

DOMINION OF CANADA

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE

FISCAL YEAR ENDING MARCH 31, 1935

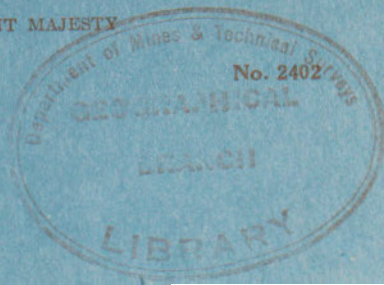


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*To His Excellency Captain the Right Honourable the Earl of Bessborough,
P.C., G.C.M.G., Governor General and Commander-in-Chief of the
Dominion of Canada.*

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency, in compliance with 6-7 Edward VII, chapter 29, section 18, the report of the work of the Department of Mines, for the fiscal year ending March 31, 1935.

W. A. GORDON,
Minister of Mines.

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REPORT
OF THE
DEPARTMENT OF MINES
FOR THE FISCAL YEAR ENDING MARCH 31, 1935

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

SIR,—In accordance with the requirements of Parliament, I have the honour to submit the Annual Report of the Department of Mines for the fiscal year ending March 31, 1935.

Extensive progress in the mining industry during the year has been reflected in a marked increase in the demands on the department as compared with the previous fiscal year. In the detailed sections of the report the preponderance of investigations related to gold development will be noted. Some fifty new gold milling plants entered production during the year and most of these plants are using ore treatment processes designed in the Ore Dressing and Metallurgical Laboratories at Ottawa. In addition, considerable preliminary test work was undertaken on gold ores from properties in early stages of development. The laboratories for microscopic and spectroscopic examinations of specimens again proved indispensable in enabling the staff to take care of the demand.

In its geological field work, as applied to gold development, the department has sought to reduce to a minimum the waste of effort in searching for new sources of the metal. Canadian prospectors, engineers, and exploration companies, as in the past, consulted the geological maps and reports of the department as a guide to their field work, and the department, in order to be of increased service, made special efforts to place such information in their hands with the least possible delay.

The relatively small number of ore treatment investigations primarily associated with base metal ores appears out of line with the outstanding achievements recorded by that branch of the mineral industry during the year. This can be largely attributed to a lack of incentive to proceed either with the development of enterprises that are inactive as a result of low metal prices, or to search for new sources of the metals.

With the position of the fuels and non-metallics group of minerals steadily improving, the department's work in these fields is becoming of increasing economic importance. Greater utilization of Canadian sources of these minerals in the domestic market has been encouraged through research and investigative work.

The department's activities for the year are reviewed in detail hereunder by the heads of each branch and division. The Bureau of Economic Geology, established April 1, 1934, is a reorganization of the Geological Survey, effected to develop a more fully co-ordinated machine in the Geological Survey, to hasten the publication of maps and reports, as well as to give them a more practical character, and generally to intensify the services of the department to the industry. As a step toward shortening the time interval between the conclusion of field work and the publication of maps and reports, a start was made on the publication of maps on which the geology is shown provisionally. Twenty-five geological, and seven topographical, field parties were engaged in mapping and

investigating strategic mineral areas throughout the Dominion, with major attention given to gold, petroleum, and asbestos areas.

A feature of the Mines Branch activities was the completion of 116 major investigations in the Ore Dressing and Metallurgical Laboratories during the year, this number comparing with a combined total of 170 investigations during the three previous years. Company and consulting engineers have had the full use of the laboratories for the investigation of their own problems in co-operation with the staff.

Burning efficiency tests on Canadian bituminous coals in comparison with anthracite and coke, further sizing and washing tests on Nova Scotia coals, and large scale storage tests at Sydney, Nova Scotia, constituted the more important investigations conducted by the fuel research laboratories. The work has been of decided importance in the extension of the domestic markets for Canadian coals, as is shown in the greatly increased use of these coals in the manufacture of coke and gas in Montreal, Winnipeg, and Vancouver, and has served as an incentive to colliery operators to install equipment that will enable them to furnish fuel specially suited for particular purposes.

Greater use of scientific principles in the clay industries, the introduction of new processes, and the development of new products are shown in a steadily increasing demand on the department's ceramic laboratories. Attention was given during the year to investigational work on heavy clay products and refractories. Two major investigations having to do with a series of tests on structural assemblies of bricks and tiles were completed.

The beginning made during the year on the production of rock wool in the Niagara district of Ontario is an event of outstanding interest to the department. Raw sources of this product, one of the most effectual insulating materials on the market, were discovered in the course of a survey of the limestone resources of the country. Hitherto no rock wool had been produced in Canada as no deposits suitable for use in its manufacture were known to exist.

Exclusive of French editions, 93,500 publications were distributed during the year, a slight decline from the previous year, but well above the average of recent years. Distribution of French editions totalled 13,800, as compared with 10,300 in the previous fiscal year and with 3,700 in the fiscal year 1932-1933.

Field activities of the National Museum, which had been virtually at a standstill since 1930, were resumed on a small scale during the past fiscal year.

A feature of National Museum activities was the increasing popularity of the winter series of lectures. The publication of "Birds of Canada," a report that gives a full account of all species of birds found in the Dominion, has met, as expected, with a wide popular appeal. A donation by Mr. Harry Snyder of Montreal of a group of wood bison from Great Slave lake is worthy of special mention.

Efforts toward keeping the industry and the public acquainted with the various activities of the department were materially assisted and expedited through the excellent co-operation of the Press. This field of endeavour, combined with the personal contacts made by officers, has produced that measure of good will so essential to the success of the department's work. Contact was maintained with the High Commissioner's office in London through the fortnightly mining newsletter service, now in its twelfth year.

Opportunity is taken here to acknowledge gratefully the hearty co-operation received during the year from the mineral industry; from other departments of the Dominion Government; from the various provincial departments; from the development branches of the two large railways; 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.

Throughout the impressive record of Canada's mineral industry in 1934 one fact stands out. It is the ability of the industry to register outstanding progress during a period of readjustment in world industrial conditions. The achievement of a new high record in the volume of output of nickel, copper, lead, and zinc is all the more impressive since in the face of the highly competitive markets for all of the metals with the exception of nickel it did not involve any appreciable accumulation of stocks. Canada's base metal industry has a decided advantage over similar industries of other mineral producing countries in that most Canadian ores contain appreciable values in gold. In so far as competition in world markets is concerned this factor has the decidedly advantageous effect of lowering the cost of production. Equally as important it has served the industry well as an effective and logical argument against curtailment of output by cartel agreements. The increase in the value of sales of the base metals to the United Kingdom over the previous year is traceable on the one hand to the demand caused by the huge electrification and building projects under way in that country, and on the other hand to the Ottawa agreements of 1932.

The base metal outlook, none too bright at the beginning of 1935, has since materially improved, largely as a result of the control agreements decided upon at the International Copper Conference in March. In respect to world stocks of the metal one widely quoted authority suggests that "in a year's time world stocks of copper will be quite normal or perhaps even dangerously low." As this report goes to press there is considerable discussion as to the extent to which the copper outlook may be affected by the adverse decision of the United States Supreme Court in respect to the N.R.A. codes. The advances in the prices of lead and zinc which have been under way since the beginning of 1935 are justified by the statistical position of these two metals.

Accelerated by the gold price rise, which in turn facilitated the financing of new enterprises, gold operations set the pace for the mineral industry during the year. The new high record in the value of gold output of \$102,454,000 in 1934, and the increase in dividend disbursements from \$23,400,000 in 1933, to \$34,200,000 in 1934, are indicative both of the extent of activities in the industry and of the generous manner in which effort is being rewarded. In the many phases of its activities—the search for new sources of the metal, the rejuvenation of old properties and old areas, the development of newly discovered deposits, the erection of mills on proved ore-bodies, and the flow of gold from established producers—Canada's gold industry is contributing to the prosperity, not only of the communities in which operations are centred, but to the industrial life of the nation as a whole.

With reports from Yukon, the Slocan area in British Columbia, and from Cobalt, indicating that definite moves have already been made toward re-opening of properties, Canada is apparently to witness a return of activities to her once famous silver camps.

More than usual interest is being shown in the non-metallic group of minerals. These minerals bulk largely in the annual value of Canada's mineral output, and with continued improvement in industrial conditions they should play a large part in the establishing of a new high record in total mineral output value in 1935. A more optimistic feeling exists in the asbestos industry as a result of the substantial improvement in sales in the early months of 1935. More efficient

methods of operation have been introduced and consequent lower operating costs have strengthened the position of producers against outside competition. The United States remains the principal market for the product, but several other countries increased their purchases substantially in 1934.

The outlook indicated for the structural materials group of minerals for 1935 is gratifying, with practically every limestone quarry in the Dominion now in full operation, and with building awards for the first few months of the year well ahead of those for the corresponding period in 1934.

Dominion Fuel Board

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

The principal work of the board for the year was again administrative in character, including administration of the various Orders in Council authorizing assistance to the movement of Canadian coal into central Canada, and in the case of British Columbia to coal sold for deep-sea bunkering use; also of payments to coke plants operating under the benefits of the Domestic Fuel Act (1927).

During the fiscal year 2,260,415 tons of Canadian coal were moved under assistance at a cost to the Dominion Government of \$2,024,428, or 90 cents a ton, as compared with the movement of 2,088,941 tons during the preceding year at a cost of \$2,299,511, or \$1.10 per ton.

These figures, however, do not reflect the actual increase in tonnage for which new markets for Canadian coal have been opened up during the year. Coal transportation subventions are designed to overcome the laid-down cost disadvantage of Canadian coal in competing with imported coals that would otherwise be used. The high stabilized prices of United States coal brought about by N.R.A. reduced this competitive disadvantage of Canadian coal, so that although large tonnages of Canadian coal were assisted into Manitoba and Quebec during the fiscal year 1933-34 and preceding years no assistance was required last year. Substantial new tonnages of Canadian coal were moved into the more remote areas of southern Ontario at necessarily higher rates of assistance per ton than formerly paid on movements into the now competitive areas of Quebec and Ontario.

The administrative work in connexion with this assisted movement of Canadian coal has thus continued to grow, the movements of assisted coal showing an increase of 8 per cent over those of the preceding year, and of 98 per cent over those of 1932-33. All applications for assistance must be carefully checked to see that they are in accordance with the various provisions of the relevant Order in Council before acceptance. Thorough audits of railway and other accounts are necessary where payments are based upon differentials in laid-down costs, or upon records prepared by beneficiaries. A close check of usage distribution in Manitoba is made by a Resident Inspector to assure that assistance is paid only on coal entitled to such.

Coke plants operating under the benefits of the Domestic Fuel Act (1927) are located at Vancouver, Quebec, and Halifax. Each plant was inspected to make certain that operations were in conformity with agreements entered into under the authority of the Act before accounts of benefits were certified for payment.

Investigatory work related to the assisted movements of Canadian coal was also extensive during the year. The Orders in Council providing assistance are so drafted as to simplify administration to the greatest practicable degree. The competitive situation between Canadian and imported coals—which, in principle, determines the assistance granted—has been changing with the changing prices of coals in the United States since 1930. Until the midsummer of 1933 the

declining prices of United States coals had made necessary an increasing scale of assistance to secure larger markets for Canadian coal in central Canada. The adoption of N.R.A. in the United States and its consequent heightening of coal prices in that country has made it more necessary than before to investigate fully the effects of such price increases in order that the Government may be fully informed as to the changes required in the assistance Orders in Council, not only to preserve the principle upon which the assistance is granted, but also to secure the largest possible movement of Canadian coal at the minimum cost to the Dominion Treasury.

Other economic studies or investigations of various phases of Canada's fuel problems have been made for the information of the board and of the Government.

The survey of fuels used annually for domestic heating in coal-less provinces, as conducted each year for several years past for the board by the Mineral Resources Division of the Mines Branch, was discontinued as an economy measure.

The annual survey of the operating costs and revenues of Canadian coal mines was again completed. The value of this survey is becoming increasingly apparent—not only to the Government in consideration of coal assistance policies, but to the board in its administration of those policies. It is also valuable to the coal operator as a means of determining possible economies in his production costs through comparison with average production costs as deduced from the survey and made available in chart form.

The usual field investigations to obtain first hand information on local conditions in the Canadian coal mining districts were not as complete as in former years. A thorough inspection of the system of supervision of the Manitoba distribution of assisted coal was made by the Chairman and Secretary, who have also at various times participated in conferences with coal operators and railway executives with reference to problems connected with the operation of the assistance Orders in Council, and with the enlargement of markets for Canadian coal.

The board's bulletins have been in continued demand during the year, particularly those related to house insulation and humidification.

The staff of the board suffered a severe loss during the year in the death of one of its senior technical members, Mr. M. D. McCloskey, following a long illness.

The board acknowledges 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., June 26, 1935.

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- Hooded Hadrosaurs of the Upper Cretaceous, by C. M. Sternberg. Annual Meeting, Palæontological Society, Rochester, N.Y., December 28, 1934.
- Dinosaur Restoration Group in the National Museum of Canada, by L. S. Russell. Annual Meeting, Palæontological Society, Rochester, N.Y., December 28, 1934.

- Plesiosaur from the Upper Cretaceous of Manitoba, by L. S. Russell. Annual Meeting, Palaeontological Society, Rochester, N.Y., December, 1934.
A Middle Eocene Mammal from British Columbia, by L. S. Russell. American Journal of Science, January, 1935.

Mining Newsletter Series

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

- Thirty-fifth Annual Meeting of the Canadian Mining Institute.
Forecast of Prospecting and Exploratory Activities for 1934.
Development of Low Grade Gold Deposits in Canada.
Asbestos Mining in Canada.
Dividends from Canada's Mineral Industry.
Gold Mining and Development in Northwestern Quebec.
Canada Finds Market in Britain for Crude Gypsum.
Manitoba to the Forefront as a Metal Producer.
Diatomite in Canada.
Bureau of Economic Geology Field Investigation, 1934.
Canada's Mineral Industry Interim Report of Progress, 1934.
Geophysical Survey of Malagash Salt Deposit, Cumberland County, Nova Scotia.
Silica Sand from Manitoba Finds Ready Market in Western Canada.
One Company Increases Production, Another Nearing Production in Cariboo Mining Division, British Columbia.
Canada's Mica Industry Shows Improvement.
Activities in Chibougamau Area, Quebec.
British Columbia on Way to New Gold Output Record.
Canada's Salt Industry Shows Healthy Progress.
Secondary Line of Defence to Canada's Gold Industry.
113 Gold Milling Plants Treat 32,600 Tons of Ore Daily.
Gold Developments in Yukon.
Canadian Radium Industry Now Firmly Established.
Local Capital Playing Conspicuous Rôle in British Columbia's Gold Development.
World Copper Conference Focuses Attention on Canada's Position.
Mineral Development Along Mackenzie River System, 1934.

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

The Bureau of Economic Geology has for its objective the provision of adequate geological information for the prospector, and the solution of the many problems in practical geology that have to do not only with mining but with other industrial development and water supply. The increasing activity in prospecting for gold, due to its 70 per cent rise in price over the old standard valuation, has, in the last year or two, imposed upon the Geological Survey an increased responsibility to see, so far as may be practicable, that prospecting for, and development of, gold and other mineral resources are concentrated in the areas where results of economic importance are most likely to be achieved. The results obtained by the mining industry from exploratory, prospecting, and development work in 1933 acted as a stimulus to even greater efforts during 1934. Moreover, the development of rapid and efficient means of transportation, as represented by the airplane, tractor train, combined water and marine railway transport systems, has brought within the scope of profitable mining mineral occurrences that until very recently would have failed to obtain financial backing because of their remote location. The airplane having demonstrated the physical practicability of setting down prospecting parties, with their equipment and supplies, in almost any region, even as far north as the shores of the Arctic, the demands have multiplied for reconnaissance and regional geological surveys which will show by maps and reports the areas of greatest promise for mineral discovery.

In the year's work covered by this report, attention was focused most largely upon gold, petroleum, and asbestos areas, and detailed investigations formed a considerable part of the work. Although the appropriations were such that it was necessary to continue operating under a policy of stringent economy, twenty-four parties were placed in the field, or four more than in the previous year.

Study has been directed toward shortening the time elapsing from the conclusion of field work to the issue of maps and reports. With the object of giving available information to the prospector at the earliest possible date, a start has been made in the issue of maps on which the geology is provisionally shown. Twenty maps were published compared with seven in the previous year, and, at the close of the year, nine additional maps were in the hands of the King's Printer and thirty-three in progress as against six and twenty, respectively, in the same stages of completion at the end of the preceding fiscal year. As a further step in the speeding-up of data to the mining industry, the Summary Reports, which were an annual series, have given way to individual reports issued as rapidly as the geological information becomes available. The distribution office sent out 47,995 maps and reports, exclusive of French editions.

The Bureau lost the services of two of its geologists during the year through the resignations of J. F. Wright, who is engaged in private practice, and of J. F. Walker, who was appointed Provincial Mineralogist, British Columbia Department of Mines. One member of the staff, F. DeWitt, packer, was retired on superannuation.

The Mineralogical Division reports that prospectors and mining organizations, as well as departmental officers, were very active in sending in mineral and rock specimens, more than 4,000 of those being studied and reported upon. The demand for educational collections of minerals reached new proportions and 53,630 specimens were broken, numbered, and assembled in the 1,464 collections of minerals and rocks issued during the year. The increased volume of work included a continuation by the chief of the division of his investigations of mineral residues in human silicotic lungs, a study being made at the request of the Ontario Department of Health.

The work of the Division of Pleistocene Geology, Water Supply, and Borings is being steadily enhanced in effectiveness through the co-operative sending in of samples of borings. The unusually large number of 42,936 samples received during the year included a collection of 30,000 samples from oil and gas wells turned over to the division by the Ontario Department of Mines, and almost one-third that number were received from Alberta authorities. The advice of the division continues to be much in demand not only by oil and gas operators but by inquirers in regard to underground water and occurrences of placer gold, peat, moss, clays, sands, and gravels.

A large number of visitors to the British Columbia office indicates that the public is fully availing itself of the facilities there and the division reports a considerable increase in microscopic examinations of mineral specimens submitted by mining companies seeking solution of their particular problems.

Details of the field operations and other activities are contained in the following divisional reports.

GEOLOGICAL DIVISION

G. A. Young, Chief Geologist, reports:

Yukon

H. S. Bostock completed the geological mapping of the Carmacks map-area and finished also his geological map of the Laberge sheet. A review of the mining industry of the Yukon in 1934, as prepared by him, has been published as Memoir 178.

Northwest Territories

D. F. Kidd made a geological reconnaissance of the Marian River-Camsell River route from Rae to Great Bear lake.

British Columbia

F. A. Kerr investigated the mineral deposits in the vicinity of the Canadian National railway, from Prince Rupert to Fort George.

G. Hanson completed the geological mapping of the Willow River map-area. He also completed a detailed examination of the Barkerville gold belt. A report and map covering the latter investigation are now in press.

J. F. Walker made a geological investigation of the mineral deposits in the basins of Moyie and St. Mary rivers, Kootenay district.

C. E. Cairnes commenced a detailed geological investigation of Bridge River gold area.

W. E. Cockfield investigated the lode gold deposits of Fairview Camp, Camp McKinney, and Vidette lake. He also examined the deposits of the Dividend-Lakeview property near Osoyoos and completed a study of the B.C. nickel deposit near Choate.

Alberta

B. R. MacKay made a detailed examination and a map, on the scale of 800 feet to the inch, of an area, 21 square miles in extent, in Canmore coal field.

G. S. Hume made a geological map of the west half of Wildcat Hills map-area. Included in his investigation was a detailed study of the Grease Creek structure which has been favourably regarded as an oil-gas prospect. Hand-coloured photographic copies of his manuscript map of this structure on a scale of 5 inches to the mile were made available to the public.

L. S. Russell was engaged in making a detailed geological map of an area in Milk River district, adjacent to Sweetgrass hills.

Saskatchewan

F. J. Alcock made a geological map of the Mudjatik-Haultain district, near the headwaters of Churchill river. He also made a reconnaissance trip to Lac la Ronge.

Manitoba

C. H. Stockwell geologically mapped and investigated the mineral deposits of Elbow and Morton Lakes district east of Flinflon.

J. M. Ambrose geologically mapped a part of Flinflon district.

Ontario

W. H. Collins continued his investigations and re-mapping of the Sudbury nickel basin and surrounding district.

T. L. Tanton investigated the mineral deposits in Mine Centre area, Rainy River district. A preliminary report of his work was published early in 1935.

C. S. Evans commenced detailed investigations of the occurrences of oil and gas in Kent and Lambton counties.

A. E. Wilson continued geological mapping of the Ottawa district. One purpose of this work is to aid in the development of underground water.

D. C. Maddox, assisted by M. Mahoney, collaborated with A. E. Wilson in the investigation of water supply.

Quebec

M. E. Wilson continued detailed investigations in an area of about 45 square miles taking in Noranda and vicinity. As this is a key area to the geology and mineral deposits of the region the results obtained should be of value to prospectors and to those engaged in the development of mineral deposits.

H. C. Cooke continued a detailed investigation of the asbestos, chromite, and other mineral deposits of southern Quebec, and the geological mapping of the serpentine belt where these deposits occur.

H. C. Gunning investigated the geology and mineral deposits of Cadillac district. He also visited developments at Mud Lake gold camp south of Rouyn.

A. H. Lang made a general study of the gold deposits of northwestern Quebec.

L. J. Weeks completed the geological mapping and investigations in Amos map-area within the Rouyn mineral field.

G. W. H. Norman geologically mapped about 200 square miles in Chibougamau district on a scale of 1 mile to the inch.

Nova Scotia

W. A. Bell carried on geological investigations in the vicinity of Oxford and Malagash in conjunction with a torsional balance survey of the Malagash salt deposit conducted by A. H. Miller of the Dominion Observatory staff.

TOPOGRAPHICAL DIVISION

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

FIELD WORK

Yukon

W. H. Miller completed the field work for the topographical mapping of the Carmacks sheet, latitudes $62^{\circ} 00'$ to $63^{\circ} 00'$, longitudes $136^{\circ} 00'$ to $138^{\circ} 00'$; and of the Laberge sheet, latitudes $61^{\circ} 00'$ to $62^{\circ} 00'$, longitudes $134^{\circ} 00'$ to $136^{\circ} 00'$. The field work on the Ogilvie sheet, latitudes $63^{\circ} 00'$ to $64^{\circ} 00'$, longitudes $138^{\circ} 00'$ to $140^{\circ} 00'$, was commenced and approximately 25 per cent completed. All this work was done by photo-topographical reconnaissance methods for publication on a scale of 1 inch to 4 miles, contour interval 500 feet. Infra red plates were used throughout the season and again proved very successful under the smoky and hazy conditions encountered. The results of three years' use of these plates have been embodied in a paper presented before the Annual Meeting of the Canadian Institute of Surveying.

British Columbia

R. Bartlett completed the field work for the topographical mapping of the Willow River sheet, latitudes $53^{\circ} 00'$ to $53^{\circ} 15'$, longitudes $121^{\circ} 30'$ to $122^{\circ} 00'$, in the Cariboo gold district. This work is for publication on a scale of 1 inch to 1 mile, contour interval 100 feet, and was done by a combination of photo-topographical and plane-table traverse methods. The Barkerville sheet was brought up to date for inclusion in the Willow River sheet.

J. W. Spence mapped in detail an area in the valleys of Cadwallader creek and Bridge river. This is an area of considerable mining activity. The field scale was 1 inch to 2,000 feet, contour interval 100 feet, and both photo-topographical and plane-table traverse methods were used. Horizontal control was from triangulation carried to the area by the British Columbia Government; and vertical control from elevation by the British Columbia Power Corporation. S. M. Steeves was attached to this party.

Alberta

J. A. Macdonald completed 45 per cent of the field work for the topographical mapping of the Pekisko sheet, latitudes $50^{\circ} 15'$ to $50^{\circ} 30'$, longitudes $114^{\circ} 00'$ to $114^{\circ} 30'$. The field scale was 1 inch to 2,000 feet, contour interval 50 feet, and the method used was plane-table traverse.

Quebec

A. G. Haultain carried out field work in the Thetford Mines asbestos area in connexion with the detailed mapping of the area. H. N. Spence was attached to this party.

R. C. McDonald established six astronomical stations in Eastmain River area as control for oblique aerial photography to be used in the mapping of 1 inch to 4 mile sheets. These sheets are included between latitudes $52^{\circ} 00'$ and $53^{\circ} 00'$, longitudes $75^{\circ} 00'$ to James bay. Transportation from Moosonee to Eastmain river and return, as well as all transportation in the area, was furnished by the Royal Canadian Air Force. A. C. Tuttle was attached to this party.

New Brunswick

J. V. Butterworth carried out the control surveys for the mapping from vertical air photographs of three sheets as follows: St. George, latitudes $45^{\circ} 00'$

to 45° 15', longitudes 66° 30' to 67° 00'; Watt Junction, latitudes 45° 15' to 45° 30', longitudes 67° 00' to 67° 30'; McDougall lake, latitudes 45° 15' to 45° 30', longitudes 66° 30' to 67° 00'. The publication scale of these sheets is 1 inch to 1 mile, without contours, and the control surveys were made by transit and tape and transit and stadia.

OFFICE WORK

D. A. Nichols dealt with numerous requests for information on physiographic and allied subjects. The large museum relief model of Canada was nearly completed. Considerable time was spent in preparing exhibits of geological and physiographical material for the Central Canada Exhibition and for scientific societies. A course of lectures was delivered to air pilots in training, on: The Use of Aerial Photography and the Aeroplane in Geological and Physiographical Work.

MINERALOGICAL DIVISION

Eugene Poitevin, Chief of the Division, reports:

Owing to an increased public demand the volume of work performed by the staff of the Division of Mineralogy was greater than for some years past and in December, 1934, Mr. J. R. Marshall, associate geologist, was transferred to the division.

In connexion with his work on silicosis Eugene Poitevin made two short trips to Toronto in order to co-operate with Dr. J. G. Cunningham, Director, Industrial Hygiene Division, Ontario Department of Health.

H. V. Ellsworth attended the meetings of the American Mineralogical Society in Rochester, N.Y., as the delegate of the Mineralogical Division and also participated in the meeting of the United States National Research Council Committee on "Geological Age by Atomic Disintegration" held at the same time.

LABORATORY

During the year the mineralogists of the division, Eugene Poitevin and H. V. Ellsworth, examined and described a very large number of minerals and rocks sent in from various parts of Canada by mining organizations, departmental officers, prospectors, and others interested in the mineral industry. Over five hundred memoranda and reports were issued through the Director of the Bureau of Economic Geology. A large number of verbal reports were also furnished to visitors and departmental officers, who personally consulted the mineralogists. Altogether more than four thousand specimens were studied and reported upon, a considerably larger number than in the previous year.

At the request of the Ontario Department of Health, Mr. Poitevin continued his investigations of mineral residues obtained from human silicotic lungs. So far, twenty-three lungs have been studied and the work is still in progress. A special report on the subject is being prepared.

Mr. Ellsworth continued investigative work on rare-element minerals, radioactive minerals, and vanadium, and undertook spectroscopic investigations on behalf of other departments, research involving the analytical chemistry of vanadium and chromium, and the determination of tellurides from various gold mines.

R. J. C. Fabry, rock analyst, made the following chemical investigations:

- Two samples of kaolin for F. J. Fraser, from north of highway near Willows, Sask.
- Norite: east of Ross mine, Foy township, Sudbury district, Ont., for W. H. Collins.
- Andesite: Beaver Hill, Dufresnoy township, Abitibi county, Que., for M. E. Wilson.
- Rhyolite: North Waite trail, Duprat township, Abitibi county, Que., for M. E. Wilson.
- Concretion: Grand lake, N.S., for iron and manganese, for E. M. Kindle.

Analyses for H. C. Cooke:

- Asbestos: Deloro township, Porcupine district, Ont.
 " Q.A.C., Ltd., lot 13, range XI, Broughton township, Que.
 " Johnson mine, Thetford, Que.
 " Beaver mine, Thetford, Que.
 " King mine, Thetford, Que.
 " Vimy Ridge, southwest of Black Lake, Que.
 " Bell pit, Thetford, Que.
 " British Canadian pits, Black Lake, Que.
 Asbestos-like fibre: King mine, Thetford, Que.
 Asbestos-like fibre: King mine, Thetford, Que.
 Serpentine: Lambly mine, Coleraine, Que.
 " lot 19, N.W. range X, Coleraine township, Que.
 Slip serpentine: King mine, Thetford, Que.
 Slip serpentine: King mine, Thetford, Que.
 Peridotite: Frechette pit, Coleraine township, Que.
 Peridotite: Bell pit, Thetford, Que.
 Alt. peridotite: Frechette pit, Coleraine township, Que.
 Picrolite: King mine, Thetford, Que.
 Picrolite: King mine, Thetford, Que.
 Picrolite (brucite?): King mine, Thetford, Que.
 Talcose alteration product: Bell pit, Thetford mine, Que.
 Pseudo-asbestos: North of Robertsonville, Thetford township, Que.
 Fault fibre: King mine, Thetford, Que.
 Serpentine: Bell pit, Thetford, Que.

The usual routine tests for the commoner elements occurring in samples, brought in or mailed to the division, were carried out throughout the year and upwards of one hundred specific gravity determinations were made on rock specimens for W. H. Collins, the samples originating in the Sudbury area of Ontario. The acquisition of additional laboratory equipment (platinum, mechanical grinder, etc.) has permitted a considerable increase in the output of analytical work.

EDUCATIONAL COLLECTIONS

This branch of the division experienced a greatly increased demand from the public for mineral collections and specimens. The Quebec Bureau of Mines submitted a particularly large order for their special collection and altogether 1,464 collections of minerals and rocks were issued, the collections containing 53,630 specimens broken to proper size, numbered, and assembled. Previously the greatest demand for specimens and collections was in 1930-31 when 850 collections, containing 36,313 specimens, were issued. Mr. J. R. Marshall in charge of the work reports that the educational collections assembled by him were distributed as follows:

| Province | Standard | Grade 2 | Grade 3 | Grade 4 | Miscel- laneous | Prospector's | |
|--------------------------|----------|------------|------------|------------|--------------------|---------------|-------|
| | | | | | | Min- erals | Rocks |
| Yukon..... | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| British Columbia..... | 0 | 2 | 3 | 0 | 7 | 77 | 51 |
| Alberta..... | 0 | 0 | 0 | 0 | 2 | 10 | 8 |
| Saskatchewan..... | 1 | 0 | 0 | 0 | 3 | 26 | 21 |
| Manitoba..... | 0 | 0 | 0 | 0 | 15 | 7 | 6 |
| Ontario..... | 5 | 1 | 40 | 0 | 23 | 54 | 25 |
| Quebec..... | 1 | 1 | 26 | 1,000 | 9 | 10 | 4 |
| New Brunswick..... | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Nova Scotia..... | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Foreign..... | 1 | 0 | 2 | 0 | 12 | 3 | 3 |
| | 8 | 4 | 71 | 1,000 | 72 | 190 | 119 |
| Number of specimens..... | 1,152 | 176 | 2,840 | 40,000 | 2,806 | 3,800 | 2,856 |

Total number of collections distributed..... 1,464
 Total number of specimens distributed..... 53,630

In addition to the above three boxes of mineral chips, consisting of 120 bags, were sent out, and a large number of specimens were prepared for loan to Normal School students.

MUSEUM

For details of assistance rendered *See* Annual Report, National Museum of Canada.

PALÆONTOLOGICAL DIVISION

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

FIELD WORK

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

C. M. Sternberg collected during the month of July, 1934, two monasaur skeletons, not entirely complete, from the base of the Pembina beds (Upper Cretaceous) of Manitoba. Late in the summer Mr. Sternberg made a collection of amphibian footprints from the Pennsylvanian sediments near Parrsboro, N.S.

OFFICE WORK

F. H. McLearn was occupied during most of the year in writing a memoir on the geology of southern Saskatchewan. He gave some time also to a study of Triassic fossils from Peace River district.

W. A. Bell was chiefly engaged in the preparation of a memoir on the fossil plants of the Sydney coal field.

The office work of A. E. Wilson included the preparation of a detailed map, cross-section, and report on the geology of the city of Ottawa for the use of the Borings Division.

L. S. Russell collaborated with F. H. McLearn in the preparation of a paper on the Cretaceous stratigraphy of Peace River district, Alberta, and was also engaged in compilation of the results of field work.

E. M. Kindle completed a manuscript on the manganiferous concretions of Nova Scotia lakes and a short paper on early discoveries of fossils by Indians in North America. Progress was made with abstracting information for the Catalogue of North American Devonian fossils.

MUSEUM

For details of assistance rendered *See* Annual Report, National Museum of Canada.

PLEISTOCENE GEOLOGY, WATER SUPPLY, AND BORINGS DIVISION

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

References to field work by D. C. Maddox and M. Mahoney are given under the Geological Division.

The examination of samples from well borings made in search for oil, gas, and water, and the supplying of information to the operators 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 in the province of Quebec in co-operation with the Quebec Bureau of Mines. Partial analyses of a number of samples of underground waters found in oil, gas, and water wells were made by F. J. Fraser to determine the approximate mineral character of the water, and this information was supplied to the

operators. Information was also supplied to a number of inquirers as to the possibilities of underground water supplies at various places.

R. T. D. Wickenden continued his studies of deep 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 restudied in part by geologists of this department.

Samples from oil, gas, and water wells received during the year numbered 42,936. Of these, 30,000 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. These samples were collected over a period of years by the provincial officials and were forwarded to this department for study by C. S. Evans of the Geological Division. From Alberta, 9,716 samples were received through the courtesy of Mr. William Calder of the Department of Lands and Mines of the province and there were 126 from British Columbia, 1,406 from Saskatchewan, 11 from Manitoba, 679 from Quebec, and 998 from New Brunswick.

DRAUGHTING AND REPRODUCING DIVISION

A. Dickison, Chief of the Division, reports:

Maps Published April 1, 1934, to March 31, 1935

| Series A | Publication number | Title | Remarks |
|---------------------------|--------------------|---|--|
| BRITISH COLUMBIA | | | |
| 283A | 2303 | Salmo sheet, Kootenay district; scale, 1 inch to 1 mile..... | Topography. |
| 299A | 2337 | Salmo sheet, Kootenay district; scale, 1 inch to 1 mile..... | Geology. For memoir by J. F. Walker, and separate distribution. |
| 300A | 2343 | Copper Mountain mining area, Similkameen district; scale, 1 inch to 1,000 feet..... | Geology. For memoir by V. Dolmage. |
| 307A | 2362 | Portland Canal area, Cassiar district; scale, 1 inch to 4 miles..... | Geology. For memoir by G. Hanson, and separate distribution. |
| 315A | 2372 | Mining properties in the Portland Canal area, Cassiar district; scale, 1 inch to 4 miles..... | Geology. For memoir by G. Hanson. |
| 324A | 2386 | Cadwallader Creek area, Lillooet district; scale, 1 inch to 1,000 feet..... | Topography. |
| ALBERTA | | | |
| 302A | 2349 | Nordegg sheet (west of fifth meridian); scale, 1 inch to 1 mile..... | Topography. |
| SASKATCHEWAN | | | |
| 267A | 2271 | Regina sheet; scale, 1 inch to 8 miles..... | Geology. For memoir by F. H. McLearn, and separate distribution. |
| — | 2341 | Sections supplementing Map 267A (2271)—Regina sheet..... | Geology. For memoir by F. H. McLearn, and separate distribution. |
| 267A | 2271 | Regina sheet; scale, 1 inch to 8 miles..... | Geography. |
| 314A | 2370 | Amisk Lake sheet; scale, 1 inch to 2 miles..... | Geology. For separate distribution. |
| MANITOBA AND SASKATCHEWAN | | | |
| 268A | 2272 | The Pas sheet; scale, 1 inch to 8 miles..... | Geology. For separate distribution. |

Maps Published April 1, 1934, to March 31, 1935—Continued

| Series A | Publication number | Title | Remarks |
|--------------------|--------------------|---|--|
| MANITOBA | | | |
| 305A | 2357 | Oxford House sheet; scale, 1 inch to 4 miles..... | Geology (provisional edition). |
| ONTARIO | | | |
| 312A | 2368 | Sturgeon River area, Thunder Bay district; scale, 1 inch to 2 miles..... | Geology (reprint). |
| 313A | 2369 | Little Long Lac area, Thunder Bay district; scale, 1 inch to 2 miles..... | Geology (reprint). |
| QUEBEC | | | |
| 285A | 2311 | Taschereau sheet, Abitibi county; scale, 1 inch to 1 mile..... | Geology. For separate distribution. |
| 293A | 2325 | Palmarolle sheet, Abitibi county; scale, 1 inch to 1 mile..... | Geology. For separate distribution. |
| 298A | 2336 | Macamic sheet, Abitibi county; scale, 1 inch to 1 mile..... | Geology. For separate distribution. |
| 306A | 2359 | Kinojevis sheet, Témiscamingue and Abitibi counties; scale, 1 inch to 1 mile..... | Geology (second edition). For separate distribution. |
| NOVA SCOTIA | | | |
| — | 2375 | Mabou coal field, Inverness county; scale, 1 inch to 800 feet..... | Geology. For memoir by G. W. H. Norman. |

Maps In Hands of King's Printer, March 31, 1935

| Series A | Publication number | Title | Remarks |
|-------------------------|--------------------|--|---|
| 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. |
| 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. |
| ONTARIO | | | |
| 155A | 1553 | Lake Huron sheet; scale, 1 inch to 8 miles..... | Geology (reprint of third edition). For separate distribution. |
| 308A | 2364 | Lake Nipigon sheet; scale, 1 inch to 8 miles..... | Geology. For separate distribution. |

Other Map-Work In Varying Stages of Progress

| — | Title | Remarks |
|--------------------------|--|-------------------|
| NORTHWEST TERRITORIES | | |
| 1 | Rae-Great Bear lake (North sheet), district of Mackenzie; scale, 1 inch to 4 miles..... | Geology. |
| 2 | Rae-Great Bear lake (Centre sheet), district of Mackenzie; scale, 1 inch to 4 miles..... | Geology. |
| 3 | Rae-Great Bear lake (South sheet), district of Mackenzie; scale, 1 inch to 4 miles..... | Geology. |
| YUKON | | |
| 4 | Carmacks sheet; scale, 1 inch to 4 miles..... | Geology. |
| 5 | Laberge sheet; scale, 1 inch to 4 miles..... | Geology. |
| BRITISH COLUMBIA | | |
| 6 | Camp McKinney, Similkameen district; scale, 1 inch to 1 mile..... | Geology. |
| 7 | Part of Fairview Camp, Similkameen district; scale, 1 inch to 1,000 feet..... | Geology. |
| 8 | Dividend-Lakeview Property, Similkameen district; scale, 1 inch to 1,000 feet..... | Geology. |
| 9 | Vidette Lake area, Lillooet district; scale, 1 inch to 2,000 feet..... | Geology. |
| 10 | Claims in the vicinity of British Columbia Nickel Company, Yale district; scale, 1 inch to 1,000 feet..... | Geology. |
| 11 | Willow River sheet (West half), Cariboo district; scale, 1 inch to 1 mile..... | Geology. |
| 12 | Willow River sheet (East half), Cariboo district; scale, 1 inch to 1 mile..... | Geology. |
| 13 | Keremeos sheet (West half), Similkameen district; scale, 1 inch to 1 mile..... | Geology. |
| 14 | Keremeos sheet (East half), Similkameen district; scale, 1 inch to 1 mile..... | Geology. |
| 15 | Chilko Lake and vicinity, Coast and Lillooet districts; scale, 1 inch to 4 miles..... | Geology (reissue) |
| 16 | Dease Lake area, Cassiar district; scale, 1 inch to 2 miles..... | Geology (reissue) |
| 17 | Barkerville Gold Belt (North portion), Cariboo district; scale, 1 inch to 1,000 feet..... | Geology. |
| 18 | Barkerville Gold Belt (South portion), Cariboo district; scale, 1 inch to 1,000 feet..... | Geology. |
| ALBERTA | | |
| 19 | Canmore area (North portion), west of fifth meridian; scale, 1 inch to 800 feet..... | Geology. |
| 20 | Canmore area (South portion), west of fifth meridian; scale, 1 inch to 800 feet..... | Geology. |
| 21 | Sections supplementing Canmore area (North portion)..... | Geology. |
| 22 | Sections supplementing Canmore area (South portion)..... | Geology. |
| 23 | Wildcat Hills sheet (Northwest quarter), west of fifth meridian; scale, 1 inch to $\frac{1}{2}$ mile..... | Geology. |
| 24 | Wildcat Hills sheet (Southwest quarter), west of fifth meridian; scale, 1 inch to $\frac{1}{2}$ mile..... | Geology. |
| MANITOBA | | |
| 25 | Elbow-Morton area; scale, 1 inch to 2 miles..... | Geology. |
| ONTARIO | | |
| 26 | Mine Centre area, Rainy River district; scale, 1 inch to $\frac{1}{2}$ mile..... | Geology. |
| 27 | Copper Cliff sheet, Sudbury district; scale, 1 inch to 1 mile..... | Geology. |
| 28 | Espanola sheet, Sudbury district; scale, 1 inch to 1 mile..... | Geology. |
| QUEBEC | | |
| 29 | Chibougamau sheet, Abitibi territory; scale, 1 inch to 1 mile..... | Geology. |
| 30 | Amos sheet, Abitibi county; scale, 1 inch to 1 mile..... | Geology. |
| 31 | Rouyn-Bell River area, Abitibi and Témiscamingue counties; scale, 1 inch to 4 miles..... | Geology. |
| 32 | Mineral properties, Rouyn-Bell River area, Abitibi and Témiscamingue counties; scale, 1 inch to 4 miles..... | Geology. |
| QUEBEC AND NEW BRUNSWICK | | |
| 33 | Chaleur Bay area; scale, 1 inch to 4 miles..... | Geology. |

In addition to the foregoing, fifty-five map and other figure drawings were prepared for reproduction by zinc-cut process, for illustrating reports, papers, and memoirs of the Bureau of Economic Geology; other draughting and related work necessary for staff and public use amounted to one hundred and ninety-six 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 x 5 to 36 x 48..... | 8,958 |
| Bromide enlargements, 4 x 5 to 40 x 72..... | 811 |
| Exposures developed, 3½ x 4½ to 6½ x 8½..... | 2,210 |
| Dry plate negatives, 4 x 5 to 11 x 14..... | 737 |
| Wet plate negatives, 8 x 10 to 24 x 30..... | 195 |
| Zinc plates, 11 x 14 to 24 x 30..... | 19 |
| Photostat copies, 7 x 11 to 11 x 14..... | 266 |
| Lantern slides, 3½ x 4..... | 1,570 |
| Photos and maps mounted..... | 1,353 |
| Total..... | 16,119 |

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Chief of the Division, reports:

During the year 47,995 publications of the Bureau of Economic Geology and National Museum, exclusive of French editions, were distributed. Of these 9,903 were sent to addresses on the regular mailing lists, and 38,092 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)..... | 289 |
| Books (by gift)..... | 858 |
| Canadian Government documents (by exchange and gift)..... | 492 |
| British and foreign Government documents (by exchange and gift)..... | 1,016 |
| Periodicals and continuations subscribed for..... | 314 |
| Periodicals, annuals and continuations, by exchange and gift..... | 761 |
| Pamphlets..... | 340 |
| Maps..... | 354 |

Two hundred and twenty-two volumes were bound. The recorded loans were 4,890. Inter-library loans amounted to 313 and 61 books were borrowed from other libraries for members of the staff. Cards added to the catalogue numbered 5,507, of which 106 were bibliographical and 49 biographical. The systematic analysing of important monographs and other significant papers in periodicals added 781 new titles to the catalogue. Pamphlets catalogued amounted to 304, maps to 354, and lantern slides to 1,587.

The Geological Society of America has made this a depository library to receive copies of all the Society's publications. Other notable gifts during the year were:

- Potonie, Henry: *Abbildungen und Beschreibungen fossiler Pflanzen-reste der palaeozoischen und mesozoischen Formationen*, 7 vols. Presented by the Geological Survey of Germany.
- Kaudern, Walter: *Ethnographical studies in Celebes*, vols. 1-4, 1925-1929.

Liverpool Biological Society: Proceedings and transactions, 45 volumes, 1888-1932.

Société royale de botanique de Belgique: Bulletin, 20 volumes, 1909-1934.

Pan Pacific Science Congress, 5, 1933: Proceedings, 5 vols.

"Nickel Coins": Presented by Mr. R. C. Stanley, President of the International Nickel Company of Canada.

BRITISH COLUMBIA OFFICE

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

As in the preceding year the use made by the public of the facilities offered by this office again showed an increase. The number of visitors registering totalled 6,224, which constitutes a record, and 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 5,665 and 1,420 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 that the number of specimens for microscopic determination received from mining companies, seeking the solution of particular problems, showed a considerable increase.

NATIONAL MUSEUM OF CANADA

W. H. Collins, Acting Director

This report is an outline summary of the annual report of the National Museum for 1934. Readers who wish fuller information are referred to the latter report.

A brief explanation of the present organization of the Museum is given in the longer report. No appointments, retirements, or other changes of personnel within the divisions of anthropology and biology, the two sections of the Museum under its own control, occurred during the fiscal year.

There was in 1934 a small resumption of field work, which had been almost completely prohibited since 1930. C. M. Sternberg collected two skeletons of an extinct marine reptile from the Cretaceous rock formation of southern Manitoba and some fossil footprints of a still more ancient animal from the Pennsylvanian strata near Parrsboro, Nova Scotia. Douglas Leechman was afforded passage on the annual Government expedition to the eastern Arctic for the purpose of collecting at the various ports of call specimens and information about ancient Eskimo habitations.

The one activity to which there has been no serious impediment is educational work, and considerable effort has been concentrated upon this work, particularly beyond the immediate vicinity of Ottawa. "Birds of Canada," a new book to take the place of the earlier "Birds of Eastern Canada" and "Birds of Western Canada," was published. A new edition of "Indians of Canada" has been published. These two works, which are written in non-technical style and elaborately illustrated, are the first of what is hoped will be a series of authoritative works for encouraging and disseminating interest in Canadian natural history at home and abroad. Visual education is being extended by enlarging our loan collections of moving picture films and lantern slides. This service is being used so much more that four and five duplicate sets of the more popular series of lantern slides are now required to be kept in circulation. Experiments are being made towards extending loan of specimens and special displays beyond Ottawa, but the fragility of much of this material and costs of transportation put a limit upon this activity. The annual report of the Museum contains a list of the lectures and radio broadcasts, indicating the extent to which members of the Museum are in demand for this purpose. Likewise it indicates the growing popularity of the annual museum lecture series given at Ottawa.

Growth of interest in the Museum by the public has been evidenced particularly this year by the increased number and importance of donations. Among those that should be specially mentioned are: a group of wood bison from Great Slave lake that Mr. Harry Snyder, of Montreal, collected and is having mounted at his own expense in their natural environment; a large supply of nickel-copper ore specimens for educational collections from Falconbridge Nickel Mines, Limited; and a collection of nickel coins of countries throughout the world from The International Nickel Company of Canada.

Assistance to the work of the National Museum in palæontology and mineralogy was provided by various officers of the Bureau of Economic Geology.

C. M. Sternberg continued preparatory work on the collection of Hooded Hadrosaurs from the Belly River Cretaceous, assisted by J. Skillen and J. E. Proulx.

E. M. Kindle prepared an exhibit illustrating various types of lamination in sediments.

F. H. McLearn made considerable progress with an exhibit representing characteristic Cretaceous fossils of the Great Plains, geological sections from which they came, and graphic restorations of Cretaceous life and geography.

During the year just ended the Mineralogical Division has added considerably by collection, exchange, and donation, to the specimens not on display in the Museum.

The division, as in previous years, contributed a large exhibit for the Central Canada Exhibition, Ottawa.

At the request of Mr. F. P. Cosgrove of the Canadian Government Exhibition Commission, Department of Trade and Commerce, a mineral exhibit was prepared for display during British Empire Week at Johannesburg, South Africa.

Statements of work in the divisions of anthropology and biology follow.

ANTHROPOLOGICAL DIVISION

C. M. Barbeau continued his studies of the early arts and handicrafts of Quebec and Ontario, also a comparative study of songs of the natives of Siberia and those of northwestern Canada with a view to tracing the relations of these two groups of people. He prepared for publication a collection of the folk songs of Quebec. He organized a special exhibition of Canadian handicrafts in the Museum for the occasion of the visit of the delegates to the Jacques Cartier Fourth Centenary in August and another similar exhibition that was shown in Toronto during January, 1935, and later at Ottawa.

Diamond Jenness completed a report on the grammar of the Eskimo language used in the Coppermine region. As a member of a committee on Arctic exploration set up by the International Congress of Anthropological and Ethnological Sciences held in London, 1934, he drew up an outline of archæological and ethnological work that remains to be done in the Canadian Arctic as part of a larger scheme covering the Arctic regions of the Old and New Worlds.

J. D. Leechman accompanied the Government expedition to the eastern Arctic in the summer of 1934. During the rest of the year he was fully occupied with the care of collections and with exhibition work. Harlan I. Smith continued to build up a reference file of information on Canadian archæology.

W. J. Wintemberg was occupied with the care and study of archæological specimens and revision of a report on the Roebuck ancient village site, situated near Cornwall, Ontario.

BIOLOGICAL DIVISION

R. M. Anderson continued compilation of two books on Canadian mammals, one a check-list, the other an illustrated handbook on the mammals of Canada, similar in design to the "Birds of Canada" and "Indians of Canada" already published by the Museum. He served on several inter-departmental committees concerned with the care of game and fur-bearing animals.

P. A. Taverner, in addition to routine duties in anthropology, completed a new edition of his work on the "Birds of Canada," combining into one book the two books, "Birds of Eastern Canada" and "Birds of Western Canada," that had previously been issued.

Since the death of M. O. Malte in 1933 his position as museum botanist has been vacant and systematic botanical work has been suspended.

C. L. Patch and his staff of preparators were occupied throughout the year with preparation of mounted specimens of birds and mammals for exhibition in the public halls when space becomes available. He prepared a special exhibit for the Central Canada Exhibition at Ottawa. Also, he took an important part in arranging the museum lecture series, increased the collections of reptiles and amphibia in his charge, and expanded the school loan collections.

MINES BRANCH

John McLeish, Director

The Mines Branch has continued during the past year, within the limitations imposed by reduced staff and appropriations, 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.

The technical staff was reduced during the year by the resignation on June 22, 1934, of T. W. Hardy, engineer in charge of pyrometallurgical investigations, in the Division of Ore Dressing and Metallurgy, who was not replaced. Toward the close of the year, C. L. O'Brian, assistant chemist, Division of Chemistry, was transferred by promotion to the staff of the Dominion Fuel Board. It is with regret that we record the death of R. P. Bray, engineer in the Administrative Division, on March 9, 1935. Mr. Bray had been in the service of this branch for a year and eight months only, having been transferred from the Natural Resources Intelligence Service of the Interior Department to replace V. A. Minnes in the position of office engineer. Miss L. A. Lindsay, stenographer, Grade I, resigned on November 18. During parts of the year, six university undergraduates were permitted to work in the Fuel Testing and Ore Dressing Laboratories in order that they might benefit by the experience so gained.

Field investigations of mineral resources and field studies of mining problems and ore treatment methods have been severely curtailed during the past three 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 most 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 beginning made during the year in the production of rock wool in Niagara district is perhaps an outstanding example of the development of a new industry resulting from the investigative work carried on by this division of the Mines Branch.

Last year it was pointed out that the facilities of the Ore Dressing and Metallurgical Laboratories had been pressed to the limit of equipment and staff to meet the demand for test work on ore samples submitted, and the same situation continued throughout 1934. One hundred and sixteen major investigations were completed in 1934, as compared with a total of one hundred and seventy investigations during the three previous years.

Although gold ores constituted the majority of those tested, a number of tests on non-metallies were made, including corundum-bearing rock, mica, silica, graphite, gypsum, anhydrite, garnet, and several sand blasting tests. Some eleven investigations in ferrous metallurgy were also completed, and a number of examinations made of radium-bearing ores and minerals from Beaverlodge and Hottah lakes, Northwest Territories.

In the Fuel Research Laboratories technical studies and laboratory research work have been continued on the classification, constitution, beneficiation, storage, carbonization, hydrogenation, and efficiency of use of Canadian coals and a number of investigations on natural gas, petroleums, and Alberta bitumen.

These laboratory and large-scale studies and test work are furnishing much basic scientific information regarding the structure of our Canadian coals, as well as most valuable information respecting their preparation for markets and the products that may be derived from them. This knowledge is of great assistance in extending the home market for Canadian coal, as has been evidenced during the past two or three years in the greatly increased use of Canadian coal for coke and gas-making at Montreal, Winnipeg, and Vancouver. It has also stimulated Canadian colliery operators in installation of coal-washing equipment to improve the quality, and screening and sizing equipment to furnish fuel specially suited to particular purposes.

In the Ceramic Laboratories during the year some fifty-one samples of clays and associated raw materials were examined to determine their suitability for the manufacture of industrial products. General study and research work were continued on the following investigations: physical properties of Canadian bricks; tests on structural assemblies; refractory industry and resources of Canada; white and buff-burning clays of southern Saskatchewan; magnesian dolomite refractories; increasing the density of brick; reinforced brick masonry.

With the greater use of scientific principles in the clay industry, the introduction of new processes, and the development of new products the services of the ceramic laboratories are being called upon more and more for advice and laboratory assistance.

The close contact which the officers of this division have made with industry is illustrated in the prominent part they have been asked to take during several years past in the management and activities of both the Canadian and the American Ceramic Societies.

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 Act. The Annual Meeting of the Canadian Institute of Mining and Metallurgy in Quebec, April, 1934, and in Winnipeg, March, 1935, and the Annual Western Meeting in Calgary in September, were attended. A review of the coal situation in Canada in 1934 was presented at the Winnipeg meeting. In company with W. B. Timm, Chief of the Division of Ore Dressing and Metallurgy, an inspection was made of the gold mills of British Columbia in regard to the operation of which very definite contributions had been made by ore dressing tests conducted in the department's Ore Dressing Laboratories. At the same time personal contacts were renewed with officials of the Provincial Departments of Mines of British Columbia, Alberta, and Manitoba.

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

MINERAL RESOURCES DIVISION

Conforming with the practice of recent years, a comprehensive survey of the progress of the mineral industry of Canada during the previous calendar year (1933) was compiled for publication in mimeograph form. In all, sixty-one separate products were reviewed. Reports were completed and published on: Zinc Dust Consumption at Canadian Gold Mines; Limestones of Canada, Part II, Maritime Provinces; Chrysotile Asbestos in Canada (reprint of French edition); Abrasives, Part IV, Artificial Abrasives (French edition); Mineral Industries of Canada, 1933 (French issue of second edition); Characteristics of Rock Wool

Experimentally Prepared from Rock Available in the St. Davids-Thorold District, Ontario; abridged editions of Mineral Industries of Canada, 1933 (English and French); lists of Milling Plants and Coal Mines in Canada. In addition, members of the staff made ten public addresses on phases of the mineral industry, seventeen articles were prepared and published in the technical press, and twelve newsletters were prepared for the British Press.

As in previous years, a very large number of replies, either as letters or extensive memoranda, were prepared in answer to inquiries received by the department on questions relating to mining incorporations, to minerals or mineral products, and to the use of mineral products in industry. Most of these inquiries are from Canadian sources, at least twenty-five per cent from the United States, and a few from Great Britain, and other parts of the world. In addition to inquiries by letter, the technical officers of the staff receive many personal calls from inquiring engineers and representatives of industry.

This type of inquiry is undoubted evidence of the value of the investigative work of the mineral technologists on the staff, and of the information conveyed in the series of monographs and other publications dealing with many phases of the Canadian mineral industries that have been published during the last decade. Our efforts to cope with this demand for information naturally interrupt the continuity of investigative work in progress, and frequently delay the publication of the results of field investigations. The work of the division necessitates the maintenance of a very complete reference index covering all important publications dealing with our mineral industries and the use of minerals in arts and industry. These important reference files and index have been more than a quarter of a century in the making.

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 interviews with many inquirers, and the preparation of certain special reports for the use of other departments as well as the compilation of two semi-annual and one annual report. He served on two inter-departmental committees, one dealing with the leasing of certain Crown lands containing valuable known mineral deposits, and the other dealing with matters relating to our export trade in minerals and mineral products. There were a number of consultations on technical matters with four other departments. Only a very short time was available for informative field work, about one month being spent in visiting producing mineral properties in Nova Scotia, a week in the asbestos areas of Quebec, and two weeks in eastern Ontario.

H. S. Spence continued his investigations of work in progress, in Ontario and Quebec, in the mining and preparation for market of the group of non-metallic mineral products in which he specializes. This work included the examination of many old and some new localities in which rare-element minerals occur. In this connexion he spent some three weeks in company with Dr. K. K. Landes, of the Department of Geology, University of Kansas, re-visiting many of the pegmatite areas in Quebec and Ontario where both industrial minerals and rare-element minerals occur, Dr. Landes being engaged in a special study of pegmatites and the mineral associates that occur therein, particularly mica phosphate deposits. A short time was spent in Manitoba visiting localities in which had been found certain lithium-bearing minerals, beryl, and feldspar. Bentonite deposits in Manitoba and Alberta were visited, and various plants in western Canada using or treating non-metallic minerals were also inspected. Throughout the year Mr. Spence kept in as close touch as possible with all developments relating to pitchblende discoveries, mining, and treatment, with field work limited to two visits to the Eldorado refinery at Port Hope. Several press articles on phases of our radium industry were prepared during the year. Calls were also made at a number of industrial plants in Ontario and Quebec, a

number of manufacturing firms, consumers of non-metallic mineral products, were visited in the United States, and consultations were had with mineral technologists engaged in research work at Washington, Philadelphia, and New York. Studies were continued of minerals and mineral products acquired by direct collection, or submitted by correspondents. An exhibit of fluorescent minerals was also completed, and a large number of minerals on file were tested for fluorescent properties.

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 current progress on sandstones or freestones. He also kept in touch as far as possible with development in industries producing or utilizing gypsum, salt, and sodium sulphate. Sixty-eight days were spent on field work in various provinces, which included Nova Scotia, New Brunswick, Quebec, and Ontario. Progress was made in the assembling of data for use in reports, and in the arranging of some of the representative collections of building and ornamental stones, and other mineral products that have been assembled during the past four years.

S. C. Ells continued his studies of the possibility of utilizing the asphalt resources of Alberta. Visits were made to a number of representative consumers of asphaltic materials in Toronto and western Ontario, with a view to determining industrial applications for bitumen separated from Alberta bituminous sand. Mr. Ells co-operated with officers of the Fuel Testing Laboratories in the preparation of a number of batches of bitumen blown to various standards and distributed to industrial firms utilizing such material, in order that trials of the material might be made under plant-operating conditions. Some estimates of the reserves of bitumen in the Horse River Reserve were made.

M. F. Goudge continued his studies of the limestone industries; his report on limestones of the Maritimes was issued early in the year; the companion report on the limestones of Quebec was completed and is now in press, and considerable progress has been made on the volume dealing with Ontario. A great deal of information concerning Canadian limestones, limes, and marbles was furnished to correspondents and to direct inquirers during the year. It is interesting to note that a black marble discovered at St. Albert, Ontario, during the course of these investigations, is now on the market both in the United States and Canada, where it is successfully competing with similar marbles from other localities; this marble was used in the British Empire building, Radio City, New York, and also in the interior of the new Hydro-Electric Commission's building in Toronto. Some additional work was done on the development of a rock wool industry in Ontario, based on impure dolomitic limestones discovered in Niagara peninsula, and technical advice was furnished to several organizations; one new plant using a newly developed process is now in commercial production at Thorold, Ontario; a standard cupola plant has been installed at Asbestos, Quebec, and two other firms are planning operations in Niagara peninsula, one of these having already made considerable progress. About forty-five days were spent on field work in Ontario and Quebec checking data and obtaining new information for use in the reports in progress, and for the preparation of annual reviews of the lime industry.

A. H. A. Robinson was engaged during the early part of the year in completing the manuscript for the abridged edition of his report on "The Mineral Industries of Canada, 1933"; a number of special articles for press use by executive officials were also compiled. About two months were spent in the field inspecting mining developments in British Columbia, with special reference to gold mining, with a view to gathering recent information for use in the preparation of the third edition of the report on "Gold in Canada," now in progress.

V. L. Eardley-Wilmot continued his studies of abrasives. During the year an exhaustive report on diatomite was completed, and two shorter reports, one

on diatomite in Ontario and one giving a skeleton outline of the subject were prepared. During the year a large number of samples of abrasive materials, chiefly diatomites, were examined, and detailed reports, analyses, and maps of deposits compiled, the material examined being in part that collected on the previous year's field work, and in part supplied by correspondents.

John Casey, statistician, continued the annual survey of fuel oil for all purposes used throughout Canada. A report entitled "Petroleum Fuels in Canada, Deliveries for Consumption, Calendar Years 1930-1931-1932" was issued in September of 1934 and a similar report covering the calendar year 1933 was issued in March, 1935. A similar survey of Bunker fuels used in Quebec, Ontario, and Manitoba was also conducted. Tabular statistical tables covering these surveys were compiled during the year. About twenty-eight days were spent on field inquiries in Quebec and Ontario, during which one hundred and forty-nine calls were made to secure data not obtainable by correspondence.

A. Buisson continued his office work in the Records Section during most of the year. He made special surveys relating to zinc dust consumption in Canada, dividends paid by operating mines in Canada, mercury consumption in Canada, chemical reagents used in flotation, milling capacities and processes at the gold concentrators, probable gold output for 1934 (estimated), sixteen graphs relating to monthly output of the principal mineral products (brought up to date). Several special tabulations were prepared, a list of all milling plants in Canada was compiled and published, and a list of "Gold Mines" nearly completed. This section dealt with 992 inquiries, miscellaneous correspondence totalled 1,173 letters, and circular inquiries totalled 1,036.

C. H. Freeman was engaged chiefly on his report on moulding sands; a number of samples submitted by inquirers were examined.

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

H. A. Leverin of the Chemical Division was engaged on a field survey of the natural waters of the provinces of Ontario and Quebec. Water is an important natural mineral product; large quantities are used daily by all organized communities, as well as by such industries as soap makers, pulp and paper mills, breweries and distilleries, dyers, and laundries. Natural waters usually contain small amounts of both organic and inorganic materials in solution, and the presence of these substances may be advantageous or disadvantageous to the consumer. Mr. Leverin is conducting, on behalf of the department, a survey of natural waters available for domestic or industrial use to ascertain their characteristics. Systematic sampling is being done and the samples are subjected to laboratory examination. The immediate objective of the work undertaken in 1934 is the securing of data for the preparation of a hardness map showing the distribution of hard and soft waters in the two provinces being surveyed.

During the year senior technical officers of this division were called upon to advise on technical matters with which they were familiar, by officials of the Departments of Interior, Public Works, Commerce, National Defence, National Revenue, National Research Council, Tariff Board, and Secretary of State.

ORE DRESSING AND METALLURGICAL DIVISION

W. B. Timm, Chief of Division, reports an increase in the amount of investigative work conducted on Canadian ores to determine methods adaptable to their treatment and on improvements in operating plant practices, over the preceding year. One hundred and sixteen reports of investigations were issued, fifty-six of which were prepared for publication, the remainder being submitted only to those directly interested. In addition, considerable experimental test work of

minor importance was conducted. The ores and non-metallic minerals tested originated from every province and territory in the Dominion with the exception of Prince Edward Island. The majority of the investigations were on gold ores, or ores in which gold was the principal valuable mineral, which indicates the activity in gold mining due to the enhanced price of the metal. Resulting from the investigations many new properties were brought into production and milling plants were in course of erection or under consideration for many others.

The growth of the gold mining industry, the excellent laboratory facilities provided, and the confidence the industry has placed in the results of the work as set forth in the reports already prepared, have been responsible for the increasing requests for investigative work. These could be dealt with much more fully and satisfactorily were the additional staff necessary for the purpose available.

The closest co-operation has been maintained with the industry and those engaged in it. Company and consulting engineers have had the fullest use of the laboratory facilities for the investigation of their own problems in co-operation with the staff. They have had the benefit of the knowledge and experience of the staff in the design of milling plants and concentrators by consultation and study of the reports issued. This personal contact is of material assistance towards the design of plants for the most economical treatment of the ores.

FIELD STUDIES

W. B. Timm spent three weeks in the field in northeastern Ontario and northwestern Quebec, and five weeks in northwestern Ontario and in British Columbia, visiting milling plants and concentrators and discussing with the operators their milling problems. C. S. Parsons spent five weeks, and A. K. Anderson three weeks, at the plants in northwestern Quebec on problems of plant operation. J. D. Johnston and M. H. Haycock spent three weeks on a visit to the milling plants in northeastern Ontario and northwestern Quebec, and W. R. McClelland two weeks visiting milling plants in Nova Scotia.

LABORATORY INVESTIGATIONS

Metallic Ores. Investigations were carried out by C. S. Parsons, A. K. Anderson, J. D. Johnston, W. R. McClelland, and W. S. Jenkins on the concentration of, or on methods of recovering the metals from, the following ores:

- Copper-gold ore from Manitoba and Eastern Mines, Limited, Goward, Ontario (551).
- Arsenical-gold ore from B.C. Cariboo Goldfields, Limited, near Moyie, B.C. (552).
- Gold ore from the Edwards Mining property, Lochalsh, Ontario (553).
- Gold ore from the Pickle Crow mine, Patricia district, Ontario (554).
- Gold ore from the Casey Summit Gold Mines, Limited, Summit lake, Patricia district, Ontario (555).
- Gold ore from the Dufferin mine, Port Dufferin, N.S. (556).
- Silver and silver-pitchblende ores from Bear Exploration and Radium, Limited, Great Bear lake, N.W.T. (557).
- Gold ore from Lac des Mille Lacs, Thunder Bay district, Ontario (558).
- Gold ore from the Pascalis Gold Mines, Limited, Pascalis township, Abitibi county, Que. (559).
- Gold ore from the Dikdik Exploration Company, Limited, Thunder Bay district, Ont. (560).
- Lead-zinc-gold ore from the Howard mine, Nelson mining district, B.C. (561).
- Gold ore from Normont Gold Mines, Limited, Rouyn township, Que. (562).
- Gold ore from Montague Gold Mines, Limited, Montague, N.S. (563).
- Lead-copper-zinc ore from Stirling mine, Stirling, N.S. (565).
- Copper-nickel ore from Cuniptau Mines, Limited, Goward, Ont. (566).
- Gold ore from the Arntfield Gold Mines, Limited, Arntfield, Que. (567).
- Gold ore from Little Long Lac Gold Mines, Limited, Geraldton, Ont. (568).
- Silver ore from White Eagle Silver Mines, Limited, Camsell river, N.W.T. (569).
- Gold ores from Amisk (Beaver) Lake district, Saskatchewan (570).
- Gold-copper ore from Greene Stabell Mines, Limited, Dubuisson township, Abitibi county, Que. (571).

- Gold flotation concentrates (sintering tests on) from Beattie mine, Duparquet township, Abitibi county, Que. (572).
- Gold ore from McWatters Gold Mines, Limited, Rouyn township, Que. (573).
- Gold ore from Arbade Gold Mines, Limited, Matachewan, Ont. (574).
- Gold ore from Matachewan Consolidated Mines, Limited, Matachewan, Ont. (575).
- Gold ore from Gillies lake, Porcupine Gold Mines, Limited, Timmins, Ont. (576).
- Gold ore from McKenzie Red Lake Gold Mines, Limited, Red lake, Ont. (578).
- Gold flotation concentrate from Beattie Gold Mines, Limited, Duparquet township, Abitibi county, Que. (579).
- Gold ore from Bussièrès Mining Company, Louvicourt township, Abitibi county, Que. (580).
- Gold ore from Island Mountain Mines Company, Limited, Cariboo district, Wells, B. C. (581).
- Gold-silver ore from Kozak mine, Algoma district, Ont. (582).
- Gold ore from Bosquet Gold Mines, Limited, Mongowin township, Sudbury, Ont. (583).
- Gold ore from Bluenose Gold Mining Co., Limited, Guysborough county, N.S. (584).
- Gold ore from Canadian Malartic Mines, Limited, Malartic township, Abitibi county, Que. (585).
- Gold ore from Stadacona Rouyn Mines, Limited, Rouyn township, Quebec. (586).
- Gold ore from Rice Lake Mines, Limited, Bissett, Man. (587).
- Gold ore from the Queen mine, Sheep Creek Gold Mines, Limited, Salmo, B. C. (588).
- Arsenical gold ore from the Minto Gold Mines, Limited, Bridge River district, Minto, B. C. (589).
- Gold ore from the Grandora Mines, Limited, Penticton, B. C. (590).
- Gold ore from Central Patricia Mines, Limited, Patricia district, Ont. (590).
- Gold ore from Porcupine Peninsular Gold Mines, Limited, Nighthawk lake, Ont. (592).
- Gold-copper ore from the Wendigo Gold Mines, Limited, Lake of the Woods district, Ont. (593).
- Gold ore from the Kilo mine, C. Q. Mining Company, Limited, Slocan City, B. C. (594).
- Gold ore from the Arntfield Gold Mines, Limited, Arntfield, Que. (595).
- Gold ore from the Pontiac-Rouyn Gold Mines, Limited, Rouyn township, Que. (596).
- Gold ore from Gods Lake Mines, Limited, Gods Lake, Man. (597).
- Gold-silver-lead ores from Marysville Mining Company, Limited, Fort Steele mining division, B. C. (598).
- Gold-copper ore from Tashota Goldfields, Limited, Tashota, Ont. (599).
- Copper-gold ores from the Sunset and Motherlode mines, Boundary district, Greenwood, B. C. (600).
- Gold ore from Reno Gold mines, Limited, Salmo, B. C. (601).
- Gold ore from Powell-Rouyn Gold Mines, Limited, Rouyn township, Que. (602).
- Gold ore from Hudson-Patricia Gold Mines, Limited, Narrow lake, Ont. (603).
- Gold-silver ore from Monashee Mines Syndicate, Limited, Vernon, B. C. (604).
- Arsenical gold ore from the Hedley Mascot mine, Hedley, B. C. (605).

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

- Gold ore from the Wayside Consolidated Gold Mines, Limited, Bridge River district, B. C.
- Gold ore from Ceepeecee, west coast of Vancouver island, B. C.
- Antimonial-gold tailings from West Gore, Hants county, N. S.
- Gold-bearing flotation and blanket concentrates from Bussièrès Mining Company, Limited, Louvicourt township, Abitibi county, Que.
- Lead-zinc-gold ore from Canyon creek, Bayonne district, B. C.
- Gold-copper ore from the Roseberry mine, Slocan City, B. C.
- Arsenical gold ore from Thompson-Cadillac Mining Company, Limited, Cadillac township, Abitibi county, Que.
- Gold ore from Mr. Algot Nelson, Kenora, Ont.
- Gold ore and mill products from Granada Gold Mines, Limited, Rouyn township, Que.
- Gold ore from McCarthy-Webb property, Goudreau-Lochalsh area, Algoma district, Ont.
- Gold ore from the Mathews Gold Mines, Limited, Pascalis township, Abitibi county, Que.
- Gold-silver-lead-zinc ore from the Goodenough mine, Ymir Gold Mines, Limited, Ymir, B. C.
- Copper-gold ore from the Lee Gold Mines, Limited, Greenlaw township, Sudbury district, Ont.
- Gold ore from mining claims 29114-5, Scadding township, Sudbury district, Ont.
- Gold ore from Wanapitei Gold Syndicate, Scadding township, Sudbury district, Ont.
- Gold-bearing flotation concentrate from Northern Empire Mines Company, Limited, Empire, Ont.

- Gold ore from Craig Gold Mines, Limited, Madoc, Ont.
 Gold ore from mining claim T.B. 10971, Little Long Lac area, Ont.
 Gold-silver ore from Favourable lake, Patricia district, Ont.
 Gold ore from the Big Slide mine, Grange Mines, Limited, Kelly creek, Pavilion, B.C.
 (Supplementary Report).
 Gold ore from Pickle Crow Gold Mines, Limited, Patricia district, Ont.
 Gold ore from Thompson-Joannes Syndicate, Joannes and Rouyn townships, Que.
 Gold ore from Lardeau Gold and Silver Mines, Limited, Lardeau district, B.C.
 Gold ore from Birrell Gold Mines, Limited, Duprat township, Abitibi county, Que.
 Gold-bearing blanket and table concentrates from United Goldfields of N.S., Limited, Brookfield Mines, Queens county, N.S.
 Gold-copper ore from Nanoose creek, Vancouver island, B.C.
 Gold flotation concentrates from Dentonia Mines, Limited, Greenwood, B.C.
 Gold ore from the Sakoose Gold Mines, Limited, Dymont, Ont.
 Gold ore from the Harwood Lake Mines, Limited, West River district, Ont.
 Gold-bearing concentrate from Salmon River Gold Syndicate, Dufferin Mines, Halifax county, N.S.
 Gold-silver-lead-zinc ore from the J. and L. Mineral Claims, Revelstoke, B.C.
 Gold-copper ore from Fox Lake Gold Syndicate, Mongowin township, Sudbury district, Ont.
 Gold ore from the Amca Mines Syndicate, Timmins, Ont.
 Gold-copper ore from the Roderick Gold Mines, Limited, Hole River lake, Man.
 Gold ore from the Geiler mineral claims, Quadra island, B.C.
 Gold ore from the Avocalon Mining Syndicate, Limited, Vauquelin township, Abitibi county, Que.
 Gold ore from the Gomak mine, Porcupine Crown Mines, Limited, Chester township, Sudbury district, Ont.
 Gold-silver-lead-zinc ore from the Black Bear claim, Hall creek, Kitsumgallum lake, B.C.

A report was also submitted on the use of "Crocetol" frothing reagents for flotation purposes to the Shawinigan Chemical Company, Limited, Shawinigan Falls, Que.

Non-Metallic Minerals. Investigations were carried out by R. K. Carnochan on the following non-metallic minerals:

- Concentration of corundum-bearing rock from Dungannon township, Renfrew county, Ont. (577).
- Concentration of mica from Baker inlet, near Prince Rupert, B.C. (606).
- Sandblasting tests on Canadian silica sands (608).

In addition to the list of published reports, experimental tests were conducted by R. K. Carnochan and R. A. Rogers on the following non-metallic minerals and products and reports issued to those directly interested:

- Concentration of opal silica from Minaki, Ont.
- Concentration of graphite from St. John, N. B.
- Sandblasting tests on quartz from Chicoutimi, Que.
- Sandblasting tests on garnet rock from Labelle county, Que.
- Sandblasting tests on quartz from Lac Remi, Que.
- Sandblasting tests on silica sand from Keoma, Alta.
- Sandblasting tests on silica sand from St. Andrews East, Que.
- Sandblasting tests on garnet products from Labelle county, Que.
- Anhydrite samples from H. B. McCurdy, Sydney, N.S.
- Gypsum cake from Consolidated Mining and Smelting Company of Canada, Limited, Trail, B.C.
- Sandblasting tests on silica sands from Lac Remi, Que.
- Concentration of garnet rock from Loughlin township, Sudbury district, Ont.

In addition, numerous minor tests were conducted.

Ferrous Metallurgy. T. W. Hardy, who was in charge of the investigations in ferrous metallurgy, resigned early in the year, the work after May 31, 1934, being considerably curtailed, and carried on under H. H. Bleakney.

This included the following investigations:

- Grain size determinations on several steel samples for Canadian Atlas Steels, Limited, Welland, Ont.
- Carburization and heat treatment of 72 small parts for camera mounts for Department of National Defence.

- Microscopic examination of an engine mounting in the region of the weld for Department of National Defence.
- Deep etching and inspection of 64 recuperator adapter breech lugs from 18-pounder Q.F. guns for Department of National Defence.
- Heat treatment of two airplane axles for Department of National Defence.
- Endurance limit tests on two side rods for Canadian National Railways.
- Impact tests on 21 samples of steel and 2 samples of brass for Dominion Engineering Works, Montreal, Que.
- Investigation of damaged boiler tube to determine cause of failure, for the Department of Public Works.
- The making of four ingots of nickel-molybdenum iron to develop more satisfactory stay-bolt material, for Canadian Pacific Railway Company and Canadian Atlas Steels, Limited.
- Metallization of high-grade concentrates from Texada Island magnetite.
- Relative value of sponge iron and scrap iron as a base for steel making.

R. J. Traill investigated certain problems in connexion with the treatment of the Great Bear Lake pitchblende in co-operation with the staff of the Port Hope refinery. He was also engaged on research problems in connexion with the treatment of metallic ores above listed.

In the radium measuring laboratory six radium measurements were carried out by W. R. McClelland on samples of ores from the Great Bear Lake district, N.W.T., and twenty-seven measurements for radioactivity were made with the alpha electrocope.

In the mineralogical laboratory, 1,056 polished sections of ores and mill products and 21 thin sections of non-metallic minerals were prepared for microscopic examination. The list of polished sections prepared is given in the following table:

| | |
|---|-------|
| For examination for the Ore Dressing and Metallurgical Laboratories | 757 |
| For Geological Survey, Canada | 136 |
| For Mineral Resources Division, Mines Branch..... | 3 |
| For Queen's University, Kingston, Ont..... | 25 |
| For Nova Scotia Technical College, Halifax, N.S..... | 23 |
| For Noranda Mines, Limited, Noranda, Que..... | 73 |
| For Macassa Mines, Limited, Kirkland Lake, Ont..... | 19 |
| For Lake Shore Mines, Limited, Kirkland Lake, Ont..... | 10 |
| For Consolidated Mining and Smelting Company of Canada, Limited, Trail, B.C..... | 10 |
| Total..... | 1,056 |

M. H. Haycock prepared 95 reports on the microscopic examination and spectrographic analysis of 94 Canadian ores and mill products and one Rhodesian ore and mill products, the results of which were embodied in the reports of investigations or separately reported.

H. C. Mabee, Chief Chemist, reports 4,155 samples were received in the chemical laboratories of the division, on which over 12,000 chemical determinations were made, an increase of 12 per cent over the preceding year. In addition, investigations were carried out on the reduction of chrome ores by hydrogen; on a basic flux method for the determination of gold and silver by furnace assay; and physical and chemical tests on hydrated limes and plasters.

FUELS AND FUEL TESTING DIVISION

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

Among the more important investigations conducted were burning efficiency tests on Canadian bituminous coals, in comparison with anthracite and coke, further sizing and washing tests on Nova Scotia coals, and large scale storage tests at Sydney, Nova Scotia. Laboratory research work on the classification, constitution, beneficiation, carbonization, and hydrogenation of Canadian coals was carried on throughout the year, and further natural gas field work in western

Ontario was conducted. 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 April he attended the annual meeting of the Canadian Institute of Mining and Metallurgy held at Quebec city, and early in June attended the annual meeting of the Canadian Gas Association held in Montreal. Towards the latter part of June, accompanied by Mr. Strong, he held a conference with officials of the Dominion Coal Company at Sydney, Nova Scotia, regarding the preparation and storage of Nova Scotia coal, and also attended the annual meeting of the Nova Scotia Mining Society held at Pictou. In September, in company with Mr. Strong, he attended the annual western meeting of the Canadian Institute of Mining and Metallurgy, held at Calgary and Banff, and later visited the Crowsnest Pass district. Mr. Haanel conferred with officials of the gas and coke plant of the British Columbia Electric Company at Vancouver, and investigated the coal situation in that district. He also held a conference with the Minister and the Deputy Minister of Mines of the province at Victoria, where the entire fuel situation of British Columbia was discussed. On his return from British Columbia, Mr. Haanel held conferences, in Edmonton, with officials of the Collieries in the Mountain Park, Alberta, area, and in Winnipeg with officers of the Crow's Nest Pass Coal Company and the Winnipeg Electric Company. While in Winnipeg, in company with the Chairman of the Dominion Fuel Board, he attended a meeting of the Retail Coal Operators. During the year Mr. Haanel also conferred with officials of: the Montreal Coke and Manufacturing Company, the fuel department of the Canadian National Railways, and the Dominion Coal Company, all in Montreal, concerning Canadian fuel problems. In February, he attended the annual meeting of the Engineering Institute of Canada held in Toronto, and also attended the annual meeting of the Canadian Institute of Mining and Metallurgy held at Winnipeg in March.

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 to co-operate with the staff of this division at their respective universities on problems pertaining 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, in accordance with his regular duties, supervised and correlated the work of the different sections of the division and devoted considerable time to the preparation of reports on investigations of fuels and fuel testing. He 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 committees. Mr. Gilmore, as Mines Branch member of the American Society of Testing Materials, acted as chairman of the sub-committee dealing with the development of a standard laboratory method for testing the comparative handling properties of coals, and he also participated in the work of the "grindability" committee having to do with the comparative pulverizing characteristics 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 to typical United States coals shown. This arrangement of Canadian coals is shown in tabular form and in charts published in the General Review of Investigations section of Investigations of Fuels and Fuel Testing, 1933 and 1934.

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 the section involving the routine examination of nearly 1,100 samples of coal, coke, peat, and other solid fuels, and 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 were screen analyses, apparent specific gravity and bulk density determinations, grindability, and special friability tests.

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 are used 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, 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 were made on Canadian and imported fuels used in Canada. They were as follows: (a) five special tests on coke; (b) thirteen tests on anthracite from the United States; (c) two tests on briquettes; and (d) ten tests on Canadian bituminous coals. The work on boiler furnace refractories in connexion with the extended utilization of Canadian coals was continued. Three days were spent in Montreal on field work, and C. E. Baltzer, assisted by H. P. Hudson, made certain progress in the investigation of the grindability of coal, by making check tests on methods employed in other laboratories and by carrying out special, as well as routine, tests. A paper on the wood burning tests was written and submitted for publication. A number of tests were made on city gas for its utilization as a domestic fuel in three residences and in a large office building, and one test was made on fuel oil as a domestic fuel in an Ottawa residence. The routine work of collecting, tabulating, and charting the daily mean temperatures of Ottawa was continued.

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 having been examined during the year. This investigation, which includes a study of the washing characteristics of the coals examined, 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, is completed and a series of tests is planned for the coming year. A second experimental coke oven of 500 pounds capacity was designed and will be erected during the coming fiscal year. This unit is for further studies on the

coking reaction of coals and experimental tests on coal mixtures for the production of domestic coke at different temperatures. The briquetting of coal by pressure and impact, without binders, is being studied and the suitability of Canadian coals for this treatment will be reported on conclusion of the tests. Eleven 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. A large number of samples of gasoline were collected from different cities in Canada, were analysed, and a report prepared showing the character of the gasoline being sold throughout the country. Additional samples of oil were secured and analysed for inclusion in a lubricating oil report. Samples of natural gas from a number of new wells in different parts of Canada were obtained and their composition determined. Technical officers of this section have been called upon frequently as consultants and advisors in regard to the interpretation and revision of specifications for motor fuels and lubricants, and to co-operate with the National Research Council on problems relating to natural gas, liquid fuels, and lubricants. Three addresses on the subjects of gas, gasoline, and lubrication were prepared and presented at meetings of different organizations. A report on the properties of crude oils produced in Canada was prepared.

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. A study of the lubricating oils that can be obtained from the bitumen and of methods for their improvement was made. The results of this study were negative, showing that the Alberta bitumen cannot be considered as a source of high quality lubricating oil. It is, however, recognized that it is a valuable source of refined asphalt for road, mastic, and rubber filler purposes, and of motor fuel, by pressure cracking and hydrogenation processes.

Hydrogenation

Experimental hydrogenation was continued by T. E. Warren, assisted by K. W. Bowles. The materials investigated were coal, bitumen, and petroleum. The petroleum was used in several tests to demonstrate that the continuous apparatus could be used with a packed catalyst for the vapour phase treatment of oils of intermediate boiling points. Two series of experiments on coal hydrogenation are in progress. One of these is for the purpose of obtaining information on the relative amenability of various Canadian coals to hydrogenation and will use a fixed procedure. In the other series the continuous apparatus is being used with one coal to determine the effect of varying the conditions of temperature pressure, rate of flow, and catalyst. A special report on the present status of hydrogenation of coal for the production of motor fuel has been prepared for publication.

Testing and Examination of Explosives

The analyses of explosives submitted by the Explosives Division were continued by P. V. Rosewarne and W. P. Campbell.

Routine Chemical Laboratory Work

During the year a total of 1,565 samples of solid, liquid, and gaseous fuels, and explosives, were examined. Of these, 1,129, that is, roughly, 72 per cent, pertained to investigations of the division, the remaining 28 per cent originating outside the division. On the same basis, approximately 13 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, and 2 per cent from the Departments of Marine and National Defence. From provincial Governments and public institutions were received 1.3 per cent of the total and the corresponding percentages from commercial firms and private individuals were 1.5 and 1.7 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..... | | 730 | 46.6 |
| | Coals (various kinds)..... | 341 | | |
| | Cokes and chars..... | 389 | | |
| | Liquid fuels; total number samples..... | | 300 | 19.2 |
| | Gasoline and other motor fuels..... | 256 | | |
| | Lubricating oils..... | 17 | | |
| | Crude and miscellaneous oils..... | 27 | | |
| | Gases from coals, tars, bitumen, etc..... | | 33 | 2.1 |
| | Natural gas..... | | | |
| 2 | Samples from other divisions of the Department of Mines: | | | |
| | Geological Survey—coals..... | | 4 | 0.3 |
| | Explosives Division (27 dynamites and 17 fireworks)..... | | 198 | 12.6 |
| | Other Mines Branch divisions..... | | 2 | 0.1 |
| 3 | Samples from outside the department: | | | |
| | Department of Pensions and National Health, coals..... | | 60 | 3.8 |
| | Departments Marine and National Defence, coals, motor fuels, and lubricating oils..... | | 49 | 3.1 |
| | Other Government departments, coals and oils..... | | 58 | 3.7 |
| | Provincial Governments and public institutions, coals and oils..... | | 20 | 1.3 |
| | Commercial firms, coals, oils, and natural gas..... | | 24 | 1.5 |
| | Private individuals, coals and oils..... | | 21 | 1.7 |
| | Total..... | | 1,565 | 100.0 |

CERAMICS AND ROAD MATERIALS DIVISION

Howells Frechette, Chief of the Division, reports a very active year, particularly in investigational work on heavy clay products and refractories. Notwithstanding a very small staff, two major investigations were carried to completion within the year and good progress made in other investigations.

With the keen competition existing at present, manufacturers are making efforts to improve their wares in order to stimulate sales. With the greater use in the clay industry of scientific principles, the introduction of new processes, and the development of new products, the services of the division are being called upon more and more for advice and laboratory assistance.

In addition to his routine office duties and supervising the investigational work of the division, Mr. Frechette served on the Associate Committee on Magnesian Products of the National Research Council, the Panel on Standard Brick Sizes (Chairman) of the Canadian Engineering Standards Association, and the sub-committees on Paint Specifications, Standard Testing Sieves, and Refractories Specifications (Chairman) of the Canadian Government Purchasing Standards Committee. Mr. McMahon served on this last named sub-committee. The members of the staff served on committees of the Canadian Ceramic Society, of which Mr. Frechette was president, and Mr. McMahon was chairman of the Porcelain Enamel Division. Mr. Phillips prepared a paper on the Outstanding Developments in Ceramics in 1934 for the annual meeting of the society.

The services of the division were called upon on numerous occasions by other departments of the Government, in particular: National Revenue, Customs and Excise Division, in connexion with classifications of ceramic raw materials and products; Trade and Commerce, Commercial Intelligence Service, regarding sources of raw materials, and Dominion Bureau of Statistics, regarding ceramic industries and products; Justice Department, Penitentiary Branch, tests and advice in connexion with refractories; Pensions and National Health, Engineering Division, tests and advice in connexion with refractories; Public Works, Architect's Branch, information furnished regarding the character of building bricks and sources of supply, and the Engineer's Branch was afforded the use of the freezing chamber for weathering tests on rock for breakwater construction.

During the laboratory work on structural assemblies of brick and tile, valued assistance was rendered by Mr. Viens and his staff of the Engineer's Branch of the Department of Public Works, in connexion with the formulating of concrete mixtures.

Ceramics

Physical Properties of Canadian Bricks. Mr. Collin continued the investigation on the physical properties of Canadian bricks. Transverse and compressive strength tests were completed on all of the samples collected from Ontario, Quebec, and the Maritime Provinces. Ten cycles of freezing and thawing were made on 300 half-bricks, and the loss of compressive strength was determined on those that did not fail in the freezing tests. Determinations of hardness were made on several hundred brick cores, following which these cores were prepared for the toughness test.

Considerable experimental work was carried on to determine the most suitable temperature and air circulation conditions for the freezing tests to be conducted on full-sized bricks. Following this 600 bricks have been subjected to 10 cycles of freezing and thawing.

The second of a series of individual reports was sent to manufacturers, giving the results of certain tests on the bricks of their manufacture.

Tests on Structural Assemblies. At the request of the Canadian Ceramic Society, the Canadian Brick Manufacturers Association, and the Structural Clay Tile Association, a series of tests was made on structural assemblies of bricks and tiles. The tests of brick-mortar assemblies were made on seven types of brick, using five different mortars. Certain physical characteristics of the bricks, and their effect on the bond and strength of commonly used mortars, both in direct adhesion and shear, were determined.

The tests of tile-concrete assemblies were made on four types of tile to determine the effect of the absorption of tile upon the strength of various thicknesses of concrete joists, and of the strength of bond between the tile and concrete.

All these tests have been completed and reports written. These investigations were carried out by Mr. Collin, assisted by the other engineers of the division.

Refractory Industry and Resources of Canada. Mr. McMahon continued the investigation on the refractory industry and resources of Canada. A new list of the producers of refractories was prepared.

Twenty brands of fire-clay brick were tested during the past year, including brick from Great Britain, United States, and Canada. Some time was given to problems connected with the destructive action of certain coal ash slags on boiler house refractories.

Tentative specifications were drawn up for fire-clay brick for use in Government boiler furnaces.

White and Buff-Burning Clays of Southern Saskatchewan. A report on the more refractory clay resources of southern Saskatchewan was prepared by Mr. McMahon in collaboration with F. H. McLearn of the Geological Survey and was published by the Geological Survey in Summary Report 1933, Part B.

Magnesitic Dolomite Refractories. The research on the manufacture of high-grade refractories from Canadian magnesitic dolomite has been continued throughout the year. This investigation is being conducted in co-operation with the National Research Council of Canada.

Increasing the Density of Brick. The effect of de-airing and the effect of additions of small percentages of electrolytes have been the two chief lines of attack in the continuation of this investigation during the year, by Mr. Phillips.

A substantial reduction in absorption having been obtained in the laboratory tests from additions of from 0.4 to 0.6 per cent of sodium carbonate, a plant trial was made during the year at the Citadel Brick, Limited, plant. After the test bricks were burned, specimens of treated and untreated brick were collected and tested in the laboratory for strength and absorption. It is planned to conduct further plant trials with sodium carbonate after plant operations are renewed in 1935.

In studying the effect of additions of sodium carbonate to the clay used by the St. Lawrence Brick Company, Limited, at La Prairie, Quebec, it was incidentally observed that an addition of from 0.4 to 0.6 per cent of sodium carbonate eliminated scum and produced a marked improvement in colour. The significance of this will not be known until plant trials are carried out so that a comparison of treated and untreated brick can be made when processed under plant conditions.

During the year de-airing experiments were carried out on clays from a number of plants and in one case the improvements resulting from the laboratory de-airing tests led to the purchase of equipment to carry out the de-airing process in one of these plants.

Petrographic Examinations. In addition to the microscopic examinations made for identification purposes, a considerable amount of petrographic work was carried out in connexion with the research on the manufacture of high-grade refractories from Canadian magnesitic dolomite in which the division has been co-operating with the National Research Council of Canada. In order to verify the inferences drawn from the determinations made of the optical properties of the products of crystallization formed in these refractories, a separation of the crystalline matter was effected (by magnetic separation, and flotation in heavy liquids) for chemical analysis.

Hydrogen Ion Concentration (pH) Determinations. An electrometric hydrogen ion concentration determination apparatus was set up, and is being used by Mr. Phillips in connexion with the investigation to increase the density of certain Canadian bricks, as well as other investigations being carried out in the division.

Tests of Clays, Shales, Etc. Forty samples of clays and shales, six samples of mineral pigments, and five samples of miscellaneous mineral substances were tested and reported upon during the year as to commercial value.

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

Reinforced Brick Masonry. Three reinforced brick masonry test structures were built at the request of the Canadian Ceramic Society by the Ontario Department of Justice at the Mimico Prison brick plant and later tested to destruction. Mr. Frechette was present during the construction of these test structures to observe that they were built in accordance with the specifications.

During the testing, four weeks later, he and Mr. Picher attended the tests to which they were subjected and made check observations on loads and deflexions. The results of these tests will be published by the Canadian Ceramic Society.

Road Materials

R. H. Picher was engaged in the writing of a general report on gravels and rocks suitable for road building in the Maritime Provinces, and the revising of the French translation of the report on road gravels of Quebec. He also conducted an investigation on the effect of salt (sodium chloride) on the properties of clay for road purposes, in compliance with a request of the Malagash Salt Company, Limited, of New Glasgow, N.S.

Four samples of gravel and five samples of rock were tested for the public.

CHEMISTRY DIVISION

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

From April 1, 1934, to March 31, 1935, 1,414 specimens, requiring about 5,000 chemical determinations, were reported on.

Complete analyses were made of 119 samples of limestone, 81 waters, 66 diatomaceous earths, 15 coal ash, 8 brines, 7 talcs, 5 barytes, 5 clays, 5 mineral wools, 5 mineral rocks, 4 bentonites, 4 molybdenites, 4 marls, 3 firebricks, 3 beryls, 3 sands, 2 fuller's earth's, 2 titanites, 1 bauxite, 1 ferrosilicon, 1 solder, 1 soapstone, 2 dolomite.

Partial analyses of 14 bullions, 9 metals, 8 sodium sulphates, 6 radiums (radioactivity), 3 silicas, 3 aluminiums, 2 calciums, 1 graphite, 1 glass, 1 gypsum, 1 oil, 1 peat, 1 quartzite, 1 sulphide, 1 titanium oxide. Identifications of 180 specimens of minerals and ores were made.

Four hundred and fourteen furnace assays were made. Quantitative determinations were made as follows: copper 20, tin 17, lead 13, platinum 11, antimony 9, zinc 9, nickel 7, lime 4, molybdenite 4, arsenic 2, potash 2, titanite 2, cobalt 1, aluminium oxide 1, iron 1, manganese 1, uranium 1.

The investigation on the condition of the silica in diatomaceous earth was finished and reported.

Three hundred and eighteen mine air samples were analysed during the year: 26 were from Alberta, and the balance excepting a few miscellaneous ones were from British Columbia. They were mainly from fire areas, spontaneous heating locations, or after blasting operations. New Brunswick contributed eleven samples relating to a multiple asphyxiation requiring special consideration, two of natural gas, and correspondence was maintained with the Provincial Geologist at Fredericton. Assistance was given the engineers of the Dominion Steel and Coal Corporation in Nova Scotia in evolving a suitable method for detecting and estimating carbon monoxide in the Allan mine. Special work was done on the sensitivity, selectivity, and pH value of palladium chloride for this purpose, and the method and results forwarded for their use. Twenty-one samples were analysed for the Experimental Farm to assist the Poultry and Horticultural Divisions in their investigations on ventilation problems and the cold storage and fermentation of fruit. Assistance was given the Mineral Resources Division in connexion with physical problems relating to the manufacture of Glauber's salt, and also on paper mills machinery. A visit was made to Washington and Pittsburgh, chiefly to study the methods, technique, and apparatus employed by the United States Bureau of Mines for gas detection and estimation.

Considerable time was spent in working on the uses of clay for clarifying mineral, vegetable, and animal oils. A visit was made to the Imperial Oil

Refinery at Sarnia, also the McColl-Frontenac Plant at Toronto for the purpose of getting information on the nature of the clay and methods used in oil and gasoline refining. At the same time a visit was made to the Canadian Swift, and Canada Packers, Plants at Toronto to study their methods of using fuller's earth in bleaching and clarifying vegetable and animal oils and fats.

A visit was made to the Ile Verte and Cacouna peat bogs in advisory capacity as regards drainage and plant equipment for manufacture of heat insulation material and litter peat. In connexion with the Industrial Waters Investigation the territories covered were Ontario, south of the line Ottawa-Penetanguishene, and for Quebec a smaller section between Ottawa and Quebec city; 26 surface waters were collected and complete analysis made, and 70 samples of civic waters were analysed for total hardness.

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, 1935:

Preparing seventeen maps, and one hundred and fifty-nine charts, flow-sheets, and mechanical drawings for reproduction.

Preparing six charts and bringing nineteen others up to date for the Dominion Fuel Board.

Two thousand two hundred and ninety-four negatives and prints were made on the Rectigraph machine.

Three hundred and seventy-seven negatives, black and white, and blueprints were made on the blueprint machine.

One hundred and twenty-five halftone blocks and zinc cuts were filed during the year.

DISTRIBUTION OF PUBLICATIONS

During the fiscal year ending March 31, 1935, the distribution of Mines Branch reports, memorandum series, maps, lists of mines, mine operators, etc., amounted to 45,546 copies.

Mimeographed work comprised some 34,735 pages and 15,000 notification cards were sent out.

LIBRARY

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

Accessions to the Library, 1934

| | |
|---|-------|
| Books (by purchase) | 251 |
| Books (by gift) | 28 |
| Books (by transfer) | 48 |
| Books (complete unbound volumes)..... | 356 |
| Books and bulletins added to the circulating division | 100 |
| Pamphlets | 72 |
| Canadian Government documents (by exchange and gift) | 1,819 |
| British and Foreign Government documents (by exchange and gift)..... | 989 |
| Scientific societies' bulletins, proceedings, and transactions (by exchange and gift) | 1,981 |
| Trades catalogues (by gift)..... | 424 |
| Periodicals and continuations subscribed for..... | 239 |
| Annals, continuations, and periodicals (by gift) | 549 |
| Three hundred and thirty-three volumes were bound. | |

EXPLOSIVES DIVISION

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

FACTORIES

The licensed factories in operation at the commencement of the year numbered nine—three engaged in the manufacture of commercial blasting explosives; one in that of sporting ammunition, detonators, and other explosive supplies; one safety fuse factory; three fireworks factories; and one for the manufacture of caps for toy pistols. These remained in operation during the year and another, the Brainerd factory, was established by the Canadian Industries, Limited, near Selkirk, Manitoba, for the manufacture of high explosives. This factory was licensed and commenced operation in December.

The production of explosives in 1934 showed an increase of 29.5 per cent over that of the previous year, consequent on the increased demand for explosives required for use in mining and road construction activities. The output of the fireworks factories also showed a marked increase.

There is unfortunately one sad fatality to record arising from an accidental explosion that occurred at the Brownsburg factory of the Canadian Industries, Limited, on August 1. Investigation showed that the explosion occurred when the victim, a female employee, was picking out, as usual, one or two uncapped plugs included in a bundle of No. 8 electric detonators, with 6-foot lead wires, which she had placed on her bench preparatory to taking them one by one and coiling the leads in a manner suitable for packing. It is believed that when so arranging the supply of detonators she inadvertently knocked one against a wooden partition placed as a shield between the bundle of detonators and that part of the bench on which later she would have done the coiling operation. The explosion of one detonator so initiated would have detonated the adjacent mass of about 200 detonators. The circumstances of this accident are dealt with more fully in the Annual Report of the division.

At the same factory an employee sustained minor injuries on the explosion of an electric detonator in the capping block. More serious consequences were averted as the construction of the capping block proved effective in confining the explosion to the one detonator.

An employee in the Macdonald Metal Products Company's factory at Waterloo suffered minor burns when cutting a sheet of caps for toy pistols. Evidently the sheet had not been fed true to the cutter, which in consequence cut into the caps so that the whole sheet flared.

Inspectors of the division made twenty-seven visits of inspection to licensed factories, and three additional inspections were made by Deputy Inspectors of the Royal Canadian Mounted Police.

MAGAZINES

There were 339 magazine licences in force on March 31, 1935, an increase of 9, and in addition 200 licences were issued during the year covering the operation of temporary magazines, being 20 in excess of the issues of the previous year.

The quantity of deteriorated explosives it was found necessary to condemn on inspection showed a slight decrease but was still considerable. Distributed over twenty-three magazines there were in all 1,650 pounds of dynamite and 790 pounds of black blasting powder so condemned and destroyed.

The loss of explosives from magazines by theft amounted to 149 pounds of dynamite, 200 detonators, and 175 feet of safety fuse. Eight magazines had been forcibly entered.

Proceedings were taken against three contracting firms who were found to be in possession of explosives in excess of the quantity allowed to be kept elsewhere than in licensed factories or magazines. They were convicted and fined.

Inspectors of the division made 373 inspections of magazines and 176 were made by the Deputy Inspectors of the Royal Canadian Mounted Police.

UNLICENSED PREMISES

The manner in which small quantities of explosives held for retail by dealers should be kept is generally well understood, as are also the regulations relating to the keeping of records of sales of explosives and rifle and pistol cartridges. Inspections are made of these stores and attention is also given to the keeping of explosives by parties carrying out small construction operations. Instances of failure to properly safeguard explosives are practically confined to these. Four prosecutions were entered against users of explosives for failure to keep them in locked receptacles. A conviction was also obtained against a user of explosives for violation of the conveyance regulations, he having left a motor car containing a few cases of dynamite unattended in a city street.

Inspectors of the division made 805 inspections of unlicensed premises, and Deputy Inspectors of the Royal Canadian Mounted Police about 2,100.

EXPLOSIVES FOUND

The finding, by incoming tenants, of 119 pounds of explosives and 380 detonators distributed over ten properties may be attributed to the hard-dying custom followed by some private users of explosives of having explosives in or about their dwellings and not in proper security, and then forgetting about them when no longer needed. Explosives, to a total of 156 pounds, were found in five places near which blasting operations had been in progress some time previously.

IMPORTATIONS

The chief importations of explosives are those of nitro compounds for use in the manufacture of explosives and of lacquers and for use as propellants, also of nitroglycerine for immediate use in the oil fields. Large importations are made of fireworks, of which approximately 65 per cent are of Chinese manufacture, about 5 per cent of which, in 1934, were refused entry after examination. The importations were effected under the authority of 501 permits and 35 special permits.

AUTHORIZATION OF EXPLOSIVES

Five new high explosives were authorized, also thirty-six new varieties of fireworks.

ACCIDENTS

Accidents occurring in the use of explosives during the year 1934 resulted in thirty deaths and caused injury to 196 persons. This represented a considerable increase over the casualties sustained in recent years, even when allowance is made for the increase in consumption of explosives, and was most marked in the accidents arising in the course of road construction. The efforts made by the authorities concerned to check these by instruction and discipline are bringing good results, as judged by the relatively few reports received during the latter part of 1934 and the first quarter of 1935.

Miscellaneous accidents, not directly associated with the use of explosives, caused the death of six persons and injury to 46 during the year 1934.

Playing with explosives accounted for 2 of those killed and 32 of the injured, the average annual loss from this particularly regrettable cause, during the five year period preceding, having been 2 killed and 48 injured.

These accidents and their causes are discussed in more detail in the Annual Report of the Division.

STAFF CHANGES

Miss L. M. Kelly, typist, resigned July 17, 1934.

EDITORIAL DIVISION

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

Under authority of Order-in-Council, P. E. Lévesque, Principal Translator, G. R. G. Benoit, and H. Lemieux, of the translation staff, were transferred to the Bureau of Translations on January 1. However, with the exception of Mr. Benoit, who is acting as secretary to the new department, the translating staff continue to act as translators for the Department of Mines.

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

At the end of the fiscal year there were in the hands of the King's Printer six English reports of the Geological Survey, two English reports of the National Museum, ten English reports and one French translation 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 Publication

2360. *Report of the Department of Mines for the Fiscal Year ending March 31, 1934: 44 pages; 1,500 copies; published September 18, 1934.*

French Translation

2361. *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars, 1934 (extraits): 30 pages; 800 copies; published September 26, 1934.*

GEOLOGICAL SURVEY

English Publications

2344. *Memoir 171. Geology and Ore Deposits of Copper Mountain, B.C.—by V. Dolmage: 69 pages; 3 plates; 1 map; 1,550 copies; published May 14, 1934.*
2345. *Memoir 172. Geology and Mineral Deposits of Salmo Map-area, B.C.—by J. F. Walker: 102 pages; 3 plates; 1 map; 2,050 copies; published June 22, 1934.*
2346. *Economic Geology Series No. 13. Platinum and Allied Metal Deposits of Canada—by J. J. O'Neill and H. C. Gunning; 165 pages; 1 plate; 9 figures; 2,000 copies; published June 15, 1934.*
2350. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1933, Part A: 82 pages; 5 figures; 2,500 copies; published May 4, 1934.*
2351. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1933, Part D: 162 pages; 5 plates; 12 figures; 2,500 copies; published May 31, 1934.*
2353. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1933, Part B: 176 pages; 2 plates; 4 figures; 88 tables; 1,500 copies; published July 5, 1934.*
2358. *Memoir 173. Slocan Mining Camp, B.C.—by C. E. Cairnes: 137 pages; 13 plates; 9 figures; 2 maps; 2,550 copies; published October 4, 1934.*

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

Report
No.

2363. Memoir 174. *Surface Deposits and Ground-Water Supply of Winnipeg Map-Area, Manitoba*—by W. A. Johnston: 110 pages; 3 figures; 1 map; 12 tables; 2,500 copies; published November 19, 1934.
List of Prices for Publications of the Geological Survey and the National Museum of Canada: 43 pages; 500 copies; published February 21, 1935.
List of Published Maps (1917-1934): 17 pages; 1,000 copies; published June 22, 1934.
 Separates: *Mammals of the Eastern Arctic and Hudson Bay and Arctic Flora*—by R. M. Anderson: 71 pages; 300 copies; published December 22, 1934.
 Separate: *Birds of the Eastern Arctic*—by P. A. Taverner: 15 pages; 6 plates; 300 copies; published December 22, 1934.
 Separate: *Silver-Lead Deposits in Atlin District, B.C.*—by W. E. Cockfield (from Geological Survey Summary Report 1925, Part A): 10 pages; 2 figures; 1,000 copies; published March 6, 1935.
 Separate: *Gold Placers of Dease Lake Area, Cassiar District, B.C.*—by W. A. Johnston (from Geological Survey Summary Report 1925, Part A): 41 pages; 3 plates; 4 figures; 1,000 copies; published March 21, 1935.

French Translation

2352. *Rapport sommaire de la Commission géologique, Ministère des Mines pour l'année civile 1933, Partie D (extraits)*: 64 pages; 1 plate; 7 figures; 1,250 copies; published January 13, 1935.

NATIONAL MUSEUM OF CANADA

English Publications

- Bulletin 72. *Birds of Canada*—by P. A. Taverner: 445 pages; 87 plates; 488 figures; 10,000 copies; published March 18, 1935.
 Bulletin 73. *Annual Report for 1933*: 30 pages; 1,700 copies; published June 27, 1934.

French Translation

- Bulletin 67-5. *Moyens de préserver les spécimens anthropologiques dans les Musées*—by D. Leechman: 34 pages; 1,000 copies; published December 18, 1934.

MINES BRANCH

English Publications

736. *Investigations of Ore Dressing and Metallurgy, 1932*: 287 pages; 2 plates; 14 figures; 2,500 copies; published May 17, 1934.
 737. *Investigations of Fuels and Fuel Testing, 1932*: 155 pages; 7 plates; 10 figures; 2,700 copies; published May 26, 1934.
 742. *Limestones of Canada, Pt. II: Maritime Provinces*—by M. F. Goudge: 186 pages; 29 plates; 12 figures; 2 maps; 8 tables; 3,000 copies; published June 5, 1934.
 743. *Investigations of Ore Dressing and Metallurgy, January to June, 1933*: 157 pages; 4 plates; 5 figures; 2,500 copies; published November 8, 1934.
 Separates 483-510: 156 pages; 4 plates; 5 figures; 50 copies of each separate; published July 10, 1934.
 745. *The Use of Petroleum Fuels in Canada: Deliveries for Consumption, Calendar years 1930, 1931, 1932*—by John M. Casey: 11 pages; 500 copies, published September 4, 1934.
 746. *Gasoline Survey for 1933*—by H. McD. Chantler: 21 pages; 1 figure; 1,000 copies; published October 11, 1934.
 749. *Mineral Industries of Canada, 1933*—by A. H. A. Robinson (Abridged Edition): 39 pages; 25,000 copies; published December 6, 1934.
 Separates 511-549 (Investigations of Ore Dressing and Metallurgy, July to December, 1933): 177 pages; 50 copies of each separate; published November 16, 17, 1934.
 Separate 550 (Investigations of Ore Dressing and Metallurgy, July to December, 1933): 12 pages; 400 copies; published August 1, 1934.
 Separates 551-580 (Investigations of Ore Dressing and Metallurgy, January to June, 1934): 204 pages; 1 figure; 50 copies of each separate; published February 14, 1935.
 Separates 581-586 (Investigations of Ore Dressing and Metallurgy, July to December, 1934): 44 pages; 2 plates; 50 copies of each separate; published February 13, 1935.
 Lists of Mines and Mine Operators in Canada:
 Coal: 1,500 copies; published March 4, 1935.
 Milling Plants: 1,500 copies; published February 6, 1935.

MINES BRANCH—(Continued)

*French Translations*Report
No.

700. *Les Abrasifs, Partie IV. Abrasifs artificiels, Produits abrasifs et Usages*—by V. L. Eardley-Wilmot; 153 pages; 19 plates; 14 figures; 11 tables; 1,000 copies; published July 31, 1934.
708. *Amiante chrysotile au Canada*—by James Gordon Ross (Second Edition); 162 pages; 34 plates; 8 figures; 6 charts; 21 tables; 1,500 copies; published July 17, 1934.
739. *Les Industries minérales du Canada, 1933*—by A. H. A. Robinson (Second Edition): 124 pages; 34 plates; 1,200 copies; published August 10, 1934.
750. *Les Industries minérales du Canada, 1933*—by A. H. A. Robinson (Abridged Edition): 40 pages; 5,000 copies; published December 5, 1934.

EXPLOSIVES DIVISION

English Publication

35. *Annual Report of the Explosives Division for the Calendar Year 1933*: 19 pages; 1,800 copies; published May 1, 1934.

French Translation

36. *Rapport annuel de la Division des Explosifs pour l'année civile 1933*: 20 pages; 300 copies; published May 25, 1934.

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. P. E. Levesque of the Translation Division supervised distribution until his transfer to the Bureau of Translations on January 1, 1935. During the fiscal year 1934-35, 13,786 copies were distributed in Canada and foreign countries, as follows: 1,338 copies from addresses on the mailing lists, through the Printing Bureau Distribution Office, and 12,448 copies from this office in compliance with written or personal requests; 1,101 copies of this number were sold. During the preceding fiscal year, 10,315 copies were distributed and in 1932-33, 3,675 copies, a comparison that affords an idea of the constant increase in the demands for information on the mining industry. 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, 1935, were:

| | Grant | Expenditure | Grant not used |
|--|------------|-------------|----------------|
| | \$ cts. | \$ cts. | \$ cts. |
| CIVIL GOVERNMENT— | | | |
| Salaries— | | | |
| Administrative and Explosives Divisions..... | 61,146 00 | 60,933 61 | 212 39 |
| Mines Branch..... | 190,062 00 | 189,999 52 | 62 48 |
| Geological Survey..... | 247,320 00 | 244,145 76 | 3,174 24 |
| | 498,528 00 | 495,078 89 | 3,449 11 |
| Contingencies..... | 20,000 00 | 12,284 11 | 7,715 89 |
| EXPLOSIVES DIVISION— | | | |
| For administration of the Explosives Act, etc..... | 7,000 00 | 6,414 77 | 585 23 |
| MINES BRANCH— | | | |
| For investigation of mineral resources, etc..... | 185,000 00 | | |
| Salaries and wages..... | | 138,581 87 | |
| Mineral Resources Division..... | | 13,000 68 | |
| Ore Dressing and Metallurgical Division..... | | 9,584 70 | |
| Fuels and Fuel Testing Division..... | | 7,293 69 | |
| Ceramics and Road Materials Division..... | | 1,636 84 | |
| Chemical Division..... | | 2,047 77 | |
| Mechanical Section..... | | 2,882 86 | |
| Administrative Division..... | | 1,482 60 | |
| Dominion Fuel Board..... | | 4,047 06 | |
| | | 180,558 07 | 4,441 93 |
| For publications, English and French, etc..... | 30,000 00 | | |
| Publication of reports, maps, etc..... | | 12,303 66 | |
| Salaries and wages..... | | 3,083 38 | |
| Equipment, stationery, typewriters, etc..... | | 7,174 11 | |
| Miscellaneous..... | | 534 22 | |
| | | 23,095 37 | 6,904 63 |
| GEOLOGICAL SURVEY— | | | |
| For explorations, surveys, and investigations, etc..... | 107,800 00 | | |
| Explorations, surveys, and investigations..... | | 57,649 80 | |
| Salaries and wages..... | | 33,629 38 | |
| Equipment and supplies..... | | 11,570 55 | |
| Miscellaneous..... | | 2,848 59 | |
| Photographic work..... | | 155 92 | |
| | | 105,854 24 | 1,945 76 |
| For publication of English and French editions, etc..... | 75,000 00 | | |
| Printing of reports, etc..... | | 29,274 59 | |
| Printing of maps, etc..... | | 14,133 70 | |
| Engraving services..... | | 12,987 98 | |
| Salaries and wages..... | | 7,583 70 | |
| Miscellaneous..... | | 90 00 | |
| | | 64,069 95 | 10,930 05 |

STATEMENT—Continued

| | Grant | Expenditure | Grant not used |
|---|-----------|-------------|----------------|
| | \$ cts. | \$ cts. | \$ cts. |
| For maintenance of offices and museum, etc..... | 70,202 00 | | |
| Salaries and wages..... | | 50,250 92 | |
| Stationery, printing, typewriters, etc..... | | 7,195 94 | |
| Miscellaneous..... | | 4,397 88 | |
| Library..... | | 4,235 46 | |
| Photographic Division..... | | 1,477 27 | |
| Postage..... | | 722 11 | |
| Instruments and repairs..... | | 698 51 | |
| Chemicals and drugs..... | | 183 21 | |
| B.C. Office..... | | 287 34 | |
| | | 69 428 64 | 773 36 |
| For museum equipment..... | 5,000 00 | | |
| Salaries and wages..... | | 2,787 12 | |
| Maintenance..... | | 1,551 75 | |
| New equipment and material..... | | 614 59 | |
| | | 4,953 46 | 46 54 |
| For purchase of specimens..... | 300 00 | 280 69 | 19 31 |

Summary

| | | | |
|-------------------------------------|------------|------------|-----------|
| Civil Government salaries..... | 498,528 00 | 495,078 89 | 3,449 11 |
| Civil Government contingencies..... | 20,000 00 | 12,284 11 | 7,715 89 |
| Explosives Division..... | 7,000 00 | 6,414 77 | 585 23 |
| Mines Branch..... | 215,000 00 | 203,653 44 | 11,346 56 |
| Geological Survey..... | 258,302 00 | 244,586 98 | 13,715 02 |
| | 998,830 00 | 962,018 19 | 36,811 81 |

Grants and Miscellaneous Statutory Expenditure

MISCELLANEOUS—

| | | | |
|---|----------------|----------------|--------------|
| For payments in connexion with movements of coal, etc..... | \$2,450,000 00 | | |
| Subventions..... | | \$2,091,231 93 | |
| Salaries and wages..... | | 5,858 57 | |
| Miscellaneous administrative expense..... | | 3,314 60 | |
| | | \$2,100,405 10 | \$349,594 90 |

MISCELLANEOUS (STATUTES)—

| | | | |
|--|-----------|--|--|
| Domestic Fuel Act (1927) payments..... | 23,565 99 | | |
| Salary Deduction (Continuance) Act 1934..... | 1,530 25 | | |
| Miscellaneous gratuities..... | 1,320 00 | | |

DEPARTMENT OF MINES

STATEMENT—Concluded

DETAILS OF REVENUE

Revenue for the Department of Mines for the Fiscal Year Ending March 31, 1935

| | \$ | cts. | \$ | cts. | \$ | cts. |
|--|-------|------|-------|------|-------|------|
| Casual Revenue— | | | | | | |
| DEPARTMENT— | | | | | | |
| Miscellaneous revenue..... | | | 2 | 10 | | |
| EXPLOSIVES DIVISION— | | | | | | |
| Sale of explosives permits, etc..... | 1,920 | 88 | | | | |
| Sale of equipment..... | 200 | 00 | 2,120 | 88 | | |
| MINES BRANCH— | | | | | | |
| Assays and analysis..... | 704 | 65 | | | | |
| Sale of equipment..... | 117 | 00 | | | | |
| Sale of publications..... | 276 | 47 | | | | |
| Sale of publications (French)..... | 114 | 53 | | | | |
| Miscellaneous revenue..... | 186 | 79 | 1,399 | 44 | | |
| GEOLOGICAL SURVEY— | | | | | | |
| Sale of publications..... | 1,735 | 66 | | | | |
| Sale of publications (French)..... | 320 | 14 | | | | |
| Sale of minerals..... | 1,478 | 82 | | | | |
| Sale of equipment..... | 393 | 00 | | | | |
| Sale of relief models..... | 165 | 00 | | | | |
| Miscellaneous revenue..... | 332 | 89 | 4,425 | 51 | | |
| DOMINION FUEL BOARD— | | | | | | |
| Sale of publications..... | | | 301 | 11 | | |
| GEOGRAPHIC BOARD OF CANADA— | | | | | | |
| Sale of publications..... | | | 14 | 85 | 8,263 | 89 |
| Premium Discount and Exchange— | | | | | | |
| Premium on U.S. money orders, etc., Geological Survey..... | | | 03 | | 03 | |
| Fines and Forfeitures— | | | | | | |
| Explosives Division..... | | | 47 | 00 | 47 | 00 |
| | | | | | 8,310 | 92 |

Miscellaneous Revenue

Casual Revenue—

DOMINION FUEL BOARD—

Subvention refunds.....\$ 7,630 26



