous mineral substances were tested and reported upon.

Tests of hardness and toughness on several samples of porcelain balls and liners for grinding mills were made for manufacturers of these products.

Road Materials

R. H. Picher was occupied, for the greater part of the year, with the preparation of his report on the road gravels of Quebec, which has since been published in English and French, and in writing a general report on road materials in the Maritime Provinces.

Mr. Picher spent seven weeks in Nova Scotia and New Brunswick completing the field work on road materials for the last-mentioned report, the purpose of the work being to bring up to date the information obtained in previous years.

In addition to the testing of samples of road materials collected during field work, six samples of rock and gravel, submitted by the public, were tested in the laboratory.

CHEMISTRY DIVISION

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

From April 1, 1935, to March 31, 1936, 1,750 specimens, requiring about 7,000 chemical determinations, were reported on.

Complete analyses were made of 35 samples of coal ashes, 24 limestone, 8 rock wool, 8 sodium sulphates, 8 slates, 8 iron ores, 7 natural sodium products, 7 waters, 6 feldspars, 4 manganese ore, 4 diatomites, 3 oxides, 1 silica, 3 mica, 3 smaltite, 3 beryl, 2 bog manganese, 2 alum, 2 mineral wool, 2 rock powder, 2 Athabaska sandstone, 1 solder, 1 brine, 1 common salt, 1 silver polish, 1 sodium carbonate, 1 kyanite, 1 talc, 1 gypsum, 1 firebrick, 1 dental clasp, 1 brass pipe, 1 bauxite, 1 sericite (massive), 1 slag, 1 silt.

Six hundred and sixty-nine furnace assays were made. Quantitative determinations were made as follows: copper 60, lead 35, nickel 18, zinc 17, platinum 14, silica 9, tin 6, cobalt 5, arsenic 5, molybdenum 5, sand 4, ochre (iron) 3, aluminium 3, antimony 2, bentonite 2, lead sulphides 2, potassium 2, sulphur 2, vanadium 1, sodium carbonate 1, uranium 1, radium (radioactivity) 1, phosphorus pentoxide 1, pitchblende 1, marl 1, lithium 1, moss (peat) 1, iron alumina 1, bismuth 1. Identifications of 280 specimens of minerals and ores were made.

For the Industrial Waters Investigation 26 complete analyses were made of surface waters, and 140 samples of civic waters were analysed for alkalinity, total hardness, carbonate hardness, non-carbonate hardness, calcium, and magnesium.

For other parties a number of brines and waters have been analysed, mostly all complete analyses.

Two meetings of the Committee on Water Analysis held in Toronto were attended, and progress reported.

A visit was made to Washington reporting on methods of analysis, methods of sampling, methods of reporting analytical results and general working plan of the Quality Waters Investigation of the United States Geological Survey, also visiting and reporting on water works problems in Washington, Baltimore, Chester, Pa., and New York city.

Four hundred and eighty-three mine air samples were reported on during the year from the provinces of British Columbia and Alberta. A number related to fatalities in both provinces; a considerable proportion came from gold-producing mines after blasting operations; others involved special problems on spontaneous combustion, fires, use of electrical equipment, etc., in coal mining areas, requiring the preparation of special reports and correspondence. The Ringrose Firedamp Detector, being used at present in some of our Canadian mines, is being tested as to accuracy and dependability for methane detection.

A visit was made to the Sherwin-Williams Company, Limited; Canada Paint Company, Limited; Brandram-Henderson, Limited; and Martin-Senour Company, Limited, Montreal, for the purpose of finding out the market condition of oxides of iron in Canada, and method of testing same.

DRAUGHTING DIVISION

L. H. S. Pereira, Acting Chief Draughtsman

The following work was performed by the Draughting Division during the fiscal year ending March 31, 1936:

Preparing five maps for reproduction, and one hundred and eight charts, flow-sheets, and mechanical drawings, also sixty-four additional charts brought up to date. Sixty-two special cards were prepared for exhibition purposes.

Preparing nine charts and bringing twenty-four others up to date for the Dominion Fuel Board.

Two thousand two hundred and eighty negatives and prints were made on the Rectigraph machine.

Two hundred and eighty negatives, black and white, and blueprints were made on the blueprint machine.

One hundred and ninety-nine halftone blocks and zinc cuts were filed during the year.

DISTRIBUTION OF PUBLICATIONS

During the fiscal year ending March 31, 1936, the distribution of Mines Branch reports, memorandum series, lists of mines, metallurgical works, etc., amounted to 38,272 copies.

Mimeographed work comprised some 24,735 pages, and 36,000 notification cards were sent out.

LIBRARY

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

Accessions to the Library, 1935

Books (by purchase)	225
Books (by gift)	57
Books (complete unbound volumes)	390
Books and bulletins added to the circulating division	123
Canadian Government documents (by exchange and gift)	1,922
British and Foreign Government documents (by exchange and gift)	1,044
Scientific societies' bulletins, proceedings, and transactions (by exchange and gift)	1,739
Trades catalogues (by gift)	326
Periodicals and continuations subscribed for	228
Annuals, continuations, and periodicals (by gift)	520
Ninety-eight volumes were bound.	

EXPLOSIVES DIVISION

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

FACTORIES

The Toronto Fireworks Company, Limited, ceased to manufacture fireworks in August and dismantled their factory at Islington, Ontario. This was the only change in the list of licensed explosives factories, of which nine remain in operation. In all, the regulations and terms of licence were well observed, and in the high explosives factories the study made of the rules of safe practice by the employees was marked and, not infrequently, was productive of useful suggestions. It is pleasing to record that no accident, involving injury to anyone, occurred in the manufacture of explosives.

The production of high explosives in 1935 showed a slight increase over that of the previous year, and the production of fireworks a decrease. Inspectors of the division made thirty-three visits of inspection during the year.

MAGAZINES

The number of magazines under licence on March 31, 1936, was 348, an increase of 9, and 195 temporary magazine licences were issued during the year. Inspectors of the division made 359 inspections and deputy inspectors of the Royal Canadian Mounted Police, 245.

Only occasional minor irregularities were observed in the maintenance of magazines and these, on attention being called to them, were promptly rectified. In no case was it found necessary to have recourse to prosecution to secure full observance of the regulations.

The quantity of deteriorated explosives, condemned on inspection, and subsequently destroyed, again showed a decrease, although explosives to the amount of 1,250 pounds, distributed over eighteen magazines, were so destroyed.

Thirteen magazines were forcibly entered and approximately 1,350 pounds of explosives stolen. Except in the cases of two thefts, one of 500 pounds and one of 350 pounds, the quantity taken at any one time was relatively small. Three of the lots taken were recovered, in whole or in part, and in two cases arrests were made and convictions obtained.

UNLICENSED PREMISES

In the enforcement of the regulations relating to the keeping of small quantities of explosives by dealers and by those engaged in operations necessitating the use of explosives, 659 inspections were made by inspectors of the division and about 2,200 by deputy inspectors of the Royal Canadian Mounted Police. No serious fault was found in the storage of explosives by dealers, but four were prosecuted and convicted for failing to keep records of their receipts and issues as required by the regulations. The provision made by users of explosives for the safe keeping of explosives is more often open to criticism and failure in this respect led to three convictions.

EXPLOSIVES ABANDONED

Two abandoned magazines, one in the Northwest Territories containing 750 pounds of dynamite, and the other, an old mine magazine about 100 miles east of Fort Frances, containing over 6,000 pounds, were located by the Royal Canadian Mounted Police and destroyed. The former had been abandoned for

several years and the latter since 1912. At an abandoned claim in British Columbia 125 pounds of dynamite and 100 detonators were found by an inspector of the division and destroyed. Ten small lots, totalling about 140 pounds, were also found and destroyed.

IMPORTATION

With the exception of nitroglycerine for use in the oil and gas fields, and an occasional shipment of blasting explosives at points more accessible to a source of supply in the United States, the importation of explosives, for use as such, is very small. Nitro cotton for use in the manufacture of lacquers constitutes the largest item in the list of imported explosives, with some also for use in explosives manufacture. Over 1,000,000 pounds were imported for manufacturing purposes other than in explosives factories during 1935. Considerable importations are made of manufactured fireworks, of which approximately 75 per cent were from China. Details of the importations are given in the annual report of the division.

AUTHORIZATION OF EXPLOSIVES

Two new high explosives were authorized during the year under review, and nine new varieties of fireworks.

ACCIDENTS

No accident is known to have occurred in connexion with the conveyance of explosives. The use of explosives is not subject to regulation under the Explosives Act, but a comprehensive record of accidents occurring in the use of explosives, and of others in which explosives are involved, is obtained with the valued co-operation of provincial Departments of Mines and Highways, of Workmen's Compensation Boards, of the Dominion Department of Labour, as well as from the study of press dispatches, from reports of the Royal Canadian Mounted Police, and from information received from various other sources. A summary of these accidents was published in the annual report of the division, attention being directed to the attributed causes. During the year 1935, 38 persons were killed and 125 injured in consequence of accidents in the use of explosives, being an increase of 8 in the number of fatalities and a decrease of 71 in the number injured compared with the figures for the preceding year. The disaster in the Allan Shaft Mines, Nova Scotia, alone was responsible for the death of seven men. The decrease in the number of injured is mainly attributable to better enforcement of preventive measures in many road construction parties, particularly in regard to taking proper cover from projected debris.

Accidents arising from playing with detonators and other explosives led to 2 deaths and to 43 persons, nearly all young boys, being injured. The corresponding figures for the preceding year were 4 and 32. Three lives were lost and 5 persons sustained injury in other accidents with explosives which could not be regarded as associated either with playing with explosives or with their use.

EDITORIAL DIVISION

G. C. Monture, *Editor-in-Chief*

No changes in the permanent staff took place during the year. Owing to increased work in the publishing of reports and distribution of French publications, Miss D. Burke was temporarily transferred to the Editorial Division from the Bureau of Economic Geology to assist in typing and proof-reading.

During the fiscal year fifty-two separate English publications were issued by the department, consisting of annual reports, memoirs, bulletins, and pamphlets; also three lists of mine operators and mines. In addition, a series of twelve radio addresses on Canada's mining industry, given by the Minister of the Department of Mines, was printed for distribution. These talks were translated into French and mimeographed for distribution.

Papers dealing with field work of the Bureau of Economic Geology were edited and mimeographed for distribution. All the papers of this series dealing with the province of Quebec were translated into French and mimeographed for distribution.

Eight reports were published in French, exclusive of the series of radio talks given by the Minister and the mimeographed papers dealing with the field work by officers of the Bureau of Economic Geology.

At the end of the fiscal year there were in the hands of the King's Printer two English reports and one French report of the Geological Survey, one English report of the National Museum, six English reports and two French translations of the Mines Branch, and one English and one French report of the Explosives Division. In addition to the reports translated and published in French, a large number of museum labels, letters, and papers on technical subjects, were translated.

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*

2402. *Report of the Department of Mines for the Fiscal Year ending March 31, 1935*: 48 pages; 1,500 copies; published October 17, 1935.

French Translations

2408. *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars, 1935 (extraits)*: 41 pages; 1,500 copies; published December 9, 1935.

GEOLOGICAL SURVEY

English Publications

2159. Economic Geology Series No. 7. *Prospecting in Canada* (second edition)—by Officers of the Geological Survey: 288 pages; 23 plates; 25 figures; 2,500 copies; published June 4, 1935.
2371. Memoir 175. *Portland Canal Area, B.C.*—by G. Hanson: 179 pages; 17 figures; 2 maps; 2,500 copies; published May 23, 1935.
2373. Memoir 176. *Geology of Southern Saskatchewan*—by F. J. Fraser, F. H. McLearn, L. S. Russell, P. S. Warren, and R. T. D. Wickenden: 137 pages; 5 plates; 4 figures; 2 maps; 4,000 copies; published October 2, 1935.
2374. Memoir 177. *Lake Athabasca Map-Area*—by G. W. H. Norman: 103 pages; 4 plates; 3 figures; 2 maps; 1,800 copies; published July 4, 1935.

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

Report
No.

2387. Memoir 178. *The Mining Industry of Yukon, 1934*—by H. S. Bostock: 10 pages; 1 figure; 2,500 copies; published April 6, 1935.
2392. Memoir 179. *Lode Gold Deposits of Fairview Camp, Camp McKinney, and Vidette Lake Area, and the Dividend-Lakeview Property near Osoyoos, B.C.*—by W. E. Cockfield: 38 pages; 1 figure; 4 maps; 3,000 copies; published August 27, 1935.
2393. Memoir 180. *Mudjatik-Haultain Area, Saskatchewan*—by F. J. Alcock: 16 pages; 2 plates; 2 figures; 4 maps; 2,500 copies; published August 19, 1935.
2396. Memoir 181. *Barkerville Gold Belt, Cariboo District, B.C.*—by G. Hanson: 42 pages; 4 figures; 2 maps; 2,500 copies; published August 24, 1935.
2397. Memoir 182. *A Preliminary Contribution to the Floras of the Whitemud and Ravenscrag Formations*—by E. W. Berry: 107 pages; 20 plates; 1,500 copies; published October 30, 1935.
2398. Memoir 183. *Geology of Chaleur Bay Region*—by F. J. Alcock: 146 pages; 16 plates; 15 figures; 1 map; 2,500 copies; published November 13, 1935.
2399. Memoir 184. *Descriptions of Properties, Slocan Mining Camp, B.C.*—by C. E. Cairnes: 274 pages; 2 plates; 14 figures; 2,500 copies; published October 21, 1935.
2407. Memoir 186. *Gold Deposits of Elbow-Morton Area, Manitoba*—by C. H. Stockwell: 74 pages; 11 figures; 1 map; 3,000 copies; published January 24, 1936.
2409. Memoir 185. *Chibougamau Lake Map-Area, Quebec*—by J. B. Mawdsley and G. W. H. Norman: 95 pages; 5 plates; 1 figure; 1 map; 3,500 copies; published February 26, 1936.
2412. Memoir 188. *The West Half of Wildcat Hills Map-Area, Alberta*—by G. S. Hume: 15 pages; 2 plates; 2 figures; 2 maps; 2,000 copies; published March 17, 1936.
- List of Publications of the Geological Survey and National Museum of Canada:*
42 pages; 500 copies; published February 5, 1936.
- Separate: *Pemberton Area, Lillooet District, B.C.*—by C. E. Cairnes (from Geological Survey Summary Report 1924, Part A): 23 pages; 1 figure; 1,000 copies; published May 28, 1935.
- Separate: *Chilko Lake and Vicinity, B.C.*—by V. Dolmage (from Geological Survey Summary Report 1924, Part A): 17 pages; 2 plates; 1 figure; 1 map; 1,000 copies; published November 18, 1935.
- Separate: *Dease Lake Area, Cassiar District, B.C.*—by F. A. Kerr (from Geological Survey Summary Report 1925, Part A): 26 pages; 2 plates; 1 figure; 1 map; 1,000 copies; published November 22, 1935.

French Translation

2406. Memoir 183: *Géologie de la région de la Baie de Chaleur*—by F. J. Alcock: 165 pages; 16 plates; 15 figures; 1 map; 1,250 copies; published March 30, 1936.

NATIONAL MUSEUM OF CANADA

English Publications

- Bulletin 65. *Indians of Canada* (revised edition)—by D. Jenness: 446 pages; 115 plates; 7 coloured plates; 9 figures; 1 map; 2,000 copies; published May 31, 1935.
- Bulletin 74. *Botanical Investigations in Wood Buffalo Park*—by H. M. Raup: 174 pages; 13 plates; 15 figures; 1,000 copies; published October 3, 1935.
- Bulletin 75. *Folk-Songs of Old Quebec*—by Marius Barbeau: 72 pages; 7 plates; 5,000 copies; published September 4, 1935.
- Bulletin 76. *Annual Report for 1934*: 25 pages; 1,800 copies; published July 19, 1935.
- Bulletin 77. (1) *Hooded Hadrosaurs of the Belly River Series of the Upper Cretaceous*—by C. M. Sternberg; (2) *Musculature and Functions in the Ceratopsia*—by L. S. Russell: 48 pages; 7 plates; 2 figures; 2,000 copies; published February 14, 1936.
- Bulletin 78. *The Ojibwa Indians of Parry Island, Their Social and Religious Life*—by D. Jenness: 115 pages; 2,000 copies; published December 12, 1935.
- Bulletin 79. *The Freshwater Mollusc Helisoma Corpulentum and Its Relatives in Canada*—by F. C. Baker: 28 pages; 5 plates; 3 figures; 1,200 copies; published March 18, 1936.

French Translation

- Bulletin 75. *Chansons populaires du Vieux Québec*—by Marius Barbeau: 61 pages; 7 plates; 2,000 copies; published March 16, 1936.

MINES BRANCH

Report
No.*English Publications*

744. *Investigations in Ore Dressing and Metallurgy, July to December, 1933*: 194 pages; 2,500 copies; published May 10, 1935.
747. *Investigations in Ore Dressing and Metallurgy, January to June, 1934*: 209 pages; 1 figure; 2,500 copies; published August 26, 1935.
748. *Investigations in Ore Dressing and Metallurgy, July to December, 1934*: 202 pages; 2 plates; 3 figures; 2,000 copies; published March 10, 1936.
751. *Road Gravels in Quebec*—by R. H. Picher: 214 pages; 1,500 copies; published September 17, 1935.
753. *Analyses of Coals and Other Solid Fuels, 1932, 1933, 1934*—by J. H. H. Nicolls: 58 pages; 2,500 copies; published May 21, 1935.
754. *Clay Winning and Costs, Ontario and Quebec*—by J. F. McMahon: 90 pages; 19 plates; 3 figures; 3,500 copies; published August 29, 1935.
755. *Limestones of Canada, Part III, Quebec*—by M. F. Goudge: 274 pages; 36 plates; 13 figures; 2 maps; 2,500 copies; published November 19, 1935.
759. *Use of Petroleum Fuels in Canada, 1933*—by M. J. Casey: 12 pages; 2,500 copies; published April 13, 1935.
760. *Canadian Mineral Industry, 1934*: 119 pages; 2,500 copies; published May 23, 1935.
761. *Wood Fuel Burning Tests*—by E. S. Malloch and C. E. Baltzer: 6 pages; 1 plate; 1 figure; 1 table; 2,500 copies; published September 19, 1935.
762. *Coal Friability Tests*—by R. E. Gilmore, J. H. H. Nicolls, and G. P. Connell: 102 pages; 4 plates; 9 figures; 1,300 copies; published January 21, 1936.
764. *Gasoline Survey for 1934*—by H. McD. Chantler: 22 pages; 1 figure; 2,500 copies; published October 25, 1935.
765. *Canadian Crude Oils*—by P. V. Rosewarne, H. McD. Chantler, and A. A. Swinnerton: 21 pages; 2 plates; 3 figures; 4 tables; 2,500 copies; published March 30, 1936.
766. *Tests on Structural Assemblies of Brick and Tile*—by L. P. Collin: 33 pages; 2 plates; 1 figure; 2,500 copies; published December 14, 1935.
769. *Gold in Canada, 1935*—by A. H. A. Robinson: 127 pages; 7 figures; 50 tables; 5,000 copies; published November 27, 1935.
- Separates 587, 591, 594-599* (Investigations in Ore Dressing and Metallurgy, July to December, 1934): 53 pages; 1 figure; 50 copies of each separate; published April 30, 1935.
- Separates 588-590, 592, 593, 600-604* (Investigations in Ore Dressing and Metallurgy, July to December, 1934): 76 pages; 50 copies of each separate; published August 14, 1935.
- Separate 605* (Investigations in Ore Dressing and Metallurgy, July to December, 1934): 12 pages; 50 copies; published June 6, 1935.
- Separates 606 and 608* (Investigations in Ore Dressing and Metallurgy, July to December, 1934): 10 pages; 50 copies of each separate; published July 31, 1935.
- Separates 609-617* (Investigations in Ore Dressing and Metallurgy, January to June, 1935): 84 pages; 50 copies of each separate; published November 20, 1935.
- Separates 618-627* (Investigations in Ore Dressing and Metallurgy, January to June, 1935): 88 pages; 50 copies of each separate; published December 6, 1935.
- Separates 628-635* (Investigations in Ore Dressing and Metallurgy, January to June, 1935): 51 pages; 50 copies of each separate; published March 14, 1936.
- Separates 636-639, 641 and 642* (Investigations in Ore Dressing and Metallurgy, July to December, 1935): 46 pages; 50 copies of each separate; published March 14, 1936.
- Separates 643-647* (Investigations in Ore Dressing and Metallurgy, July to December, 1935): 39 pages; 50 copies of each separate; published March 18, 1936.
- Lists of Mines and Mine Operators in Canada*:
 Gold in Canada: 6,500 copies; published July 3, 1935.
 Milling Plants: 1,500 copies; published June 22, 1935.
 Producers of Coke in Canada: 500 copies; published December 2, 1935.

French Translations

752. *Graviers de voirie dans la province de Québec*—by R. H. Picher: 241 pages; 2,000 copies; published September 30, 1935.
758. *Les Calcaires du Canada, Partie III, Québec*—by M. F. Goudge: 294 pages; 36 plates; 13 figures; 2 maps; 1,500 copies; published March 7, 1936.

EXPLOSIVES DIVISION

Report
No.*English Publications*

37. *Annual Report of the Explosives Division for the Calendar Year 1934*: 18 pages; 1,800 copies; published June 14, 1935.
Order-in-Council No. 471: 2 pages; 5,000 copies; published November 15, 1935.
Instructions for Dynamite and Black Powder Magazines and Instructions for Detonator Magazines: 2 pages; 1,000 copies of each; published November 23 and 27, 1935.

French Translations

12. *Le Maniement des Explosifs*: 11 pages; 2,000 copies; published March 26, 1936.
38. *Rapport annuel de la Division des Explosifs pour l'année civile 1934*: 20 pages; 300 copies; published July 8, 1935.

DISTRIBUTION OF FRENCH PUBLICATIONS

The French publications of the Department of Mines, including those of the Geological Survey, the National Museum, the Mines Branch, and the Explosives Division, are distributed by the Editorial Division. During the fiscal year 1935-36, 7,106 copies were distributed in Canada and to foreign countries, as follows: 1,068 copies from addresses on the mailing lists, through the Printing Bureau Distribution Office, and 6,038 copies from this office in compliance with written or personal requests; 329 copies of this number were sold. In neither case, however, does this distribution include the publications sent out directly by the Dominion Fuel Board and the Explosives Division.

ACCOUNTING DIVISION

STATEMENT

Representative of the Treasury, E. A. Sawyer

The funds available for the work and the expenditure of the Department of Mines for the fiscal year ending March 31, 1936, were:

	Grant	Expenditure	Grant not used
	\$ cts.	\$ cts.	\$ cts.
CIVIL GOVERNMENT—			
Salaries—			
Administrative and Explosives Divisions.....	57,905 48	57,905 48	
Mines Branch.....	201,166 45	201,166 45	
Geological Survey.....	256,335 54	256,335 54	
	515,407 47	515,407 47	
Contingencies.....	20,000 00	13,794 14	6,205 86
EXPLOSIVES DIVISION—			
For administration of the Explosives Act, etc.....	8,000 00	6,717 07	1,282 93
MINES BRANCH—			
For investigation of mineral resources, etc.....	238,538 55		
Salaries and wages.....		148,901 63	
Mineral Resources Division.....		8,875 52	
Ore Dressing and Metallurgical Division.....		18,813 90	
Fuels and Fuel Testing Division.....		18,309 24	
Ceramics and Road Materials Division.....		1,830 76	
Chemical Division.....		1,531 41	
Mechanical Section.....		2,983 00	
Administrative Division.....		2,614 89	
Dominion Fuel Board.....		1,701 02	
Publications, supplies, and contingencies.....		28,072 72	
		233,634 09	4,904 46
GEOLOGICAL SURVEY—			
For explorations, surveys, and investigations, etc.....	190,000 00		
Explorations, surveys, and investigations.....		14,620 06	
Salaries and wages.....		48,224 55	
Engraving services.....		13,854 00	
Equipment and supplies.....		51,125 01	
Printing of reports, etc.....		26,539 84	
Printing of maps, etc.....		15,926 39	
Photographic work.....		12,994 22	
Miscellaneous.....		79 98	
		183,364 05	6,635 95
For maintenance of offices and museum, etc.....	87,800 30		
Salaries and wages.....		57,626 35	
Stationery, printing, typewriters, etc.....		21,638 04	
Library.....		3,749 97	
Photographic Division.....		527 24	
Miscellaneous.....		2,009 37	
Chemicals and drugs.....		176 56	
Postage.....		638 28	
Specimens.....		670 69	
B.C. Office.....		272 56	
		87,309 06	491 24

STATEMENT—Continued

Summary

	Grant	Expenditure	Grant not used
	\$ cts.	\$ cts.	\$ cts.
Civil Government salaries.....	515,407 47	515,407 47	
Civil Government contingencies.....	20,000 00	13,794 14	6,205 86
Explosives Division.....	8,000 00	6,717 07	1,282 93
Mines Branch.....	238,538 55	233,634 09	4,904 46
Geological Survey.....	277,800 30	270,673 11	7,127 19
	1,059,746 32	1,040,225 88	19,520 44

Grants and Miscellaneous Statutory Expenditure

MISCELLANEOUS—			
For payments in connexion with movements of coal, etc.	2,450,000 00		
Subvention.....		2,032,883 65	
Salaries and wages.....		5,557 55	
Miscellaneous administrative expense.....		3,535 12	
		2,041,976 32	408,023 68
MISCELLANEOUS (STATUTES)—			
Domestic Fuel Act (1927) payments.....		60,654 83	
Miscellaneous gratuities.....		120 00	
SUPPLEMENTARY PUBLIC WORKS CONSTRUCTION ACT, 1935—			
Geological surveys and investigations in the Northwest Territories and elsewhere in Canada.....	1,000,000 00		
Explorations, surveys, and investigations.....		506,772 66	
Salaries and wages.....		82,990 49	
Equipment and supplies.....		173,025 49	
Photographic work.....		22,362 34	
Miscellaneous.....		11,031 79	
		796,182 77	203,817 23
RELIEF ACT, 1935—			
Equipment and supplies.....	14,999 20	14,999 20	

DETAILS OF REVENUE

Revenue for the Department of Mines for the Fiscal Year Ending March 31, 1936

Casual Revenue—	\$ cts.	\$ cts.	\$ cts.
DEPARTMENT—			
Miscellaneous revenue.....		1 50	
EXPLOSIVES DIVISION—			
Sale of explosives permits, etc.....	1,804 20		
Sale of equipment.....	125 00		
Miscellaneous revenue.....	2 50		
		1,931 70	
MINES BRANCH—			
Assays and analysis.....	693 42		
Sale of publications.....	243 68		
Sale of publications (French).....	8 70		
Sale of equipment.....	100 00		
Miscellaneous revenue.....	162 25		
		1,208 05	
GEOLOGICAL SURVEY—			
Sale of publications.....	8,122 89		
Sale of publications (French).....	121 47		
Sale of minerals.....	2,285 65		
Sale of equipment.....	600 25		
Miscellaneous revenue.....	191 95		
		11,322 21	

DEPARTMENT OF MINES

STATEMENT—Concluded

	\$	cts.	\$	cts.	\$	cts.
Casual Revenue—Concluded						
DOMINION FUEL BOARD—						
Sale of publications.....			270	55		
GEOGRAPHIC BOARD OF CANADA—						
Sale of publications.....			6	75	14,740	76
Premium Discount and Exchange—						
Premium on U.S. money orders, Geological Survey.....			3	00	3	00
Fines and Forfeitures—						
Explosives Division.....			72	77	72	77
					14,816	53

Miscellaneous Revenue

Casual Revenue—						
DOMINION FUEL BOARD—						
Subvention refunds.....					2,552	45

