DOMINION OF CANADA

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE

FISCAL YEAR ENDING MARCH 31, 1934

OTTAWA
J. O. PATENAUDE
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
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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, 1934.

W. A. GORDON,
Minister of Mines.

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REPORT

OF THE

DEPARTMENT OF MINES

FOR THE FISCAL YEAR ENDING MARCH 31, 1934

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

SIR,—In accordance with the requirements of Parliament, I have the honour to submit the Annual Report of the Department of Mines for the year ending March 31, 1934.

Though it is perhaps not pertinent to the main purpose of this report, it seems imperative to record the splendid response made by the Canadian mineral industry during the year to improved conditions throughout the industrial world. The sharp reversal in the trend of the industry as a whole is generally recognized as the year's highlight of Canadian industrial endeavour. The ability of the industry to respond so quickly to a favourable turn in economic conditions, aided by the manner in which gold operations have attracted attention as a result of the enhanced price of the metal, has had a decidedly gratifying outcome, in that Canadians, irrespective of their pursuits, are regarding the industry in a new light—an outlook that augurs well for the continued successful development of our mineral resources.

The increased demand made on the department's research and investigative facilities during the year may be credited largely, but not altogether, to a reflex of the quickening of activities throughout the industry. Recognition among mining men of the excellent facilities afforded by the Dominion Government has perhaps been the main contributing factor to this increased demand. As the industry has grown, the facilities have been enlarged until today few if any mineral producing countries are better prepared than Canada to extend to their mineral industries the benefits of scientific research.

Field activities of the two main branches of the department were sharply curtailed during the year, only those of an urgent nature being undertaken, owing to the continued need to economize wherever possible.

The Geological Survey had twenty parties in the field in 1933, as compared with thirty-five in 1932, and in accordance with the keen interest taken in the search for new sources of gold, the field work was directed mainly toward the mapping and investigation of areas known to be favourable to gold deposition. Field work undertaken by the Mines Branch was limited to a minimum requirement to keep a personal contact with the progress of the industry during the year, and to field studies necessary to complete investigations and reports that had been in progress for some time.

The laboratory facilities of the Mines Branch, particularly those of the Ore Dressing and Metallurgical Division, were pressed to the limit in coping with the demand for tests and investigational work. This division has felt the full weight of unprecedented interest in the development of our gold resources, and in addition has been called upon to handle an increasing number of investigations in respect to other metals and to non-metallics. The mineragraphic section of the laboratories of the division, installed in 1931, has become of primary importance in facilitating and expediting the conducting of investigations.

It may be of interest to note that during the past three years, twenty-eight milling plants have been erected, nine are under construction, and twenty-nine plants are being planned for the treatment of ores on which preliminary tests have been made in the Ore Dressing and Metallurgical Division Laboratories.

Laboratory and large scale studies and test work conducted in the Fuel Research Laboratories have furnished further valuable information in respect to the greater utilization of Canadian coals in the domestic market. Exhaustive tests on the physical properties of Canadian brick constituted the major activity of the Ceramics Division. These tests were begun at the request of the ceramic industry.

Significant both of the growing interest in Canadian mineral development and of the desire of those directly concerned with this development to make full use of available authoritative information, is the sharp increase in requests for the department's maps and reports and for information on the Dominion's sources of mineral supply. During the past fiscal year, the Geological Survey distributed more than 59,000 maps and reports, which compares with 35,500 distributed in the fiscal year 1930-31. The marked increase in the distribution of French publications from 3,675 in the fiscal year 1932-1933 to 10,315 in the past fiscal year, is worthy of mention. Revised editions of the two gold reports "Gold in Canada", and "Gold Occurrences of Canada" were issued to meet an exceptionally keen demand.

An increasingly important function of the department is its endeavour to widen the market both in Canada and abroad for Canadian minerals and mineral products. The Mineral Resources Division, which is mainly responsible for this phase of the department's activities, has complete information on practically every mineral or mineral product, and in the year under review reports an unusually large number of requests for information from all parts of Canada and from abroad.

Constituting an important and highly appreciated service to the industry is the department's effort to keep both the industry and the public acquainted with its various activities. Press bulletins are despatched to a selected list of newspapers and financial and technical periodicals on the issuance of maps and reports, and on any phase of activity of general interest. Members of the staff are encouraged to prepare papers and addresses on topics relating to their particular field of activity, and mining newsletters are despatched fortnightly to the High Commissioner's Office in London, one objective of these newsletters being to inform those interested in the United Kingdom of available Canadian sources of supply of minerals and their products. The success of the department's publicity service is in a great measure attributable to the excellent co-operation received from the press in Canada. A selection of the papers and addresses is listed on pages 6 to 9, and of mining newsletters on page 9.

The series of lectures and addresses presented during the winter months under the auspices of the National Museum of Canada again proved highly popular both to adults and to children, though the extremely cold weather was reflected to some extent in the attendance. No field parties were sent out by the National Museum during the year.

In the more detailed reports that follow it will be noted that several members of the staff retired on superannuation during the year. In addition to those mentioned in the reports, namely, F. J. Nicolas, O. E. Prud'homme, A. T. McKinnon, Arthur Miles, and Miss M. H. Barry, should be included the names of two members of the Administrative Division, D. A. Esdale, who entered the service as carpenter in 1883, and who retired as Chief Mechanic on February 1, 1934, and of John Duggan who retired as confidential messenger after 45 years of service. The services of one of the foremost botanists on the continent, and of an outstanding contributor to the natural history of Canada were lost to the Dominion in the death in August last of Dr. M. O. Malte, Chief Botanist, shortly

after his departure for field duties. Acknowledgment in this report of the many years of valuable service rendered by these members of the staff is a source of gratification.

A very important contributing factor to the success of the department's service to the industry has been the excellent co-operation received from the industry itself; from other departments of the Dominion Government; from the various provincial departments; from banks and chambers of commerce; from the development branches of the two large railways; from the United States Bureau of Mines and Geological Survey; and from related research and investigative organizations in Canada and in the United Kingdom.

The Deputy Minister, in addition to his departmental activities, served as Chairman of the Dominion Fuel Board, the main activities of which are shown below; Chairman, Interdepartmental Committee on Air Surveys and Base Maps; Member, Interdepartmental Committee on Economic Co-operation; and Member, the National Research Council of Canada.

Gold, nickel, and asbestos figure prominently in the record of Canada's mineral industry in 1933, one of the most colourful years in the history of the industry. Canada's status as a leading gold producer was well established prior to the rise in the price of the metal, but following the rise there has come a new conception of that status. The gold industry's record in 1933, when the value of output reached $84,300,000 as compared with $71,480,000 in 1932, is perhaps only a prelude to a new era for the industry. In substantiation of this are the hundreds of thousands to millions of tons of formerly waste material that has been moved up to the ore category at the leading producing properties; the encouraging results that have attended the preliminary development of properties that had been abandoned, and of prospecting and exploratory campaigns in older mineral areas; and above all the attention that has been given to the development of low-grade deposits, mainly by established companies with plenty of funds at their disposal. The evolution of an industry, like the evolution of a mining property, is of necessity a gradual process, and some years will pass before a proper perspective of Canada's new status as a gold producer may be had.

Nickel output and nickel exports, sensitive barometers of world industrial conditions, eclipsed the record of 1932 by 175 per cent in the case of the former, and by 180 per cent in the case of the latter. The substantial increase in the output and sales of asbestos in 1933 as compared with 1932 is of special significance in view of the all but discouraging trend of the industry during the depression years.

The feature of the year, apart from gold, nickel, and asbestos, was the sharp increase both in output and in the sales of lead and zinc and to a lesser extent copper. The most favourable aspect of this improvement was the rise in the value of exports of these metals to the United Kingdom, a factor which may be credited firstly to the Imperial Economic Conference agreements at Ottawa, and secondly to the vastly improved industrial status of Great Britain. Canada has been definitely launched as a heavy exporter of base metals, and the immediate and decisive response of producers to the stimulus of improved industrial conditions may be regarded as a criterion of the Dominion's ability to hold her place in this rôle.

Base metal prices, after undergoing a sharp rise in the earlier months of 1933, have since moved within narrow limits, indicating a fine adjustment between world rate of consumption and world rate of production. As against the steady and discouraging increase of unsold metal in producing countries prior to April 1933, there has since been a gradual depletion of stocks on hand. But, until such time as inventories of metals have receded to something approaching the 1930 levels there appears to be little hope of an enhancement in present price levels. Fortunately, however, Canadian producers have been disposing of

their metals as produced, and fortunately also they have been able to offset to a large extent an unfavourable world metal position by a lowering of production costs, mainly through the medium of improved metallurgical practices. Striking evidence of this is had in the recent annual reports of two of the leading producers.

The fortunes of the ceramic and building stone section of our mineral industry will be followed closely this year. This highly important and aggressive branch of the industry has had to contend with a dearth of building construction, and consequently has a great deal of ground to regain before it reaches the normal level of operations. Appreciable improvement has been noted in recent months, and future prospects are encouraging as there is a general recognition of the need in the Dominion for new building and dwelling construction.

Dominion Fuel Board

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

Most of the Orders in Council providing assistance through transportation subventions for the movement of Canadian coal into competitive markets remote from the coal fields expired early in the year. New Orders in Council as required to assure the continuity and enlargement of this movement of Canadian coal into these competitive markets were approved. Thus on April 4 the Order in Council providing assistance to the movement of Maritime coal into Quebec and Ontario for railway use was amended by increasing the maximum amount payable, thereby enlarging the territory in Ontario into which such coal would move. On April 24 a new Order in Council approved assistance to the movement of Alberta coal into Ontario on a basis arrived at as the result of the experimental test movements that had been in progress since 1928. On May 30 new Orders in Council were approved substantially continuing the assistance provided by expiring Orders assisting the marketing of British Columbia coal for bunker use and for export, the movement of Alberta and British Columbia Crows Nest Pass coal, also of Saskatchewan coal, into Manitoba and western Ontario, and of New Brunswick coal into Quebec and Ontario. In addition, an Order of March 3, 1934, amended the Order providing assistance to Maritime coal moved by water to points west of the island of Montreal, to remove discrimination against the railways.

The Dominion Fuel Board continued in charge of administering the assistance provided by these Orders in Council.

During the fiscal year roundly 2,089,000 tons of Canadian coal were moved under the assisted rates, at a cost to the Government of approximately $2,306,000, as compared with the movement of 1,140,000 tons during the preceding fiscal year at a cost of $986,000.

This increase in movement amounting to 949,000 tons has correspondingly increased the administrative work of the board which involves a close examination of all applications for assistance before authorization of payments. In this connexion a Resident Inspector is maintained in Winnipeg to supervise and check assisted movements of western coal.

Although the Domestic Fuel Act (1927) with respect to the matter of new contracts expired on June 30, 1932, the board is required to administer its provisions with respect to contracts entered into prior to that date. In addition, the new coke plant at Vancouver, erected under the benefits of the Act and partly put into operation in early 1933, was fully completed in the latter part of the year—and the final inspections as required by the Act were made. This new plant has an annual coking capacity of roughly 92,000 tons of British Columbia coal, producing approximately 60,000 tons of coke.

The annual survey of fuels used for domestic heating conducted for the board by the Mineral Resources Division of the Department of Mines was again carried out—its scope for the year being limited to the provinces of Quebec, Ontario, and Manitoba.

The annual survey of coal mine operating costs was again completed, and the costs of the various operations connected with the production of coal correlated and published in chart form for distribution, principally to the mine operators. It might be mentioned that not only is this information required for the proper administration of the assisted movements of Canadian coal but that it is exceedingly useful to the mine operators by enabling them to discover wherein economies in production may be effected.

The secretary carried out the customary inspections of Canadian coal mining districts required to keep the board fully informed of local conditions in the industry, also of the coking plants operating under the benefits of the Domestic Fuel Act (1927).

A selected distribution to architects, building contractors, and others directly interested has been made of the booklet "The Insulation of New and Old Houses" issued in the interest of effecting economies in the use of fuel for the heating of houses and other buildings. Many requests have been received for this and other publications of the board.

The chairman and secretary participated in several conferences with coal producers and railway executives with reference to problems arising out of changing conditions in the industry—particularly with regard to the enlarging of Canadian markets for Canadian coal. Various plans and schemes proposed for the betterment of conditions in the industry have been thoroughly canvassed.

The board again acknowledges with pleasure the hearty co-operation received from members of the Canadian coal mining industry and of the various services concerned with the movement and marketing of Canadian coal, and from Government departments throughout Canada.

Your obedient servant,

CHARLES CAMSELL,
Deputy Minister.

OTTAWA, ONT., May 31, 1934.

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Mining Newsletter Series

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

Gold Prospecting in Western Quebec
Thirty-fourth Annual Meeting Canadian Institute of Mining and Metallurgy an Outstanding Success
Oil and Gas in Alberta
Canadian Soapstone Industry Definitely Established
Fort Steele Mining Division, Kootenay District, British Columbia
Canada's Lesser Known Minerals
Recent Gold Developments on Vancouver Island, B.C.
Bituminous Sands of the McMurray Area, Northern Alberta, Canada
Mining Activities in Manitoba
Canada's Mineral Industry Makes Progress
Canada's Nickel Industry
Sources of Canada's Silver
Prospects for British Coal in Canada
Mineral Possibilities of New Brunswick
New Gold Mills in Canada
Mining Progress in Western Quebec
Some Canadian Gold Mining Costs
The Precambrian of Manitoba, Scene of Mining Activity
Sodium Sulphate Industry of Western Canada Shows Rapid Growth
Review of Metal Mining Industry in British Columbia, during 1933
Canadian Radium Situation
Mining Activities in Yukon, 1933
Canada's Clay Resources
Revival of Placer Activities in the Omineca District, British Columbia
Medicine Hat as a Pottery Centre
Nahanni-Frances River District Again Attracting Attention

GEOLOGICAL SURVEY

W. H. Collins, Director

CHANGES IN STAFF

In accordance with the plan of the Government to retire employees over sixty-five years old three members of the staff accepted superannuation, namely, Miss M. H. Barry, Library Assistant, who had been continuously in the Geological Survey for fifty-two years, from February 1, 1934; Allan T. McKinnon, Mineralogical Collector Preparator, who had been in the same service for forty-five years, from February 1; and Arthur Miles, Artist, Geological Survey, on November 1, 1933, after nineteen years. Miss A. H. Campbell, clerical assistant in the Division of Pleistocene Geology, Water Supply, and Borings, resigned on August 25, 1933.

FIELD AND OFFICE WORK

In 1932 the impetus of prospecting and mining gold largely offset depression in other branches of the mineral industry. During the fiscal year 1933-1934 this impetus and a degree of general recovery were evidenced in the Geological Survey by increasing demands for information. In 1930-31, 35,495 reports and maps were distributed, 51,155 in 1932-33, and 59,046 in 1933-34. The Division of Mineralogy has also received, examined, and reported on an unusually large number of specimens for prospectors and others.

Owing, however, to a reduction of appropriations, in accordance with the general policy of stringent economy, fewer field parties were sent out in 1933. There were twenty as compared with thirty-five in 1932. Most of the field work related to the search for gold, but some was directed to the important task of studying geological difficulties that beset some other branches of the mineral industry, already seriously affected by the general business depression.

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

GEOLOGICAL DIVISION

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

Yukon

H. S. Bostock continued geological mapping and investigation of Carmacks 4-mile map-area (latitudes 62° to 63°, longitudes 136° to 138°). This quadrangle is one of the as yet unmapped areas most easily accessible to prospectors. It is close to the great Klondike placer mining field and may contain marginal parts of the formation in which the placer gold was found. A lode gold strike of some importance has also been made recently in this quadrangle. The incomplete study of the area has yielded information of value to those searching for placer deposits. This information appears in Summary Report 1933, Part A. Mr. Bostock also visited the placer operations in Klondike and Sixtymile districts. A review of mining activities during 1932, prepared by him, appears in Summary Report 1933, Part A.

British Columbia

F. A. Kerr commenced geological mapping and investigation of a 4-mile map-area (latitudes 55° to 56°, longitudes 124° to 126°) that includes the larger part of the basins of Nation, Manson, and Omineca rivers. He gave special attention to the placer area of Manson river and Slate creek. An account of the placer operations and of the principles that should control the search for placer deposits are given in Summary Report 1933, Part A.

W. E. Cockfield and George Hanson continued the geological mapping and investigation of the Cariboo gold field, previously conducted by Mr. Cockfield and J. F. Walker. This season work was begun in the Willow River 1-mile map-area (latitudes 53° to 53°15′, longitudes 121°30′ to 122°), which includes Barkerville and the nearby lode gold deposits that have attracted so much attention. A report by Mr. Hanson in Summary Report 1933, Part A, contains valuable information relating to the lode deposits and bedrock formations. Mr. Cockfield also gives a description of the placers in the greater part of the western part of the map-area. An account of the placers of the eastern part of this map-area had been published some years ago.

Mr. Cockfield, with J. F. Walker, spent a short time in the late autumn investigating the nickel-bearing deposits near Choate. The investigation was not completed, but an account of the results so far obtained is presented in a joint report in Summary Report 1933, Part A.

J. F. Walker commenced the geological mapping and investigation of a 2-mile map-area (latitudes 50°30′ to 51°, longitudes 122° to 123°) embracing Bridge River district, which is now the most active gold mining field in the province. A brief account of some of the results of the season's field work is given in a report by Mr. Walker, in Summary Report 1933, Part A.

B. R. MacKay, assisted by C. S. Evans, made a detailed investigation of the Michel coal area. One result of the work, a full account of which appears in Summary Report 1933, Part B, was to establish the presence of a considerable number of coal seams whose existence had not previously been suspected. The results have also been assembled in the form of a celluloid geological model for the use of the coal companies in planning mine developments.

Alberta

B. R. MacKay made a detailed examination of the Coleman South coal area, 15 square miles in extent. A full account of the results obtained appears in Summary Report 1933, Part B. A celluloid geological model has been prepared, as for the Michel area.

G. S. Hume, with R. T. Wickenden, geologically mapped a strip of country along the trail from Morley to Red Deer river, in the foothills region. The area studied includes a structure on Red Deer river that is being tested for petroleum. The structure is a clearly defined anticline considered to have gas and oil prospects, and the test being made is of great importance in relation to future drilling in this part of the foothills.

Saskatchewan

J. F. Wright and C. H. Stockwell completed the geological mapping and investigation of the Amisk Lake 2-mile map-area (latitudes 54° 30′ to 55°, longitudes 102° to 103°) in which numerous finds of gold have been made. An account of this work appears in Summary Report 1933, Part C.

Manitoba

J. F. Wright and C. H. Stockwell commenced the geological mapping of the Flinflon 1-mile map-area (latitudes 54° 45′ to 55°, longitudes 101° 30′ to 102°). The mineral possibilities of this area are enhanced by the presence in it of the Hudson's Bay Mining Company's smelter at Flinflon. An account of a number of the mineral prospects within the area is given in Summary Report 1933, Part C.

G. W. H. Norman continued geological mapping and investigation of the Granville Lake 4-mile area (latitudes 56° to 57°, longitudes 100° to 102°), northern Manitoba, that was commenced the previous season by J. F. Henderson. The study of the main part of the eastern half of the area has been completed and a report thereon, accompanied by a map, appears in Summary Report, 1933, Part C.

Ontario

J. F. Wright and C. H. Stockwell examined a silica deposit north of Minaki. A report on the occurrence is given in Summary Report 1933, Part D.

F. T. Jolliffe geologically mapped an area of volcanic and sedimentary schists north of Dog lake, Thunder Bay district. As yet the area has received little attention from prospectors, although the rock assemblage is similar to that in which mineral deposits have been found elsewhere in Thunder Bay district. A report on this area, accompanied by a geological map, appears in Summary Report 1933, Part D.

D. F. Kidd, assisted by T. L. Tanton, geologically mapped and investigated the Obonga-Kashishibog area, Thunder Bay district. A report dealing with the geology, the chromite occurrences, and other mineral possibilities, illustrated with a map, is included in Summary Report 1933, Part D.

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

D. C. Maddox commenced a systematic survey of the underground water supply in and near Ottawa, working in conjunction with Miss Wilson.

Quebec

M. E. Wilson continued a detailed investigation of a limited area that includes the Noranda, Amulet, and Waite-Ackerman-Montgomery mines in the vicinity of Noranda. The purpose is to correlate information belonging to the several mining companies and to learn as much as possible about the source of the ores and the conditions that govern the extent and position of the ore-bodies. The rocks in this area are exceptionally well exposed; their study will afford information that should be of value to prospectors and to those engaged in the development of mineral deposits in this region. A report setting forth the present knowledge concerning the Amulet mine is included in Summary Report 1933, Part D.

A. H. Lang revised the geology of the Kinojevis sheet (latitudes 48° to 48° 15′, longitudes 78° 30′ to 79°), now out of print. The Kinojevis quadrangle, which is part of the Rouyn mineral area, contains a belt of great interest to prospectors, in which several important mineral deposits have been discovered. Hand-coloured advance copies of the more important northern half of the area were issued early in 1934.

L. J. Weeks commenced geological mapping and investigation of the Amos 1-mile map-area (latitudes 48° 30′ to 48° 45′, longitudes 78° 00′ to 78° 30′), also within the Rouyn mineral field. This sheet is one of a block of sixteen

1-mile sheets commenced in 1922, which cover most of the area in western Quebec undergoing development.

H. C. Cooke continued investigation of the asbestos, chromite, and other mineral deposits, and the geological mapping of the serpentine belt of southern Quebec, where these deposits occur. The geological mapping of the Thetford 1-mile map-area (latitudes 46 ° to 46 ° 15′, longitudes 71 ° to 71 ° 34′) has been completed, and that of the Disraeli 1-mile map-area (latitudes 45° 45′ to 46°, longitudes 71° to 71° 30′) has been commenced. A report, one of a series giving some of the results of this work, appears in Summary Report 1933, Part D.

H. C. Gunning accompanied the annual Dominion Government expedition to the eastern Arctic, as geologist. He obtained information regarding the general and economic geology of the districts visited by the expedition. Three weeks were spent in the vicinity of cape Smith, east shore of Hudson bay, in examining the geology and studying sulphide deposits near the coast. The results of this examination are given in the form of a report in Summary Report 1933, Part D.

New Brunswick

F. J. Alcock and C. E. Cairnes commenced geological mapping and investigation of a 1-mile map-area (latitudes 47° to 47° 15′, longitudes 67° to 67° 30′) that includes the headwaters of Serpentine river, northwestern New Brunswick. This area and one of the same size lying immediately to the north have been mapped by the Topographical Division. The region, owing to the fact that it lies along the border of a granite batholith, is regarded as a possible prospecting field.

TOPOGRAPHICAL DIVISION

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

FIELD WORK

Yukon

W. H. Miller continued the field work for the Carmacks quadrangle, latitudes 62° to 63°, longitudes 136° to 138°, commenced in 1932. This field work was done by photo-topographical reconnaissance methods for publication on a scale of 1 inch to 4 miles, contour interval 500 feet. Observations for magnetic declination were made throughout the season. Further experimental work with infra red plates was carried on. The results indicate the advantages of these plates for this type of work and country.

British Columbia

R. Bartlett carried out field work for the mapping of the quadrangle, latitudes 53° 00′ to 53° 15′, longitudes 121° 30′ to 122° 00′, in the Cariboo gold district. This work was done by a combination of photo-topographical and plane-table traverse methods for publication on a scale of 1 inch to 1 mile, contour interval 100 feet. Observations for magnetic declination were made throughout the season. H. N. Spence was attached to this party.

R. C. McDonald carried out photo-topographical reconnaissance mapping in the Bridge River quadrangle, latitudes 50°30′ to 51°00′, longitudes 122°00′ to 123°00′. This work is for publication on a scale of 1 inch to 2 miles, contour interval 200 feet. The triangulation control was connected to the stations of the British Columbia Lands Department; and the vertical control was connected to the elevations of the Pacific Great Eastern railway.

A. C. Tuttle continued the exploratory mapping in Manson Creek area, latitudes 55° to 56°, longitudes 124° to 126°. This area is being mapped by photo-topographical methods for publication on a scale of 1 inch to 4 miles, with contour interval 500 feet. Triangulation control is connected to the nets of the Pacific Great Eastern Railway Survey, and the British Columbia Department of Lands. Elevations are based on those established by the British Columbia Department of Lands along the 124th meridian. Observations for magnetic declination were made throughout the season.

Alberta

J. W. Spence mapped the Canmore coal area on a scale of 1 inch to 800 feet, with contour interval of 25 feet. The area was mapped by plane-table traverse supplemented by photo-topography. Elevations are based on Geodetic Survey bench marks along the Canadian Pacific railway. This work is similar in character and purpose to that previously done at Michel and Hillcrest. Observations for magnetic declinations were made throughout the area. S. M. Steeves was attached to this party.

Ontario

A. G. Haultain completed the contouring of an area at Sudbury. He also carried out control surveys in Wanapitei area, latitudes 46°30′ to 46°45′, longitudes 80°30′ to 81°00′. Both areas are for publication at 1 inch to 1 mile.

New Brunswick

J. V. Butterworth completed the surveys of all railways and roads for the mapping of the Petitcodiac area, latitudes 45° 45′ to 46° 00′, longitudes 65° 00′ to 65° 30′. Surveys were made by transit and tape, and transit and stadia. This work is for publication on a scale of 1 inch to 1 mile, without contours.

Office Work

D. A. Nichols continued to supply information and exhibits on physiographic and allied subjects. Revision of the Geological Map of Canada, on a scale of 1 inch to 100 miles, was completed. Satisfactory progress was made on the large Museum relief model of Canada.

MINERALOGICAL DIVISION

Eugene Poitevin, Chief of the Division, reports:

No field work was done.

The mineralogists of the division, Eugene Poitevin and H. V. Ellsworth, examined a greater number than usual of minerals and rocks for prospectors, and others in the mineral industry, over four hundred and fifty reports being supplied. Formerly the bulk of these reports were sent to English speaking provinces, but this year, owing to a vigorous educational campaign carried on by the Bureau of Mines of the province of Quebec, inquiries from that province have considerably increased. A great number of oral reports were given to visitors who brought in specimens for determination, and other short reports were given to officers of the department. Altogether more than 3,500 specimens were examined.

Mr. Poitevin supervised the preparation of special exhibits displayed at Chicago, Ottawa, and Montreal. Also, at the request of the Ontario Department of Health, he has been studying mineral residues from silicotic lungs. Six lungs have been examined and the work is still in progress.

Mr. Ellsworth continued his qualitative and quantitative determinations of rare elements and radioactivity. He prepared two papers for publication: "Uraninite from Lac Pied des Monts, Que. (in collaboration with Prof. F. F. Osborne, McGill University) and "Nickeliferous and Uraniferous Anthraxolite from Port Arthur, Ont." The investigation of possible Canadian sources of vanadium ores was continued. A new vanadium mineral was discovered, a description of which will be published shortly.

R. J. C. Fabry, Chemist, completed the following analyses:

Norite, from Copper Cliff, Ont., for W. H. Collins
Norite, from Copper Cliff, Ont., for W. H. Collins
Bigwoodite, from Bigwood, Ont., for T. T. Quirke
Hornblende andesite, from Cross Lake, Man., for H. C. Horwood
Scapolite (two analyses), from lot 3, range III, Grenville tp., Que., for E. Poitevin
Scapolite, from N. ½ lot 18, range II, Harrington tp., Que., for E. Poitevin
Manganese concretion, from Lake Ossipie, N.H., for E. M. Kindle
Jarosite (?) from Manitoba, for J. F. Wright and C. H. Stockwell
Complete analysis of silicotic lung residue (Ont. Bur. Health No. 1448) for E. Poitevin
Complete analysis of silicotic lung residue (Ont. Bur. Health No. 1539) for E. Poitevin

Mr. Fabry has also done a considerable amount of qualitative work required in the determination of specimens sent in by the public. Among the more numerous tests may be cited those for nickel, sulphate, alumina, manganese, phosphate, lime, and magnesia, as well as other common elements.

MUSEUM

A number of exhibits were prepared for display:

Two large collections for the Canadian Section, Century of Progress Exposition, Chicago
One large exhibit for Central Canadian Exhibition, Ottawa
One large exhibit for Canada's Foreign Relations Exhibition, James A. Ogilvy, Limited, Montreal, Que.
A collection of pitchblende ore from Labine point, Great Bear lake, N.W.T., loaned to G. D. Russell, Winnipeg, Man.
A mineral exhibit for loan to other museums and educational institutions in Canada

An itemized list of the mineral specimens obtained by collecting, donating, and purchase is given in the Annual Report of the National Museum.

EDUCATIONAL COLLECTIONS

Since joining the division Mr. J. R. Marshall has made several changes contributing to the facilities for assembling and distributing the various collections.

The following collections of minerals and rocks were distributed during the fiscal year:

Province	Standard	Grade 2	Grade 3	Grade 4	Special	Prospector's	
						Minerals	Rocks
British Columbia	0	1	0	0	4	46	41
Alberta	0	0	0	0	1	51	51
Saskatchewan	0	0	0	0	1	16	11
Manitoba	0	0	1	0	15	9	6
Ontario	0	0	33	0	8	65	22
Quebec	1	0	2	250	9	5	3
New Brunswick	0	0	0	0	1	0	0
Nova Scotia	0	0	0	0	1	10	0
Foreign	0	0	0	0	9	4	3
	1	1	36	250	49	206	137
Number of specimens	144	44	1,440	10,000	1,169	4,120	3,288

Total number of collections distributed 680
Total number of specimens distributed 20,205
In addition to the above three boxes of mineral chips, consisting of 120 bags, were sent out.

PALÆONTOLOGICAL DIVISION

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

FIELD WORK

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

At the request of the Deputy Minister of Mines of Ontario, E. M. Kindle investigated erosion problems at Pelee island, Lake Erie. In co-operation with Mr. W. R. Rogers, of the Ontario Department of Mines, a part of the month of June was spent at Pelee island and adjacent small islands in Lake Erie. The results of the surveys will be published by the Ontario Department of Mines.

Unique specimens of recently formed manganiferous concretions sent to the Director of the Geological Survey from Ship Harbour lake, N.S., in 1933, led to an investigation by Mr. Kindle of the occurrence, origin, and distribution of manganese concretions in Nova Scotia lakes. Manganese oxide was found to occur on the bottoms of several lakes. A report on this work is in preparation.

During the latter part of the summer a good collection of the Helderbergian fauna and of the Silurian fauna was made in Jacket River area, New Brunswick, by Mr. Kindle.

OFFICE WORK

Map work in conjunction with the Geological Division was carried on by all field officers of this division.

The preparation of reports on collections of fossils for the purpose of dating and establishing in the general geological section the relative positions of formations that are being mapped in various parts of Canada by the Geological Survey has taken about the usual amount of time. The several stratigraphic specialists in the division have participated in the preparation of these highly important, special reports on fossils. In addition to reports for members of the staff, reports have been supplied to the Quebec Bureau of Mines. In many areas the soundness of the geological maps depends upon the reports of the palæontologists, and the quality of these in turn rests in part on the excellence of the collections secured during the field work on the map.

F. H. McLearn has given a considerable part of his time to the preparation of a report on the geology and mineral resources of Saskatchewan. A report on the White and Buff Burning Clays of Southern Saskatchewan, written in collaboration with J. F. McMahon, of the Mines Branch, will appear in the Summary Report 1933, Part B.

W. A. Bell has prepared, for a series of volumes on the stratigraphy of North America, two papers—"Stratigraphy of the Mississippian System in Eastern Canada," and "Stratigraphy of the Pennsylvanian System in Eastern Canada."

A. E. Wilson has given considerable time to studies of ostracods from southwestern Ontario in connexion with the work of Mr. C. S. Evans and of the Borings Division. A paper on the Synopsis of the Ordovician of Ontario and Western Quebec was completed.

Professor Stanley Smith's monograph on the Upper Devonian Corals of the Mackenzie Valley is nearing completion.

MUSEUM

Work on the extensive collection of dinosaurs that is still awaiting preparation and study has been continued. Work has been started during the year on seven of the hooded dinosaur specimens which are in various stages of completion.

Preparator work on the invertebrate fossil collections has included considerable work putting in good order certain parts of the Whiteaves collection of Recent shells.

PLEISTOCENE GEOLOGY, WATER SUPPLY, AND BORINGS DIVISION

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

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

An important work of the division has been, as in previous years, the examination of samples from well borings made in search of oil, gas, and water. Samples of a number of wells drilled for oil and gas in Saskatchewan were examined in co-operation with the Department of Natural Resources of the Government of that province, and in the province of Quebec in co-operation with the Quebec Bureau of Mines.

D. C. Maddox, in addition to his field studies of well waters in the vicinity of Ottawa, examined samples from wells in Ontario and Quebec.

R. T. D. Wickenden continued his studies of deep well samples in the Prairie Provinces, particularly with reference to the occurrence of microfossils and the correlation of formations by this means.

F. J. Fraser, assisted by M. Mahoney, examined the samples from a number of wells in Saskatchewan, and eastern Canada. Mr. Fraser made a number of partial analyses of well waters from different parts of Canada, to show the salinity and hardness of these waters. Owing to the number of requests for information as to the hardness and mineral character of well waters throughout Canada, information to meet these requests is being collected.

Samples from oil and gas wells received during the year numbered 9,456. Of these, 7,751 were from Alberta and were received through the courtesy of the Department of Lands and Mines of the province. There were 253 from British Columbia, 706 from Saskatchewan, 5 from Manitoba, 96 from Ontario, 640 from Quebec, and 5 from New Brunswick.

DRAUGHTING AND REPRODUCING DIVISION

A. Dickison, Chief of the Division, reports:

Maps Published April 1, 1933, to March 31, 1934

Series A	Publication number	Title	Remarks
		NORTHWEST TERRITORIES	
296A	2328	Great Bear lake (McTavish arm), between Richardson island and Hornby bay, district of Mackenzie; scale, 1 inch to 4 miles.....	Geology. For report by D. F. Kidd, Summary Report, part C, 1932.
		BRITISH COLUMBIA	
294A	2326	Quesnel Forks sheet, Cariboo district; scale, 1 inch to 1 mile	Geology (provisional edition).
295A	2327	Brisco-Dogtooth area, Kootenay district; scale, 1 inch to 4 miles.	Geology. For report by C. S. Evans, Summary Report, part A, 1932.
297A	2335	Cranbrook sheet, Kootenay district; scale, 1 inch to 1 mile.	Topography.
		MANITOBA	
301A	2348	Granville Lake area; scale, 1 inch to 4 miles.....	Geology. For report by G. W. H. Norman, Summary Report, part C, 1933.
		ONTARIO	
155A	1553	Lake Huron sheet; scale, 1 inch to 8 miles.....	Geology (third edition).
		MISCELLANEOUS	
—	—	Early Precambrian sedimentary formations in the Canadian Shield; scale, 1 inch to 60 miles.	Geology.

Maps in Hands of King's Printer, March 31, 1934

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.
300A	2343	Copper Mountain mining area, Similkameen district; scale, 1 inch to 1,000 feet.	Geology. For memoir by V. Dolmage.
		MANITOBA AND SASKATCHEWAN	
268A	2272	The Pas sheet; scale, 1 inch to 8 miles.....	Geology.
		QUEBEC	
285A	2311	Taschereau sheet, Abitibi county; scale, 1 inch to 1 mile.	Geology.
293A	2325	Palmarolle sheet, Abitibi county; scale, 1 inch to 1 mile.	Geology.

Other Map-Work in Varying Stages of Progress

—	Title	Remarks
	CANADA	
1	Dominion of Canada; scale, 1 inch to 100 miles.....	Geology.
	BRITISH COLUMBIA	
1	Stikine area, Cassiar district, 56° 30′ to 57°, 131° to 132°; scale 1 inch to 2 miles.	Geology.
2	Stikine area, Cassiar district, 57° to 57° 30′, 131° to 132°; scale, 1 inch to 2 miles.	Geology.
3	Stikine area, Cassiar district, 57° 30′ to 58°, 131° to 132°; scale, 1 inch to 2 miles.	Geology.
4	Portland Canal area, Cassiar district, 55° 15′ to 56° 30′, 129° to 130° 30′; scale, 1 inch to 4 miles.	Topography.
	ALBERTA	
1	Nordegg sheet (west of fifth meridian), 52° 15′ to 52° 30′, 116° to 116° 30′; scale, 1 inch to 1 mile.....	Topography.
	SASKATCHEWAN	
1	Regina sheet, 49° to 52°, 102° to 109°; scale, 1 inch to 8 miles.....	Geology.
2	Sections supplementing Regina sheet.....	Geology.
	MANITOBA	
1	Winnipeg sheet, 49° to 52°, 95° to 102°; scale, 1 inch to 8 miles.....	Geology (bedrock).
2	Sections supplementing Winnipeg sheet.....	Geology.
	ONTARIO	
1	Espanola sheet, Sudbury district, 46° 15′ to 46° 30′, 81° 30′ to 82°; scale, 1 inch to 1 mile.....	Geology.
2	Copper Cliff sheet, Sudbury district, 46° 15′ to 46° 30′, 81° to 81° 30′; scale, 1 inch to 1 mile.....	Geology.
3	Lake Superior sheet, 48° to 52°, 85° to 90°; scale, 1 inch to 8 miles.....	Geology.
	QUEBEC	
1	Macamic sheet, Abitibi county, 48° 45′ to 49°, 78° 30′ to 79°; scale, 1 inch to 1 mile.....	Geology.
2	Chibougamau sheet, Abitibi territory, 49° 45′ to 50°, 74° to 74° 30′; scale, 1 inch to 1 mile.....	Geology.
3	Escuminac sheet, Bonaventure county, 48° to 48° 15′, 66° to 66° 30′; scale, 1 inch to 1 mile.....	Geology.

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

—	Title	Remarks
	QUEBEC AND NEW BRUNSWICK	
1	Chaleur Bay area, 47° 30′ to 48° 30′, 64° 30′ to 66° 45′; scale, 1 inch to 4 miles	Geology.
	NEW BRUNSWICK	
1	Benjamin River sheet, Restigouche county, 47° 45′ to 48°, 66° to 66° 30′; scale, 1 inch to 1 mile	Geology.
2	Belledune sheet, Gloucester and Restigouche counties, 47° 45′ to 48°, 65° 30′ to 66°; scale, 1 inch to 1 mile	Geology.
3	Bathurst sheet, Gloucester county, 47° 30′ to 47° 45′, 65° 30′ to 66°; scale, 1 inch to 1 mile	Geology.

In addition to the foregoing, forty-eight map and other figure drawings were prepared for reproduction by zinc-cut process, for illustrating reports and memoirs of the Geological Survey; other draughting and related work necessary for staff and public use amounted to one hundred and twenty-one items.

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

PHOTOGRAPHIC DIVISION

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

The following work was done during the fiscal year:

Contact prints, 4 x 5 to 36 x 48	8,811
Bromide enlargements, 4 x 5 to 40 x 72	1,153
Exposures developed, 3¼ x 4¼ to 6½ x 8½	2,398
Dry plate negatives, 4 x 5 to 11 x 14	434
Wet plate negatives, 8 x 10 to 24 x 30	188
Zinc plates, 11 x 14 to 24 x 30	21
Photostat copies, 7 x 11 to 11 x 14	189
Lantern slides, 3¼ x 4	969
Photos and maps mounted	2,753
Total	16,916

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Assistant Director, reports:

During the year 59,046 publications of the Geological Survey and National Museum, exclusive of French editions, were distributed. Of these 7,701 were sent to addresses on the regular mailing lists, and 51,345 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)	186
Books (by gifts)	233
Books (by transfer)	65
Complete unbound volumes (by purchase)	164
Complete unbound volumes (by gift and exchange)	683
Pamphlets	439
Maps	321
Periodicals subscribed for	304
Periodicals and serials by gift or exchange (separate files)	683

Two hundred and sixty-five volumes were bound. Recorded loans 5,294. Inter-library loans amounted to 249, and 85 books were borrowed from other libraries for members of the staff. Cards added to the catalogue numbered 5,546, of which 121 were bibliographical entries. The map catalogue was increased by 176 cards.

The library collection of lantern slides has been re-catalogued in accordance with a revised classification, prepared with the assistance of Mr. D. A. Nichols, Physiographer.

From the Gray Herbarium 4,343 cards were added to the Botanical Index in the library.

Grateful acknowledgment is made to the following for gifts to the Library: Dr. Charles Schuchert, Dr. Reginald Daly, G. Godwin, A. H. Sonsthagen, Harlan I. Smith, D. Jenness, D. A. Nichols, A. Miles, R. Pearce, and to the Carnegie Institution of Washington and the British Museum of Natural History for very valuable selections of their publications.

BRITISH COLUMBIA OFFICE

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

The use made by the public of the facilities offered by this office showed a very large increase during the year, which is indicative of the public interest in the mining industry of the province. A total of 6,042 visitors registered at the office, and a large number of inquiries were handled by mail and telephone. Reports issued totalled 5,013 and 2,769 separate maps were issued. The number of rock and mineral specimens received for determination also showed a large increase.

NATIONAL MUSEUM OF CANADA

W. H. Collins, Acting Director

No field work was carried on by members of the staff of the National Museum of Canada during the summer of 1933 and activities were limited to office and laboratory work.

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

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

It is with deep regret that we here record the death of M. O. Malte, Chief Botanist, on August 12, 1933, and of J. A. Rochon, Osteological Preparator, on May 26. O. E. Prud'homme, Senior Museum Assistant, having reached the age limit, was superannuated on February 1. Miss C. E. Farmer, clerical assistant in the Division of Anthropology, resigned her position on November 4, 1933.

Statements of the progress of the work of the Anthropological and Biological Divisions follow. Work accomplished in geology, geography, mineralogy, and palæontology is referred to under the Geological Survey.

ANTHROPOLOGICAL DIVISION

D. Jenness organized and presided over the anthropological section of the Fifth Pacific Science Congress that was held in Victoria and Vancouver in June and July. With the assistance of nine other scientists he compiled and edited for distribution at that congress a special volume on the "Origin and Antiquity of the American Aborigines", and himself prepared a short paper on the same subject which was read during the meeting.

Mr. Jenness prepared a monograph on the Carrier Indians of British Columbia. He compiled a map for the Department of the Interior showing the distribution and boundaries of the Indian tribes in northeastern North America in the year 1774. He acted as a member of the Interdepartmental Reindeer Committee.

C. M. Barbeau divided attention between research at the museum, the collecting of new materials in Quebec and eastern Canada, and the preparation of materials, papers, and addresses. Research into the Asiatic origin of our northwestern natives was further advanced through the study of ethnographic data for Siberian and Alaskan tribes, and the analysis of Chinese and Siberian songs recorded on the phonograph, along with those of the Athapaskan tribes of the northwest. A large number of pictorial documents by the painter Cornelius Krieghoff on the early folk and Indian life on the St. Lawrence were discovered and compiled, so as to be available for further use and reference.

Harlan I. Smith continued assembling and arranging information on Indian village sites and other subjects of Canadian archæology. He continued his efforts to induce artists and manufacturers to use Indian and archæological art to produce distinctive Canadian manufactures and souvenirs. His services were

lent for a short time to the Quebec Government as consultant on the preservation and erection of a totem pole in the new Zoological Garden near Quebec city.

W. J. Wintemberg revised his report on the Roebuck Indian village site and continued the study of material from other village sites. His services were given for a short time to the supervision of excavations at Fredericton, New Brunswick.

Douglas Leechman, in addition to the usual routine work on the cleaning, preservation, and repairing of anthropological specimens, finished the habitat group showing the interior of an Eskimo igloo. He prepared an exhibit for the Central Canada Exhibition in Ottawa, an exhibit for the Handicrafts Guild of Toronto, one for the National Exhibition at Toronto, and an exhibit of Indian articles of personal adornment for loan by the National Museum.

As no field work was done during the year accessions were few, comprising 118.

BIOLOGICAL DIVISION

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

FIELD WORK

Field work was limited to collection near Ottawa of a few specimens for the Museum collections and for school loan collections; a considerable amount of accessories needed for preparing museum exhibits was also collected.

R. M. Anderson and P. A. Taverner served on the Interdepartmental Advisory Board on Wild Life Protection and attended the 50th Anniversary meeting of the American Ornithologists' Union held at New York city, November 14 to 18. Mr. Anderson served as member of Northern Advisory Committee, the Interdepartmental Reindeer committee, and as honorary advisory zoologist for the Gatineau-Lièvre-Nation Division of the Province of Quebec Association for the Protection of Fish and Game. He delivered one public lecture on "The Wild Mammals of Quebec" to the Province of Quebec Society for the Protection of Birds.

OFFICE WORK AND PUBLICATIONS

R. M. Anderson, in the course of systematic work on the mammal collections, made special studies of several groups of Canadian rodents. A "Check-List of Canadian Mammals" is in card catalogue form and with some revision of the range of certain species and subspecies will be in shape for publication. Progress was made on a comprehensive book on the "Mammals of Canada" and on a bulletin on "Animal Life and Life Zones of Southern British Columbia." Two papers were prepared for the Fifth Pacific Science Congress, held in Victoria, on the subjects: "The Distribution, Abundance, and Economic Importance of the Game and Fur-bearing Mammals of Western North America," and "Effect of the Introduction of Exotic Animal Forms." He prepared for the Department of the Interior a chapter on "The Mammals of the Eastern Arctic and Hudson Bay Region", for a book on the Eastern Arctic Region of Canada. Other reviews and short articles were contributed to scientific periodicals.

P. A. Taverner completed the compilation and revision of the "Birds of Canada", which is now in press. In collaboration with Dr. George Miksch Sutton, of Cornell University, he finished a report on "The Birds of Churchill, Manitoba," now being published by the Carnegie Museum of Pittsburgh. A chapter on the "Birds of Eastern Arctic Islands" was also prepared for the above-mentioned book by the Department of the Interior.

MUSEUM WORK

C. L. Patch mounted a number of mammals and birds for exhibition in the Museum halls. Extension of such exhibits is much handicapped by the crowded condition of the Museum. Twenty-two new specimens were mounted for the school loan collection, and 496 mammals, birds, amphibians, reptiles, and photographs were lent to educational institutions for use in art and nature study work.

Owing to suspension of field work, accessions to the Museum collections have largely been dependent upon donations, most of which were obtained through the courtesy of the Dominion Lands Administration, and the National Parks of Canada, Department of the Interior. At the end of the year the catalogued specimens of birds in the National Museum of Canada numbered 25,727, an addition of 548 during the year; mammals 12,304, an addition of 654 specimens; and amphibians and reptiles 4,561, an addition of 79 specimens. A complete list of the donors is given in the Annual Report of the National Museum.

NATIONAL HERBARIUM

M. O. Malte, Chief Botanist of the National Herbarium, made considerable progress during the early part of the year on the "Flora of Arctic Canada", and several genera were virtually monographed and numerous keys worked out. About seventy-five pages were completed and typed and a considerable quantity of manuscript notes written. The National Herbarium collections were also greatly benefitted by corrections in labelling made during the progress of the revisionary work. The progress of the work was also aided by loans of Arctic plants from the Gray Herbarium, Cambridge, Mass.; The New York Botanical Garden, New York; the Danish Arctic Station, Godhavn, Greenland; the Botanical Division of the Government Museum, Stockholm, Sweden; and the Department of Botany, University of Lund, Sweden. Dr. Malte died on August 12, 1933, and left much unfinished work, but the records of his work and his impress on the National Herbarium will be of value for many years to come. Arrangements have been made with Professor M. L. Fernald, of the Gray Herbarium, Cambridge, Mass., to complete and publish in *Rhodora* as much of Dr. Malte's manuscript as can be used in this way.

The number of plants received on account of exchange and donation during the year was 1,520, and 1,359 specimens were distributed on account of exchange. A list of the donors is given in the Annual Report of the Museum.

MINES BRANCH

John McLeish, Director

The contribution by the Mines Branch, through its investigational and experimental test work, to the development, production, and utilization of the country's mineral resources has been reflected in some degree in the increased mineral production, particularly of metals, during the past year. The increased price, in Canadian funds, of gold has, of course, been a great stimulus to the increased production of this metal, but in very great measure the increased production of base metals, as well as of gold, has been due to the greater efficiency with which mining and metallurgical operations have been conducted and the consequent lowering of costs of production of the metals involved.

The general financial stringency during the past four years has not lessened the demand for investigational and test work such as the Mines Branch laboratories are designed to undertake. On the contrary, the demands for this work have increased to such an extent that many requests have to be turned aside, or postponed for future consideration.

Reduced appropriations of the past three years have, however, halted all expansion in the scope of investigations and experimental test work undertaken, and have severely curtailed field investigations of mineral resources and field studies of mining problems and ore treatment methods.

In the general investigations of mineral resources, field studies have been limited to keeping a personal contact with the progress of the industry during the year, and to securing information required to complete investigations and reports that have been in progress for some time.

With limited field work, the engineers of the Mineral Resources Division have been enabled to devote more attention to the completion of reports on subjects that have been under investigation and to prepare new reports of special interest, such as those on gold mining and reports of general and educational interest on the mineral industry of Canada.

The public demand for information respecting the mineral resources and the mineral industries continues unabated, and the information and records collected by this division are proving of immense value, both in showing Canadian sources of raw materials hitherto imported, as well as possible production that may find foreign markets.

The facilities afforded by the Ore Dressing and Metallurgical Laboratories of the Mines Branch have been pressed to the limit of equipment and staff during the past year to meet the demand for test work on ore samples submitted, a considerable number of which are now always on hand awaiting their turn. Indeed, it would have been impossible to complete the number of tests that have been put through during the past two years had it not been for the assistance rendered by the Mineragraphic Section of this division. The microscopic examination of ores and mill products in the Mineragraphic Section has enabled tests on individual samples to be put through much more rapidly.

During the past three years, 170 or more investigations of the ore treatment type have been made. During the same period, 28 plants have been erected; substantial changes effecting greater efficiency in operation have been made in 6 established plants; 9 plants are now under construction (April, 1934), and 29 plants are being planned and their construction contemplated; all for the treatment of ores on which preliminary tests have been made in the Ore Dressing Laboratories.

The Fuel Research Laboratories have combined technical studies of Canadian fuels and laboratory research work 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, and 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 and displacing imported fuels, a development of the highest importance when it is remembered that for many years Canada has imported over 50 per cent of the country's coal requirements.

The Ceramic Laboratories, in addition to testing clays and associated raw materials to determine their suitability for the manufacture of industrial products, are carrying on a very extensive study of the physical properties of Canadian brick, as well as investigations of problems relating to the production of ceramics and refractory products from Canadian raw materials.

During the year, the Director, in addition to departmental administrative duties, served as a member of the Dominion Fuel Board; the Advisory Committee on Mining Regulations; several Associate Committees of the National Research Council; and the Government Advisory Committee on the Civil Service Superannuation Act.

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

MINERAL RESOURCES DIVISION

At the beginning of the year the staff prepared and issued in mimeograph form a comprehensive survey of the progress of the mineral industry during the year 1932, a total of fifty-six separate products being reviewed. Members of the staff completed, and the department published, reports on: Canadian Limestones for Building Purposes; Gold in Canada, second edition; The Mineral Industries of Canada with a mineral map, fourth edition; and the Annual Report on Investigations of the Mineral Resources and the Mining Industry 1932, containing three papers on investigations that had been in progress and were completed during the preceding year. French editions of reports on Chrysotile Asbestos and on The Mineral Industries of Canada, fourth edition, were issued. A list of operating gold mines was published to accompany the report on Gold in Canada.

During the year the staff of this division as a group has been called upon to prepare a very large number of replies to inquiries relating to minerals, mineral products, and industries. These requests for information are received from all parts of Canada and from abroad. The reference files and index, which are the foundation of this work, have been more than twenty-five years in the making and the records are being constantly edited and increased. During the year there has been a much greater demand for information service from the staff than ever before.

The Chief of the Division, A. W. G. Wilson, was employed during most of the year on administrative duties of the division. Only a very short time was given to field inspection work, including two weeks spent at the Century of Progress Exhibition in Chicago, studying technical advances in the industrial applications of mineral products.

H. S. Spence continued his investigations on the mining and preparation for market of the group of non-metallic mineral products in which he specializes. This work also included the examination of old and new localities in which rare-

element minerals occur. Visits were made to a number of industrial plants in Ontario, Quebec, and the United States.

L. H. Cole continued his work on granites and other crystalline igneous rocks as building stones. He spent about two months on field work in Ontario and in the Prairie Provinces. This work included a review of the present status of the sodium sulphate industry in western Canada, as well as some work on Canadian sandstones as structural materials.

S. C. Ells continued his studies of the utilization of asphalt resources, paying more particular attention to the possibilities of utilizing in industry asphalt products derived from the bitumens of the Alberta bituminous sands.

M. F. Goudge continued his studies of the limestone industries; his report on Limestones of the Maritimes was completed and will be issued early in the fiscal year 1934-35. Progress has also been made in the preparation of the manuscripts of the separate reports dealing with the Limestones of Quebec and the Limestones of Ontario. A great deal of information on limestones was furnished to interested persons through correspondence and personal interviews. Some additional work was done on rock wool during the year.

A. H. A. Robinson completed the manuscript for a second edition of his report on Gold in Canada, which was published in August; he also completed the compilation of the fourth edition of the general report on The Mineral Industries of Canada, this being published on March 28. Mr. Robinson also prepared a number of short articles for the technical press. About four weeks were devoted to visits to the gold-producing properties in British Columbia.

V. L. Eardley-Wilmot continued his studies on diatomite, about six weeks being devoted to field examinations in Ontario, Quebec, and the Maritime Provinces. Laboratory examinations of the material collected, and of material sent in by inquiriers, occupied most of his office time. A general review of the Abrasive Industries for the year 1932 was also prepared for publication in Mineral Industry.

John Casey, statistician, continued the series of annual surveys of fuels for domestic use marketed in Quebec, Ontario, and Manitoba. A survey of fuel oil for all purposes used throughout Canada during the year 1932 was made; a similar survey of bunker fuels used in Quebec, Ontario, and Manitoba was also conducted. Tabular statistical tables covering these surveys were completed during the year. Mr. Casey also prepared, both in tabular form and as graphs, a series of comprehensive statements based on the official annual trade reports of each country, visualizing the intertrade between Canada and the United States over a period of years (1920 to 1932). These tabulations cover all commodities falling within each of ten economic groups and were apportioned to show both "free" goods and "dutiable" goods as well as totals. These statements will not be published as the cost of reproduction is prohibitive under present conditions, but they are available for office consultation.

A. Buisson continued his office work in the Records Section during most of the year, and also prepared a number of short articles for publication.

C. H. Freeman concluded his laboratory studies of moulding sands and completed the manuscript of his report on this investigation.

E. H. Wait was engaged in compiling the records of all mining companies organized in Canada; copies of these records were furnished to many inquirers in Canada and in the United States.

ORE DRESSING AND METALLURGICAL DIVISION

W. B. Timm, Chief of Division, reports a greater amount of investigative work on Canadian ores, non-metallic minerals, and metallurgical products was undertaken and completed than in any previous year. Reports were issued on seventy-three investigations, sixty-eight of which will be published in the report of Investigations in Ore Dressing and Metallurgy for 1933. In addition,

considerable experimental test work was conducted of minor importance. Of the total investigations, fifty were on ores, in which gold was the principal valuable mineral, indicating the activity in gold mining in Canada. Eight were from British Columbia, five from Manitoba, twenty-three from Ontario, nine from Quebec, and five from Nova Scotia. An investigation of Texada Island (B.C.) and Moose Mountain (Ont.) magnetic iron ores, was conducted and is in progress in the metallurgical laboratories, and further work on the radium-bearing ores of Great Bear Lake district, Northwest Territories, was carried out in the hydrometallurgical laboratory.

The laboratories were used to a greater extent by consulting engineers and metallurgists, representing the mining companies. Every facility was extended to them in the investigation of their ores and ore treatment problems. The experience and knowledge of the staff of the division were placed at the disposal of consulting engineers engaged on the design, construction, and operation of new milling plants, and on the operating problems of existing plants.

FIELD STUDIES

W. B. Timm, C. S. Parsons, and A. K. Anderson spent about four weeks each in the field at different periods, visiting the milling plants and concentrators in northern Ontario and Quebec, discussing with the operators their milling problems.

R. J. Traill and W. R. McClelland spent a week at the radium extraction plant at Port Hope on problems of plant operation.

T. W. Hardy spent two weeks at the steel plants at Sault Ste. Marie, Welland, and Montreal, on problems relating to the manufacture of alloy steels.

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 valuable metals from the following ores:

Arsenical gold ore from the Tamarac mine, Ymir, B.C. (483).
Gold ore from Cranberry head, Yarmouth, N.S. (484).
Gold ore from the Cochenour-Williams property, Red Lake, Ont. (485).
Gold ore from the Michael-Boyle property, Alden, Algoma district, Ont. (486).
Gold ore from Canadian Minerals, Limited, Morton Lake, Man. (487).
Gold ore from Wine Harbour district, Guysborough county, N.S. (488).
Gold ore from Hunts Gold Mines, Limited, Central Rawdon, N.S. (489).
Gold ore from Beattie mine, Duparquet township, Abitibi county, Que. (490).
Gold ore from Halcrow-Swayze Mines, Limited, Halcrow township, Sudbury district, Ont. (491).
Complex gold ore from Lynx property, Oxford lake, Man. (492).
Mill tailings from Bussieres Mining Company, Limited, Senneterre, Que. (493).
Gold ore from Kootenay Belle mine, Salmo, B.C. (494).
Gold ore from Sullivan Consolidated Mines, Limited, Dubuisson township, Abitibi county, Que. (495).
Gold ore from Young-Davidson property, Matachewan, Ont. (496).
Gold-silver ore from Dentonia Mines Syndicate, Greenwood, B.C. (497).
The precious metal and vanadium content of mineralized rock from Delta Mines Syndicate, near Worthington, Ont. (498).
Arsenical gold ore from Blomfield property, Marmora township, Hastings county, Ont. (499).
Nickel-copper ore from the gersdorffite property, near Worthington, Ont. (500).
Silver-lead ore from Queensborough, Ont. (501).
Lead-zinc ore from Marsouins Mining Company, Limited, Marsouins, Gaspe, Que. (502).
Gold ore from Little Long Lac Gold Mines, Limited, Bankfield, Ont. (503).
Copper-nickel ore from Calumet island, Pontiac county, Que. (504).
Molybdenum ore from Pigeon lake, Gloucester county, N.B. (505).
Gold-copper ore from Columario Gold Mines, Limited, Usk, B.C. (506).

Gold ore from Dyment Mining and Investments, Limited, Swayze-Denyes' gold area, Sudbury district, Ont. (507).
Gold ore and mill tailings from Parkhill Gold Mines, Limited, Wawa, Ont. (508).
Gold-silver-lead-zinc ore from the Yankee Girl mine, Ymir, B.C. (509).
Gold ore from Alcona Gold Mines, Limited, Alcona, Ont. (510).
Gold ore from Canadian Pandora Gold Mines, Limited, Cadillac township, Abitibi county, Que. (511).
Gold ore from Buffalo Ankerite Gold Mines, Limited, South Porcupine, Ont. (512).
Gold ore from Canadian Matachewan Gold Mines, Limited, Matachewan, Ont. (513).
Antimonial-gold-silver ore from Tatlayoco Lake district, B.C. (514).
Magnetic iron ore from Texada island, B.C. (515).
Gold ore from the Guelph mine, Wawa, Ont. (516).
Gold ore from Northern Metals Limited Katrine township, Larder lake, Ont. (517).
Gold ore from Lakeland Gold Mines, Limited, Bourkes, Ont. (518).
Gold ore from Onaman Lake area, Thunder Bay district, Ont. (519).
Gold ore from Norgold Mines, Limited, Bousquet township, Abitibi county, Que. (520).
Gold ore from Casey Summit property, Summit lake, Ont. (521).
Gold ore from Maskwa Gold Mines, Limited, central Manitoba district, Man. (522).
Silver ore from Kozak mine, Goudreau district, Ont. (523).
Mill tailings from Boston-Richardson mine, N.S. (524).
Gold ore from Northern Empire Mines, Limited, near Jellicoe, Ont. (525).
Lead ore from Dominion Mining and Smelting Company, Limited, Godfrey, Ont. (526).
Gold ore from Demara Mines, Limited, Barraute township, Abitibi county, Que. (527).
Gold ore from West Caledonia, N.S. (528).
Gold ore from Kirkland Gold Belt Mines, Limited, King Kirkland, Ont. (529).
Copper-nickel ore from Cuniptau Mines Development Company, Limited, Strathy township, Timagami Forest Reserve, Ont. (530).
Gold ore from Elbow lake, Cranberry Portage, Man. (531).
Gold-copper ore from Chester township, Three Duck area, Sudbury district, Ont. (532).
Gold ore from Chartered Explorers, Limited, Sturgeon lake, Ont. (533).
Gold ore from Home Gold Mining Company, Limited, Yale mining division, B.C. (534).
Gold ore from Bidgood Kirkland Gold Mines, Limited, Kirkland Lake, Ont. (535).
Gold ore from Alcona Gold Mines, Limited, Alcona, Ont. (536).
Copper-gold ore from Ventures, Limited, Opemiska lake, Que. (537).
Gold ore from Gunville claims, near Sherridon, Man. (538).
Gold ore from Meridian Mining Co., Limited, Cambourne, B.C. (539).
Gold ore from Mikado mine, Bag bay, Shoal lake, Lake of the Woods, Ont. (540).
Gold ore from Manley mine, near Duprey, Que. (541).
Gold-bearing flotation concentrates from Vidette Gold Mines, Limited, Vidette lake, B.C. (542).
Gold ore from Sullivan Gold Mines, Limited, Dubuisson township, Abitibi county, Que. (543).

Non-Metallic Minerals. The major investigations carried out by R. K. Carnochan on non-metallic minerals are listed below, in addition to which numerous minor tests were conducted:

The cleaning of broken glass (544).
Concentration tests on garnet rock from lot 25, range B, Joly township, Labelle county, Que. (545).
Concentration tests on garnet rock from lot 10, range I, Joly township, Labelle county, Que. (546).
Concentration tests on barite from Langmuir township, Timiskaming district, Ont. (547).
Laboratory tests on diatomite from Burnaby lake, New Westminster mining division, B.C. (548).

Ferrous Metallurgy. The specific investigations listed below were carried out by T. W. Hardy and H. H. Bleakney, in addition to which a considerable amount of work was undertaken for various Government departments, steel manufacturers, and engineering plants, dealing with such problems as the causes of failure of metal in equipment; the preparation of specifications for improved steel products; studies of the characteristics of the metal in various steel products; the examination of small steel products to determine flaws; the heat treatment of steel products, etc.:

The sintering and metallization of Moose Mountain (Ont.) magnetic iron concentrates (549).
The sintering, metallisation, and briquetting of Texada Island (B.C.) magnetite.

A metallurgical study of certain samples of spring steel for Algoma Steel Corporation, Limited, Sault Ste. Marie, Ont.
Metallurgical characteristics of three car axles for Canadian Pacific Railway Company, Montreal, Que.
A metallurgical study of two nickel steel crank pins for Canadian Pacific Railway Company, Montreal, Que.
A metallurgical examination of two exhaust valves for Aeronautical Division, Department of National Defence, Ottawa, Ont.
Metallurgical characteristics of a carburized pinion gear for Dominion Engineering Company, Limited, Montreal, Que.

R. J. Traill investigated certain problems in connexion with the treatment of the Great Bear Lake pitchblende, such as the production of black oxide of uranium, the content and recovery of rare earths, silver concentration and separation, and examination of the pitchblende and radium products for the presence of thorium. He co-operated with the staff of the Port Hope Radium Refinery on problems of plant operation.

In the radium measuring laboratory, sixty-seven radium measurements were carried out by W. R. McClelland on radioactive ores, concentrates, solutions, and residues. Ninety-nine measurements were made by the alpha electroscope on test products and nineteen mineral specimens from various parts of Canada examined for radioactivity. He also prepared for publication the following report:

Health hazards in the production and handling of radium and report on the precautions taken during a laboratory investigation of the treatment of radium-bearing ores (550).

In the mineragraphic laboratory, 716 polished sections of ores and mill products and 30 thin sections of non-metallic minerals were prepared and examined and 225 spectrographic analyses made. M. H. Haycock prepared eighty-six reports, giving the results of the microscopic examination and spectrographic analysis of the ores and mill products, which are embodied in the reports of investigations.

H. C. Mabee, Chief Chemist, reports 3,699 samples received in the chemical laboratories of the division, on which over 11,000 chemical determinations were made. Of the total number of samples, 70 per cent were of precious metal ores and their test products, 20 per cent of base metal ores and their test products, and 10 per cent in connexion with the investigative work on non-metallic minerals.

FUELS AND FUEL TESTING DIVISION

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

Among the more important investigations conducted were burning efficiency tests on wood, gas, and fuel oil in comparison with anthracite and coke, further sizing and washing tests on Nova Scotia coals, and plant scale coking tests at Vancouver, Brandon, and Ottawa. Laboratory research work on the classification, constitution, beneficiation, storage, 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 again carried out in 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 early part of the year, accompanied by R. A. Strong, he was in Vancouver, British Columbia, where he was engaged in completing the large-scale tests which were carried out in the new gas plant of the British Columbia Electric Company. He also held several conferences with officials of the Montreal Coke and Manu-

facturing Company, and in company with E. S. Malloch examined the pulverized fuel burning boiler plants of the Sherwin-Williams Paint Company and the Toilet Launderies Limited, Montreal, where it was said Dominion (Nova Scotia) coal was being burned successfully. On September 18 and 19 Mr. Haanel attended the annual meeting of the Canadian Gas Association held in Ottawa, at which meeting he presented a paper on the investigations conducted at the Fuel Research Laboratories on the coking of Canadian coals. Towards the end of September, accompanied by Mr. Strong, he attended the meeting of the International Gas Conference and the 18th Annual Convention of the American Gas Association, held in Chicago.

Professors E. A. Smith and G. B. Frost, who had been engaged 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 of 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, supervised and correlated the work of the different sections of the division and devoted considerable time to the preparation of the annual report "Investigations of Fuels and Fuel Testing". He paid special attention to the work and reporting of the results of an "Anthracite and Coke Analysis Survey", and at the annual meeting of the Nova Scotia Mining Society presented a paper reviewing the results of investigations on Sydney coals conducted by technical officers of the laboratories during the past five years. 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 dealing 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". By means of charts prepared at the Fuel Research Laboratories the position in the classification scheme of typical Canadian coals from the different mining areas has been indicated and their relation shown to typical United States coals.

J. H. H. Nicolls, C. B. Mohr, G. P. Connell, and R. J. Young comprised the senior staff of the Solid Fuels Analysis Section. Over one thousand analyses of Canadian coals were selected and tabulated on the "mineral-matter-free" basis, on which the classification charts were prepared. Mr. Connell, who assisted in this coal classification work, also conducted a series of tests on bituminous border line coals, to illustrate the relation of agglomerating and caking index methods employed in the Fuel Research Laboratories to the method used by the United States Bureau of Mines for designating agglutinating index. Mr. Nicolls compared different laboratory methods for testing the friability of coals, and Mr. Mohr examined and reported the available nitrogen content of certain typical Canadian peat deposits.

Purchase of Coal by Specification. A considerable part of the work on coal analyses was on samples submitted by the Department of Pensions and National Health, in connexion with the coal purchases of that department. 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 sever centres throughout the country.

Combustion Engineering Investigations

E. S. Malloch, assisted by C. E. Baltzer and J. R. Kirkconnell, carried on the work of the Mechanical Engineering Section, which consisted of general routine and preparation of memoranda in connexion with the economic use of Canadian fuels in power plants and domestic heating equipment. A study on the effect of insulation on the heating requirements of a house heated by a gas furnace was continued. A series of domestic furnace tests were made, as follows: (a) three tests on Peco (peat briquets); (b) seven tests on wood fuel in co-operation with the Forest Products Laboratories, Department of the Interior; (c) twenty-seven tests on city gas when burned in a conversion type burner. During the year considerable progress was made with the investigation of the grindability of coal—a number of determinations were made by both the F.R.L. and Hardgrove methods. C. E. Baltzer, in addition to representing the division at a committee meeting on oil burners, of the Canadian Engineering Standards Association held in Toronto, made a very complete field survey of boiler furnace refractories, in connexion with which survey he visited four industrial centres in Canada and seven in the United States.

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. Satisfactory 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 three collieries in Sydney area having been examined during the year. This investigation includes small laboratory-scale washing tests to indicate the amenability of the different coals tested, in respect to beneficiation on a commercial scale. A "Lehmann" mill is being installed for separating the "banded constituents" comprised of fusain and bright and dull coal. An experimental coke oven of 500 pounds capacity was built and put into operation, for the purpose of testing specially prepared Canadian coals to determine to what extent they are suitable for use in coke ovens without admixture with imported coals. After necessary alterations to the briquetting installation satisfactory briquettes from Welsh anthracite fines have been made on a full-size plant scale and the plant pronounced ready for testing the comparative values of different binders. A survey was made of the different kinds of coal briquettes marketed in Canada, and the history and development of the briquetting industry in Canada in relation to that in the United States and Europe has been reviewed and recorded.

Petroleum Oils, Bitumen, and Natural Gas

P. V. Rosewarne was in charge of the Oil and Natural Gas section and was assisted by H. McD. Chantler, in the oil laboratory, and by Messrs. W. P. Campbell and R. J. Offord, on natural gas work. The annual gasoline analysis survey was conducted and during the year an analysis survey of typical lubricating oils marketed in central Canada was made. Further samples of natural gas were collected from producing wells in Ontario, on which were carried out the usual fractionation tests, and examination as to helium content. Technical officers of this section are repeatedly called upon in a consulting capacity in connexion with the interpretation and revision of specifications for motor fuels and lubricating oils, and to co-operate with the National Research Council's Associate Committee on Natural Gas and Helium.

A. A. Swinnerton continued work on bitumen from Alberta bituminous sands, with special attention to its amenability for the production of refined asphalt and associated products. In this work, which was conducted in co-operation with the Mineral Resources Division and the Imperial Oil Company, small laboratory-scale refining experiments were supplanted by large-scale runs

in which half ton lots of oxidized asphalt were produced and shipped to commercial firms, for the purpose of determining its industrial application.

Hydrogenation

T. E. Warren, assisted by K. W. Bowles, conducted further hydrogenation tests on Canadian coal, coal tar, and bitumen. A new vertical, high-pressure reaction chamber and accessory equipment was installed and successfully operated. From a standard coal in admixture with coal tar, a yield of nearly 90 per cent of oil suitable for the production of motor fuel has been obtained, and further work will include tests to determine the suitability of different Canadian coals for their direct conversion into oils by the hydrogenation treatment.

Testing and Examination of Explosives

The analysis of explosives submitted by the Explosives Division was continued, and the investigation concerning the permissible limits of acidity in explosives as manufactured and stored was brought to a tentative conclusion, by P. V. Rosewarne and W. P. Campbell. This work, of a consulting and advisory nature, pertained to the testing and examination of explosives, as per Order-in-Council P.C. 2883, February 21, 1931, concerning The Explosives Act.

Routine Chemical Laboratory Work

During the year a total of 1,632 samples of solid, liquid, and gaseous fuels, and explosives, were examined. Of these, 1,233, that is, roughly, 75 per cent, pertained to investigations of the division, the remaining 25 per cent originating outside the division. On the same basis, approximately 12 per cent of the total examined was from other divisions of the Department of Mines, 4 per cent from the Department of Pensions and National Health, 3 per cent from the Departments of Marine and National Defence, and 1 per cent from other departments. From public institutions were received 1 per cent of the total and the remaining 4 per cent from commercial firms and private individuals.

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		666	40·8
	Coals (various kinds)	363		
	Cokes and chars	192		
	Peat and miscellaneous	111		
	Liquid fuels; total number samples		445	27·3
	Gasoline and other motor fuels	296		
	Lubricating oils	104		
	Crude oils	11		
	Other petroleum oils and miscellaneous	34		
	Gases from coals, oil-shales, etc		6	0·4
	Natural gas		116	7·1
2	Samples from other divisions of the Department of Mines—			
	Geological Survey—coals		29	1·8
	Explosives Division (dynamites, fireworks, etc.)		165	10·1
	Other Mines Branch divisions		2	0·1
3	Samples from outside the department:			
	Department Pensions and National Health, coals		63	3·8
	Departments Marine and National Defence, coals and oils		50	3·0
	Other Government departments, coals, etc		11	0·7
	Provincial Governments, coals, etc		3	0·2
	Public institutions		12	0·7
	Commercial firms—coals, oils, and natural gas		37	2·3
	Private individuals—coals, oils, and natural gas		27	1·7
	Total		1,632	100·0

CERAMICS AND ROAD MATERIALS DIVISION

Howells Fréchette, Chief of the Division, reports continuation, with satisfactory progress, of the general investigational work in ceramics and road materials, including a very thorough evaluation of the various physical properties of Canadian-made building bricks, and an investigation of the refractory resources and industry of Canada. He also reports that the services of the division have been sought to a greater extent than usual on technical matters and for special laboratory tests due to the fact that, though the clay products industries have suffered a very severe decline in output (the 1933 production being about 16¼ per cent that of 1929), a number of manufacturers have been taking advantage of the periods during which their plants were idle to conduct experimental work and to improve their manufacturing equipment, so as to be ready with more efficient plants to profit from any revival of business.

In addition to his routine office duties and supervising the investigational work of the division, Mr. Fréchette served on the Associate Committee on Magnesian Products of the National Research Council of Canada. Accompanied by Mr. Phillips, Mr. Fréchette attended the annual meetings of the American Ceramic Society. Mr. Fréchette has been collaborating with a number of American ceramists and physicists on definitions of ceramic terms.

The ceramic officers of the division have in a number of ways furthered the aims of the Canadian Ceramic Society, the purpose of which is to promote ceramic technology in Canada. Three members of the staff attended the annual meeting of the society in Toronto. Mr. Collin gave an address on the Testing of Building Brick and discussed the significance of the various tests. Mr. Phillips prepared a paper on the Outstanding Developments in Ceramics in 1933, which was presented in his absence by Mr. McMahon. Mr. McMahon who for the past two years has been Secretary of the Porcelain Enamel Division was elected chairman of that division, and Mr. Fréchette who has been Vice-President of the society was elected President.

In connexion with the establishment of a brick plant by the Department of National Defence at the Rockcliffe relief labour camp, extensive tests of the clay were made in the Ceramic Laboratories and advice given regarding design of plant, equipment, and operation. Other departments of the Government that have been served were as follows: National Revenue, Customs and Excise Divisions 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; 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 laboratories on several occasions; Pensions and National Health, Engineering Division, tests and advice in connexion with refractories for use in the boiler plants of two hospitals.

Ceramics

Physical Properties of Canadian Bricks. Mr. Collin continued the investigation on the physical properties of Canadian bricks. Transverse and compressive strength tests were conducted on some 1,000 bricks. Absorption and absorption ratios were determined on 1,500 bricks. Ten cycles of freezing and thawing were made on 1,500 half-bricks, and the loss of compressive strength was determined on those that did not fail in the freezing tests.

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

Refractory Industry and Resources of Canada. Mr. McMahon has continued the investigation on the refractory industry and resources of Canada. Con-

siderable time was given in the field and office to problems connected with the destructive action of certain coal ash slags on boiler-house refractories.

White- and Buff-burning Clays of Southern Saskatchewan. Mr. McMahon collaborated with F. H. McLearn of the Geological Survey in the preparation of a report on the Whitemud and Willowbunch series of southern Saskatchewan, which contain clays having characteristics that make them of industrial importance. Mr. McMahon's work dealt with the classification of the clays as to their economic value, the classification being based on observations in the field and on the results of laboratory tests. The report will be published by the Geological Survey in Summary Report 1933, Part B.

Winning of Clays and Shales. In April, 1933, Mr. McMahon presented a paper at the annual meeting of the Canadian Institute of Mining and Metallurgy on the winning of clays and shales, based on his investigation of the methods in use in Canada in connexion with the manufacture of brick and tile. The full report dealing with methods, equipment, and costs has been completed.

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. In some sections of the country there is a persistent demand by architects for face brick of low absorption, and difficulty is experienced by manufacturers, when using certain shales, in meeting the requirements. An investigation of the possibilities of increasing the density of such bricks was assigned to J. G. Phillips. He has attacked the problem along the following lines: (a) the effect of grain sizes; (b) the effect of de-airing; (c) the effect of electrolytes; (d) the effect of low-fusion plastic clay or cheap fluxing materials.

Utilization of Soapstone Waste. As an outgrowth of the work on the bonding of soapstone dust with sodium silicate, additional work was done by Mr. Phillips on the feasibility of forming heavy shapes suitable for use as liners for black-ash furnaces in pulp mills.

Microscopic Examinations. Mr. Phillips carried out considerable microscopic work on raw materials and the products of thermo-chemical reactions in ceramic test pieces and finished products. An important part of this was in connexion with 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.

Tests of Clays, Shales, Etc. In addition to the large amount of clay testing necessary to the investigations above noted there were tested during the year some sixty samples of clay and shale and fourteen miscellaneous minerals submitted from various Canadian sources.

Tests on Structural Assemblies. At the request of the Canadian Ceramic Society, the Canadian Brick Manufacturers Association, and the Structural Clay Tile Association, it was agreed that a series of tests on structural assemblies of bricks and tiles would be undertaken. This work is designed to determine certain factors governing the strength of brick and tile masonry. Preliminary arrangements have been completed and the work will be proceeded with as soon as the samples are delivered.

Road Materials

No field work was conducted on road materials. R. H. Picher was engaged entirely on the testing of samples of road materials and in the writing of a general report on the road gravels of Quebec.

Sixty-four samples of gravel and one sample of rock collected during 1932 were tested to determine their suitability for road purposes. Two samples of gravel and seven samples of rock were tested for the public.

CHEMISTRY DIVISION

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

From April 1, 1933, to March 31, 1934, 1,637 specimens have been reported on.

Complete analyses of 74 samples of limestone, 55 diatomites, 16 waters, 8 whitings, 6 clays, 6 feldspars, 6 marls, 3 peats, 3 brines, 3 alloys, 4 talcs, 2 alkali salts, 2 steels, 1 iron ore, 1 gypsum, 1 silver coil, 1 beryl, 1 glass, 1 seed cleaner, 1 realgar, 1 stibnite, 1 sinter, 1 manganese ore, 1 copper ore, 3 samples of aluminium alloy for alumina and iron content, and 281 samples of mine air were made. Two hundred pounds of mercury were distilled.

Partial analyses of 3 bullions, 4 apatites, 2 bentonites, 2 soapstones, 21 samples of coal ash, 1 bitumen ash, 2 samples of wood ash, 10 barites, 1 china clay, 11 mineral wools, and 35 manganese determinations were made. Identifications of 238 specimens of minerals and ores were made. A report on the analysis of limestones was made.

Solubility tests on 4 samples of whiting and 3 specimens of alloy for analysis and specific gravity were made. Thirty-one determinations were made for radioactivity. Bleaching tests were made on 27 specimens of clay and bentonite.

Four hundred and forty-five furnace assays were made. Quantitative determinations were made as follows: lead 109, copper 22, boron 2, nickel 4, arsenic 19, zinc 43, tin 12, antimony 17, cobalt 2, chromium 1, titanium 1, silica 6, lime 6, iron 15, manganese 18, uranium oxide 1, cobalt 2, aluminium 1, combined water 10, alkalis 2, and sulphur 30.

Considerable work was done on investigating the effect of certain reagents for activating clays for oil clarification purposes. Investigation of the quality of Ile Verte peat for litter and heat insulating purposes, preliminary work on the Industrial Water investigation, the possibilities of the separation of aluminium from beryllium by the organic method, and the investigation on the condition of the silica on diatomaceous earth were carried on.

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, 1934:

Preparing one hundred and eighteen maps, mechanical drawings, charts, and flow-sheets for reproduction.

Preparing eight charts and bringing twelve up-to-date for the Dominion Fuel Board.

Two thousand four hundred and forty-five negatives and prints were made from the Rectigraph machine.

Four hundred and forty-nine negatives, black and white, and blueprints were made from the blueprint machine.

One hundred and twelve halftones and zinc blocks were sent out, received, and filed during the year.

DISTRIBUTION OF PUBLICATIONS

During the fiscal year ending March 31, 1934, the distribution of Mines Branch reports, bulletins, memorandum series, maps, lists of mine operators, etc., amounted to 37,150 copies.

Mimeographed work comprised some 62,500 pages, and 14,000 notification cards were issued.

LIBRARY

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

Accessions to the Library, 1933

Books (by purchase)	231
Books (by gift)	35
Books (by transfer)	14
Books (complete unbound volumes)	335
Books and bulletins added to the circulating divisions	89
Canadian Government documents (by exchange and gift)	1,659
British and Foreign Government documents (by exchange and gift)	966
Scientific societies' bulletins, proceedings, and transactions (by exchange and gift)	1,678
Trades catalogues (by gift)	319
Periodicals and continuations subscribed for	270
Annuals, continuations, and periodicals (by gift)	557

Two hundred and seventy-two volumes were bound.

EXPLOSIVES DIVISION

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

Factories

One factory, licensed for the manufacture of fulminate of mercury, was not brought into operation during the year, and the licence was not renewed for the year 1934. With this exception the factories under licence and in operation remained as in the previous year. The production of the explosives factories proper, as distinct from the fireworks factories, showed a marked recovery from the low level reached in 1932, an increase of 11 per cent having been recorded for 1933. This increase is attributable chiefly to the revival in mining activity. On the other hand the output of fireworks, as might be expected in the case of a luxury product, remained below normal.

The history of manufacture of explosives for the year was sadly marked by a disastrous explosion which occurred at the Belœil factory of the Canadian Industries, Limited, on July 19 and took the lives of three men. There were actually two explosions, separated by an interval of three minutes, in one building—a nitrating house. The first explosion was that of the charge in the "prewash" tank, which wrecked the building, killed the three men in it, and practically destroyed the barricades. The nitrator itself, in which the next charge was being nitrated, crashed from the top floor to the ground level where, three minutes later, the charge exploded. The effect of this explosion, in so far as regards the projection of debris, was greater than that of the first, since, at this time, but little was left of the protective barricades. The circumstances of this accident are discussed in the Annual Report of the Division.

In another licensed factory an employee was injured by burns received when destroying refuse from danger building at the factory burning-out ground.

A fatality also occurred in the course of the experimental manufacture, not in a licensed factory, of a chlorate explosive when, according to the account of a surviving assistant who suffered burns, the victim had used an iron or steel tool to straighten a bent nail, so accidently igniting the explosive mixture by a spark, and himself sustained severe burns from which he succumbed.

Inspectors of the division made twenty-six visits of inspection to licensed factories and one other was made by a deputy inspector of the Royal Canadian Mounted Police.

Magazines

There were 330 magazines under licence on March 31, 1934, an increase of 3, and in addition 180 licences were issued during the year covering the operations of temporary magazines. this being 9 fewer than during the previous year.

Nineteen magazines were forcibly entered, including two on two separate occasions and one on three occasions. The total quantity of explosives stolen amounted to approximately 1,650 pounds of dynamite and 6,000 detonators, as well as 30 quarts of nitroglycerine and 6,000 feet of safety fuse. In one case the theft was traced and two men were prosecuted by provincial authorities on a charge under the Criminal Code of breaking and entering. They were sentenced to terms of two and five years imprisonment.

Inspectors of the division made 361 inspections of magazines and 251 were made by Deputy Inspectors of Explosives of the Royal Canadian Mounted Police. In the course of these inspections 3,250 pounds of dynamite, which had deteriorated, was condemned and destroyed, with the exception of one large lot

of 1,350 pounds which was held awaiting favourable conditions in the spring. Recourse had to be had to prosecution in only one case of violation of the regulations, a magazine owner being convicted on a charge of operating a magazine without a licence.

Unlicensed Premises

The term "unlicensed premises" is used in reference to all places where explosives are kept for sale or use in smaller quantities than necessitate the provision of licensed magazines, and includes also the numerous stores in which sporting cartridges are retailed. Inspectors of the division made 680 visits of inspection to these, and over 2,600 were made by the Royal Canadian Mounted Police. Forty-six pounds of dynamite found in two places in unserviceable condition was destroyed. Eight cases of theft from the detached stores of users of explosives were reported, involving, in all, a loss of 500 pounds of dynamite and 300 detonators. The regulations relating to the storage of explosives and the keeping of records were generally well known and observed by dealers. Casual users of explosives are not so well informed, and considerable attention was given to the matter of their instruction in the safe keeping of their explosives.

Importations

The importations of explosives for commercial use are relatively very small, but considerable quantities of explosives are imported for use in explosives factories, and of nitrocotton for use in lacquer manufacture. The importation of these explosives and of manufactured fireworks, the bulk of which were Chinese fireworks, was effected under 462 permits and 34 special permits.

Authorization of Explosives

One new high explosive was authorized and minor changes were approved in 17 others after examination. Authorization was given also to 98 new varieties of fireworks and refused in the case of 6 others.

Accidents

Accidents in the course of conveyance are rare, but the most calamitous of all explosive accidents during the year was one that occurred while about fifty dynamite cartridges, some primed, also a few detonators, were being transported in a boat carrying a party of thirteen lumbermen across a lake from camp to place of work. An explosion occurred when, according to a statement by one of the survivors, a detonator had been dropped to the bottom of the boat. Seven lives were lost, and whether the immediate cause of the explosion was as stated or not, the primary fault lay in the conveyance of explosives—and these exposed since the preparation of charges had been in progress en route—in a boat loaded with passengers.

The number of casualties due to accidents in the use of explosives during the year 1933 showed a decrease amounting to nineteen killed and ninety injured, but still included many that must be regarded as arising from failure to observe well established precautions. These are discussed in the Annual Report of the Division. Playing with explosives accounted for injury to forty-three persons, the victims being nearly all boys. Miscellaneous accidents not associated with the use of explosives, nor occurring under circumstances that could be regarded as playing with explosives, were accountable for the death of four persons and injury to six others.

EDITORIAL DIVISION

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

F. J. Nicolas, Editor-in-Chief, having reached the age of retirement, was superannuated on November 1.

During the fiscal year thirty-one separate English publications were issued by the department consisting of annual reports, memoirs, bulletins, and pamphlets; there was issued, also, one list of mine operators and mines. Nine 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, one English report of the National Museum, four English reports and one French translation of the Mines Branch, and one English report of the Explosives Division. In addition to the reports translated and published in French, a large number of museum labels, letters, papers, and radio talks 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 distributed[1] during that period:

DEPARTMENT OF MINES

English Publications

Report No.

2338. *Report of the Department of Mines for the Fiscal Year ending March 31, 1933:* 43 pages; 1,500 copies; published September 28, 1933.

French Translations

2334. *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars, 1932:* 31 pages; 800 copies; published October 10, 1933.

2342. *Rapport du Ministère des Mines pour l'année financière se terminant au 31 mars 1933:* 27 pages; 800 copies; published January 30, 1934.

GEOLOGICAL SURVEY

English Publications

2128. Economic Geology Series No. 5. *Oil and Gas in Western Canada* (revised edition)—by G. S. Hume: 359 pages; 26 figures; 3,000 copies; published January 29, 1934.

2309. Economic Geology Series No. 10. *Gold Occurrences in Canada* (second edition 1933)—by H. C. Cooke and W. A. Johnston: 71 pages; 9 figures; 3,000 copies; published September 1, 1933.

2329. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1932, Part B:* 107 pages; 3 plates; 14 figures; 2,000 copies; published May 8, 1933.

2330. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1932, Part D:* 81 pages; 1 plate; 8 figures; 2,500 copies; published May 13, 1933.

Separate. *Michipicoten River Area, Ontario*—by A. F. Matheson: 21 pages; 100 copies; published July 3, 1933.

2331. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1932, Part A I:* 151 pages; 4 figures; 2,500 copies; published May 19, 1933.

2332. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1932, Part C:* 127 pages; 4 plates; 11 figures; 1 map; 2,500 copies; published May 30, 1933.

2333. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1932, Part A II:* 197 pages; 4 plates; 18 figures; 1 map; 2,500 copies; published June 7, 1933.

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

GEOLOGICAL SURVEY *(Continued)*

English Publications

Report No.

Separate. *Brisco-Dogtooth Map-area, B.C.*—by C. S. Evans: 71 pages; 3 plates; 13 figures; 1 map; 200 copies; published June 23, 1933.

2347. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1933, Part C:* 44 pages; 1 map; 2,000 copies; published March 27, 1934.
List of Publications of the Geological Survey and National Museum of Canada: 42 pages; 1,000 copies; published November 28, 1933.
List of Prices for Publications for Distribution in Foreign Countries: 42 pages; 500 copies; published December 12, 1933.

French Translations

2339. *Rapport sommaire de la Commission géologique, Ministère des Mines pour l'année civile 1932, Partie D* (extraits): 48 pages; 1 plate; 5 figures; 1,250 copies; published December 5, 1933.

2340. Série de la géologie appliquée n° 7. *La Prospection au Canada:* 321 pages; 23 plates; 25 figures; 1,000 copies; published March 16, 1934.
Liste des publications françaises, Ministère des Mines: 14 pages; 1,200 copies; published March 31, 1934.

NATIONAL MUSEUM OF CANADA

English Publication

Bulletin 71. *Annual Report for 1932:* 25 pages; 2,000 copies; published September 15, 1933.

MINES BRANCH

English Publications

725. *Investigations in Fuels and Fuel Testing, 1930-31:* 166 pages; 3 plates; 17 figures; 1 table; 3 charts; 3,300 copies; published April 28, 1933.

725–3. Separate. *British Columbia Coals and Boiler Trials*—by E. S. Malloch, B. F. Haanel, and C. E. Baltzer: 50 pages; 1 plate; 1 table; 4 charts; 500 copies; published June 5, 1933.

725–4. Separate. *Analyses of Solid Fuels*—by J. H. H. Nicolls and C. B. Mohr: 40 pages; 500 copies; published May 27, 1933.

725–5. Separate. *Natural Gas and Liquid Fuels*—by P. V. Rosewarne, T. E. Warren, W. P. Campbell, and R. J. Offord: 70 pages; 2 plates; 17 figures; 500 copies; published June 7, 1933.

726. *Investigations in Ceramics and Road Materials 1930-31:* 175 pages; 1 plate; 28 figures; 3,000 copies; published June 19, 1933.

733. *Canadian Limestones for Building Purposes*—by M. F. Goudge: 196 pages; 40 plates; 11 figures; 6 tables; 4,000 copies; published May 16, 1933.

734. *Gold in Canada*—by A. H. A. Robinson: 92 pages; 8 figures; 31 tables; 5,000 copies; published August 21, 1933.

735. *Investigations of Mineral Resources and the Mining Industry, 1932:* 31 pages; 1 plate; 5 figures; 3,000 copies; published January 26, 1934.

737–1. *Method of Rating of Grindability or Pulverizability of Coal.* (Advance Section of Investigations of Fuels and Fuel Testing, 1932): 17 pages; 1 plate; 500 copies; published May 13, 1933.

737–2. *Laboratory Test on Coals, for Predicting the Physical Properties of the Resultant By-Product Cokes.* (Advance Section of Investigations of Fuels and Fuel Testing, 1932): 24 pages; 2 plates; 1 figure; 1 table; 8 charts; 500 copies; published September 18, 1933.

737–3. *Report of Experimental Work on the Hydrogenation of Canadian Coal, Coal Tar, and Bitumen for the Production of Motor Fuel.* (Advance Section of Investigations of Fuels and Fuel Testing, 1932): 31 pages; 4 plates; 2 figures; 500 copies; published November 16, 1933.

737–4. *A Study of the Natural Gas and Naphtha Products from Twenty-Four Wells in Turner Valley, Alta.* (Advance Section of Investigations of Fuels and Fuel Testing, 1932): 22 pages; 5 figures; 500 copies; published November 7, 1933.

737–5. *Anthracite and Coke Analysis.* (Advance Section of Investigations of Fuels and Fuel Testing, 1932): 13 pages; 1,000 copies; published November 28, 1933.

738. *Mineral Industries of Canada*—by A. H. A. Robinson: 116 pages; 34 plates; 1 map; 6,500 copies; published March 28, 1934.

MINES BRANCH *(Concluded)*

English Publications

Report No.

Lists of Mines and Mine Operators in Canada:
Gold: 4,000 copies; published August 18, 1933.

French Translations

708. *Amiante chrysotile au Canada*—by J. G. Ross: 160 pages; 34 plates; 8 figures; 6 charts; 1,500 copies; published June 26, 1933.

739. *Les Industries minérales du Canada*—by A. H. A. Robinson: 129 pages; 34 plates; 1 map; 1,500 copies; published March 31, 1934.

DOMINION FUEL BOARD

English Publications

15. *The Insulation of New and Old Houses*—by G. D. Mallory: 73 pages; 1 plate; 32 figures; 20,000 copies; published April 10, 1933.
Fuels Distributed for Domestic Heating, Quebec, Ontario, Manitoba, Calendar Years 1928-1932: 4 pages; 6,000 copies; published February 3, 1934.

French Translation

16. *Isolation calorifuge des nouvelles et des vieilles Maisons*—G. D. Mallory: 74 pages; 1 plate; 32 figures; 3,000 copies; published December 2, 1933.

EXPLOSIVES DIVISION

English Publication

33. *Annual Report of the Explosives Division for the Calendar Year 1932:* 21 pages; 1,800 copies; published April 20, 1933.

French Translation

34. *Rapport annuel de la Division des Explosifs pour l'année civile 1932:* 22 pages; 300 copies; published June 19, 1933.

DISTRIBUTION OF FRENCH PUBLICATIONS

The French publications of the Department of Mines, including those of the Geological Survey, the National Museum, the Mines Branch, and the Explosives Division, are distributed by the Editorial Division under the supervision of P. E. Lévesque, in charge of the Translation Office. During the fiscal year 1933-34, 10,315 copies were distributed in Canada and foreign countries, as follows: 1,830 copies to addresses on the mailing lists, through the Printing Bureau Distribution Office, and 8,485 copies from this office in compliance with written or personal requests. During the preceding fiscal year 3,675 reports were distributed —a comparison that gives some idea of the increased demand 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, 1934, were:

—	Grant	Expenditure	Grant not used
	$ cts.	$ cts.	$ cts.
CIVIL GOVERNMENT—			
Salaries—			
Administrative and Explosives Division	66,654 00	65,136 07	1,517 93
Mines Branch	194,490 00	191,907 12	2,582 88
Geological Survey	262,098 00	256,320 39	5,777 61
	523,242 00	513,363 58	9,878 42
Contingencies	20,000 00	10,781 35	9,218 65
DEPARTMENT—			
For administration of the Explosives Act, etc	10,000 00	6,003 74	3,996 26
MINES BRANCH—			
For investigation of mineral resources, etc	215,000 00		
Salaries and wages		138,817 48	
Ore Dressing and Metallurgical Division		16,746 56	
Fuels and Fuel Testing Division		10,239 01	
Mineral Resources Division		5,361 93	
Ceramics and Road Materials Division		2,264 37	
Chemical Division		2,213 37	
Mechanical Section		3,186 70	
Administrative Division		994 76	
Dominion Fuel Board		2,175 44	
		181,999 62	33,000 38
For publications, English and French, etc	35,000 00		
Publication of reports, maps, etc		15,881 39	
Salaries and wages		3,342 00	
Printing, stationery, typewriters, etc		2,241 25	
Library		3,176 52	
Miscellaneous		482 98	
		25,124 14	9,875 86
GEOLOGICAL SURVEY—			
For explorations, surveys, and investigations, etc	127,500 00		
Explorations, surveys, and investigations		41,137 55	
Salaries and wages		32,745 30	
Equipment and supplies		2,644 35	
Miscellaneous		810 30	
Photographic work		80 95	
		77,418 45	50,081 55
For publication of English and French editions, etc	50,000 00		
Printing reports, etc		15,054 71	
Engraving services		12,960 00	
Printing of maps, etc		3,384 35	
Salaries and wages		6,634 35	
		38,033 41	11,966 59

STATEMENT—*Continued*

—	Grant	Expenditure	Grant not used
	$ cts.	$ cts.	$ cts.
For maintenance of offices and museum, etc.	42,500 00		
Salaries and wages		18,913 09	
Stationery, printing, typewriters, etc.		7,026 81	
Library		4,167 45	
Instruments and repairs		569 21	
Miscellaneous		5,688 49	
Photographic Division		1,425 16	
Chemicals and drugs		340 22	
Postage		660 26	
B. C. Office		253 73	
		39,044 42	3,455 58
For museum equipment	8,000 00		
Salaries and wages		3,002 59	
New equipment and material		939 15	
Maintenance		673 63	
		4,615 37	3,384 63
For purchase of specimens	1,000 00	202 03	797 97

Summary

Civil Government salaries	523,242 60	513,363 58	9,878 42
Civil Government contingencies	20,000 00	10,781 35	9,218 65
Department	10,000 00	6,003 74	3,996 26
Mines Branch	250,000 00	207,123 76	42,876 24
Geological Survey	229,000 00	159,313 68	69,686 32
	1,032,242 00	896,586 11	135,655 89

Grants and Miscellaneous Statutory Expenditure

MISCELLANEOUS—		
For payments in connexion with movements of coal, etc.	$2,750,000 00	
Subventions		$ 2,735,684 01
Salaries and wages		10,235 24
Miscellaneous administrative expense		4,080 75
		2,750,000 00
Grant to Imperial Institute	9,733 33	9,733 33
MISCELLANEOUS (STATUTES)—		
Domestic Fuel Act (1927) payments		21,787 18
Salary Deduction (Continuance) Act (1933)		1,761 31
Miscellaneous gratuities		1,060 00

STATEMENT—*Concluded*

DETAILS OF REVENUE

Revenue for the Department of Mines for the Fiscal Year Ending March 31, 1934

	$ cts.	$ cts.	$ cts.
Casual Revenue—			
DEPARTMENT—			
Sale of French publications	.....	382 77	
EXPLOSIVES DIVISION—			
Sale of explosives permits, etc.	1,703 60		
Sale of equipment	200 00	1,903 60	
GEOLOGICAL SURVEY—			
Sale of publications	1,955 53		
Sale of minerals	1,162 98		
Sale of equipment	247 30		
Sale of relief models	56 00		
Miscellaneous revenue	102 70		
		3,524 51	
MINES BRANCH—			
Assays and analysis	737 38		
Sale of equipment	137 17		
Sale of publications	389 79		
Miscellaneous revenue	369 99		
		1,634 33	
DOMINION FUEL BOARD—			
Sale of publications	.....	327 25	
			7,772 46
Premium Discount and Exchange—			
Premium on U.S. money orders, etc., Geological Survey	10 68		
" " " Mines Branch	1 38		
" " " Dominion Fuel Board	6 22		
		18 28	18 28
			7,790 74

Miscellaneous Revenue

Casual Revenue—	
DOMINION FUEL BOARD—	
Subvention refunds	$ 10,766 09