

CANADA
DEPARTMENT OF MINES
HON. CHARLES STEWART, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

NATIONAL MUSEUM OF CANADA
W. H. COLLINS, ACTING DIRECTOR

BULLETIN No. 50

Annual Report for 1926

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OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1928

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GENERAL ACTIVITIES OF THE MUSEUM

By W. H. Collins

Until 1916 the Geological Survey of Canada, of which the present National Museum was then a part, published an annual Summary Report in one volume. These reports consisted of the Director's administrative report to the Government, followed by reports of officers of the Survey dealing with investigations of more than ordinary economic or scientific interest. The administrative part contained an account of the field work, accession of specimens, and all other Museum activities and the special technical reports included some on Museum subjects.

These Summary Reports increased in size with the growth of the Survey until those issued between 1910 and 1916 were volumes of from 400 to 500 pages. They required a long time for publication and an unusually large edition was required, since no provision existed for issuing separates of their constituent articles. Hence, under the accentuated need for economy during the war period, it was decided in 1917 to issue the Summary in parts, Part A containing the administrative report and the other parts containing the special reports of field officers grouped according to the main geographical divisions of Canada. For some less apparent reason, perhaps because Museum activities were brought nearly to a standstill during the latter years of the war, special articles on Museum subjects ceased to appear in the subdivided Summary Reports.

In 1920 anthropological and biological work was separated from the Geological Survey and placed under a Director of the Victoria Memorial Museum, and there were numerous other changes in the personnel of the Department of Mines. One consequence was that an annual administrative report for the whole department was inaugurated in 1921 to take the place of the separate administrative reports by the Geological Survey and the Mines Branch.

Since 1921 the only periodical account of the Museum activities of the Survey and Museum has been a statement in the annual administrative report of the department, which dealt briefly with both business and scientific affairs. This arrangement had some disadvantages. As the annual administrative report is essentially a business report intended for the information of the Government, matters of scientific character may be treated only in the barest outline and, even then, are not likely to come to the attention of fellow scientists in other institutions. The present volume represents an endeavour to remedy this condition by providing the National Museum with an annual report of its own corresponding to the annual Summary Report of the Geological Survey and to contain the kind of information about the Museum which used to be included in the Summary Reports of the Survey before 1917. It is intended to issue a volume each year which will acquaint fellow workers in other Museums and scientific institutions and the interested individuals with what is being accomplished by the National Museum of Canada. For information about business affairs readers are referred to the annual reports of the Department of Mines.

Accounts of the work of the divisions of anthropology, biology, mineralogy, and palaeontology are given in following sections written by the heads of these divisions. No special reports are given for geology and geography, although Museum work is being carried on in both these subjects by the Geological Survey. Field operations are carried on by a large number of parties, the results of which are described in the various publications of the Survey. The most important exhibition work being carried on in geology is the preparation of displays of the principal ores and economic minerals, and their industrial products. Fairly complete exhibits of this kind have been prepared for coal, petroleum, asbestos, talc, magnesite, and clays, during the last year, and similar exhibits of gold, silver, copper, nickel, lead and zinc, graphite, and gypsum are being rearranged. Geographical exhibits, up to the present, have been confined to maps, relief models, and photographs. A large collection of photographs of Canadian examples of physiographic forms, selected from photographs taken by the Geological Survey and by other Government organizations, has been made and provision has been made to supply prints, enlargements, or lantern slides of these at cost to universities, schools, and other educational institutions in Canada or other countries. A large number of requests for these have been received and satisfied during 1926.

MUSEUM LECTURES

In 1912 a course of lectures in natural history was begun by Mr. H. I. Smith, mainly for the benefit of the school children of Ottawa. At first the lectures were held at any convenient time in a vacant room on the top floor of the Museum. Planks supported on boxes were used for seats. Later some seats were installed in the lecture hall and it was used until February, 1916, when the parliament buildings were burned and the Museum was used temporarily for legislative purposes. During this time the Museum lectures were held in schools and other buildings.

On restoration of the Museum building to its original purpose, the lecture hall was thoroughly equipped with seats, projection lantern, moving picture projector, and other facilities and the lecture courses have been held in it since 1920. Use of the lecture hall is also given free of charge to learned societies and other organizations for holding conventions, lectures, and demonstrations of scientific or cultural character. The hall seats about 250 on the ground floor and an equal number in the gallery.

A Museum lecture committee consisting of D. B. Dowling, M. Y. Williams, and H. I. Smith (chairman) was appointed in 1921 by the late Director of the Museum, Dr. William McInnes, to arrange and conduct the course. This committee, now consisting of Mr. Smith, M. E. Wilson, and C. L. Patch, arranges a series of lectures each year extending from November until April. A lecture is given each Saturday morning at 10 o'clock to children and is repeated in somewhat modified form on the following Wednesday evening for the benefit of adults. At first the lecturers were secured entirely from the Museum and Survey, but during the last two or three years an increasing proportion has been obtained from other Government departments. The lectures are illustrated with lantern slides and moving pictures. Those on Saturday morning are attended by about 1,000 children, so that they have to be repeated, the first lecture commencing at 10 o'clock and the second at 11 o'clock.

During the series for 1926-27 the total attendance of children was 11,650 and of adults 2,695, as compared with 12,350 and 2,303 the year before. Following is the program delivered:

- A Visit to the Stars, by R. M. Motherwell, November 13 and November 17, 1926.
 Canada's Forest Wealth, by Roland D. Craig, November 20 and November 24, 1926.
 Iron in the Lake Superior Region, by T. L. Tanton, November 27 and December 1, 1926.
 The Story of Our Migratory Birds, by Hoyes Lloyd, December 4 and December 8, 1926.
 A Pinch of Salt, by L. H. Cole, December 11 and December 15, 1926.
 Who Are the Indians, by D. Jenness, December 18 and December 22, 1926.
 The Age of Reptiles, by C. M. Sternberg, January 8 and January 12, 1927.
 A Piece of Coal, by B. R. MacKay, January 15 and January 19, 1927.
 What Are Snakes Good For, by Clyde L. Patch, January 22 and January 26, 1927.
 The Story of Good Seed, by F. T. Wahlen, January 29 and February 2, 1927.
 Petroleum and Natural Gas, Their Origin, and World Distribution, by G. S. Hume, February 5 and February 9, 1927.
 Small Friends and Foes, by L. S. McLaine, February 12 and February 16, 1927.
 Five Weeks in Sunny Spain, by M. E. Wilson, February 19 and February 23, 1927.
 Fish Culture, by J. A. Rodd, February 26 and March 2, 1927.
 The Fruit Industry of Canada, by A. Fulton, March 5, 1927.
 The Fruit Industry of Canada, by M. B. Davis, March 9, 1927.
 A Naturalist in Baffin Island, by Richard Finnie, March 12, 1927.
 A Naturalist in Baffin Island, by J. Dewey Soper, March 16, 1927.

CONVERSAZIONI

The Museum building, with its well-equipped lecture hall, growing natural history exhibits, and facilities for entertainment provided by the large staffs of the Geological Survey and Museum and Mines Branch, is being used more and more for scientific conventions and other gatherings and conversazioni are becoming a popular form of entertainment. During 1926, the increasing desire of the technical services of the Government to learn as much as possible of the special activities of the different scientific Federal departments led the Professional Institute of the Civil Service of Canada (the organization representative of the technical service), to hold a conversazione in the Museum on the night of April 14. The Museum was decorated for the occasion with flags, shields, and bunting, by the Public Works Department, and numerous special exhibits complementary to those on permanent view were prepared by officers of the Department of Mines. To facilitate the inspection of exhibits a program was issued giving a plan of the Museum with a suggested route of inspection and a list of special exhibits to be seen. Following the reception in the Museum Lecture Hall by the Honourable Minister of Mines and Mrs. Charles Stewart, the guests, numbering over eight hundred and including many members of both Houses of Parliament and their wives, were conducted on simultaneous tours through each of the four floors of the Museum including the galleries, departmental offices, library, and preparatory rooms, about one hundred officers of the Department of Mines being engaged in either escorting the guests or explaining the exhibits.

An interesting and unique exhibit of over thirty of the most characteristic, striking, and beautiful plants and wild flowers of the Yukon, mounted against water-coloured backgrounds, was contributed by Mrs. George Black, F.R.G.S., wife of the Member of Parliament for the Yukon.

Refreshments were served at 10.30, after which there were music, singing, and dancing, in the Anthropological Halls, and a program of educational departmental moving pictures in the lecture hall.

A second conversazione for the Professional Institute was held on the evening of March 23, 1927. It was an even more noteworthy and elaborate display of Canada's wealth in resources and natural history. The various branches of the Civil Service dealing in natural resources collaborated with those of the Department of Mines, under whose auspices it was held, in the presentation of special exhibits and every inch of the available exhibit space in the halls and corridors of the four floors of the Museum was taxed to accommodate the display. The Department of the Interior was represented by five branches, including Natural Resources, Forestry, Parks, Water Powers, and North West Territories and Yukon. The Department of Agriculture was represented by the Entomological Branch and the Experimental Farm Branch; the Department of Marine and Fisheries by the Fisheries Branch, which made a unique exhibit of fish hatching; and the Department of Mines by the Geological Survey, Mines Branch, and National Museum of Canada. Mural decorations in flags, shields, and bunting, and a beautiful display of potted foliage, were supplied by the Department of Public Works. Two special exhibits of mounted flowers, including wild flowers of the Yukon and of Vancouver island, were contributed by Mrs. George Black, wife of the member of the Yukon, and Mrs. A. E. Planta, wife of Senator Planta of Nanaimo.

Refreshments were served in the Anthropological Halls at 10.30 p.m., after which moving pictures illustrative of Canada's natural resources in wild life, timber, mines, agriculture, and national parks were shown in the lecture hall and music and dancing took place in the Anthropological Halls.

As there was a general desire expressed after the conversazione in 1926 that the public should have an opportunity to inspect the exhibits, the exhibits remained on view until the following Sunday afternoon, departmental officers being on hand during the mornings, afternoons, and evenings to explain the exhibits and answer any questions. The moving picture program was also repeated on Thursday, Friday, and Saturday evenings, and Saturday morning. Special invitations were extended to the teachers and pupils of the various schools, convents, collegiates, and colleges of the city, and to nurses of the local hospitals, to visit the Museum at stated periods. It is estimated that approximately 11,500 people viewed the exhibits during the week, this number including over 4,000 school pupils under the guidance of their teachers.

Entertainment of similar value was provided on the occasion of the Forty-fourth meeting of the American Ornithologists' Union at Ottawa on October 12-14, 1926, a description of which is given in the section of this volume devoted to the work of the division of biology.

DONATIONS

Individual acknowledgment is made in other parts of this volume for donations of specimens and other materials to the Museum, but special mention should be made of a munificent gift of paintings from Messrs. William Southam and Sons, the proprietors of newspapers in various Canadian cities. They purchased a collection of over forty paintings of Indians and Indian surroundings on the Pacific coast of British Columbia, painted by W. Langdon Kihn, a young American artist who has devoted himself to this particular field for the last three or four years. This collection was divided by the purchasers among some half dozen public institutions in

various parts of Canada, six fine paintings being given to the National Museum. These paintings are hung on the walls of the Anthropological halls, and serve admirably to explain and supplement the specimens in the cases.

DIVISION OF ANTHROPOLOGY

D. Jenness, Chief of the Division, reports as follows:

The Division of Anthropology is organized at the present time to carry out researches in ethnology and archæology. The composition of the staff is given in a later article on the National Museum of Canada. The study of the physical characteristics of the aborigines of Canada has been practically neglected since 1921, when Sir Francis H. S. Knowles resigned from the position of physical anthropologist on account of ill-health. The Chief of the Division has attempted a few researches along this line in the course of his ethnological and archæological work, but a successor to Sir Francis Knowles is needed.

The division also needs an assistant ethnologist to prosecute field work among the Indians of eastern Canada, that was formerly carried on by F. W. Waugh, who disappeared mysteriously near Montreal in the autumn of 1924 when returning from a field trip.

The ethnological and archæological collections of the division have increased greatly during the last five years, necessitating a corresponding increase in storage facilities. Approximately 4,000 new specimens were cleaned, repaired in certain cases, catalogued, and stored away by the preparator during the fiscal year 1926-1927; an even greater number remain still unpacked, awaiting the construction of new storage cabinets. The new storage quarters on Frank street are in full use; though greatly superior to the old quarters on Wellington street, now finally abandoned, they are much less convenient than rooms in the Museum itself would be if accommodation were available. The Frank Street quarters, indeed, can house only those specimens that are least perishable and least often required, since the building is not heated during the winter months.

The policy of monthly inspections of all specimens in storage has been continued, and a printed "Monthly Inspection" form is attached to each case to enable its history to be read at a glance, thereby facilitating the closer observation of objects peculiarly liable to deterioration or destruction. It is a pleasure to record that no specimens were lost through the depredations of insects.

During the past year a selection of specimens of French-Canadian wood carving and other crafts was made for the Toronto Art Gallery; a special exhibit of specimens of French-Canadian hand-made pottery was sent to the Canadian Handicrafts Guild for exhibition at Montreal; and some specimens of French-Canadian homespun were exhibited temporarily in the Museum itself. About three hundred and fifty specimens from various Indian tribes have been selected from the storage cases for the festival of the Oblate Order at Joliette, Quebec, during the coming summer, and nine of the best examples of British Columbia native carvings were lent to the National Gallery for exhibition at Paris, France, with the Wembley collection of Canadian paintings.

So many specimens are lent each year to teachers from the Normal School that small collections have been set aside expressly to meet the

demand. Since most of the teachers have little or no knowledge of the specimens they borrow, the preparator furnishes the necessary instruction.

The Coast Salish and Bella Coola cases in the west exhibition hall were entirely revised during the summer, and the space given to these tribes appreciably increased. Labels accompany all specimens, and use is made also of maps and case labels. The division is deeply indebted to the Messrs. Southam, the well-known publishers, for the donation of six valuable pictures of British Columbia subjects, painted by W. Langdon Kihn; five of them now hang in the east exhibition hall, where they have attracted much favourable attention.

The creation of a series of habitat groups is under consideration, and the preparator has been instructed to design a model of a group, illustrating a scene from the Plains' Indian area, that could be erected in the east exhibition hall. Already he has made considerable progress with the model, although the manifold routine duties that attach to his position seriously interfere with this and other technical work that would vastly improve the exhibits. In fact, the specimens under his care have so greatly increased in number, and their use is becoming so extended, that the work they entail is beyond the capacity of any single man and the help of a permanent assistant is sorely needed. It is of interest to note that the preparator has introduced an electrolytic method of treating iron specimens that are coated with rust. It has proved so satisfactory that a short description was sent to "Popular Science Monthly," which will publish it in the near future.

Mr. O. E. Prud'homme has made drawings during the past year of a large number of Eskimo specimens for a future report by Mr. Jenness. He also prepared a map for Professor McIlwraith's report on the Bella Coola Indians, and made the drawing of Eskimo harpoons incorporated in this annual report of the division.

During the winter Dr. F. G. Speck, Professor of Anthropology in the University of Pennsylvania, paid a visit to the Museum to study the collections gathered by himself and others among the North-Eastern Algonkian tribes.

Professor Leonard Bloomfield, State University of Ohio, who was engaged by the Museum in 1925 to carry out some researches on the Cree reserves of Saskatchewan and Manitoba, has presented 1,536 pages of his final report, which he will complete in the near future. Miss Helen H. Roberts, Yale University, who was engaged to transcribe and draft the music of a collection of Nootka Indian songs recorded on the phonograph by Dr. Sapir, completed her work and sent in the manuscript, which has been forwarded to Dr. Sapir, University of Chicago, that he may add his translations of the songs and prepare a full report for possible publication.

The photographic collections of the division were transferred during the winter to the Library for inclusion in a central collection that will illustrate every phase of the department's activities and be available to all students.

Field Work

Four parties were sent into the field during the summer of 1926, one to Alaska, two to British Columbia, and one to Ontario. Details of some of the work accomplished, and the results achieved, will appear

in the scientific monographs to be prepared by its various officers. Preliminary statements are given below, and more extended accounts of two parties will be found at the conclusion of this report.

Mr. D. Jenness spent the summer in Bering strait, where he excavated some of the ancient ruins in order to determine their relation to similar ruins in Arctic Canada, and thereby throw light on the early history and migrations of the Canadian Eskimos. He also studied several Eskimo dialects in that region for comparison with the dialects spoken in the Canadian Arctic.

H. I. Smith left in May for Kitwanga, on Skeena river, B.C., to continue direction of the interdepartmental work on the conservation of totem-poles along the line of the Canadian National railways. During such leisure as he could obtain from this work he investigated the archaeology and material culture of the Gitksan and Carrier Indians of the neighbourhood, returning to Ottawa in October.

C. M. Barbeau was engaged in field work among the Tsimshian of Skeena river from June until the end of September. He obtained full records of the social organization, territories, privileges, and traditions of three tribes, the Gilarhdzauks and Gitrhtzaih of Gitsalas, and the Gitsemgalem. Studies were made also of the territories, and the traditions of war and migrations, of three other tribes, the Gitsees, the Gitwilgyauts, and Gitzarhlehl, whose culture in other respects had been investigated previously. The two ancient village sites of Gilarhdzauks and Gitrhtsaih, at the canyon, were explored and partly cleared for the eventual restoration of their totem-poles and large communal houses. This year's investigation practically completes the ethnographic study of the Tsimshian proper and of the Gitksan on the Skeena, which was begun in 1915 and continued subsequently in the course of five explorations. Full reports will be prepared and published on the social organization, the traditions, the arts, and the language of these tribes.

Mr. Barbeau also completed or revised, in the course of a short trip, the information already obtained on the totem-poles of the Gitksan on the upper Skeena. A report on the totem-poles of the Tsimshian is being written.

W. J. Wintemberg between June 18 and September 14 made an intensive exploration of the pre-European palisaded Tionontati village site, on the farms of W. F. Sidey and J. A. Mackay, lot 8, con. V, Nottawasaga tp., Simcoe co., Ontario. The site is situated on the more or less level top of a hill about 40 feet high. The vegetal products found in the refuse heaps of the site consisted of carbonized corn (cobs and kernels), beans, sunflower seeds, squash stems, and plum pits. A few points for arrows chipped from chert were found. All but one are of the triangular type. Some of the points are thin and delicate, and none exceeds $1\frac{1}{2}$ inches in length. An unusual type of bilaterally barbed point for a harpoon was unearthed, also a unilaterally barbed point. A few notched stones appear to have been net sinkers.

Fragments of pottery were more numerous than any other material. No whole vessels were found. Most of the ware was tempered with crushed stone, but a few pieces had shell tempering. Some of the pots were of unusual shape and others bear unusual designs. A few possessed handles. The stone objects included a few adzes and celts, hammerstones (both pitted and battering hammers), and antler flaking punches. Of

artifacts in bone, awls were the most numerous, one being made from a human ulna. There were found, also, a few bone netting needles, scrapers chipped from chert, and a fragment of a fleshing tool made from the tibia of an elk.

Pipes of earthenware and stone were very numerous, three of the latter being unfinished. One stone pipe is vasiform, two somewhat conoidal, and two others again like a truncated pyramid. On one specimen is the head of an animal, of the same type as some of those illustrated by Laidlaw in his articles on "Effigy Pipes" in the Ontario Archæological Reports; another bears a crudely incised drawing of a man; and a third, broken, a superbly carved rendering of a human face. The earthenware pipes, which are all fragmentary, belong to several different types; some have the form of an inverted cone, others are trumpet shaped, but the majority have a projecting cylindrical top decorated with oblong vertical depressions at intervals around the bowl. A pipe of black ware common in the more recent sites has the head of a dog or wolf projecting from the front of the bowl, three others have human faces modelled on the side, and one two faces. Of the trumpet pipes one has a group of short impressed bars on the front of the bowl, resembling those on pipes of the same type found at the Roebuck village site in Grenville county.

Articles of adornment in the ruins consisted of discoidal beads of stone and freshwater clams, cylindrical beads from the columella of ocean shells, a bead made from a small whole ocean shell (*Marginella apicina*), and a few made from hollow bones and freshwater snails. No graves were found, but a few human bones were uncovered.

The culture of this village possesses many features in common with that of sites in Victoria county, and more remotely with that of the Roebuck village site and Hochelaga. The character of the artifacts suggests that the Tionontati and Hurons should be included in what Skinner calls the eastern or Mohawk-Onondaga group rather than in the western group, although they were near neighbours of the Neutrals.

After completing the excavations at this site Mr. Wintemberg tested two supposed ossuaries on the Edmunds farm, lot 21, con. VI, Nottawasaga tp., but found them to be natural hollows. He was unable to excavate a site on the McMurchy farm, lot 12, con. I, Collingwood tp., Grey co., on account of a crop being on the ground. A cemetery in Norfolk county, about 9 miles west of St. Williams, where the perforated human skull now in the Museum was found, was also not excavated, because pottery secured at the site showed that it belonged to the same culture as the Uren village site, in Oxford county, which was probably occupied by early Neutrals.

Mr. Wintemberg examined a site at lake Medad, but discovered no indications that the people who inhabited it were Iroquois from New York state, rather than Neutrals as is commonly believed. The site has been dug over too much by local collectors to be worth the expense of excavation.

Office Work

Mr. Jenness attended the annual meeting of the American Anthropological Association at Philadelphia between Christmas and the New Year, mainly for the purpose of conferring with officials of the United States National Museum and of the National Research Council concerning the possibility of international co-operation in the study of Arctic problems.

Administrative work, the preparation of memoranda on various subjects for the Director of the Museum, and the handling of a considerable mass of correspondence on subjects connected with the division's activities, occupied most of his time during the winter. He supervised the plan of a report on the totem-poles of Skeena river, which is being prepared by Mr. Barbeau, and another on the materia medica of some British Columbia tribes undertaken by Mr. Smith. Professor Leonard Bloomfield, of Ohio University, has been forwarding various sections of a voluminous manuscript on the Cree Indians, the result of his field work for the division in 1925, and these sections have been edited as they came in. An even more voluminous manuscript prepared by Professor T. F. McIlwraith on the Indians of Bella Coola, whom he investigated through two field seasons, is receiving similar treatment. In such time as he could steal from these duties Mr. Jenness made considerable progress in the compilation of a Comparative Vocabulary of the western Eskimo dialects, a work for which he has been gathering material from the earliest days of his connexion with the department.

Mr. Barbeau spent most of the winter months on an extensive monograph on the totem-poles of Skeena river. Lectures and their preparation consumed an appreciable amount of his time, particularly the five lectures which he delivered before the University of British Columbia; for this reason many invitations to lecture were declined. While absent on lecture trips he inspected the Indian collections in the McGill University and McCord Museums in Montreal, and in the City Museum of Vancouver. Much time at the office was devoted to routine work and correspondence, which of late years has increased considerably, and may be grouped, for the past fiscal year, under the following headings: consultation concerning the Indians or French-Canadian folk-lore, through written or verbal inquiries; the examination of two large manuscripts on Indian lore, submitted by the Ryerson Press for an opinion as to their value; correspondence in connexion with the furnishing and decoration of the French-Canadian suite in the rebuilt wing of the Chateau Frontenac, Quebec, at the request of the Canadian Pacific railway; correspondence in connexion with the organization of the Folk-Song and Handicrafts Festival, held at the Chateau Frontenac in May, 1927, partly under the auspices of the National Museum; the preparation of an article on the Kihn Indian paintings, five of which were recently presented to the Museum by the Messrs. Southam; and, in the spring of 1926, the transcription of manuscript notes (over sixty typewritten pages) on the architecture of some old Quebec churches, to assist the work planned for last summer by Professor Ramsay Traquair of McGill University.

Mr. Smith, before leaving for the field, prepared a paper on "Kitchen Middens of the Pacific Coast of Canada" which was presented at the Pan-Pacific Congress in Tokio in the autumn. During the winter months he assembled and incorporated in his files a large body of information concerning archaeological sites in various parts of Canada. He also compiled a preliminary directory of Indian Handicrafts at the request of the Department of Indian Affairs, revised his paper on the shell-heaps of Merigomish harbour, N.S., wrote an article on "Saving the Totem-Poles" for the Canadian National railways, and prepared a paper on the materia medica of the Bella Coola and neighbouring tribes of British Columbia.

Mr. Wintemberg prepared a paper on "Foreign Aboriginal Artifacts from post-European Iroquoian sites in Ontario" which was presented at the May, 1926, meeting of the Royal Society of Canada, and will be published in the forthcoming number of its Transactions. After returning from the field he completed his study of the pottery from the Roebuck village site in Ontario, excavated by him in 1912 and 1915, and continued the preparation of a memoir covering the whole culture of that site.

Publications

The following articles were published by the staff of the division during the past fiscal year:

- Bwaidogan Grammar. By D. Jenness. *Journal of the Polynesian Society*, vol. 35, No. 4, December, 1926.
- The Church of Ste-Famille. By Prof. Ramsay Traquair and C. M. Barbeau. *Journal of the Royal Canadian Architectural Institute*, May, 1926.
- The Church of St. François. By Prof. Ramsay Traquair and C. M. Barbeau. *Ibid.*, September, 1926.
- A Prehistoric Pictograph near Tyee, B.C. By H. I. Smith. *Canadian National Magazine*.
- Preserving Indian Totem-Poles. By H. I. Smith. *Resources*, Prince Rupert, October, 1926.
- Cement Casts of Petroglyphs. By H. I. Smith. *Science*, December 24, 1926.
- A Prehistoric Earthwork in the Haida Indian Area. By H. I. Smith. *American Anthropologist*, vol. 29, No. 1, 1927.
- Archæological Evidence of the Presence of the Wapiti in Southwestern Ontario. By W. J. Wintemberg. *Canadian Field Naturalist*, vol. XI, No. 3, 1926.
- Indian Designs in Batik. By Douglas Leechman. *Canadian Homes and Gardens*, December, 1926.
- Ceinture Flechée. By Douglas Leechman. *Ibid.*, January, 1927.

Lectures

Lectures were delivered by the staff during the fiscal year as follows:

By D. Jenness:

- Anthropology and its Aims. Gyro Club, Ottawa, May 19, 1926.
- Anthropological Work in Canada. Gastronomic Club, Ottawa, January 5, 1927.
- Indian Folklore and Its Psychological Background. Women's Art Association, Ottawa, January 18, 1927.
- The Origin of the Canadian Indians. Arts and Letters Club, Ottawa, February 15, 1927.
- Who Are the Indians? Victoria Memorial Museum, December 18 and 22, 1926; Royal Canadian Institute, Toronto, February 19, 1927.

By C. M. Barbeau:

- Indian Pseudo-History. Canadian Historical Association, Ottawa, May 20, 1926.
- On the Indians of the N. W. Coast of British Columbia:
 Plastic and Decorative Arts;
 Songs and Oral Literature;
 Social and Economic Life;
 Origins and Migrations, remote and recent;
 The White Man versus the Indian.
- University of British Columbia, October 21, 22, 25, 26, 27, 1926.
- Folk-songs of French Canada. Toronto Art Gallery, May 13, 1926; Women's Press Club, Ottawa, March 22, 1927.

By *H. I. Smith:*

- Kitchen-Middens of the Pacific Coast of Canada. Read by proxy at Pan-Pacific Congress, Tokio, October, 1926.
 Mackenzie Park, illustrated with motion pictures. Hazelton, B.C., September 6, 1926.
 Saving the Totem-Poles. Observation car, C.N.R., B.C. (by request), August 23, 1926.
 The Norway of Canada. Lady Evelyn School, Ottawa, January 27, 1927.

By *Douglas Leechman:*

- Art on the West Coast. Lion's Club, Ottawa, August 10, 1926.
 The Indians of Canada. C.S.E.T., February 3, 1927.

Accessions to Museum

(a) FROM STAFF:

From D. Jenness:

- | | |
|-------|---|
| 16 | baskets from Nunivak island, Alaska. |
| 1,820 | archæological specimens from Wales, Alaska. |
| 1,378 | “ “ Little Diomedé island, Bering strait. |
| 38 | “ “ Big Diomedé island, Bering strait. |

From H. I. Smith:

- 2 Haida specimens from Masset, B.C.
 1 Carrier specimen from Hagwelget, B.C.
 16 Tsimshian specimens from Hazelton, B.C.
 7 European intrusive specimens.
 5 archæological specimens from Kitwanga and vicinity, B.C.

From W. J. Wintemberg:

- 49 cases of archæological specimens, still unpacked, from village sites in Simcoe, Norfolk, and Halton counties, Ont.

From R. M. Anderson:

- 4 specimens from Alaska collected in 1912 and misplaced in storage.

From J. D. Soper:

- 26 ethnological specimens from Baffin island.
 264 archæological specimens from Baffin island.

From C. M. Sternberg:

- 1 chipped piece of chalcedony from Red Deer river, Alberta.
 1 arrow point from Rumsey, Alberta.

(b) DONATIONS:

From the Messrs. Southam, Publishers:

- 6 paintings by W. Langdon Kihn.

From Inspector C. E. Wilcox, R.C.M.P.:

- 350 archæological specimens from Strathcona sound.

From F. Rothe:

- 1 fragment of carved stone object from Moricetown, B.C.

From Donald Cooper:

- 1 stone pipe and 1 hammerstone from Nottawasaga township, Ontario.

From T. Hisey:

- 2 stone celts from Nottawasaga township, Ontario.

(b) DONATIONS—*Continued**From Aubrey Bates:*

1 unfinished stone pipe from Nottawasaga township, Ontario.

From G. P. Mackenzie:

1 ivory harpoon head from Knud peninsula, Ellesmere island.

From Miss Mary S. Johnston:

13 stone artifacts from Theban mountains, Egypt.

From C. M. Garber:

2 skulls from Wales, Alaska.

(c) PURCHASES:

From V. H. Baker:

151 Kootenay specimens.

1 Kootenay skull.

Folk-Lore

Mr. Barbeau reports that the folk-lore data collected for the Museum during the past year stand as follows (a summary of the revised totals for the French and English Canadian collections covering the years 1914-1926 is also appended):

DONATIONS

*French**The Massicotte (E.Z.) Collection:*

77 song texts collected at St. Norbert, Berthier county.
3 folk rhymes.

The Department of Architecture of McGill University:

(Through the courtesy of the Dominion Parks Branch.)
445 photographs of ancient Canadian architecture, principally of Quebec.

The Cimon (Abbe F. X.) Collection:

11 pages of copied records on early Canadian architecture.
26 specimens of homespuns, donated to the Museum.
2 photographs.

The Barbeau (C.M.) Collection:

4 songs recorded in text and on phonograph.
7 folk anecdotes recorded on phonograph.
3 specimens on colonial technology, donated.
17 photographs of Temiscouata county (by Loraine Wyman, donated).
4 photographs from Notaire Coupal ancient inventory (donated by Paul Beau).

The Lambert (Adelard) Collection:

3 folk tales.

The Mount-Duckett (Mrs. J.) Collection:

1 folk song.
1 folk rhyme.
2 notebooks of folk songs and early nineteenth century songs (purchased).

*English**Miscellanea*

From Mrs. Mount-Duckett: 4 rhymes and omens; from W. K. Bentley, a specimen of early Ontario technology, donated; from Frits Johansen, 2 photographs; from Harlan I. Smith, 1 photograph.

*Totals (1914-1926)**French*

6,294 song texts, excluding those in a few manuscripts.
 3,766 melodies recorded on the phonograph.
 494 song melodies recorded by ear.
 319 folk tales.
 191 anecdotes and narratives.
 4,299 photographs.
 105 dance melodies (excluding those in old notebooks).
 308 specimens of colonial technology.
 Blason populaire (or folk nicknames, including geographic, in a few counties).
 A large number of rhymes, sayings, remedies, folk beliefs, etc.
 Voluminous data on the ancient architecture and manual arts of Quebec.

English

2,000 or over, formulæ, sayings, remedies recorded in various parts of Canada.
 125 or more, folk songs (a considerable part of this material has been published).
 91 manuscript pages folk-lore as recorded along Fraser river, B.C.
 Miscellaneous folk-lore collections from Ontario, Nova Scotia, etc.

DIVISION OF BIOLOGY

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

The Division of Biology has at present two main subdivisions, zoology and botany. The only zoological collections which have curators actively engaged in systematic work are mammalogy, ornithology, and herpetology, but there are considerable collections in some branches of marine and freshwater invertebrates, and a small collection of fishes. The national collection of insects, which was formerly a part of the Museum, was loaned to the Entomological branch, Department of Agriculture, several years ago at the time Parliament was occupying the museum building, and is still stored in the Birks Building. The National Herbarium has a large collection of botanical specimens, cared for by a chief botanist, with one herbarium assistant.

A list of the staff of the division as at present constituted is given in a following article on the National Museum.

Exhibits and Research

Since April, 1926, progress has been made in the installation of biological exhibits. Six more unit-sized cases of mahogany and plate-glass construction have been set up by the staff carpenters during the year. Three of these filled the remaining space on the north side of the hall, and three more, including one to be used at present as a deep wall case, were installed on the south side of the hall for the temporary reception of part of the systematic exhibit of mammals of Canada.

The systematic collection of mounted birds was much advanced and extended during the year by concentration of the preparatory staff on bird mounting, cleaning, and remodelling of old specimens and groups in anticipation of the 44th annual meeting of the American Ornithologists' Union, which was held in the Museum October 11 to 14, 1926. The mounted collection now contains representative species of all the groups of Canadian birds, and a nearly complete representation of all the Canadian species from the grebes to the hummingbirds, as follows:

Diving birds (grebes, loons, auks, murres, puffins); long-winged swimmers (skuas, jaegers, gulls, terns, skimmers); tube-nosed swimmers (albatrosses, fulmars, shearwaters, petrels); totipalmate swimmers (tropic-birds, gannets, cormorants, pelicans); anseres (ducks, geese, swans); herodiones (wood ibis, bitterns, herons, egrets); paludicolæ (cranes, rails, gallinules, coots); shore birds (phalaropes, avocets, snipes, sandpipers, plovers, surf-birds, turnstones); gallinaceous birds (pheasants, turkey, quail, partridges, grouse); pigeons and doves, birds of prey (vultures, falcons, hawks, buzzards, eagles, harriers, osprey); owls (barn owls, horned owls); cuckoos, kingfishers, woodpeckers, goatsuckers, and swifts. The smaller birds, most of them passerine birds, have not been as well filled in, although old single mounts are being remounted more attractively, and the vacant spaces filled by new mounts. The birds are mounted in positions and with accessories suitable to their habitat, and the plan contemplates ultimately filling in or substituting groups for the old single mounts, showing families, old and young, or different plumages, with nests and eggs where obtainable, in their natural surroundings.

In the winter and spring more attention was devoted to preparing for exhibition as many specimens of small mammals as possible, and a considerable number of representative species were installed in the cases. Although a fair number of suitable specimens of our larger mammals have been brought in by field parties, and by gift from the Canadian National Parks branch, and the North West Territories and Yukon branch of the Department of the Interior, as well as from the detachments of the Royal Canadian Mounted Police stationed in the Far North, any noticeable progress in exhibiting such material is definitely precluded on account of the limited space the museum building allows for public exhibits. A start is being made by preparing single mammals mounted with reference to future use in habitat groups, and plans are being made, specimens, casts, and accessories gathered and stored away in anticipation of obtaining more room for expansion in the future.

Suitable and attractive groups of such large and distinctive Canadian mammals as constitute one of the unique assets of the Dominion, such as the moose, elk, caribou, white-tailed deer, mule deer, antelope, bighorn sheep, mountain goat, polar bear, grizzly bear, black bear, seals, and sea-lions, are planned, and material for some of these groups has already been obtained. A creditable exhibit of such distinctive native mammals is expected in the National Museum and the lack of such exhibits is in many cases a source of surprise and disappointment to visitors from other parts. The same reasons apply to the need for better exhibits of fur-bearing mammals, which form one of the principal economic resources of large sections of Canada. The necessity of obtaining adequate representatives of many of these rapidly disappearing forms of animal life is well recognized by many of the museums in foreign countries, and it is essential that we should make efforts to obtain suitable specimens if posterity is not to consider us negligent. The attention of friends of the National Museum and of public-spirited citizens is called to this deficiency in the Museum, and it is hoped that donations of specimens will be made when opportunity offers. Where specimens can not be exhibited, or are not of a quality to make attractive exhibits, they are useful for reserve or study series, in the preparation of monographs on our fauna, and for comparison with speci-

mens sent from different parts of the country for identification. The identification and naming of material is an important work which the members of the staff of the Museum are always willing to do, as far as the resources of the Museum permit authoritative opinions to be reached.

When specimens are exhibited they are provided as soon as practicable with labels printed in large, legible type, carrying the English, French, and scientific (Latin) names of each species. Several duplicates are printed of each label, and as time and other duties of the staff permit, the label is extended and made more informative. The aim is to make the museum labels attractive and instructive, conveying the most important facts about each species and its habits; distribution maps show the range of each species, both the summer and winter range if the species is migratory. Where appropriate photographs are available showing the natural habitat of the animal in life they are included in the exhibit, and where specimens are donated they are accredited to the donor.

Some temporary exhibits were installed on the occasion of the *Conversazione* of the Professional Institute of the Civil Service of Canada, held on April 14, 1926. These special exhibits consisted largely of material which could not be exhibited every day on account of lack of protecting cases. They included exhibits of choice skins and skulls, series of small mammals from the Maritime Provinces and from the Prairie Provinces illustrating the typical forms of mammals occurring there, and also the method of preparing specimens in the field. An exhibition was also made of the Allan Brooks collection of one hundred paintings of western birds prepared for a publication issued by this department during the year. The exhibition was primarily designed to enable members of the staffs of other departments, members of the Government and of Parliament to become familiar with the work of the department and of the museum.

A similar exhibition was installed in the Museum for the *conversazione* held on March 23, 1927. In the biological hall three of the large exhibition cases were temporarily allotted to the Entomological Branch, Department of Agriculture, of which branch Mr. Arthur Gibson, Dominion Entomologist, has recently been appointed Honorary Curator of Insects in the National Museum of Canada. Mr. C. B. Hutchings of the Entomological Branch was detailed to prepare an exhibit and made an attractive and instructive display, including a systematic collection of the representative groups of insects found in Canada, and numerous exhibits of the life habits and methods of control of the more common field, garden, orchard, and forest pests. This exhibit attracted much attention and a considerable part of the exhibit is planned to remain in the Museum during the summer, and plans are under way to provide a permanent entomological exhibit from the National Collection of Insects which was formerly stored in the Museum in its entirety.

The Department of Marine and Fisheries, under the direction of Mr. J. A. Rodd, superintendent of fish culture, Fisheries Branch, put in several aquaria showing living specimens of speckled trout, European brown trout, salmon trout, rainbow trout, and land-locked salmon; exhibits of several kinds of fish spawn in various stages of hatching, preserved fish specimens, and models of various types of fishing vessels. Special botanical exhibits included a large exhibit of artistically mounted wild flowers of Vancouver island, by Mrs. A. E. Planta, of Nanaimo, B.C.; an exhibit of

artistic botany by Mrs. George Black, of Yukon; and an exhibit of the most important species of ferns, orchids, and lilies from the National Herbarium. An exhibit of the most important species of Canadian woods from the herbarium was used as part of an exhibit by the Forestry Branch of the Department of the Interior. Other exhibits outside of the scope of the Biological Division were made by the Department of Agriculture, which had an extensive exhibit illustrating the development of new and hardy varieties of wheat, and the Natural Resources Intelligence Service, Department of the Interior, had an interesting exhibit of natural and manufactured products of Canadian origin.

The outstanding scientific gathering of the year was the 44th annual meeting of the American Ornithologists' Union, which on invitation extended in 1925 by the Minister of Mines and accepted by the Union, was made a semi-official affair. This meeting was unique in that although the Union has numbers of fellows, members, and associates living in Canada, the annual meeting had never before been held outside of the United States. The public sessions occupied three days, October 12, 13, and 14, 1926, the regular and more popular sessions being held in the auditorium of the Museum and technical sessions on October 13 and 14 in a room in the west wing. The general sessions were opened by addresses of welcome by Hon. Charles Stewart, Minister of Mines, and by Mr. Clyde L. Patch, first vice-president of the Ottawa Field Naturalists' Club, responded to by Dr. Alexander Wetmore, president of the A. O. U. and assistant secretary of the Smithsonian Institution of Washington, D.C.

The regularly scheduled program comprised fifty-seven numbers, representing practically all fields of ornithology, including taxonomy and nomenclature, life histories, migration and bird-banding, exploration and bird photography including motion pictures. Papers of special interest to Canadian ornithology were a review of "Canadian Field Ornithology, 1750-1900," by E. A. Preble. This was supplemented to some extent by a special exhibit of the more important publications on Canadian birds illustrated by portraits of many of the authors, most of the latter being loaned from the collection of Ruthven Deane of Chicago. J. Dewey Soper, who had just returned from two years' work on Baffin island, gave an account of his work there, and Dr. W. E. C. Todd, of Carnegie Museum, Pittsburgh, who has made several expeditions across parts of Labrador and northern Quebec, gave a summary of his 1926 expedition along the east coast of Hudson bay and in Hudson strait. Mr. Harrison F. Lewis, of the Canadian National Parks branch, illustrated some of the economic phases of eider-duck conservation, including the Icelandic method of cleaning the eider-down which is being tried out on the north shore of the gulf of St. Lawrence. Other papers included "A Visit to the Queen Charlotte Islands, B.C.," by Rev. C. J. Young of Vancouver, "A Further Study of the Home Life of the Northern Parula Warbler," by H. Mousley of Montreal, and "Banding Redpolls," by Dr. R. E. DeLury of Ottawa.

As an important part of the A. O. U. meeting, and as a public exhibit for the following month in the Museum halls, an exhibit of bird art was gathered. This exhibit was world-wide in its representation, including

444 entries, showing the work of about fifty artists in oil, water colours, tempera, pastel, etchings, and line drawings, with thirteen photographers in addition to thirty-seven artists included in the following list:

William J. Belcher (Fiji).....	Claude Edward Johnson
Richard Evett Bishop.....	John G. Keulemans (1842-1912)
Allan Cyril Brooks.....	Bruno Liljefors (Sweden)
Charles Livingstone Bull.....	George Edward Lodge (England)
F. Cheverlange (Fiji).....	A. Miles
Adrian Collaert (ca. 1580).....	John Guille Millais (England)
John Templeton Coolidge, Jr.....	R. C. Patterson
Henry Carey Denslow.....	Karl Plath
Louis Agassiz Fuertes.....	Earl Lincoln Poole
William Giles.....	W. E. Powell
Henrik Gronvold (England).....	John Livzey Ridgway
Lady Elizabeth Gwillim (Fl. 1801-06).....	Robert Ridgway
Charles Hayes (fl. 1808-16).....	Edmund Joseph Sawyer
William Hayes (fl. 1729-1799).....	Will Simmons
Frank Charles Hennessey.....	George Mihsch Sutton
Robert Bruce Horsfall.....	Albert E. Ward (Fiji)
Lynn Bogue Hunt.....	Joseph Wolf (1820-1899)
Francis Lee Jaques	

The most noteworthy pictures were the historical collection loaned by the Emma Shearer Wood Library of Ornithology of McGill University; a collection of sixteen water colours by Joseph Wolf, the pioneer of accurate bird portraiture, loaned by Dame Alice Godman of England; a large collection of Ridgwayana, including a large series of original drawings by Robert Ridgway, the dean of North American ornithology, showing his development from boyhood to recent times; a large collection in different media by John G. Millais and George Edward Lodge, two of the leading modern British bird artists; and two large collections of paintings by Major Allan Brooks, including the one hundred originals prepared for "Birds of Western Canada," issued during the year by the Museum, and a special collection of thirty-two larger paintings by Brooks, assembled by Wallace Havelock Robb of Belleville. Bruno Liljefors of Sweden contributed a series of photographs of his more recent large paintings, and Johannes Larsen of Denmark sent a fine collection of paintings of birds in typical Danish landscapes.

Representatives were present at the meeting from eighteen states, the District of Columbia, and seven provinces of Canada, including all the region from the gulf of St. Lawrence to Potomac and Ohio rivers and from the Atlantic coast to Mississippi river except New Brunswick, Prince Edward Island, Rhode Island, and Delaware. In addition, representatives were present from four provinces and four states in the west and south: Alberta, British Columbia, Manitoba, Saskatchewan, and California, Missouri, South Carolina, and West Virginia. The largest delegations outside of Ontario came from Quebec, Massachusetts, New York, Pennsylvania, and the District of Columbia. Although the total attendance was somewhat smaller than that in New York the year before it was more generally distributed and represented one more state and five more Canadian provinces than were present at the meeting of 1925.

Fourteen natural history museums were represented by one or more of their members, viz.: American Museum of Natural History (New

York), Boston Society of Natural History, California Academy of Sciences (San Francisco), Carnegie Museum (Pittsburgh), Cleveland Natural History Museum (Ohio), Museum of Comparative Zoology (Cambridge), Everhart (Pennsylvania), United States National Museum (Washington), Philadelphia Academy of Natural Sciences, Princeton University Museum (New Jersey), Royal Ontario Museum of Zoology (Toronto), University of Michigan Museum (Ann Arbor), Museum of Vertebrate Zoology (University of California, Berkeley), and National Museum of Canada (Ottawa). The United States Biological Survey, Department of Agriculture, Washington, was also represented by several of its members. The Canadian attendance of associates and others included numbers from Toronto, Montreal, Hamilton, London, Winnipeg, and other points. The entertainment of the guests was much facilitated by the hearty co-operation of the Canadian National Parks Branch, Department of the Interior, through its Migratory Birds division, and by the members of the Ottawa Field Naturalists' Club. Judging by the reports in various scientific periodicals as well as in newspapers, the meeting did much to promote cordiality of feeling between scientific people in both countries, as well as doing much to make the work and resources of the National Museum of Canada known internationally as well as in Canada. Each member of the Union was presented, as a souvenir of the occasion, with a copy of the "Birds of Western Canada" by P. A. Taverner, only shortly before published by the Museum.

During the year many specimens in the lines of botany and zoology are sent in from different parts of the country for determination, and numerous requests for information on a variety of subjects pertaining to natural history are received from different departmental officers of the Dominion Government and the various provinces, as well as from the general public, and such inquiries have been answered by the officers of the division as fully as possible.

Numerous specimens have been loaned to schools for natural history work, and selected slides have been loaned for lecture purposes to persons engaged in educational work. Loans of individual specimens and in some instances special groups of animals and plants have also been made to museums and qualified individuals who have been monographing certain groups, and similar courtesies have been received by the officers of the division. A large series of red-tailed hawks of the genus *Buteo* were loaned by various institutions and individual collectors for use in a critical study of the variations of this difficult species. A large collection of weasels of the genus *Mustela* have been loaned to the Museum of Vertebrate Zoology at Berkeley, where exhaustive studies are being made of the weasels of North and South America.

Office and Field Work

Considerable new data have been secured, and systematic efforts made to fill important gaps in the list of mammalian species in the museum, both for purposes of exhibition in the mounted state and for research purposes. The filling in of these gaps is essential to furnish the necessary material for a systematic and popular handbook of the mammals of Canada, including the big game, fur-bearers, and other mammals of more or less doubtful

economic importance. Although as much scientific material as possible is brought in by field parties from the museum, the staff is so small and the country to be covered is so vast, that many areas can not be covered within a reasonable time by such means, while at the same time biological conditions are rapidly changing, on account of the extension of agriculture, devastation of large areas by lumbering and forest fires, causing the extermination of many animal and plant species.

Although field collectors for the National Herbarium, for example, might be able, if the staff were larger, to collect a fair representation of the Canadian flora during the summer field season, the zoological problem is somewhat different. Birds and mammals vary in plumage and pelage in summer and winter and there are various transition stages. As the members of our staff are not as a rule able to go into the field except during a few months of summer, we are restricted to the collection of summer specimens, and get very few winter specimens except from occasional Arctic expeditions or by infrequent donations by public-spirited citizens. To build up a balanced collection of both mammals and birds, and to have the major districts and zoogeographical zones fairly represented has been one of our problems for several years. To accomplish this object, it is in many cases desirable to purchase specimens from local collectors, trappers, or sportsmen. The museum is lacking in an adequate representation of many species and races of the important fur-bearers of Canada, and has been unable to purchase many specimens of these on account of the high prices which have prevailed for several years. Without men in the field in the winter it is virtually impossible to obtain such specimens. It is to be hoped that interested citizens will assist the museum whenever possible in locating and obtaining desirable specimens, emulating the custom which has done so much to build up the magnificent collections of the British Museum and the many modern museums which are springing up in the United States.

During the year the Chief of the Division spent some time in the work of editing and correspondence in regard to the scientific reports of the Canadian Arctic Expedition, 1913-18, a work which has been carried on for several years, and is now approaching completion. These reports have assembled and made accessible a large amount of miscellaneous information about the northern regions of Canada, basic knowledge which is of importance in many lines. By keeping in touch with Arctic work, the Museum is receiving valuable additions each year from the regular expeditions, as well as from individuals who have been working in the north.

The Chief of the Division represented the Department of Mines on the Advisory Board on Wild Life Protection, the Northern Advisory Board, the Arctic Publications Committee, and the Committee on Oil Pollution of Navigable Waters. As a member of the Board of Directors of the American Society of Mammalogists he attended the business meetings and scientific sessions of the eighth annual meeting of the society held at the American Museum of Natural History, New York, April 27-30, 1926. An important part of the meeting consisted of a symposium on furs and fur-bearing mammals, with papers on the fur industry and its conservation, fur dressing and fur dyeing, and modern fur farming. Through the courtesy of the National Association of the Fur Industry opportunity

was given to go through one of the largest wholesale fur houses, and through one of the largest plants for the conversion of raw furs into finished garments. Other papers ranged from mammalian palæontology to genetics, anatomy, and field studies of life histories. The next annual meeting was scheduled for Philadelphia, and it is hoped to have the society meet at some future date in Ottawa.

With Mr. Joseph Rochon as assistant, he spent three weeks in field-collecting of small mammals in the region of Blue Sea lake, about 50 miles north of Ottawa, and gathering information on the mammalian fauna of Gatineau district.

P. A. Taverner left Ottawa May 15, 1926, for Belvedere, Alberta, some 60 miles northwest of Edmonton and 15 miles west of Busby on the Edmonton, Dunvegan, and British Columbia railway. Here he was joined by Hamilton M. Laing of Comox, B.C., and C. G. Harrold, of Winnipeg, experienced field collectors, who have worked for the Museum during previous seasons. Their immediate field of work was at the north end of lac La Nonne, near the farm of A. D. Henderson, a well-known field ornithologist and collector whose assistance and advice were of much value to the party. After seeing through the early summer's work Mr. Taverner returned to Ottawa, leaving Mr. Laing and Mr. Harrold to continue the work during the summer and the early part of the autumn migration. Notes on two hundred and five species of birds were obtained and specimens of one hundred and sixty-four species were collected.

Charles H. Young left Ottawa, May 10, 1926, and collected at the northern edge of Cypress hills, south of Maple Creek, in southwestern Saskatchewan, until July 13. The work was interesting on account of bringing in several species which have a rather limited range in the high plains region of Canada, such as the sagebrush pocket gopher, Osgood white-footed mouse, bean mouse, and a number of specimens of the dusky mountain shrew, a notable extension of the range of the latter. He also found nests of the pink-sided junco, orange-crowned warbler, and western willet. On July 14 he moved westward to Olds, Alberta, taking up quarters towards the edge of the foothills west of Olds, where a valuable collection was made. He returned to Ottawa September 20.

J. Dewey Soper, junior zoologist (temporary), who had been working in Baffin island since 1924, spent the autumn of 1925 at Pangnirtung after returning from a summer spent in exploring the south side of Nettilling lake and the upper part of Koukdjuak river which drains Nettilling lake into Foxe channel. Some time was spent in plotting maps and preparing notes on the summer's work, as well as preparing specimens for shipment to Ottawa the next summer. Desiring to put in his time to best advantage during the winter, Mr. Soper decided to make a traverse of the island from Cumberland gulf to Foxe channel, a journey which had heretofore been made by but one white man, Bernhard Hantzsch, a young German naturalist, who made the trip with a small party of Eskimos, and died from hardships and privations on the shore of Foxe channel in 1911. Pursuing a somewhat different course Mr. Soper crossed the eastern range of mountains to Nettilling lake, westward across the lake, and the low level plain between Nettilling lake and Foxe channel. This region was found to be almost destitute of animal life in winter, and for obvious reasons is uninhabited. On the return trip Mr. Soper turned north and completed

the map of the north side of Nettilling lake. Mr. Soper's observations indicate that the lake is much smaller than it has been sketched on previous maps and that the eastern shore of Foxe channel extends much farther east in these latitudes than has been supposed. The trip was extremely difficult, taking thirty-eight days during the coldest part of the winter, between January 9 and February 15. Later the large collection and the Royal Canadian Mounted Police surf-boat *Fly* which had been cached in the summer at the east end of Nettilling lake were transported on sledges to the coast and the collections packed for shipment out on the *Beothic* in the summer, ultimately reaching Ottawa in good condition. On April 11, 1926, Mr. Soper left Pangnirtung on Cumberland sound with two Eskimos, two sledges, and twenty-seven dogs, and travelled south and west via Nettilling lake and Amadjuak lake, arriving at Amadjuak bay on Hudson strait on April 26. This change of base was considered necessary, as the prospects for spring work did not appear good in the immediate vicinity of Pangnirtung, and the southern part of Baffin island presented a large unworked field for biological research. After a short delay at Amadjuak, owing to difficulties in obtaining dog-food and assistants, he was finally able to proceed by sledge and boat to cape Dorset, at the southwest corner of Baffin island, which he reached on May 20 after covering about 500 miles of trail under various difficulties. The summer was devoted to various phases of collecting and photographic work along the south coast of Baffin island. Of particular interest was an investigation of Fox islands south of Gordon bay, where large numbers of sea birds were found breeding. Mr. Soper left Amadjuak bay on the SS. *Nascaupie* August 13 and was taken to cape Chidley, at the northeastern tip of Labrador peninsula. From here he later boarded the SS. *Bay Rupert* and arrived at St. Johns, Newfoundland, on September 30. From there he came by rail and boat to Port aux Basques and North Sydney, arriving in Ottawa on October 7. Mr. Soper on his Baffin Island trips by dog sledge, boat, and canoe, covered more than 4,000 miles of trail. Besides a large mass of data and original maps of new territory, he brought out from Baffin island nearly 4,000 scientific specimens, including mammals, birds, insects, fishes, plants, and ethnological material.

Publications

The only important publication by the Museum during the year, along biological lines, was "Birds of Western Canada," by P. A. Taverner, Museum Bulletin No. 41, Biological Series No. 10. Other members of the staff have contributed brief notes and reviews to periodicals, but few formal articles have been listed. For the Ottawa papers C. L. Patch contributed some notes on hawks and owls around Ottawa, and on toads in gardens, and D. Blakely contributed a brief article on the red snail (*Planorbis coneris* var. *rubra*), in relation to aquaria.

Preparatory Work

C. L. Patch, C. E. Johnson, D. Blakely, and J. E. Perron devoted most of their time to preparing and installing biological and botanical exhibits and preparing biological specimens for the study collections. During the early part of the year Mr. Patch and Mr. Johnson devoted

most of their efforts to completion of habitat groups of birds and specimens to fill out the systematic collection of birds, and later some time was devoted to preparing some of the older mammal specimens for exhibition. Mr. Perron, although devoting much of his time to tanning mammal skins, spent some time in assisting with the preparation of the mammal groups. Mr. Blakely was kept busy during most of the time in remaking and cleaning old skins and fresh salted skins which came in from the Arctic expedition and from some of the field parties. The following is a partial outline of the work done by the above-mentioned members of the staff:

Birds prepared for study collections (mostly large water birds, such as ducks and geese).....	254
Smaller mammals prepared for study collections.....	36
Larger mammal skins tanned (moose, caribou, deer, wolf, fox, seal, bear, etc.).....	26
Mammals and birds prepared for exhibition purposes.....	106
Specimens collected.....	14
Plaster casts.....	309
Wax and celluloid pieces for group accessories.....	1,033
Lantern slides coloured, lettered labels, and colour plates....	73

Joseph Rochon and Donald MacDonald were mostly engaged in osteological work, but did also some work in local collecting of specimens for the Museum. Work in the laboratory included the cleaning of skulls of most of the mammal accessions of the year, numbering seven hundred and eighty-one specimens, together with numerous bones, and in some cases complete skeletons of the animals. Work was continued in cleaning and maceration of large skeletons, and a complete skeleton of a large bull moose was completed and installed in the exhibition halls.

A collection of biological specimens for loan to teachers of art and natural science in educational institutions is kept. During the past year three hundred and thirty-seven loans were made. The collection is not large, and suitable or duplicate specimens of many common species are not available for loan purposes, but certain schools have found the material very useful. Of the forty-five varieties of mammals and birds available for loan, the beaver was loaned twenty-three times, the muskrat eighteen, the red fox eleven, the chickadee twenty-one, the downy woodpecker seventeen, and the crow twelve.

Accessions

ACCESSIONS TO THE BIOLOGICAL COLLECTIONS:

Mammals received and catalogued.....	781
Birds received and catalogued.....	1,605
Reptiles and amphibians received and catalogued.....	259
Birds' eggs (sets) and nests.....	

ACCESSIONS OF MAMMALS:

By members of staff:

Chas. H. Young, Saskatchewan and Alberta.....	273
J. D. Soper, Baffin island, N.W.T.....	231
Jos. Rochon, Quebec.....	90
Hamilton M. Laing, Alberta.....	44
C. G. Harrold, Alberta.....	21
R. M. Anderson, Quebec.....	20
C. E. Johnson, Ontario.....	12
C. L. Patch, Quebec.....	2
D. MacDonald, Quebec.....	2
P. A. Taverner, Alberta.....	1
F. W. Waugh, Labrador, old specimens catal.....	10

ACCESSIONS OF MAMMALS—*Continued**By gift, outside of collections made by members of staff:*

- Jack Miner, Kingsville, Ontario, 1 weasel.
 Fred W. Moore, York, Ontario, 1 star-nosed mole.
 John Hornby, N.W.T., 3 arctic wolves and 1 wolverine.
 Canadian National parks, 1 grizzly bear, 5 black bears, and 2 mule deer from Waterton Lakes park, Alberta; 1 mountain lion and 1 black bear from Jasper park, Alberta.
 Arthur Cornell, Ridgemont, Ontario, 1 weasel.
 Wm. Caven, Britannia, Ontario, 1 star-nosed mole.
 North West Territories and Yukon Branch, Department of the Interior, 2 cubs of coyote, 15 cubs of arctic wolves.
 Royal Canadian Mounted Police, 4 skins with skulls of muskoxen from Devon island, by Staff-Sergt. A. H. Joy; 1 embryo white whale, 1 embryo walrus, by Staff-Sergt. J. E. F. Wight.
 Ralph E. DeLury, Ottawa, 1 house rat, partial albino; Stuart Criddle, Aweme, Manitoba, 4 Lake Superior chipmunks.
 Morris M. Green, Ardmere, Pennsylvania, 6 Pennsylvania meadow mice, from New Jersey and Pennsylvania (the latter topotypes); 2 forest voles, lac Edouard, Quebec (topotypes); 2 bean mice, Montana (topotypes).
 J. B. Derraugh, Ottawa, 2 murine opossums.
 R. Arkell, Britannia, Ontario, 2 skunks.
 H. M. Laing, Comox, B.C., 6 skulls of Columbian blacktailed deer.
 W. E. Lake, Turtleford, Saskatchewan, 1 Hayden shrew.

By purchase:

- Clovias Seguin, Timmins, Ontario, 1 Canada otter, partial albino, a unique colour phase.

ACCESSIONS OF BIRDS:

By members of staff:

Hamilton M. Laing, Alberta.....	413
C. G. Harrold, Alberta.....	465
J. D. Soper, Baffin island.....	489
P. A. Taverner, Alberta.....	123
Chas. H. Young, Saskatchewan and Alberta, 44 birds, 5 nests with eggs.....	44
D. Blakely, Ontario.....	3
C. L. Patch, Quebec.....	2
C. L. Johnson, Ontario.....	1
R. M. Anderson, Quebec.....	1
Jos. Rochon, Quebec.....	1

By gift, outside of collections by members of staff:

- Wm. G. McKeand, Toronto, 1 golden plover.
 R. W. Tufts, Wolfville, N.S., 3 bird stomachs, 2 of goshawk, 1 of marsh hawk.
 Major L. T. Burwash, Ottawa, arctic birds, 1 red-throated loon, 1 dovekie.
 Elmer Dicks, Ottawa, 1 pine grosbeak.
 Jack Miner, Kingsville, Ontario, 34 birds in the flesh, including 2 Cooper hawks, 5 red-shouldered hawks, 9 long-eared owls, 7 screech owls, 4 mergansers, 1 starling, 1 grackle, 2 goshawks, 2 mallards.
 H. Mousley, Montreal, nests of blackpoll, yellow, and Canadian warblers, house sparrow, robin, long-billed marsh wren, indigo bunting, redstart, 1 skin of short-billed marsh wren.
 G. R. White, Ottawa, nest of Baltimore oriole.
 M. Y. Williams, Vancouver, stomachs of rusty blackbird, yellow-headed blackbird, magpie, great horned owl, Richardson merlin, willet, white-rumped shrike, marbled godwit, long-billed curlew.
 A. A. Ireland, Easton Corners, Ontario, 1 starling.
 J. A. Munro, Vancouver island, 1 sawwhet owl.

ACCESSIONS OF BIRDS—*Continued**By gift, outside of collections by members of staff:*

- Kenneth G. Racey, Vancouver, 38 bird stomachs, including yellow-headed blackbird, Brewer blackbird, mourning dove, cowbird, western tanager, Alaska horned lark, western vesper sparrow, Audubon warbler, Columbian sharp-tailed grouse, long-tailed chickadee, pine grosbeak, grey ruffed grouse, redpoll.
- Maxie Irvine, Ottawa, 1 red-winged blackbird.
- J. M. Bennett, Ottawa, 2 flickers.
- W. H. B. Hoare, N.W.T. and Yukon Branch, Ottawa, eggs of seven species of Arctic birds.
- D. Jenness, Ottawa, 1 crested auklet.
- E. G. White, Ottawa, 8 birds in the flesh, including greater snow goose, blue goose, ring-necked duck, Brunnich's murre (in exchange for other specimens); 2 pairs wings snow geese (gift).
- J. P. Williams, Picton, Ontario, 1 red-tailed hawk.
- Norman Criddle, Aweme, Manitoba, 1 white pelican.
- J. S. Harterre, Ottawa, 1 rough-legged hawk.
- A. D. Henderson, Belvedere, Alberta, 1 set of eggs of dowitcher, 1 nest of Canada jay.
- R. H. Rauch, Harrisburg, Pa., 1 nest each of Bonaparte gull, dowitcher, and brown creeper.
- R. C. Harlow, Western Maryland College, Westminster, Md., 1 nest of lesser yellow-legs, downy young of same.
- Museum of Vertebrate Zoology, University of California, Berkeley, 2 tule geese, in exchange.
- Wm. Rowan, Edmonton, 1 gull.
- Dudley Dimock, Grand Cascapedia, Que., 1 dovekie.
- Canadian National parks, Ottawa, 2 ducks, 2 whistling swans.
-, Lake harbour, Baffin island, 4 ducks, 8 eggs of snowy owl.
- Dennis Ashby, Crayle, B.C., 1 ring-necked duck, 2 European widgeon, 1 ruddy duck, 1 Clarke nutcracker.
- Stuart Criddle, Aweme, Manitoba, 1 screech owl.
- Talbot Criddle, Treesbank, Manitoba, 1 goshawk.
- H. A. C. Jackson, Montreal, 1 pellet from snowy owl.
- Manley Miner, Kingsville, Ontario, 1 blue goose.
- W. T. Macoun, Central Experimental Farm, Ottawa, 1 great horned owl.

By purchase:

- Allen L. Moses, Grand Manan, N.B., 1 common cormorant, 1 white-winged scoter, 4 American scoters, 4 surf scoters, 1 Kumlien gull.

ACCESSIONS OF AMPHIBIANS AND REPTILES AND LOCALITIES FROM WHICH THEY WERE RECEIVED:

By members of staff:

Clyde L. Patch, Grant lake, Burbidge, and Lac-des-Iles, Quebec.....	34
J. D. Leechman, Norway Bay, Quebec.....	29
Harlan I. Smith, Kitwanga and Hazelton, B.C., and Sedro-Wooley, Washington.....	5
D. MacDonald, Beech Grove, Quebec.....	1
C. M. Sternberg, Rumsey, Alberta.....	2

By gift, outside of collections made by staff:

J. Roland Brown, Hamilton and Port Maitland, Ontario.....	80
E. R. Buckell, Penticton, B.C.....	1
Lawson Caesar, Gravenhurst, Ontario.....	1
D. M. Campbell, Armstrong, B.C.....	59
Doreen Dodd, Telegraph Creek, B.C.....	2
C. M. Edwards, Harrington lake, Quebec.....	1
Hamilton M. Laing, Belvedere, Alberta, and Comox, B.C.....	8

ACCESSIONS OF AMPHIBIANS AND REPTILES AND LOCALITIES FROM WHICH
THEY WERE RECEIVED—*Continued*

By gift, outside of collections made by staff:

Eddie Lennox, Meach lake, Quebec.....	1
Edgar Lester, Ottawa, Ontario.....	10
Roy Lloyd, Christie lake, Ontario.....	1
Erich Marherr, Europe.....	6
Alan Mozley, Winnipeg, Manitoba, and Jasper park, Alberta..	6
J. A. Munro, Okanagan Landing, B.C.....	5
Lloyd W. Patch, Edgewater, Maryland.....	2
Prescott Journal, Prescott, Ontario.....	1
Max H. Ruhman, Vernon, B.C.....	1
N. B. Sanson, Banff, Alberta.....	2
M. Y. Williams, Coulée, Saskatchewan.....	1

MISCELLANEOUS ACCESSIONS:

By gift:

- James Carmack, Canadian Trade Commissioner, Kingston, Jamaica, 15 stuffed tropical fishes, 1 cabinet of assorted tropical shells.
V. Fautaux, Ottawa, 1 garpike.
Harlan I. Smith, tapeworms from porcupine.

Although no large zoological accessions were made to the collections during the year, numerous small additions were made, which in the aggregate are important. Thanks are particularly due to Colonel Cortlandt Starnes, Commissioner of the Royal Canadian Mounted Police, for reports on the wild life of the north and specimens obtained from the detachments stationed in the remote districts, also to Mr. O. S. Finnie, Director of the North West Territories and Yukon Branch, Department of the Interior, for similar courtesies, and to Mr. J. B. Harkin, Commissioner, Canadian National parks, for various valuable specimens from the National parks, including grizzly and black bear, mountain lion, mountain sheep, mule deer, and marten.

National Herbarium

M. O. Malte engaged in botanical field work chiefly in the Maritime Provinces. From June 17 to August 10, with the exception of one week spent on Prince Edward Island, he botanized in Chaleur Bay district, New Brunswick. Nearly 1,550 well-filled sheets were collected, the majority from the coast between Bathurst and Campbellton. Of this number there are a total of 250 species and varieties, 180 of which are native, which previously were not represented in the National Herbarium from the province of New Brunswick.

The week spent on Prince Edward Island was largely devoted to a study of the turf grass-seed growing industry of the province. The Seed Branch of the Dominion Department of Agriculture had reported the occurrence of a grass at Georgetown which appeared to make excellent turf. This had been identified as *A. borealis* Hn. Upon examination of the grass in question, it was found to be Velvet Bent Grass, *A. canina* L., the most valuable lawn grass so far known. It is now being propagated for commerce under the direction of the Seed Branch, Dominion Department of Agriculture.

After his return from the Maritime Provinces Dr. Malte attended the International Congress of Plant Sciences held at Ithaca, New York, U.S.A., August 16-23. Opportunity was taken of the presence of a large number of botanists from Great Britain, United States, and Canada to discuss matters pertaining to Canadian botany and particularly to botanical survey work. At the Congress he discussed with Professor C. H. Ostenfeld, Copenhagen, Denmark, the feasibility and advisability of preparing jointly a flora of Arctic Canada, the said flora to be the first of a series of sectional floras of the Dominion of Canada.

After the return from the International Congress, Mr. Malte botanized a few weeks at Constance lake, Ontario, about 20 miles west of Ottawa.

Plants received outside of collection made by staff:

Mr. F. J. A. Morris, Peterborough, Ont.....	8
Dr. M. Porsild, Disco, Greenland.....	245
Botanical Section, Hungarian National Museum, Budapest....	100
Dr. G. E. du Rietz, Upsala, Sweden.....	119
Mr. Norman Criddle, Treesbank, Man.....	223
Mr. H. Groh, Central Experimental Farm, Ottawa.....	13
Miss J. Bostock, Summerland, B.C.....	1
Mr. J. Mason, Victoria, B.C.....	80
Mr. S. E. Clark, Central Experimental Farm, Ottawa.....	1
Rev. Bro. Marie Victorin, Montreal, Que.....	157
Rev. Bro. Louis-Marie, Oka, Que.....	50
Total.....	997

At the end of the fiscal year the number of mounted sheets was about 118,100.

DIVISION OF MINERALOGY (Geological Survey)

Eugene Poitevin, Chief of the Division, reports as follows:

The Division of Mineralogy dates back to the creation of the Geological Survey more than eighty years ago. Dr. Sterry Hunt, the first mineralogist and curator, laid the foundation of the mineral collections. Many of the minerals collected and described by him at that early date are still in our possession. After Dr. Hunt retired he was succeeded in turn by Dr. B. J. Harrington, Christian Hoffmann, and Robert A. A. Johnston, who not only continued to add to the collections of the Museum, but also contributed largely to the knowledge of Canadian minerals.

The museum functions of the Division of Mineralogy, which are incidental to its duties to the Geological Survey, to which it belongs, are to collect, exchange, and display mineral specimens, to contribute to the study of Canadian minerals, and to promote knowledge of mineralogy by lectures and preparation of educational collections. A statement of the composition of the staff of the division is given in a following article on the National Museum.

Special attention was devoted to continuing the rearrangement of our collections. This work was commenced over two years ago and considerable progress has been made.

Over 30,000 specimens have been handled and arranged in systematic order. There is still much detail work to be done in verifying and labelling specimens.

Several exhibits were prepared and placed in the Museum. These exhibits are specially of an economic character. The museum cases for the systematic collection are now being made in our own shops. Early in the year a museum case designed by this office and built by the Museum cabinet makers was filled with a special collection of Canadian ornamental stones. This case proved so satisfactory and won such universal approval that it was decided a few months ago to accept the plan as a permanent one, and a number of cases to cover our requirements are under course of construction.

In addition to identifying a large number of specimens for the systematic collection, the following studies have been contributed to Canadian mineralogy.

By Eugene Poitevin—

- A New Occurrence of Phosphorite from Lake François, B.C.
- Optical Properties of Analysed Ferroprehnite from Adams sound, Baffin Island.
- Zircon from Dungannon, Hastings County, Ont.
- Epidesmire from Thetford Mines, Megantic County, Que.
- Halotricite from Ashcroft, B.C.
- Tremolite Crystals from Admaston Township, Renfrew County, Ont.
- Yellowish Barite from Port Arthur, Ont.
- Alunogen from Vernon, B.C.
- Wolframite from Mud Creek, Rocher Déboulé, B.C.
- Zircon from Monmouth Township, Haliburton County, Ont.
- Tourmaline from Bagot Township, Renfrew County, Ont.
- Scolecite from Thetford Mines, Megantic County, Que.
- Barite from Lot 4, Concession I, Madoc, Hastings County, Ont.

By H. V. Ellsworth—

- Knopite and Magnetite Occurrence, Moore Creek, B.C. (With J. F. Walker).
- Euxenite-Polycrase from Mattawan Township, Nipissing District, Ont.
- Toddite—A New Uranium Mineral from Sudbury District, Ont.
- Ellsworthite Crystals from Haliburton County, Ont.

The Division of Mineralogy of the Geological Survey was one of the first institutions in America to distribute mineral collections. Several years ago these collections were given away free of charge, but the demand became so great that it was impossible to meet it. Our mineral collections are now distributed at a price which, though less than what they cost, serves to discourage unjustifiable requests. This year our output of collections almost doubled that of any preceding year since we commenced charging for them. The collections were distributed as follows:

Province	Standard	Grade No. 2	Grade No. 3	Miscellaneous	Mineral chips	Prospectors	Total
Yukon.....	0	0	0	0	0	0	0
B.C.....	1	0	1	1	0	11	14
Alberta.....	1	0	0	0	1	1	3
Sask.....	2	0	0	3	1	1	7
Man.....	1	0	0	1	0	2	4
Ont.....	7	2	17	15	0	80	121
Que.....	2	25	1	5	1	47	81
N.B.....	1	0	0	0	1	0	2
N.S.....	0	0	0	1	0	0	1
P.E.I.....	0	0	0	0	0	0	0
Foreign.....	4	0	0	20	0	6	30
	19	27	19	46	4	148	263

The standard No. 1 collection consists of 144 specimens contained in an oak cabinet and for which there is a charge of \$35. Grade No. 2 collection is contained in a smaller one-tray oak cabinet containing 44 specimens, for which there is a charge of \$12. Grade No. 3 collection is a special collection containing 40 specimens specially prepared for the teaching of elementary geology, for which there is a charge of \$6. Prospectors collections are given free and consist of sixteen specimens of the principal ores. Mineral chips are the small pieces derived from the preparation of the other collections. These are placed in small bags and sent free of charge to schools and universities for blowpipe and mineralogical work. Miscellaneous collections are various collections prepared to suit the demands of the purchasers.

Accessions

EXCHANGES

Louis Reamer, Short Hills, N.J., U.S.A. Margarodite; lithiophilite from Branchville, Conn.; hancockite; zincite-franklinite from Franklin, N.J.; cyanite, Irasburgh, Vermont; serpentine, Lambertville, N.J.; crocidolite, Ringwood, N.J., U.S.A.

DONATIONS

Shimmatsu Ichikawa, Kitashinjo-mura, Imatate-gun, Fukui-ken, Japan. Three individual quartz crystals and one quartz crystal from mount Kinbuzan, Kai province, Japan.

T. L. Walker, Director, Royal Ontario Museum of Mineralogy, Toronto, Ont. Sodalite; nepheline; zircon in nepheline syenite; cancrinite and hydronephelite; lepidomelane; aegirine from French River, Ontario.

Charles Hoadley, Englewood, N.J. Serpentine (vorhauserite); friedilite; sphalerite (twin); hematite and magnetite, Franklin, N.J.; tourmaline, Gilletts Quarry, Haddane Neck, N.J.; beryl, Auburn, Maine; triphillite, Hebron, Maine, U.S.A.

SPECIMENS COLLECTED BY OFFICERS OF THE GEOLOGICAL SURVEY

T. L. Tanton. 1 specimen of clinozoite, one mile north of Overflow station on Canadian National railway, Rainy River, Ont.

G. S. Hume. 1 specimen of dolomite from Pincer County mine, Okla., U.S.A.

C. H. Stockwell. 1 specimen each of spodumene, lepidolite, and montebrazite from Bear mining claim, lot 20, range 16, township 16, Manitoba.

DIVISION OF PALÆONTOLOGY (Geological Survey)

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

Field Work and Collections

Collections resulting from the field work of members of the Division of Palæontology of the Geological Survey include Coal Measure plants collected by W. A. Bell in Lake Ainslie district, N.S.; a collection of Mesozoic fossils from Moose River basin, made by F. H. McLearn; a collection of Ordovician fossils from Cornwall district, Ont., by A. E. Wilson; exquisitely preserved Hamilton fossils from Thedford and a collection of Onondaga fossils from Port Colborne, by E. M. Kindle. A small collection of conodonts was made at Shaleton, N.Y., by E. M. Kindle. C. M. Sternberg collected dinosaurian and other fossil remains from the upper part of the Edmonton

formation along Red Deer river above Drumheller, Alberta. These include a nearly complete skull of *Hypacosaurus*, a disarticulated skull of *Saurolophus*, two fairly complete skeletons of *Ornithomimus*, and a complete forelimb of a small *Albertosaurus*; fish, plant remains, and invertebrate fossils were also collected. A new genus and three species of fish not hitherto reported from the Edmonton beds were obtained.

The collection of fossils made by Mr. Soper in Baffin island is noteworthy because of the presence in it of a Utica fauna identical with that found in Ontario and New York state.

The division is indebted to various friends for gifts. Among these may be mentioned a Pleistocene crustacean from Ottawa, not previously found as a fossil in North America, which was presented by Brother Alphonse of the La Salle Street Academy.

Benjamin L. Bowling of the Iowa State Highway Commission has sent to the Survey a good collection of Middle Devonian stromatoporoids from Iowa.

Dr. Alexander Wetmore of the Smithsonian Institution has contributed to our collections a cast of types of the fossil bird *Diatryma gigantea*.

The American Museum of Natural History has presented to our collections a cast of the skull of the small dinosaur *Thescelosaurus*.

Office and Research Work

Several special reports on fossils have been prepared for other members of the staff by members of the division. Preparation of these has involved the study of considerable collections from Baffin island, N.W.T., and various parts of eastern and central Canada. Various reports on fossils from drill cores have been supplied to oil companies and to private individuals.

F. H. McLearn has continued the study of the Jurassic faunas of Skidegate inlet, Queen Charlotte islands, B.C. The work on Jurassic Ammonoidea which is now more than half completed is part of a comprehensive study of the Mesozoic stratigraphy and palæontology of Skidegate inlet.

W. A. Bell has described the Mesozoic flora collected during the summer of 1926 from Moose River basin, northern Ontario, by F. H. McLearn. Mr. Bell has also described a collection of Cretaceous plants made by F. A. Kerr in Cassiar district, B.C.

E. M. Kindle has completed a paper on the Devonian fauna of lower Peace river and begun a study of the Conodont fauna from the lower Mackenzie River valley, collected by him. A short paper on the discovery of the *Leptodus* in Canada has been published. The results of the study of water stratification in certain small lakes and its influence on sedimentation have been prepared for publication.

Miss A. E. Wilson has been on leave for university work during a part of the year.

Most of the graptolites collected have been studied by Dr. Rudolf Ruedemann of Albany. Dr. C. D. Walcott and Dr. Chas. Resser have, as in previous years, furnished reports on the Cambrian fossils collected by the Survey in British Columbia.

Visiting scientists have in two instances restudied and prepared for our publications new descriptions of museum types. Dr. F. A. Bather of the British Museum has redescribed *Dendrocystis? paradoxica* Billings. Dr. Alexander Wetmore, Assistant Secretary of the Smithsonian Institution, has figured the previously unfigured type of the fossil bird *Cyphornis magnus* from British Columbia.

Dr. Auguste F. Foerste has described three new cephalopods from Survey collections of Nova Scotia Devonian fossils.

The fossil flora of the St. Eugene silts of British Columbia was submitted to Dr. Arthur Hollick of the N. Y. Botanical Garden. The study of this flora has been completed and the results were published in the Memoirs of the N. Y. Botanical Garden, vol. 7, 1927.

Museum Exhibits

One of the new exhibits in the hall of palæontology is a collection of fossil and recent ripple-marks. The significance of the different types of ripple-marks in interpreting the history of sedimentary rocks is illustrated by plaster of Paris duplicates of freshly made ripple-marks and of thread-like lines of sand left on the strand line by spent waves. In another recently installed exhibit different types of limestone are shown and the factors concerned in their production are indicated.

Considerable progress has been made towards completing the preparation of the unique skull of *Styracosaurus*.

The skeleton of a very fine specimen of Pliocene horse has been mounted for exhibition during the year, but lack of space prevents its exhibition. Exhibition of additional material from the rich collections now on hand will have to await the acquisition of more exhibition space.

Collections of Fossils Supplied by Officers of the Geological Survey During the Fiscal Year 1926-27

- Bostock, H.S. Two small bags of Triassic? fossils from Hedley, B.C.
 Cairnes, C. E. A collection of Triassic and Mesozoic fossils from Slovan district, B.C.
 Dyer, W. S. A collection of marine and freshwater Cretaceous fossils from the Cretaceous of southern Alberta.
 Evans, C. S. Six boxes of fossils representing Cambrian to Devonian horizons from Upper Columbia River basins, B.C.
 Hayes, A. O. A collection of fossils from the Cambrian of New Brunswick.
 Hanson, G. A collection of Mesozoic fossils from Portland Canal district, B.C.
 Howard, W. V. A collection of Devonian fossils and four graptolites from Gaspé peninsula, Que.
 Hume, G. S. A collection of Benton and Belly River invertebrate fossils (Cretaceous) and one tooth of carnivorous dinosaur from lower Belly River beds of Turner valley, Alberta.
 Kerr, F. A. Five boxes of Permian or Triassic invertebrates, and Upper Cretaceous and Tertiary plants from Stikine river, B.C.
 Kindle, E. M. A collection of Onondaga fossils from Port Colborne and a collection of Hamilton fossils from Thedford, Ontario.
 Soper, J. D. A collection of Ordovician and Silurian fossils from Baffin island, N.W.T., including a Utica shale fauna.

- Sternberg, C. M. A collection of dinosaurian fossils, together with some fish, plant, and invertebrate fossils from the Edmonton, above Drumheller, Alberta.
- Williams, M. Y. A collection of vertebrate fossils representing fragments of about 33 species from Oligocene beds of Calf creek, Cypress hills, Saskatchewan.
- Wilson, A. E. A collection of Ordovician fossils from Cornwall district, Ontario.

Gifts

- Mr. Benjamin L. Bowling. A collection of stromatoporoid corals and slab of polished limestone from the Cedar Valley formation, Mid Devonian, Mason City, Iowa.
- Dr. A. Wetmore, Assistant Secretary, Smithsonian Institution. A cast of the type of a fossil bird *Diatryma gigantea*.
- Brother Alphonse. Concretion with fossil crustacean, Pleistocene, Ottawa.
- Hudson's Bay-Marland Oil Company, through Mr. Delomer L. Powers. Devonian fossils from well core of Black Rock Petroleum well 2½ miles below Wabiskaw (Loon) river, Alberta.
- Mr. E. M. Fyles. Three specimens of Carboniferous fossils from Magdalen islands, gulf of St. Lawrence.
- Mr. Hoyes Lloyd. Pleistocene fossils (fishes, leaves, and molluscs) Greens creek, Ottawa.

THE NATIONAL MUSEUM OF CANADA

By *W. H. Collins*

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ORIGIN

On January 5, 1927, the Governor General in Council gave authority "to designate the Museum branch of the Department of Mines the 'National Museum of Canada'" (P.C. 2165). Assumption of this impressive name implies acceptance of important duties towards the people of Canada. But, probably less than half of living Canadians are aware that they possess and maintain a National Museum. Therefore, it is a first duty of the Museum to make itself and its aims known as widely as possible. The present review of the origin and development of the Museum is presented for this purpose.

There is a prevalent but erroneous idea, even among many who are personally acquainted with the National Museum, that it is a young institution. This notion is probably consequent to the transfer of the Museum in 1910 to the imposing new building at the foot of Metcalfe street, which was built especially for it, and which it still occupies. The notion is apt to be strengthened by the recent conference upon the Museum of a new name. As a matter of fact, however, the institution recently named the National Museum of Canada is nearly a century old and its history and growth are intimately enough connected with the history and growth of the country to render its new name appropriate. It seems desirable in this volume, which is intended to be the first of a series of separate annual reports upon the work of the National Museum, to review briefly its origin and development up to the present.

The National Museum originated in the Geological Survey of Canada, with which it is still closely connected, and its early history is inseparable from that of the Survey. As long ago as January, 1832, one Doctor Rae petitioned Sir John Colborne, Lieutenant-Governor of Upper Canada, for pecuniary assistance to make a geological survey of the province, but although recommended by the Lieutenant-Governor the request was denied by the Committee of Supply in the House of Assembly. In December of the same year the York Literary and Philosophical Society asked with no better success for a grant of money for the purpose of investigating the geology, mineralogy, and natural history of Upper Canada. No further action seems to have been taken until 1836, when, on motion of Mr. W. L. Mackenzie, grandfather of the Present Prime Minister of Canada, a committee composed of Messrs. Dunlop, Gibson, and Duncombe was selected to consider and report on a plan for a geological survey of the province. The report was made, but not considered by parliament, so in November Mr. Dunlop gave notice of a motion to bring in a bill to institute a geological survey. The bill was not proceeded with, but on motion of Mr. Dunlop later in the month the House of Assembly went into Committee of the Whole to consider the expediency of a geological survey.

"Again, in December, 1836, Mr. Dunlop, with characteristic pertinacity, gave notice of an address to the King for a grant of wild land to defray the expense of a geological survey; but again the address failed to be presented. Here the matter dropped, not to be revived until after the union of the Provinces, during the administration of Lord Sydenham, a man who fully appreciated the importance of ascertaining the nature and extent of the mineral resources of Canada.

The first united Parliament met in 1841, and in the month of July the Natural History Society of Montreal, through Mr. Benjamin Holmes, and the Literary and Historical Society of Quebec, through Mr. Henry Black, petitioned for aid to carry out a geological survey. The result was that the matter was taken up by the Government, and on the motion of the Hon. G. B. Harrison, the sum of £1,500 sterling, for the purposes of a survey, was included in the estimates."¹

During this same period a young man in England endowed with the passion for science, the singleness of purpose, and the sound body requisite to make full use of the opportunity so slowly but pertinaciously achieved, was training himself as if destined for it by the sure hand of Providence. This man, William Edmund Logan, was to exercise such a profound and lasting influence upon scientific development in Canada, that an outline of his life is essential for a proper understanding of the history of the two institutions with which this article is concerned. He was born in Montreal

¹ Harrington's "Life of Sir William Logan", pp. 125-126.

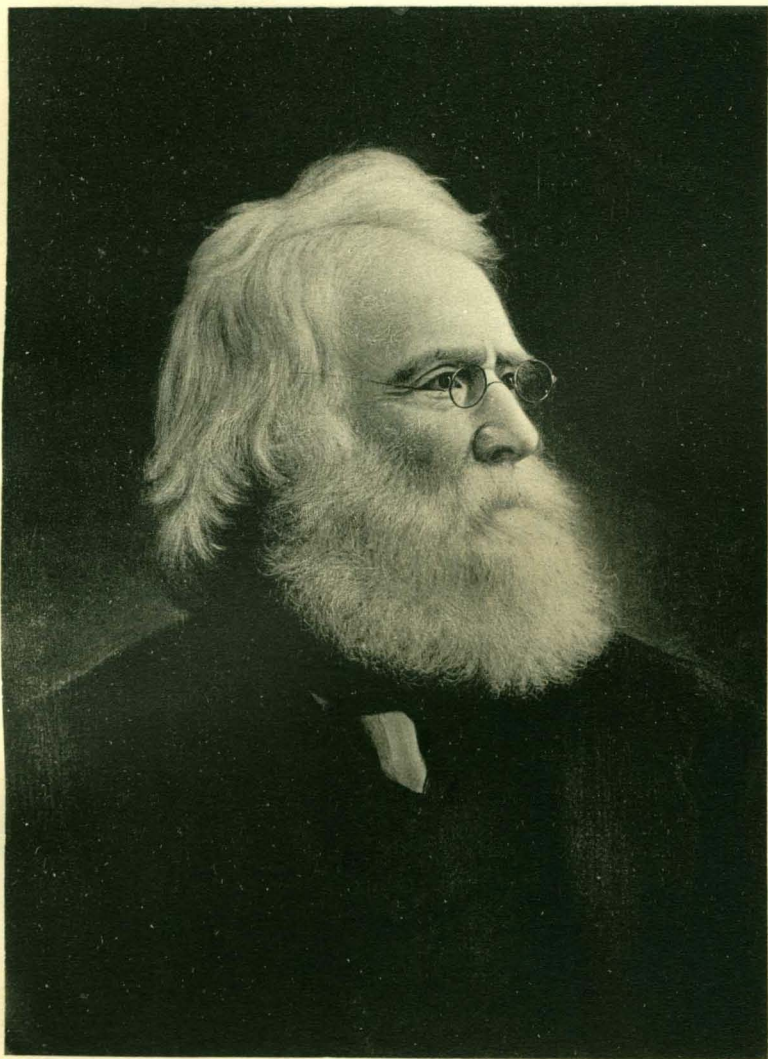
on April 20, 1798. In 1814, he was sent to Edinburgh to be educated; but, though a sojourn of only a few years was contemplated, a series of domestic circumstances was to keep him in the Old Country for twenty-six years. Although young Logan acquitted himself with distinction at Edinburgh High School, he left school in 1817 before entering a university to take a position in the counting house of an uncle in London. He lived in London for the next fourteen years. During this period, though most of his time seems to have been given to business, society, and travel, Logan must have devoted considerable attention to science, for in his letters he refers to his "scientific books" on chemistry, mineralogy, and geology and admits that he had become "a bit of a collector." Certainly, when in 1831 he went to Swansea, in Wales, to take a position in a copper-smelting works of which his uncle owned a share, he appears to have been well informed in the natural sciences. Although he was at first engaged in accounting, eventually he had to attend to the smelting of copper and mining of coal. By 1837 he was a Fellow of the Geological Society, had exhibited in that year before the British Association a geological map of South Wales coal district which attracted complimentary attention, and was Honorary Secretary and Curator of the geological department of the Royal Institution (Museum) of South Wales, to which he contributed collections of minerals, metallurgical products, and birds which he himself shot and prepared.

A naturally strong interest in Canada was accentuated now by a desire to satisfy his enthusiasm for geology in this virgin field. In August, 1840, he embarked for Halifax. The arrival in Canada of Logan, possessed with a passion for natural science, would seem to have coincided providentially with the decision of the government of the united provinces of Upper and Lower Canada to institute a geological survey. After spending the summer of 1841 in travelling in United States and Canada, engaged chiefly in geological observations, he returned to England; but his friends in Montreal, knowing his desire to obtain the position of provincial geologist, placed his name before the Governor, Sir Charles Bagot. The position was offered to him in the spring of 1842 and accepted.

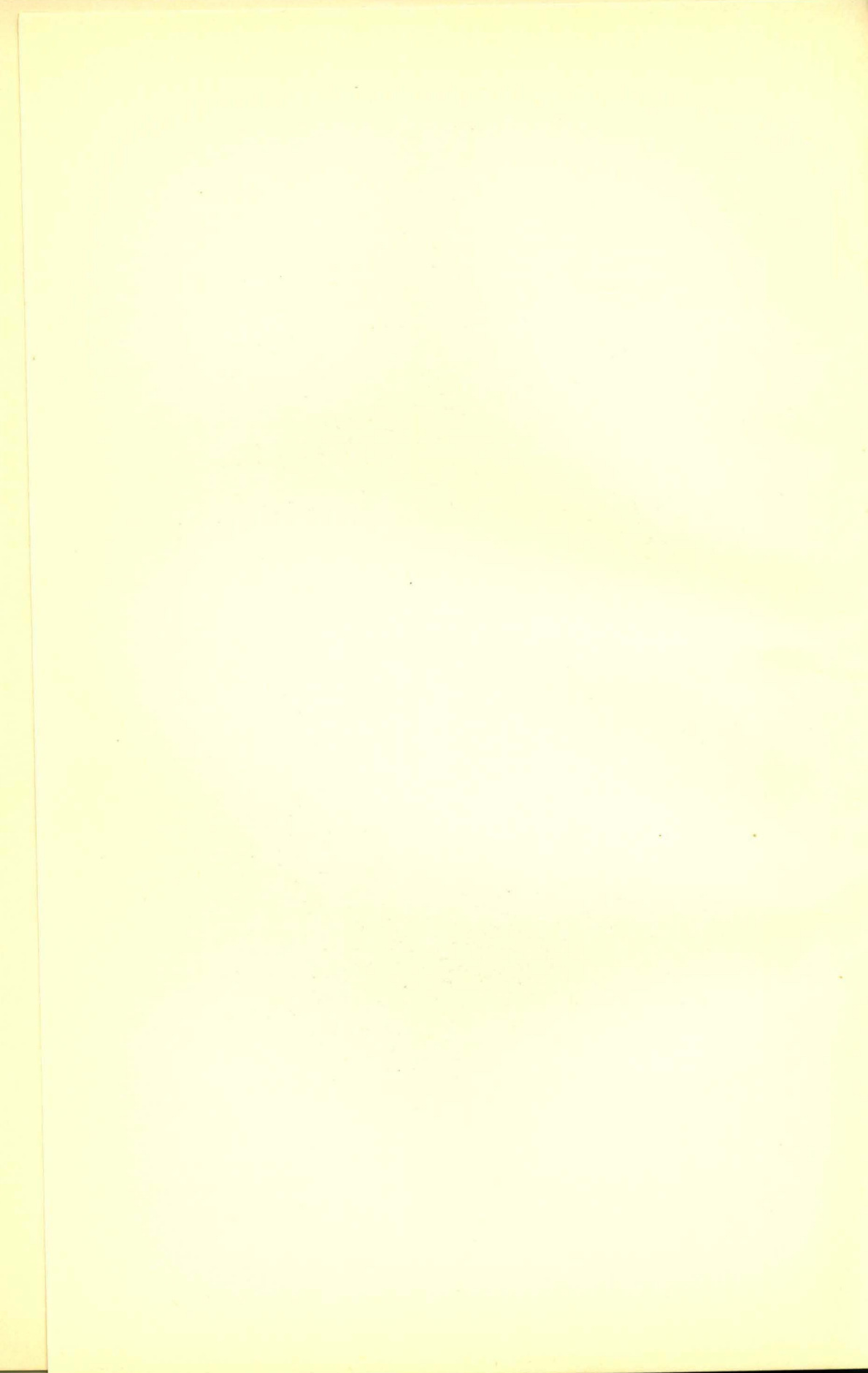
In such manner was the foundation of the National Museum of Canada laid. For, although Logan is best known as the founder of the Geological Survey of Canada, in no less degree was he the founder of the National Museum of Canada, though for many years it was not to be known by this name. As will be seen, the Museum was to become a natural adjunct and outgrowth of the Geological Survey.

THE LOGAN OR PRE-CONFEDERATION PERIOD

Logan returned to Canada in the spring of 1843 to assume his new duties. Alexander Murray had meanwhile been appointed assistant provincial geologist and the two immediately began geological field work, Murray in the territory between lake Huron and lake Erie and Logan in Gaspe. During that summer they collected large quantities of minerals and fossils, and one of their first problems on returning to Montreal was what to do with their specimens. Logan's brother, James, a business man in Montreal, came to their assistance by giving them an "upper chamber" in his warehouse on St. Gabriel street. There the specimens



Sir William Edmund Logan, first director of the Geological Survey Canada. From a painting in the possession of the Geological Survey.



were unpacked, labelled, catalogued, and repacked in numbered boxes. This was the beginning of what is now the National Museum. In a letter of December 11 to Mr. R. W. Rawson, Secretary to the Governor General, Logan wrote: "The collection of specimens the Survey has brought together is quite overwhelming, and when I observe the small impression Murray and I have yet made on our seventy great boxes, most of them requiring at least two men to lift, I am almost in despair. The fossils alone would be quite occupation enough for a palæontologist for six months."

To understand the struggle for existence of the Geological Survey and its Museum, the extremely limited facilities for its development, and the personal courage and self-sacrifice of Logan and his associates during the next ten years or so, it is necessary to consider briefly what conditions in Canada were at that time. Canada then comprised the two provinces of Upper and Lower Canada, now Ontario and Quebec. In 1843 there were about 1,100,000 people in the two provinces, less than 450,000 in Upper Canada, and nearly 700,000 in Lower Canada. These were distributed chiefly along St. Lawrence river and the Great Lakes, as far as lake Huron. The chief towns were Quebec, Montreal, Kingston, and York (Toronto). There was a small outpost settlement at Sault Ste. Marie and a still smaller and more isolated one at Prince's Harbour, now Port Arthur, and Fort William. The first railway had been built in 1836 between St. Johns and Laprairie, in Lower Canada, a distance of 16 miles, for the purpose of shortening the journey to New York; and even in 1850 there were only 66 miles of railway in all Canada. Queen's University was opened at Kingston in 1842 and Kings College (now University of Toronto) at Toronto in 1843. Kingston was the seat of government until May 10, 1844, when parliament was moved to Montreal and still later to Toronto. Ottawa, then Bytown, was a village, connected with Kingston only eleven years before by completion of the Rideau canal, and not to be the seat of government of Canada until 1866. There were over 400,000 persons living in Nova Scotia, New Brunswick, and Prince Edward Island, but communication between this maritime settlement and Canada was by water and irregular. Vancouver had planted a small British colony near Victoria on Vancouver island, but, except for the small Selkirk colony at Fort Garry (now Winnipeg), there was no white settlement between it and the head of lake Superior and no roads or railway. Except for these small settlements along the Atlantic seaboard, St. Lawrence river, and the Great Lakes, and on Vancouver island, what is now the Dominion of Canada was known only to the Hudson's Bay Company and to a few adventurers.

Money was scarce and people's efforts were being directed chiefly to clearing land, building roads, and obtaining a livelihood. Fifteen hundred pounds sterling was a considerable offering to be made to the cause of scientific research and additional contributions to the same cause could not lightly be given. Logan must have known that this sum would only begin to finance such a task as the geological survey of a region of unknown size but many times larger than England and mainly wilderness. He was sagacious enough to see that something practical must be done if further money were to be obtained for his Survey. Accordingly, he devoted special attention to economic geology and the study of minerals. In a letter to Murray, dated March 7, 1844, he wrote, "I must get a house or set of rooms for our collection. Managing this, we must put our econo-

mic specimens conspicuously forward; and it appears to me that in the exhibition of these, large masses will make a greater impression on the mind than small specimens. . . . This induces me to say that I should like you to send to Montreal, as soon as it can be done by water communication in the spring, a thundering piece of gypsum. Let it be as white as possible. . . . If you come across the lithographic stone, let us have a huge slab of it, 6 or 8 inches thick."

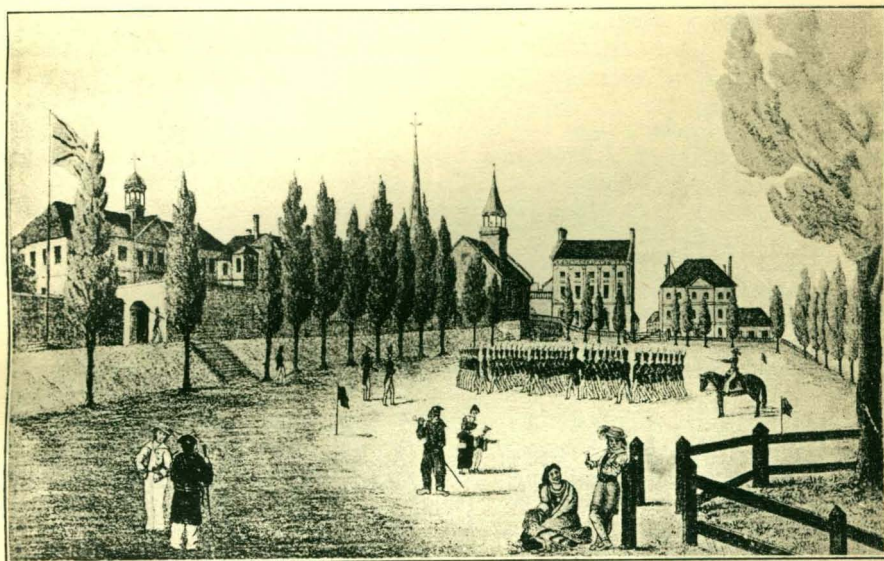
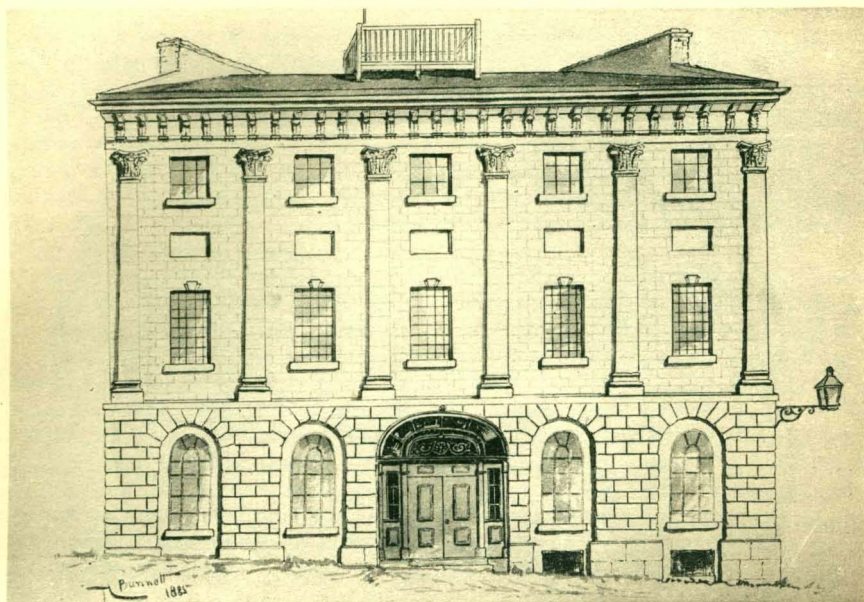
About the same time he wrote to De la Beche, Director of the Geological Survey of Great Britain: "I have hired a house on speculation and am ordering proper cases to hold some of them" (specimens collected by himself and Murray), "in the confident expectation that the expenditure will be sanctioned by the Legislature. But perhaps I may be reckoning without my host, and may be left in the lurch after all." The house referred to, which served as museum, office, and laboratory was No. 40, Great St. James street.

All Logan's courage, sagacity, and indifference to personal material gain were needed to keep his Survey going for the next few years. By the end of 1844 all of the fifteen hundred pounds was gone and eight hundred more out of his own pocket. However, he was asked by the Government to prepare an estimate of the cost of continuing the Survey, which he did with great care, taking pains also to explain his work and aims to the members of the Legislature. His bill was enacted early in 1845, providing £2,000 annually for five years. Three hundred of this went to Murray for salary, an equal amount to a Polish chemist and mineralogist, De-Rottermund, whom Logan had engaged in 1844 on his own responsibility, and one hundred and twenty for rental of their quarters; and Logan recovered his eight hundred pounds. This act of 1845 contained the first official authorization of museum work, for it provided that the Geological Survey should "furnish a full and scientific description of its Rocks, Soils, and Minerals . . . together with a collection of Specimens to illustrate the same."

During 1846 the museum and officers were moved to a more commodious building on Little St. James street, which was leased from the Natural History Society. The arrangement appears to have been mutually beneficial, for the Society retained rooms on the third floor for its specimens and books.

The government had been moved from Montreal to Toronto, and in February, 1850, Logan was there, once more striving for support to have the Act to provide support for the Geological Survey renewed. After some delay this was done, and the same annual supply of money was promised for another five years.

It was also decided at this time that a collection of Canadian economic minerals should be sent to the great 1851 Exhibition in London, and the preparation of the collection was entrusted to Logan and his staff. This was a new museum activity, the first of a long series of exhibitions of Canadian minerals and mineral products at World's fairs and similar international exhibitions, that continued until 1921, when it was finally taken over by a special organization now in the Department of Trade and Commerce, called the Exhibitions Commission, that had been created some years before. Logan performed this task so thoroughly that special commendation was given the Canadian exhibit in the report of the Exhibition Committee: "Before commencing the detailed description of objects



Another interesting drawing of Champ de Mars made at the time when barracks were maintained in the rear of the old Court House, as plainly shown in the engraving. No vestige of these soldiers' quarters remains to-day, even in the memory of the oldest inhabitant.

Former residence of Honourable Peter McGill, St. Gabriel street, Montreal, occupied by the Geological Survey of Canada from 1852 until 1874. (Courtesy of McCord National Museum, Montreal.)

A. From a drawing by H. Bunnett in 1885.

B. From a sketch by James Duncan, looking from Champ de Mars.

which have obtained medals or honourable mention, we feel bound to mention also the interesting collection from Canada procured by Mr. Logan, Director of the Geological Survey of that colony. . . . Of all the British Colonies, Canada is that whose exhibition is the most interesting and the most complete; and one may say that it is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their products to the exhibition." This enterprise did much to attract attention to the natural resources of Canada and strengthened public support of survey and museum work.

In the spring of 1852 the Museum and offices of the Survey were once more moved from Little St. James street to a building on St. Gabriel street, which had been built as a residence by the Honourable Peter McGill but was afterwards acquired by the Government. Though not designed for a Museum it was a great improvement upon the previous quarters. But Logan felt that even this should be a temporary arrangement, for in his "Report of Progress for the Years 1852-3" he observes: "It may be a consideration whether a growing country like Canada could not afford to anticipate what its future importance may require in the nature of a national museum, and at some future time not far distant, erect an appropriate edifice especially planned for the purpose." This appears to be the earliest reference to the Geological Survey Museum as a national museum.

The wisdom of Logan in having stressed the utilitarian aspects of survey and museum work was tested and amply justified in 1854, when the question of renewing financial support to the Geological Survey again had to be considered. A Select Committee was appointed by the government on September 26, 1854, to inquire into the operation and usefulness of the Geological Survey. After thorough inquiry this Committee reported: "Your Committee think that they may pronounce with confidence that in no part of the world has there been a more valuable contribution to geological science for such a small outlay (hardly more than £20,000 in all)." They recommended that greatly increased facilities be provided for the work, and in 1855, a new bill was passed providing \$20,000 annually for five years, and a sum of \$8,000 for publishing a report on the geology of Canada and a geological map. Supplies of money were voted annually after the expiration of this renewal act until 1864, when on June 8, another act was passed by a large majority, making provision for the Survey for another five-year period.

Momentous changes were in store for Canada, and for its Geological Survey, during this period. In 1867, the British North America Act was passed, uniting New Brunswick and Nova Scotia with Quebec and Ontario and providing for the entry of yet other provinces. Logan realized that the field of operations of his institution would be greatly extended and would be too great for the failing powers of a man then almost seventy years old. With the interests of the Survey ever foremost, he tendered his resignation as Director in January, 1869; but until his death, in June, 1875, he continued to devote himself, though with pathetically increasing interruptions, to geological study and writings.

Logan won distinction chiefly as a geologist and as founder of the Geological Survey, which, during the quarter century he directed it, had achieved a high reputation in Europe as well as America as a scientific institution and had grown from a transient undertaking supported by

£1,500 to a permanent establishment which the Government of Canada had come to respect and give continuous and increasing financial support. But his sympathy and aptitudes extended to other branches of natural science. That he was no mean botanist is shown by admirable drawings of plants in his note books. Before he came to Canada in 1842 he had collected and stuffed birds for the Museum at Swansea and his biographer, Harrington, tells of a visit to New York accompanied by a pet turtle, with which he took up quarters in the Astor House. He preoccupied himself from his arrival in Canada with the development of a natural history museum, upon which he expended great personal effort and at times maintained with his own money. From the first he and Murray fulfilled the geological needs of the Museum, and as time passed he drew other enthusiastic geologists into association with him. The chemist and mineralogist, DeRottermund, was secured in 1844. His services do not seem to have been entirely satisfactory and he was succeeded soon by Olmstead and, on Olmstead's death in 1846, by Thomas Sterry Hunt, who made a distinguished name by his researches and writings on Canadian minerals. Ten years later, in 1856, Logan obtained the appointment of Elkanah Billings, a barrister who had taken up the study of palæontology and who was to be the first of a distinguished line of specialists, Whiteaves, Ami, Lambe, and Kindle, the present head of the division of palæontology in the Geological Survey and National Museum. There were in Logan's time no departments of biology or anthropology, but these were soon to follow. To both the institutions which he created Logan left a reputation as a scientist and administrator which with the passing of time has grown into a proud tradition.

1867-1907

By the British North America Act in 1867 New Brunswick and Nova Scotia joined Lower Canada (Quebec) and Upper Canada (Ontario) to form the Dominion of Canada. Manitoba and the North West Territories were admitted in 1870, after purchase from the Hudson's Bay Company of this company's lands, British Columbia in 1871, and Prince Edward Island in 1873. By this time it was possible to travel by road, railway, or steamship from Nova Scotia as far west as Prince Arthur Landing and northward about to a line from Georgian bay to the city of Quebec. The remainder of the vast region, except for the isolated settlement on and near Vancouver island, and a tiny one at Fort Garry was a little known wilderness. A great curiosity existed about this vast territory. Also, British Columbia entered Confederation on condition that a railway should be built across Canada to link it with the larger settlement around the Great Lakes, and it was at once necessary to discover a practicable route and to study the resources of the country to be crossed.

The work of exploring this new country devolved largely upon the Geological Survey since it was the only Government organization equipped for survey and investigation of natural resources. Under Dr. A. R. C. Selwyn, who succeeded Logan as director on December 1, 1869, there began and continued for about thirty-five years a period of wide-faring adventure equalled by few if any other scientific institutions. Selwyn and Dawson explored a large part of British Columbia, the two Tyrrells traversed and mapped the Barren Grounds west of Hudson bay, Bell

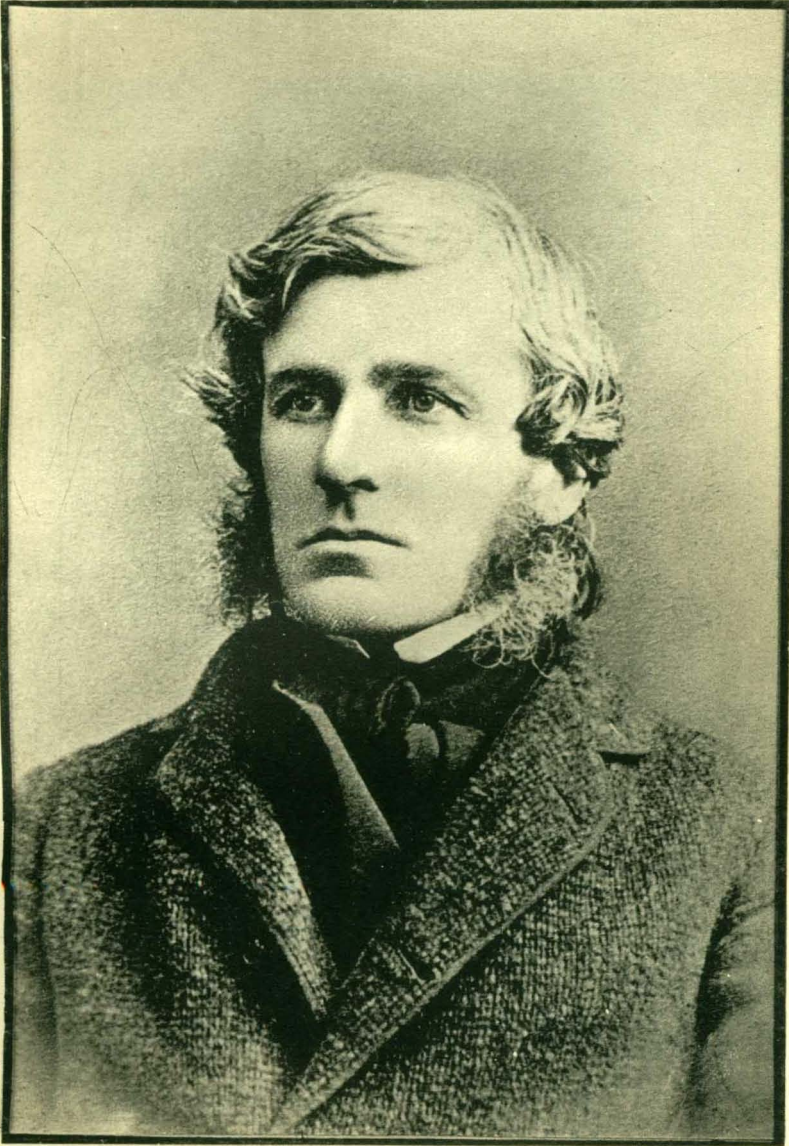


PITCHER PLANT (*Sarracenia purpurea*, L.),
A common plant in the swamps of the Laurentides.
Logan's Journal.

A sketch from the notebook of Sir W. E. Logan. From Harrington's Life of Sir William Logan.

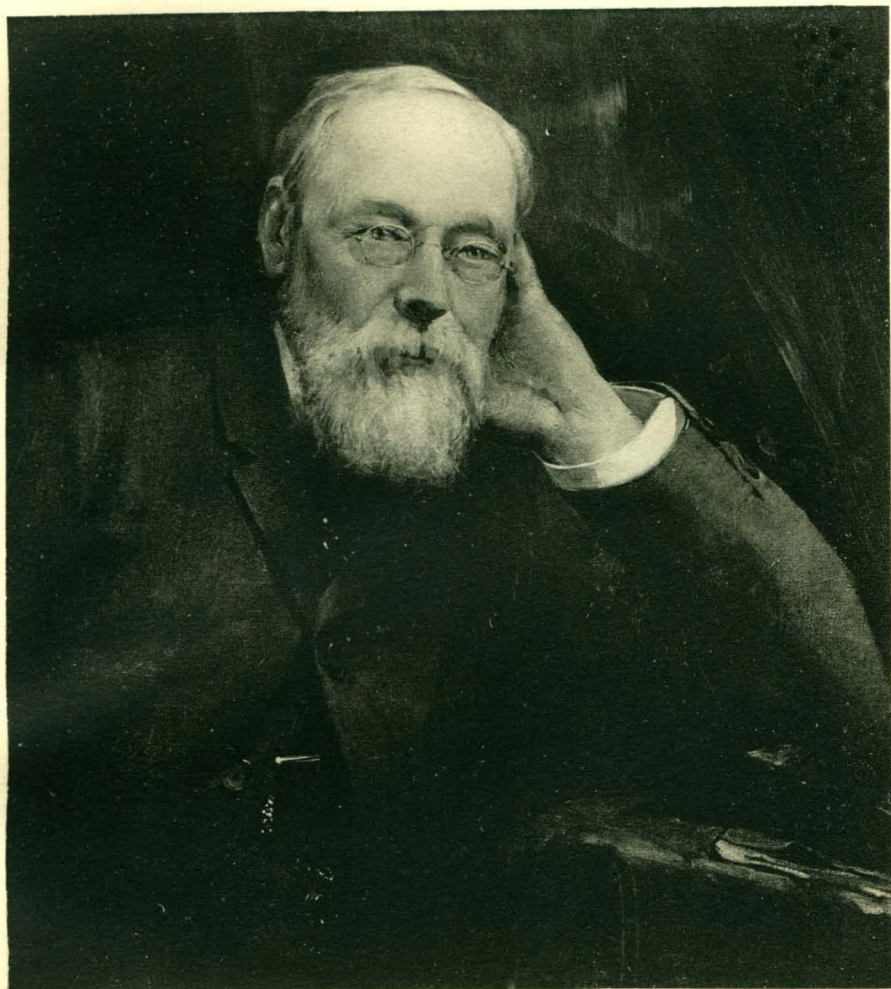


Thomas Sterry Hunt, with whom originated the division of mineralogy in the Geological Survey and the National Museum.



Elkanah Billings, first palaeontologist to the Geological Survey.





Alfred R. C. Selwyn, second director of the Geological Survey. From a painting in the possession of the Survey.

explored James Bay region and Baffin island, our present knowledge of Labrador is largely the work of Low, McConnell did extraordinary exploration work in Yukon, and the Survey publications during this period record the work of many others scarcely less deserving of mention.

It was a time peculiarly favourable for the growth of a national museum. If the new federation was to develop intelligently much had to be learned about the natural character and resources of a territory of enormous size, of great topographic and climatic diversity, and as yet practically unknown. Field officers of the Survey had not yet begun the narrow specialization characteristic of today. They practised and interested themselves in almost the whole gamut of outdoor sciences and their reports are storehouses of information regarding the topography, climate, fauna and flora, and native people, as well as the geology and mineral resources. They collected abundantly in all branches of natural history. For example, on pages 48A-50A of the Annual Report of the Survey for 1886, is a list of thousands of specimens of mammals, birds, insects, shells, fossils, minerals, rocks, and other natural history material collected in that year by field officers. Also, the Survey was established on a comparatively permanent footing, and its appropriations, and staff of trained field officers had to be greatly increased in order to deal effectively with the field so enlarged by Confederation. Between 1843 and 1869 Survey field parties had increased only from two to three; but in 1870 there were six, in 1880, eight, and in 1890, fourteen.

The existence of the Survey was still continued for five-year periods, but its purposes were becoming better understood and larger amounts of money were being appropriated to it. In 1868 a new Act was passed providing \$30,000 annually for the next five years. Among the terms of this act the Geological Survey was required to collect specimens of rocks, soils, and minerals and deposit them in the

“Geological Museum, as a collection for the whole Dominion of Canada, and which shall be open at all reasonable hours to the public, and shall be furnished with such books and instruments as may be necessary for the illustration of the science and the prosecution of the Survey.”

Four years later the annual allowance of money for all purposes was raised to \$45,000 for the next five years. At last, in 1877, the Geological Survey was given continuity of existence for an indefinite period. Thence forward to the present time it has presented to Parliament each year a budget of its needs upon which have been based the amounts of money voted for it. In this Act of 1877 the museum functions of the Survey were recognized more fully.

“It shall be the duty of the persons in charge of the said Survey:—(2) To continue to collect the necessary materials for a Canadian Museum of natural history, mineralogy and geology; (8) The Museum shall be opened to the public from ten a.m. until four p.m. Sundays excepted, and shall be furnished with such books, instruments and apparatus as may be necessary for scientific reference, and for the prosecution of the Survey; and the Governor in Council may, from time to time, cause the enlargement of the museum, and the distribution of duplicate specimens to scientific, literary and educational institutions in Canada and other countries.”

Much of this is only an expression of what the museum activities had already become under Logan and Selwyn. Selwyn appears to have been a man of methodical disposition, to whom the shopkeeping duties of museum work were not uncongenial. Under him the museum grew rapidly and its purpose and methods of conduct became well established. For example,

a regular practice had been begun as early as 1874 of recording the number of visitors to the museum. From the first of May of that year until the first of April, 1875, 1,017 persons visited the Museum. Next year there were 1,728. In 1882 the number had increased to 9,549 and in 1886 it was 14,465. A careful system of numbering, recording, and labelling specimens was in use and eventually a catalogue of rocks, minerals, and ores, upon which much labour had been expended, was published (Catalogue of Section One of the Museum of the Geological Survey, by G. C. Hoffmann, 1893). Each field officer of the Survey was habituated to collect specimens not only of rocks, minerals, and fossils, but of plants, animals, and relics of the native peoples, and was so assiduous in doing so that it was increasingly difficult to provide enough accommodation for the collections.

In the Report of Progress for 1870-71, a year after his arrival in Canada, Selwyn observes:

"The building devoted to the purpose of the Museum and Office of the Geological Survey is an old three-storey stone dwelling house, situated at the corner of St. Gabriel street and Fortification Lane. The premises have been occupied by the Geological Survey since 1852. The amount, not exceeding \$100, mentioned as having been annually expended on the premises, by Sir W. E. Logan, has been chiefly devoted to keeping the roof water tight. it will readily be believed that the buildings, especially externally, and the premises generally, are now in a condition which makes it exceedingly desirable. that they should be thoroughly and substantially repaired, without delay. The geological collections exhibited in the Museum have hitherto been restricted to specimens from the provinces of Ontario and Quebec. no space whatever now remains to exhibit any of the specimens from the other provinces, which are annually being added to the collection, in larger numbers."

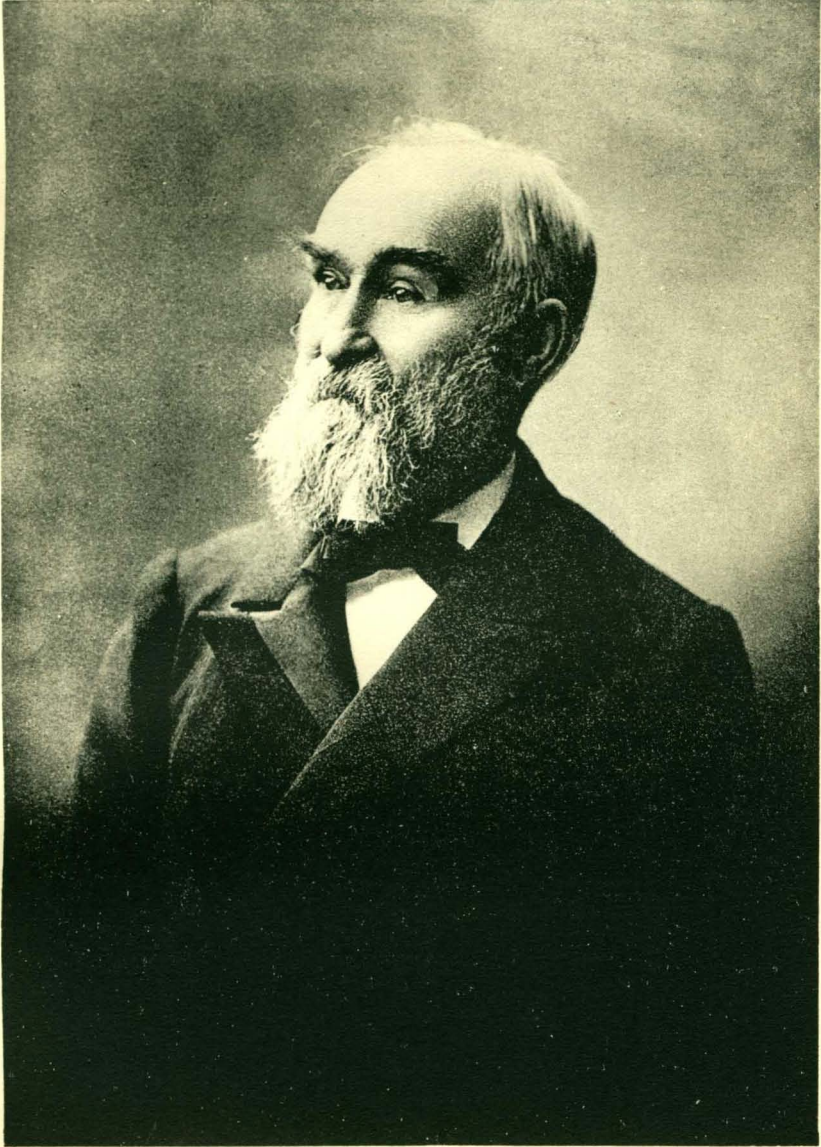
This emphatic plea seems to have been effective, for in the summer of 1874, the offices of the Survey were removed to a new building which had been built by Sir William Logan on St. James street immediately behind the brick wing of the Museum and connected with it by fireproof iron doors. Concerning this building and other evidences of Logan's devotion to the Survey, Selwyn writes in a later report:

"Not long before his death, Sir William stated that he intended the whole of his library and surveying instruments, purchased at a total cost of \$8,532, to remain for the use of the Survey. Besides the cost of the library and instruments, he expended \$8,434.38 in various items on account of the Survey and the commodious offices, on St. James street, built at a cost of upwards of \$30,000, and now occupied by the Survey, are likewise due to his liberality."

It is to be observed, however, that the Government afterwards, about 1881, paid Logan's estate \$1,500 for the library and \$3,000 for the instruments.

The growth of the Museum is referred to again in the Report of Progress for 1874-75:

"The Geological Survey Museum now possesses by far the largest collection in existence of the Secondary fossils of the British American Pacific coast. and it is much to be regretted that want of funds to provide the requisite fittings and cases in the Museum will at present prevent their being exhibited. Besides geological collections—rocks, minerals, and fossils—Mr. Richardson had brought a number of specimens of plants and marine animals. It is very desirable that there should be on exhibition in the Museum for reference and for general information, a good collection of models and examples of the newest and most improved machinery, tools, and implements, as well as of metallurgical works and processes."



John Macoun, first botanist to the Geological Survey. From a painting in the possession of the National Museum.

In his report for 1876-77, Selwyn also remarks that

"In view of the probable establishment in the Dominion, at some future time, of a general *National Museum*, it has been deemed advisable to utilize the resources of the Survey as much as possible in obtaining specimens from other countries in exchange."

How the Museum collections increased through the industry of Selwyn and his associates was revealed in 1880, when it was decided to move the Geological Survey from Montreal to Ottawa, the new seat of government. Selwyn reports in the Report of Progress for 1880-81-82 that there were shipped 1,729 boxes, 101 barrels, and 162 miscellaneous packages weighing 282,585 pounds.

Before its removal to Ottawa the Survey had given some attention to botany. Logan's notebook contains interesting botanical notes and excellent sketches of plants. About 1857 there was on the staff a Mr. D'Urban, who held the position of naturalist and botanist. The Report of Progress for 1866-69 contains a long appendix on the flora of Manitoulin island, written by Dr. John Bell, M.D., who had been a volunteer member of a geological expedition under his brother, Robert Bell. Plants and botanical information had also been collected by Richardson and others. But in 1882 there was added to the staff a specialist in botany, John Macoun, who established the present division of biology and who ranks with Logan, Selwyn, Hunt, Billings, and Dawson as originators of the existing National Museum.

Macoun was an Irishman, born April 17, 1831, in county Down, who emigrated to Canada with his parents in 1850 and settled near Belleville, Ontario. He became a school teacher in Albert College, Belleville. By reading, assiduous self-training, and through acquaintance made with the great specialists of his time in United States and in the Old Country he became also an acknowledged authority on Canadian botany, which science seems to have attracted him powerfully from boyhood. No wonder, then, that he was chosen to accompany the expedition of 1871 under Sandford Fleming, which was sent to explore and investigate the possibilities of the country across which a railway was to be built to reach British Columbia. His report, published in 1874, was influential in deciding upon the construction of the Canadian Pacific railway, inasmuch as it and later reports refuted an idea, then prevalent, that western Canada was too cold and too arid for farming. At that time Dr. Selwyn was also preparing for an expedition to British Columbia. Though mainly for the purpose of studying the geology, geography, and mineral possibilities, survey expeditions of this period concerned themselves with all matters pertaining to natural history and natural resources. Selwyn was so impressed by Macoun's report that he determined to have Macoun accompany him. This Macoun did, in 1875. He made other expeditions to western Canada between then and 1880 and after the fourth he was given a permanent appointment from January 1, 1882, as botanist to the Geological Survey, then just moved to Ottawa from Montreal.

Macoun was a botanist, but like Logan and so many other of his contemporaries, he interested himself in other branches of natural science, with considerable success. His "Catalogue of Canadian Birds" is an authoritative work and the first systematic contribution to the subject. He remained with the Survey until his death, in 1920, and during this period the Museum was enriched with well-balanced collections of mammals, birds, insects, and aquatic animals, as well as plants.

With Macoun's appointment the Survey had well-established departments of geology, mineralogy, palæontology, and biology, with specialists in each and a fair staff of artists, taxidermists, preparators, and other trained assistants. Work of a high order had also been commenced in Canadian anthropology by G. M. Dawson. Dawson, who succeeded Selwyn as Director in 1895, was one of the most brilliant scientists among the long list of men who at one time or another belonged to the Geological Survey. He was the second son of Professor (afterwards Sir) William Dawson, of McGill University. Born August 1, 1849, at Pictou, Nova Scotia, he was educated at Montreal High School, McGill University, and the Royal School of Mines, London, where he studied under Huxley and Ramsay. In 1871 he was appointed geologist and botanist to Her Majesty's North American Boundary Commission created to fix the boundary between Canada and the United States from Lake of the Woods to the Rocky mountains. The breadth of Dawson's scientific interest is indicated by the fact that five of the papers he wrote upon observations made during the boundary survey were "Lignite Formations of the West," "Occurrence of Foraminifera, Coccoliths, etc., in the Cretaceous Rocks of Manitoba," "Some Canadian Species of Spongillæ," "Superficial Geology of the Central Region of North America," and "Locust Invasion of 1874 in Manitoba and the Northwest Territories." He was appointed to the staff of the Geological Survey in 1875, and was Director from 1895 until his death, on March 2, 1901. He made numerous contributions to the ethnology of the Indian peoples, of which his report "On the Haida Indians of the Queen Charlotte Islands" in the Report of Progress for 1878-79, is probably the most important. He also collected much valuable Indian material for the Museum. W. J. McGee, writing in the *American Anthropologist*, said of his ethnological work:

"While several of Dr. Dawson's titles and the prefatory remarks in some of his papers imply that his ethnological researches were subsidiary to his geological work, and while his busy life never afforded opportunity for monographic treatment of Canada's aborigines, it is nevertheless true that he made original observations and records of standard value, that much of his work is still unique, and that his contributions, both personal and indirect, materially enlarged knowledge of our native tribes. It is well within bounds to say that in addition to his other gifts to knowledge, George M. Dawson was one of Canada's foremost contributors to ethnology, and one of that handful of original observers whose work affords the foundation for scientific knowledge of the North American natives."

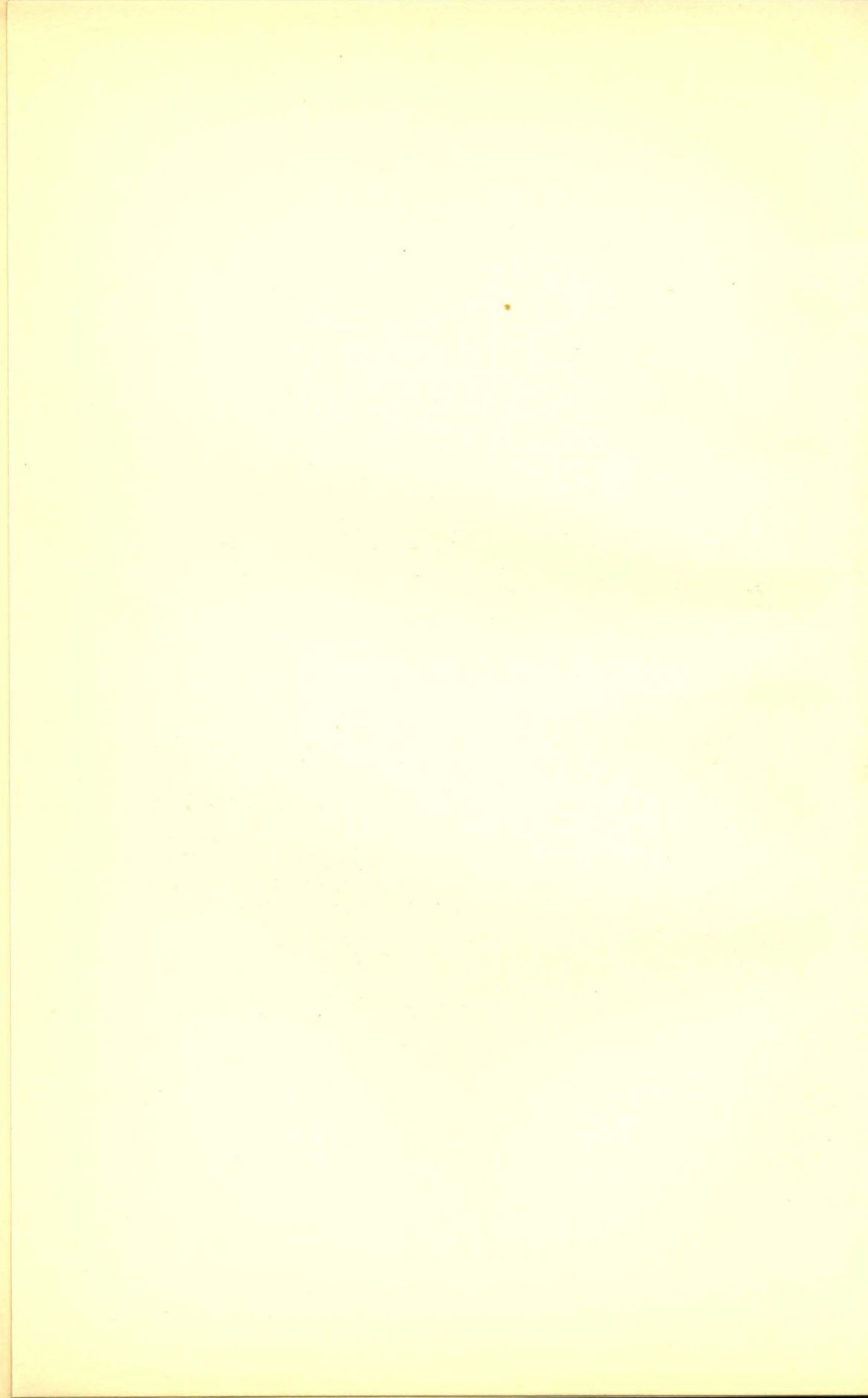
Dawson was the leading member of a committee appointed in 1884 by the British Association for Advancement of Science to study the physical character, language, and social conditions of the Indians of Canada, and in 1896 he was chosen as chairman of an ethnological survey of Canada. At the time of the meeting of the British Association for Advancement of Science in 1897 the *Victoria Colonist* said of him:

"In one sense he is the discoverer of Canada, for the Geological Survey, of which he has been the chief, has done more than all other agencies combined to make the potentialities of the Dominion known to the world."

All the principal activities of the present National Museum were being performed forty years ago, and also many of its minor activities. One of these is the distribution of specimens of minerals, rocks, and other natural history material to schools and other educational institutions. The first work of this kind was done in 1874, when, according to Dr. Selwyn,



George Mercer Dawson, third director of the Geological Survey, who was first in the Survey to make ethnological investigations.



"In December an application was received from the Board of School Teachers of Elora, Ontario, to be supplied with a geological collection for the use of the public school, and a set of typical Canadian rocks, minerals, and fossils, comprising 277 specimens, properly named and catalogued, was prepared and sent."

In the Report of Progress for 1878-79 he states that:

"Twenty-eight collections of Canadian rocks and minerals, containing together about 2,477 specimens, have been selected, labelled, and catalogued by Mr. Willimott, for distribution to educational institutions in all parts of the Dominion."

During the last fiscal year (1926-7) 263 collections, comprising many thousands of specimens of minerals, rocks, and fossils, were distributed.

1907-1920

Viewed superficially the quarter century from 1880 until 1905 was a period of growth and tranquillity for the Geological Survey. It had become a permanently established institution, located at the seat of government of the country. Its functions had broadened steadily, as may be seen by comparing the acts of 1872, 1877, and 1890. It was increasing in size of staff and financial support. The appropriations for 1880, 1885, 1890, 1895, and 1900 were respectively \$60,000, \$93,252.97, \$117,430, \$129,054.51, and \$118,783.98. Nevertheless, conditions were developing almost imperceptibly which were to have important and disturbing consequences for the Survey and for its museum. Considering the extraordinary growth and changes which have taken place in Canada since 1840 the Geological Survey has adapted itself to the changing needs of the country in a satisfactory manner. There have been a few times, however, when it has reacted slowly to changing external conditions and on these occasions its retarded readjustment has been attended with some disruptive consequences.

The period between Confederation and 1907 was ushered in with a huge expansion of Canadian territory and the task, on the part of the Geological Survey, to collect the most diversified information about this new territory—its geography, mineral resources, climate, flora and fauna, native inhabitants, forests, waterpowers, etc. To perform this great task Survey officers had to be surveyors, geologists, mineralogists, botanists, zoologists, and practical engineers of sorts. But during this period Canada was undergoing great changes. At the time of Confederation mining was confined mainly to Nova Scotia, the vicinity of the Great Lakes and St. Lawrence river, and to placer gold mining in British Columbia. There are no dependable statistics available, but the production was small. However, mineral production grew quickly. In 1886 it was worth \$10,221,255, in 1890, \$16,763,353, in 1895, \$20,505,917, and by 1900 had mounted to \$64,420,877. Population had nearly doubled, and the amount of money invested in manufactures—an expression of the industrialization of the country—had increased sixfold.

Educational standards had increased greatly. Great progress was being made in geological science, especially in America, where knowledge concerning the country was accumulating so fast that specialization in various parts of the science was becoming unavoidable. Also, the great task of exploring western and northern Canada had been prosecuted since 1867 with such energy and enthusiasm that, although it was by no means completed, the immediate need of the country for railway construction,

settlement, and mineral development was fairly well satisfied. Its place was being taken by need for more intimate and exact information about mineral deposits, mining operations, statistics, and for like intensive attention to each of the natural sciences. Even more precise methods of survey and for the collection of engineering data were becoming necessary. The time when one could run the gamut of the natural sciences was passing.

An indication of the trend of the time was given in 1884, when the operation of the Geological Survey was searchingly investigated by a Select Committee of the House of Commons on Geological Surveys. This Committee commented mainly upon the need for greater attention to the mineral industry and for the collection of mining statistics. Its conclusions prepared the way for a new Survey Act in 1890, according to which

"No person shall be appointed to this Department. unless he is a science graduate of either a Canadian or foreign university, or of the Mining School of London, or the Ecole des Mines of Paris, or of some other recognized science school of standing" "The duties, objects, and purposes of the Department shall be to make a full and scientific examination and survey of the geological structure, mineralogy, mines, and mining resources of Canada and of its fauna and flora; to maintain a museum of geological and natural history; to collect and to publish full statistics of the mineral production and of the mining and metallurgical industry of Canada.," etc.

Compared with previous Acts great stress was laid upon the scientific qualifications of Survey officers and upon the duties of the Survey to the mineral industry.

An adequate response to this command was delayed for over fifteen years and during the latter part of that period, a pressure for readjustment accumulated both within and outside the Survey. In 1901 there was created in the Department of the Interior, outside the Geological Survey, an organization under a Superintendent of Mines to collect mineral statistics and other information about the mining industry, Dr. Eugene Haanel being made Superintendent. In 1906 another Act, similar in its terms to the Act of 1890, was passed, but this was replaced within a year by another "Act to create a Department of Mines" of radically different intention. From 1842 until 1877 the Geological Survey had been an independent organization, with the status of a government department, and its reports were addressed either to The Governor General or to the Secretary of State. By the Act of 1877 it continued as a separate department under the Minister of the Interior and the Director had all the standing of a Deputy Minister except the franking privilege. The Act of 1907 created a Department of Mines under a Minister of Mines who would also be the Minister of one or another of the existing Departments. The original functions of the Geological Survey were divided between the Survey and a newly constituted Mines Branch, with the intent to invest the Mines Branch with all work pertaining directly to the mineral industry and to leave to the Survey surveying and scientific investigation. Museum work became a function of both branches and a Museum of Geology and Natural History in the Department was specified.

Practical interpretation of the Mines Act fell chiefly to the lot of three men. Dr. Eugene Haanel, then Superintendent of Mines, in the Department of the Interior, was appointed Director of the Mines Branch and held this new position until 1921. Although he had had no previous connexion with the Geological Survey, and a comparatively brief one with mining affairs in Canada, he was a splendidly educated man, of constructive

ability and forceful character. Under him the Mines Branch assumed its full functions vigorously. A. P. Low, a senior officer with long and distinguished service in the Geological Survey, was made its Director and also Deputy Minister. It was quite evident to his associates that Low appreciated the transformation which had been taking place in Canada and the need for adjustment of the Survey to it. He at once began to raise the qualifications of technical officers by setting a higher standard for new appointees and by affording those already on the staff opportunities for further university training. Reorganization of the Survey was begun and other changes were being undertaken, when in November, 1907, after only nineteen months as Director, he was seized with a devastating and almost fatal illness, from which he has never fully recovered. R. W. Brock, who succeeded to the directorship, continued and extended with great energy and ability the reconstructive plans initiated by his predecessor. The present Survey and Museum organization is essentially a result of his work from 1908 until 1914, when he resigned to take charge of the Faculty of Science in the University of British Columbia.

Intensive specialization was the outstanding characteristic of the policy inaugurated by Low and Brock. All scientific officers were required to have a high educational standing and thorough practical training. Surveying was referred to a special division of highly trained topographers. The mineralogists, palæontologists, and biologists were reinforced with specialists and formed into other distinct divisions, and a division of anthropology was created, this branch of science having hitherto been contributed to by Dawson, Low, and other geologists and having had no specialist. No effort was spared to secure good taxidermists, preparators, and other auxiliary help.

The consequences to the Museum of these radical changes, brought about by almost equally extraordinary developments in Canada, were not all salutary. The divisions of anthropology, biology, and palæontology gained, in varying degrees, in the quality of the material placed on public exhibition, and to less marked degrees in the scientific value of material collected and investigational results. On the other hand Museum activities in geology, which had hitherto been the largest and most active section, declined rapidly almost to zero. Mineralogy and palæontology were unfavourably affected to a less notable extent and even in biology the increase of accomplishment was not as much as might have been expected. This was due to an almost complete cessation of museum work by the main body of field officers. From Logan's time until about 1905 these men had been actively interested in other natural sciences besides geology and had been habituated to collect natural history material and to interest themselves in museum work. After 1907 they found the other sciences represented by specialists with whom they could not collaborate on a footing of scientific equality. Also they were required to concentrate to a greater extent upon the economic and practical aspects of geology; and had less inclination for other subjects. Because of these and various other less apparent causes museum work lapsed quickly and almost entirely into the hands of museum specialists, even in spite of the stimulus afforded by provision of finer and more commodious quarters.

The Survey Staff had given such enthusiastic attention to museum work during the time of Selwyn and Dawson that fifteen years after coming

to Ottawa the more commodious building provided there was becoming crowded and the need was felt for larger quarters more suited for museum purposes. In the Summary Report for 1895 Dawson observed that:

"The number of visitors to the Museum again shows a notable increase, having risen to 31,595 in 1896, and every year the necessity for a modern and safe building of greater size becomes more urgent."

The following year he pointed out more vigorously that:

"The absolute necessity for additional space for the preservation of specimens coming to the Museum, and for workrooms for material under examination, has led to the construction of temporary partitions and shelving on the two lower floors of the building on Sussex street adjoining that belonging to the Government and already occupied by the Survey. At best, however, this provides little more than storage room. The need for new fireproof, and more spacious quarters. becomes more pressing every day."

The matter has also interested prominent men outside Parliament. Sir B. E. Walker, president of the Canadian Bank of Commerce, said in a public address:

"The Dominion Government at Ottawa and each province, at its city of chief importance, should have a museum belonging to and supported by the people. These museums should contain exhibits of the metallic and non-metallic minerals of the country, both those of economic and of merely scientific value, the forest trees, with the bark preserved, in say 6 feet sections, cut also and partly polished, and each specimen accompanied by a small map showing its habitat; the freshwater and sea fishes mounted after the modern methods; the fur-bearing animals, the game birds, and the birds of our forests, fields, and seacoast, many of them mounted so as to tell a child their habits at a glance; the reptiles, crustaceans, insects, plants, indeed as complete a record of the fauna and flora of the country as possible; the rocks of stratigraphic importance and all the varieties of fossils which can be gathered in this country; the archaeological and ethnological evidences of the races we have supplanted in Canada, and much more that does not occur to me at the moment. I should not like to suggest a limit of expenditure on such museums. I can only repeat that we are rich enough to bear the cost with ease, but we are not intelligent enough to see our own interest in spending the money."

These representations showed their first effect in 1899. Dawson wrote:

"Since the date of the last Summary Report, no substantial progress has, unfortunately, been made toward the provision of a suitable building for a museum and offices of the Geological Survey. Preliminary plans have, however, been drawn, and the necessity for such a building has been strongly supported in the House by members of Parliament during the past session."

During the next five years progress was made, for Dr. Bell, in the Summary Report of the Geological Survey, remarks that construction of the Victoria Memorial Museum had at last been commenced. This building was not finished until 1911; but the transfer of the staff and collections of the Survey was begun in November, 1910. R. W. Brock, Director at that time, observes in his report for 1910:

"The Museum can now expand and the work of the Survey be accelerated. The Museum will include the illustrative material acquired by the various divisions of the Survey, namely, mineralogy and geology, biology, and anthropology. It will, therefore, be a complete natural history museum. For the present it is the intention to restrict the Museum to Canadian material (except in educational collections where necessary objects may be lacking in Canada) in order to make it, first, of all, the great Canadian Museum, whose collections in Canadian material will surpass all others."

Mr. Brock organized the Survey and Museum into better defined sections of geology, mineralogy, palæontology, biology, anthropology,



Former Geological Survey office and Museum on Sussex street, Ottawa,
to which the Geological Survey moved from Montreal in 1880.
Now occupied by the Mines Branch.

and topography than had previously been recognized. He strengthened most of these divisions, especially anthropology and biology, by securing specialists of various kinds from museums and other institutions in United States. He reorganized the publications of the Survey, creating a new series of Museum Bulletins for the scientific contributions relating particularly to natural history.

Through various causes, however, the progress of the Museum was not accelerated as much as had been expected. Closer specialization of Survey officers in the various branches of natural science demanded by the industrialization of the country and rapid growth of its mineral industry was, no doubt, a contributory cause, individuals being more absorbed in their particular branches of investigation and less able and less inclined to collect natural history material of all kinds, than their predecessors in the time of Logan, Selwyn, and Dawson. However, the present revival of interest in museum work seems to indicate that this was not an important factor in the decadence of interest. Probably a much more serious cause lay in the addition to the staff of the Survey of a considerable number of specialists in biology, anthropology, and palæontology, secured from other institutions, who, besides having little need for scientific intercourse with the main body of geologists, mineralogists, and others, had little or no knowledge of the traditions and customs of the Geological Survey. The personnel of the Geological Survey has always shown great pride in the achievements of the institution and some consequent spirit of exclusiveness. To these intangible causes were added three events more definitely retarding. In 1914 Mr. Brock resigned to accept charge of the Department of Science in the University of British Columbia, and the Survey was deprived of his energetic and constructive leadership. On February 3, 1916, the Parliament buildings were burned and the Victoria Memorial Museum was found to be the most suitable building in the city for temporarily housing members of Parliament and Senators. All except the exhibits and offices of the section of anthropology, the library, and certain occupants of the basement were removed to temporary quarters in various parts of the city. They remained so scattered until May, 1920, when the new Parliament buildings were reoccupied and the Museum building had been refitted for its original occupants. Museum work suffered much more from this dislocation than did the investigative work of the Survey. During the same time museum work was reduced almost to a standstill because it was not essential for the conduct of the war.

1920—PRESENT

At the beginning of 1920 the Museum was probably more disorganized than at any other time in its existence; but it was on the threshold of conditions as favourable for recovery as it had ever previously enjoyed. A business depression resultant from the war rested upon the country and the Government was compelled to exercise rigid economy; but this depression began to lift in 1921. Accommodation was obtained in the Victoria Memorial Museum for all but the division of mineralogy, which was forced, through lack of space, to remain in temporary quarters at 227 Sparks street. The space available for exhibition of museum material was small, but this was offset by the advantages of being under a single roof.

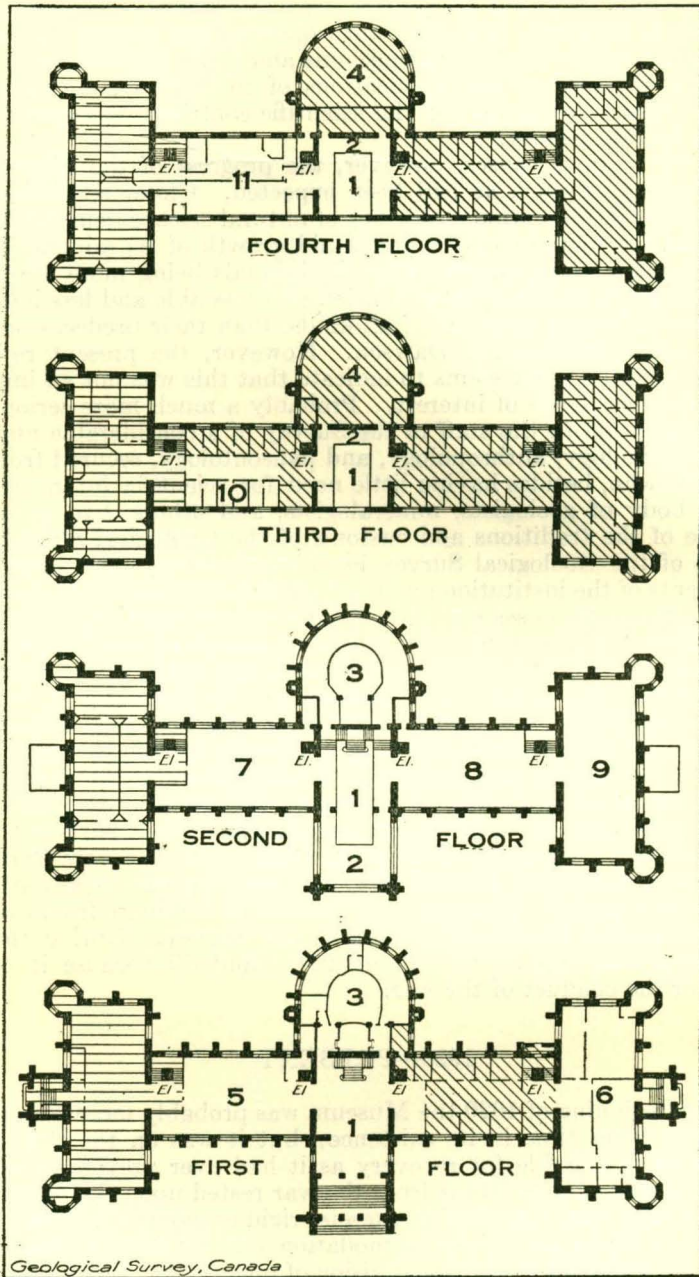
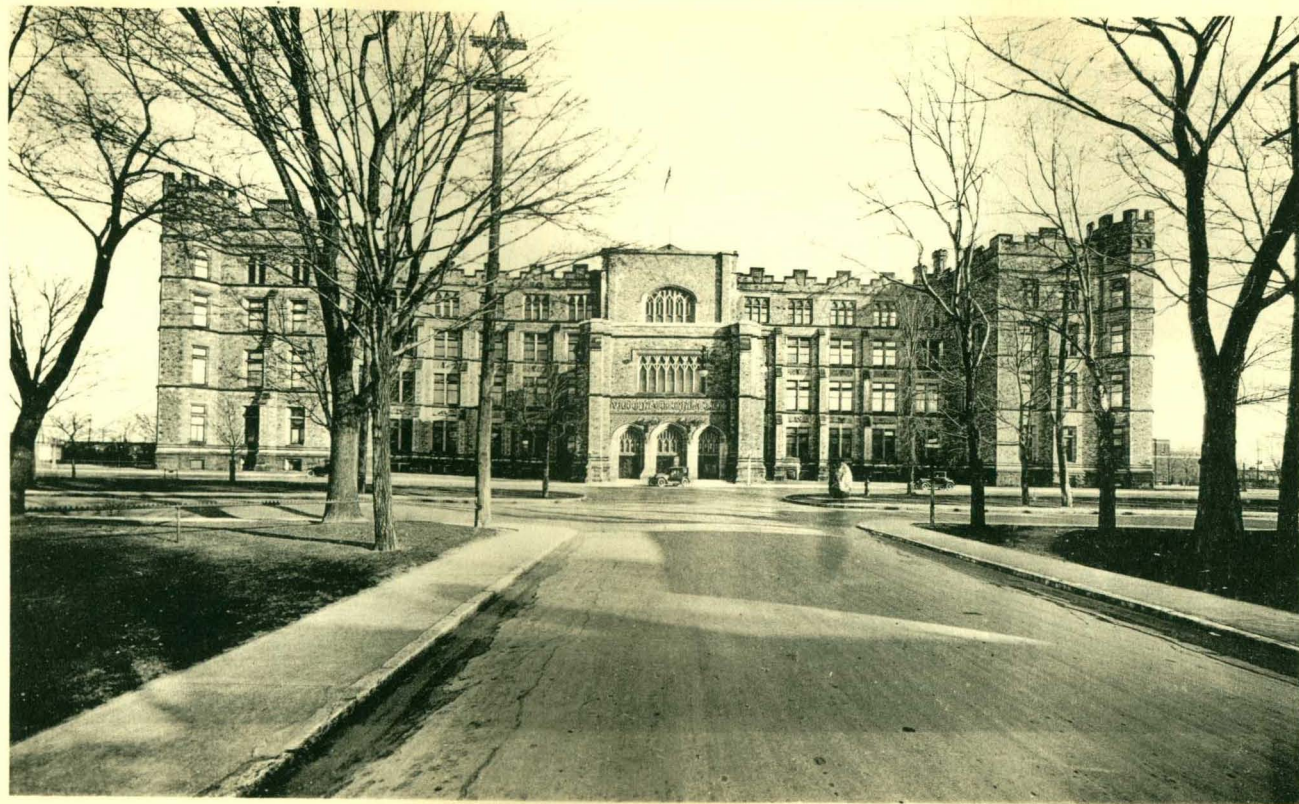
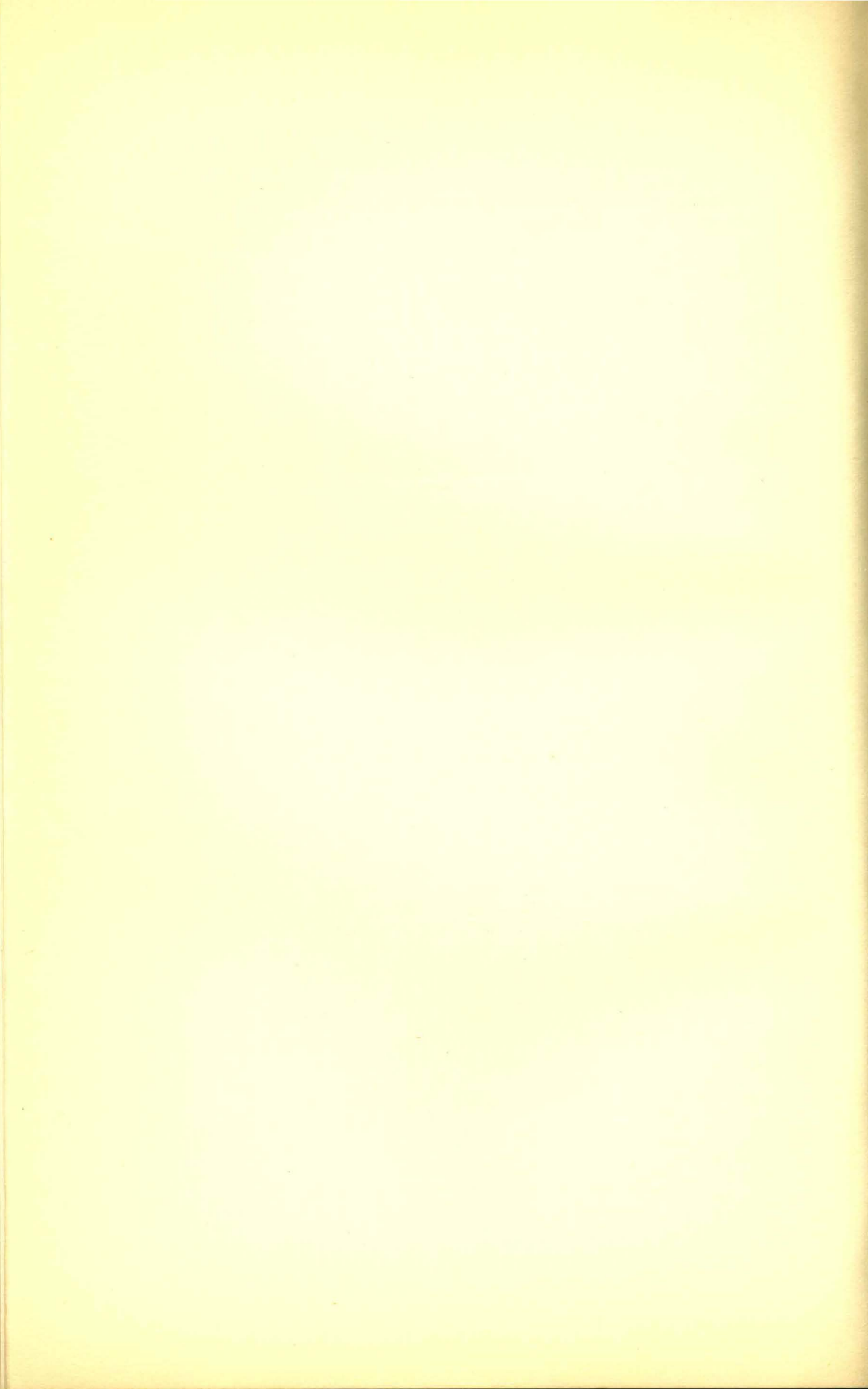


Figure 1. Floor plan of Victoria Memorial Museum. The horizontally shaded part is occupied by the National Art Gallery and the oblique shaded parts by the Geological Survey and administrative offices of the Department of Mines. 1—Entrance hall, which reaches the full height of the building. 2—Galleries around entrance hall on second, third, and fourth floors. 3—Lecture hall, with gallery on second floor. 4—Library, two stories in height. 5—Palaeontological exhibits. 6—Offices and collections of biological division. 7—Biological exhibits. 8, 9—Anthropological exhibits. 10—Offices of anthropological division. 11—Work rooms for preparation of biological and palaeontological exhibits. Elevators are represented in solid black.



Victoria Memorial Museum, present home of the National Museum and
Geological Survey.



The present interior arrangement of the Victoria Memorial Museum is shown in Figure 1. The building consists of four stories and a basement. The basement is occupied by workshops, the photographic laboratory, and storerooms. The first, second, and fourth floors were originally laid out into halls about 100 feet by 50 feet for exhibition purposes, and the third floor subdivided into rooms 20 feet square for offices. The entire east wing is occupied by the National Art Gallery. In the remaining three-fourths of the building the entire third and fourth floors and two of the three halls on the first floor are subdivided into office and storerooms for the administrative staff of the Department of Mines and the staff of the Geological Survey and National Museum. There remain three halls on the second floor, one hall on the first floor, and a small amount of space in the entrance hall on both these floors for exhibition purposes. The sections of anthropology, biology, and palæontology have each one entire hall at their disposal and the remainder is shared by these sections with the sections of geology, geography, and mineralogy. Back of the entrance hall, and occupying the first and second stories is a lecture hall (with gallery), capable of seating 500 persons. Above the lecture hall, and also two stories in height, is the library. No. 358 Frank street, about a quarter mile away from the Museum, has been obtained for extra storage of Museum specimens. The offices, laboratory, and most of the collections of the section of mineralogy are housed at 227 Sparks street, about a mile away from the Museum. Most of the publications of the Survey and Museum are at 347 Wellington street. The staff occupied with museum work at the end of 1926 comprised:

Anthropology

Chief of the division, Diamond Jenness; ethnologist, C. M. Barbeau; ethnologist (position vacant); associate physical anthropologist (position vacant); archæologist, H. I. Smith; assistant archæologist, W. J. Wintemberg; artist, O. E. Prud'homme; museum assistant, J. D. Leechman; stenographers, G. St. Laurent and A. E. Perreault.

Biology

Chief of the division, R. M. Anderson; ornithologist, P. A. Taverner; chief botanist National Herbarium, M. O. Malte; chief taxidermist and herpetologist, C. L. Patch; collector-preparator specialist, C. H. Young; artist, C. E. Johnson; osteological preparator, Joseph Rochon; taxidermist, D. J. Blakely; museum assistants, Donald MacDonald and W. K. Bentley; herbarium assistant, M. C. Stewart; museum helper-tanner, J. E. Perron; stenographer, P. M. Hurlbert.

Geology

The staff of the geological division of the Geological Survey, comprising twenty-one geologists, associate geologists, and assistant geologists.

Mineralogy (a division of the Geological Survey)

Chief of the division, Eugene Poitevin; associate mineralogist, H. V. Ellsworth; associate mineralogist (position vacant); chemist (position vacant); mineralogical collector-preparator, A. T. McKinnon; museum assistant, F. H. B. Richardson; museum helper, F. D. Moore.

Palæontology (a division of the Geological Survey)

Chief of the division, E. M. Kindle; invertebrate palæontologist, F. H. McLearn; palæobotanist, W. A. Bell; associate palæobotanist (position vacant); associate invertebrate palæontologist (position vacant); associate vertebrate palæontologist (position vacant); assistant invertebrate palæontologist, A. E. Wilson; assistant invertebrate palæontologist (position vacant); collector-preparator specialist, C. M. Sternberg; artist, Arthur Miles; museum assistants, Joseph Skillen and E. F. Goodman; museum helper, J. E. Proulx; stenographer, T. A. Egan.

This body is intimately connected with the Geological Survey. It is maintained with money supplied by Parliament to the Geological Survey. On December 1, 1920, a Directorship of the Victoria Memorial Museum was created and given to the late Dr. William McInnes, previously Director of the Geological Survey. The divisions of anthropology and biology were placed thereunder, and the other divisions remained under the Director of the Geological Survey. It afforded a greater amount of directional attention to museum problems, but it also had the disadvantage of accentuating the distinction between the divisions of anthropology and biology, engaged solely with museum work, and the divisions of geology, mineralogy, and palæontology, simultaneously occupied with Museum and Geological Survey work. It gave verisimilitude to a notion that the Museum was concerned with only two branches of natural science instead of all. This arrangement continued until April 1, 1926, when the Director of the Geological Survey was assigned the duties of both positions. The present arrangement has only a temporary aspect, however, for although the Director of the Survey performs the duties of Director of the Museum, he does so without emolument and the position of Director of the Museum continues vacant. The needs of the Museum for photography, draughting, and like services are supplied by the Geological Survey. Survey and Museum form part of the Department of Mines.

Only one relationship exists with another Government department. The chief of the Entomological branch of the Department of Agriculture is Honorary Curator of Entomology in the Museum and charged with the preparation of an exhibit of insects.

At the present time the section of anthropology has on exhibition a comprehensive collection representative of the aboriginal peoples of Canada. In biology there is a good exhibition of birds, but mammals, aquatic animals, and plants are represented by only a few specimens, and insects are not represented, the original Survey collection having been transferred to the Department of Agriculture. Geography is illustrated by a few relief models and photographs in different parts of the building. A good beginning has been made to represent economic geology, but other branches of geology are illustrated only by a few specimens in the hall of palæontology. There is a large and fine mineral collection, the work of eighty years by Geological Survey officers, part of which is on exhibition in a hall in company with anthropological and biological material. Vertebrate and invertebrate fossils are displayed together in another hall, the collection of dinosaur remains from Alberta being exceptionally good.

Field work is undertaken each year in all the main branches of natural science, for the purposes of scientific investigation and collecting of material for study and exhibition. Parties begin to leave for the field as early as

the beginning of May and remain out as late as November, the average field season being about three months for anthropology, biology, and mineralogy, but between four and five months for geology and palæontology. The occasional expeditions into Arctic Canada last from eighteen months to three years. Field parties are sent to all parts of Canada and, rarely, outside Canada, when necessary for the solution of scientific problems. The total number of Survey and Museum parties placed in the field each year has varied from forty to sixty since 1920, but only about ten of these are mainly concerned with Museum work, the others collecting information and material for the Museum incidentally to their work for the Geological Survey.

Contributions to science resulting from field investigations are published in a Museum Bulletin series, commenced in 1913, which has now reached forty-five volumes. The memoirs, summary reports, annual reports, and reports of progress of the Geological Survey also contain much information of the same kind and papers are constantly being contributed to many scientific periodicals.

A series of lectures on natural history subjects is delivered every winter in the lecture hall, under Museum auspices, the lecturers being obtained chiefly from various Government departments. These lectures are given to children on Saturday mornings between October and April, and to adults on the corresponding Wednesdays. Numerous lectures are also given in Ottawa and elsewhere in Canada under the auspices of other organizations, especially by the geologists and anthropologists. The Museum also participates in exhibitions outside Ottawa, either by making displays of natural history material or by lending it. The Victoria Memorial Museum is being used more and more by learned societies as a meeting place and numerous conversaciones have been arranged by the Survey and Museum staff since 1920. The division of mineralogy with assistance from the divisions of geology and palæontology, supplies collections of mineral rocks and fossils to schools, colleges, and other educational institutions in Canada and foreign countries and supplies other collections to prospectors.

THE FUTURE

The Museum has recently come to a crossroad in its career and is faced with three courses from which to choose. Onward extends the broadening way which it has pursued for eighty years, from infancy, in company with the Geological Survey. Rather sharply divergent on the one hand is a new path that it can take alone, and on the other hand is a third course along which it can be accompanied by the Survey and other kindred organizations. It is well to consider the choice thoroughly, for to turn back afterwards, especially from either new path, would be costly and difficult. Nevertheless, not too much time should be consumed in decision, because further provision of space for the Museum, the amount and nature of which will depend upon the Museum's relationships, must be provided very soon if the activities of the Museum are not to be greatly curtailed. Fortunately, each way is well lighted by experience.

The National Museum of Canada has always been a natural history museum and will presumably continue as such, since the Government already maintains a separate museum of art, the National Gallery of

Canada, and a separate museum of history, the Public Archives. Natural history museums have a diversity of functions, but they are generally conceded to have three major purposes: (1) to collect and to serve as a repository for natural history material of scientific or economic interest; (2) to educate the public concerning the natural history and natural resources by exhibiting specimens, by writings and lectures, and in other ways; (3) to conduct researches in the natural sciences. These appear to be the main reasons for the existence of the National Museum of Canada. Opinions will probably differ widely regarding their relative importance.

(1) If expense did not matter, either in sending collecting expeditions to all parts of Canada or in providing accommodation for the material obtained, museum material could be obtained more quickly by an independent Museum organization. This is well proved by the great quantities of ethnological and biological specimens which have been collected by the divisions of anthropology and biology since these divisions were reorganized and strengthened about 1910. Even in these branches of natural science, however, a great deal of valuable material has been incidentally contributed from all over Canada and from many parts not ordinarily accessible, by Geological Survey parties sent out for other, more economic, purposes. These contributions have been made at almost no cost. The geological, mineralogical, and palæontological collections now in the Museum, vertebrate fossils excepted, have all been made in this economical manner. Only very large mineral specimens and the remains of dinosaurs and other large creatures have been obtained by special collecting expeditions because of the special technique and special equipment needed for their recovery and preservation. Collection of geological and palæontological material by Geological Survey parties has one further advantage; it is done by a staff much larger, more highly specialized, and, therefore, more discriminating than could ever be maintained by an independent Museum.

Here one might assume that an independent Museum would have the same assistance as it does in its present close relationship with the Geological Survey; but apparently it would not. The Department of Agriculture contains several organizations which are quite as much interested in the various branches of biology as the Geological Survey is in the geological group of sciences, yet the contributions from this source to the Museum's collections have been negligibly small. Within the Department of Mines, to which the Museum belongs, the only branch which has contributed notably is the Geological Survey. Even the Geological Survey, between about 1907 and 1925, when for a variety of reasons it and the Museum drew apart, diminished its assistance to the Museum conspicuously. Experience thus indicates that complete separation of the Museum from the Geological Survey would result in the same indifference on the part of the Survey which other Government organizations have always shown.

Theoretically, the National Museum is now a repository for all natural history material collected and no longer needed by other Federal organizations, and for similar material donated by the public. It has always received a considerable quantity of material from the public, as the lists of donations published yearly show, but it has received little from any Government organization, with the notable exception of the Geological Survey. The reason for this lack of support from other departments is simple. There is not sufficient incentive. Comparatively little natural

history material is worth keeping for investigative purposes. In most cases fresh material can easily be secured, if required, and is better for study. Where serial collections are needed, they are needed close at hand and not in a distant Museum building, already crowded and without good laboratory facilities. The only other incentive is proprietary interest. The Geological Survey alone has had this proprietary interest and has had its offices and laboratories in the Museum, and it alone has given any considerable effort towards developing the Museum. Its active interest in the Museum in future may be expected to correspond with the amount of these benefits. For the same reasons it is not unlikely that certain other Government organizations occupied with systematic natural history would develop a similar active interest in the Museum if brought into immediate contact with it.

(2) Quite a different condition obtains in respect to exhibition work. The Museum affords excellent opportunities for advertising the operations of all Government organizations that are concerned with the natural resources of the country. Also these Government organizations are able to render invaluable help to the Museum in preparing exhibits that are intended to illustrate the economic aspects of the materials displayed. They can bring to the aid of the limited and purely scientific Museum staff a large number of scientists well acquainted with the uses and methods of treatment and manufacture of minerals, plants, and other natural materials. This has been well exemplified recently in an exhibit of coals and coal products assembled for the Museum by an officer of the Geological Survey. Comparison of this exhibit with similar exhibits in other museums in America indicates it to be unexcelled in completeness, scientific and technical accuracy, and educational value.

The Museum has profited by this kind of co-operation from the Geological Survey since its inception. Up to the present it has felt little need for help of the kind from other organizations, but it can undoubtedly obtain such help when it is required. Within the last year one organization in another department offered to co-operate in making a permanent display in the Museum to illustrate the branch of natural science with which it deals, and another organization accepted an invitation to do likewise. However, the scope of such co-operation is more limited than might be supposed. The Museum comprises, or will in time comprise, the following sections: anthropology; biology, which includes sub-sections for mammals, birds, insects, aquatic animals, and plants; geography; geology; mineralogy; and palæontology. Anthropology and the subsections for mammals and birds have little or no economic bearing and are not dealt with from that angle by any other Government department. No large amount of co-operation from other departments is available on these subjects, nor is it needed, since the Museum already has well-equipped staffs to deal with these subjects. All of the remaining six subjects have more or less important economic applications, for the investigation of which special Government organizations exist. Insects exert an influence upon agriculture which requires the attention of an Entomological branch in the Department of Agriculture. The Department of Marine and Fisheries gives practical consideration to the aquatic forms of life. Various economic aspects of botany are dealt with by the Department of Agriculture and by the Forestry branch of the Department of the Interior. The scientific and practical sides of geography come under the attention of the Geodetic

Survey and Topographical Surveys in the Department of the Interior, of the Surveys branch in the Department of National Defence, and of the Geological Survey. Industrial applications of minerals is a function of the Mines branch, of the Department of Mines. However, a much broader basis for co-operation exists with the Geological Survey. No less than four of these subjects, geography, geology, mineralogy, and palæontology, are more or less exclusively the field of the Geological Survey at the present time, and until about twenty-five years ago it gave attention to practically all subjects in which the museum is interested. This multiform practical and scientific relation of the Geological Survey to so many branches of natural sciences is the reason for the origin of the Museum and for the association of the two institutions up to the present time and manifestly must have an important bearing upon the future of both.

(3) In respect to the third essential function of museums, scientific research, museums can very well be divided into two classes; those which are connected with a scientific or educational institution and those which exist independently. It is difficult to value the results of scientific investigation and, doubtless, different opinions are held regarding the relative contributions of the two groups of museums here under consideration, but within the limits of the writer's observation, much greater contributions appear to have been made by the first class. It is not surprising that this should be the case. Scientific research, like most forms of human effort, needs the stimulus of a useful purpose and of reward. It thrives best in industrial organizations, universities, and bureaus maintained by public or private means for specific research. A museum attached to any of these will be used for their purposes. Its own staff will profit by the association. Workers in independent museums are apt to be restricted in scientific work and outlook largely to systematic investigation—description and classification—especially in biology, palæontology, and geology, and to give little attention to the discovery and applications of scientific principles.

The National Museum of Canada has been peculiarly fortunate in its long association with an institution which has been actively engaged upon practical scientific investigations in a wide range of natural history.

"Organized scientific research first took form in Canada with the establishment of the Geological Survey of Canada in 1841 under the direction of Sir William Logan. Before that time scientific activities were limited to individual efforts, and, while much was accomplished by these sporadic investigations in revealing the natural resources of the country, co-ordination and organized work were required and were supplied by the Survey. At its inception, the work of the Survey was confined to the investigation of the geology and mineral resources of Canada, but it was not long before its scope broadened to include both zoology and botany, and more recently, a division of anthropology and ethnology has been added."¹

Although the Survey has made its greatest contributions to the geological group of sciences its attainments in biology are thus estimated by an authority on that subject. "The Geological Survey of Canada, now attached to the Department of Mines, is one of the oldest, and from the faunistic standpoint, most effective, agencies contributing to Canadian zoology."² The earlier publications of the Survey are rich in information

¹McMurrich, J. P.: "Scientific Research in Canada": Handbook of Canada, British Association for the Advancement of Science, 1924, p. 185.

²Bensley, B.A.: *Idem.* p. 190.

and the results of scientific investigation in geology, mineralogy, palæontology, biology, and ethnology. Since 1912, when the Museum Bulletin series of publications was commenced, fifty-eight of the present total of seventy-six articles in the series have been contributed by Survey officers.

Encouragement and support of the functions of the National Museum discussed in preceding pages should be the prime object in administering it and determining its future place in the Government service; but future policy is also necessarily dependent within reasonable limits upon cost of maintenance and expansion. Until 1910 the Museum cost the people of Canada almost nothing. Natural history material was collected by the Geological Survey incidentally to the regular field work of that institution, this material was stored and arranged for the benefit of the public in the Survey quarters, and a great mass of information upon natural history was included in the published reports of the Survey. Even the botanical and zoological work of Macoun was incidental to his exploratory investigations of the agricultural possibilities of unsettled parts of Canada. The first considerable expenditure on behalf of the Museum was the construction, at a cost of between \$1,000,000 and \$2,000,000, of the Victoria Memorial Museum, to house the accumulated material. This expenditure was, in a sense, a measure of the value of what had already been accomplished towards making a national museum.

From 1910 until the present the Geological Survey had continued to maintain in the same incidental and economical manner the sections of geology, geography, mineralogy, and palæontology in the Museum. It has performed the administrative work of the Museum in the same manner except between 1921 and 1926, when the Museum possessed its own Director and staff. The sections of anthropology and biology alone are maintained solely for museum purposes. The yearly expenditure for these two divisions by the department is about \$65,000. If the Museum were to be dissociated from the Survey and made an independent institution an administrative staff and divisions of geology, mineralogy, and palæontology would have to be created. The library and some other auxiliary requirements which are now shared between Survey and Museum would have to be divided. The initial additional cost for salaries alone would be at least \$50,000 to \$60,000, and this amount would probably increase 50 per cent in the course of ten years through promotional advancement and increase of positions. To this would be added an indeterminate but considerable increase in annual outlay for running expenses, building accommodation, and field work. An independent Museum equipped in all its present departments of natural science would probably cost between \$100,000 and \$150,000 a year more than it does at present.

Of the two plans of organization to which attention has been chiefly given up to this point that of an independent Museum appears to have several serious drawbacks. Even the operative plan of control by the Geological Survey has one important disadvantage: there is little community of scientific interest between the Survey and the non-geological divisions of the Museum. Not of much consequence in the early days of the Survey, when its field officers were able to interest themselves effectively in the whole range of natural history, this feature has become accentuated with increasing specialization and now constitutes the most serious impediment to joint operation of the Museum with the Survey.

The third plan of organization for the Museum would solve this difficulty, whatever other disadvantages it might have. It is to share the conduct of the Museum among as many Government departments as have a direct interest in it, under administrative control of a joint or common board of directors or trustees. The great Indian Museum at Calcutta is conducted in this manner, and the Royal Ontario Museum, at Toronto, has adopted a slight modification of the same plan. This plan would permit of certain other organizations in the Government service which are concerned with the systematic side of natural history—particularly in biology—to form with the Museum mutually advantageous affiliations like that which has obtained for so long between the Geological Survey and the Museum. It would appear to open a way for a greater and better balanced National Museum, without great expense to the country.

In order to collect, study, and display the resources of the country in all branches of natural science the Museum should possess at least the following sections and exhibition space, halls in each case being understood to be a room about 100 feet by 50 feet, such as the Victoria Memorial Museum contains:

Anthropology.....	2 halls
Biology (Mammals).....	1 hall
(Birds).....	1 hall
(Insects).....	$\frac{1}{2}$ hall
(Aquatic and other animals).....	1 hall
(Botany).....	1 hall
(Forestry).....	1 hall
Geography.....	1 hall
Geology (stratigraphy, economic geology, etc.).....	2 halls
Mineralogy.....	1 hall
Palæontology (invertebrate).....	1 hall
(vertebrate).....	1 hall
Total.....	13 $\frac{1}{2}$ halls

There are thirteen halls in the Victoria Memorial Museum, but only four of these are available for Museum exhibition purposes. Four of the other nine are used by the National Gallery, three by the Geological Survey for offices, and two for Museum offices, storage of collections, and work shops. In consequence the division of anthropology is the only one which has sufficient exhibition space to make permanent displays, and is doing so. The division of biology has one and a half halls. It has begun upon a permanent exhibition of Canadian birds, but one-half of the hall that will ultimately be needed for this purpose is at present used for a mixed and purely temporary display of mammals, insects, fishes, plants, etc. Vertebrate and invertebrate fossil exhibits are crowded together in another hall in a manner which does justice to neither and which can only be regarded as a temporary arrangement. The highly important and interesting sections of geology, ores and minerals, and geography are represented by a few cases of specimens arranged along corridors and in odd corners. This condition is unsatisfactory and prevents a permanent plan being carried out except in the case of anthropology and birds. There is still some free space for a temporary scheme of exhibition, but it is expected that this space will all be in use by the end of 1928. Then additional exhibition work will apparently have to cease unless additional halls are provided in the meantime.

Accommodation for study collections is no better. A small building on Frank street has already been secured for the overflow, but it is too far away from the main building to be useful for specimens needed for reference. To do effective scientific work the Museum should be provided with several times as much storage and laboratory space as it now possesses, for at its present rate of growth, it seems clear that the Museum will have occupied all available space for public exhibits and for storage of specimens by the end of 1930.

LEGISLATION CONCERNING THE GEOLOGICAL SURVEY OF
CANADA AND NATIONAL MUSEUM OF CANADA

Resolution passed in the Estimates, 10th September, 1841.

81. Resolved,—That a sum of money not exceeding one thousand five hundred pounds sterling, be granted to Her Majesty to defray the probable expense in causing a Geological Survey of the Province of Canada.

ANNO OCTAVO

Victoriae Reginae

CAP. XVI

An Act to make provision for a Geological Survey for this
Province

(17th March, 1845.)

Whereas a Geological Survey of this Province of Canada has been instituted for ascertaining the Mineral Resources thereof; And whereas the sum of fifteen hundred pounds, already granted to Her Majesty to defray the probable expenses of the same, has been found inadequate for the effectual investigation of so extensive a territory as is comprised within the limits of the Province; And whereas it is expedient that the said Survey should be continued to a completion; Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Legislative Council and of the Legislative Assembly of the Province of Canada, constituted and assembled by virtue of and under the authority of an Act passed in the Parliament of the United Kingdom of Great Britain and Ireland and intituled "An Act to Re-unite the Provinces of Upper and Lower Canada, and for the Government of Canada," and it is hereby enacted by the authority of the same, That it shall and may be lawful for the Governor of this Province, in Council, to employ a suitable number of competent persons whose duty it shall be, under the direction of the Governor in Council, to make an accurate and complete Geological Survey of this Province, and furnish a full and scientific description of its Rocks, Soils and Minerals, which shall be accompanied with proper Maps, Diagrams, and Drawings together with a collection of Specimens to illustrate the same; which Maps, Diagrams, Drawings and Specimens shall be deposited in some suitable place which the Governor in Council shall appoint, and shall serve as a Provincial collection, and duplicates of the same, after they have served the purposes of the Survey, shall be deposited in such of the Literary and Educational Institutions of the Eastern and Western divisions of the Province, as by the same authority shall be deemed most advantageous.

II. And be it enacted, That from the unappropriated public monies of the Province, a sum not exceeding two thousand pounds, shall be annually applied, for a term of years not exceeding five years from the passing of this Act, to defray the expenses of the said Survey, or any arrears of expenditure already incurred, which sum shall be paid at such times and in such manner as the Governor in Council may direct.

III. And be it enacted, That the person or persons employed by the Governor in Council for the purposes mentioned in the first section of this Act, shall make a report to the Governor of this Province on or before the first day of May in each year, setting forth generally the progress made in the Survey hereby authorized.

IV. And be it enacted, That the words "Governor in Council," wheresoever they occur in this Act, shall be understood to mean the Governor, Lieutenant Governor, or person administering the Government of this Province, acting by and with the advice of the Executive Council thereof.

V. And be it enacted, That the due application of the monies hereby appropriated shall be accounted for to Her Majesty, Her Heirs and Successors, through the Lords Commissioners of Her Majesty's Treasury, in such manner and form as Her Majesty, Her Heirs and Successors shall direct; and an account thereof shall be laid before the Provincial Legislature at the then next Session thereof.

ANNO OCTAVO

Victoriae Reginae

CAP. XII

An Act to revive and continue for a limited time the Act making provision for a Geological Survey of this Province

(24th July, 1850.)

Whereas the period limited in the second section of the Act hereinafter cited as that during which the sum of money therein mentioned should be annually applied to defray the expenses of the Geological Survey directed by the said Act, hath expired, and it is expedient to revive and continue the said appropriation and the said Survey: Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Legislative Council and of the Legislative Assembly of the province of Canada, constituted and assembled by virtue of and under the authority of an Act passed in the Parliament of the United Kingdom of Great Britain and Ireland, and intituled, "An Act to re-unite the Provinces of Upper and Lower Canada, and for the Government of Canada," and it is hereby enacted by the authority of the same, That for and notwithstanding anything in the second section of the Act passed in the eighth year of Her Majesty's Reign, and intituled, "An Act to make provision for a Geological Survey of this Province," the annual appropriation made by the said section for the purposes of the said Act shall be and is hereby revived, and shall continue during five years from the passing of this Act, and thence until the end of the then next Session of the Provincial Parliament, and shall be held to have been so continued from the expiration of the period of five years mentioned in the said section, and all the provisions of the said Act shall be revived, and shall apply to the said appropriation as hereby continued.

An Act to make further provision for the Geological Survey of this Province. (Cap. XIII)

(Assented to 16th May, 1856.)

Whereas by an Act of the eighth year of Her Majesty's Reign, chaptered sixteen, the sum of two thousand pounds annually, for five years, was appropriated for making a Geological Survey of this Province, and by an Act of the thirteenth and fourteenth years of Her Majesty's Reign, chaptered twelve, the said Act was revived and further extended

for five years; And whereas the said appropriation has been found insufficient to carry on the Survey in an effectual manner, and it is desirable to make such an increase to the establishment as will hasten the completion of the undertaking and enlarge its usefulness: Therefore, Her Majesty, by and with the advice and consent of the Legislative Council and Assembly of Canada, enacts as follows:

I. Out of the unappropriated public moneys of the Province, a sum not exceeding five thousand pounds shall be annually applied for a term not exceeding five years from the passing of this Act, to defray the expenses of the Geological Survey or any arrears of expenditure already incurred, which sum shall be paid at such times and in such manner as the Governor in Council may direct, subject to the provisions hereinafter made.

II. It shall be lawful for the Governor in Council to employ a suitable number of competent persons to complete the Geological Survey of this Province, and to direct the publication of such maps and drawings as may be deemed necessary to illustrate the same; to establish a Geological Museum at some convenient place, which shall be open at all reasonable hours to the public, and which shall be furnished with such books and instruments as may be necessary for the illustration of the science and the prosecution of the Survey, and to order from time to time the distribution of the publications relative to the Survey and of duplicate specimens, to scientific institutions in this Province and other countries.

III. And further to promote the collection of geological information, all persons who, after the first day of January, one thousand eight hundred and fifty-eight, may apply to be admitted as Provincial Land Surveyors, shall be examined in the rudiments of Geology; and the Director of the Geological Survey shall, with that object, be a member of the two Boards of Examiners constituted by the Act of the fourteenth and fifteenth years of Her Majesty's Reign, intituled, *An Act to amend the Act concerning Land Surveyors*.

IV. For the purpose of attaining an accurate basis from which the geological and topographical features of the country may be ascertained, and for the purpose of connecting together local and partial surveys, it shall be the duty of the Director of the Geological Survey to cause permanent marks in some public buildings, or other marks of a durable description, to be made at several convenient stations in the Province, and to fix accurately the latitude and longitude and relative levels thereof, as points of reference.

V. All Railway and Canal Companies hereafter to be incorporated are hereby required to furnish to the Geological Survey, without charge, certified copies of all plans and sections of their Surveys; and all such Companies already incorporated, shall furnish such plans and sections of their Surveys upon the demand of the Director of the Geological Survey, and at the cost of the same.

VI. The Director of the Geological Survey shall make a report to the Governor of this Province, on or before the first day of March in each year, showing, generally, the progress made in the Survey.

VII. The due application of the moneys hereby appropriated shall be accounted for to Her Majesty, Her Heirs and Successors, in the manner provided by the Interpretation Act, and an account thereof shall be laid before the Provincial Legislature at the next Session thereof.

An Act Respecting the Geological Survey of the Province. (Cap. XXVII) 1859

Her Majesty, by and with the advice and consent of the Legislative Council and Assembly of Canada, enacts as follows:

1. Out of the unappropriated public moneys of the Province, a sum not exceeding twenty thousand dollars shall be annually applied, for a term not exceeding five years from the 16th day of May, 1856, to defray the expenses of the Geological Survey or any arrears of expenditure theretofore incurred; which sum shall be paid at such times and in such manner as the Governor in Council may direct, subject to the provisions hereinafter made. 19, 20, V. c. 13, s. 1.

2. The Governor in Council may employ a suitable number of competent persons to make and complete the Geological Survey of this Province, and to furnish a full and scientific description of its rocks, soils and minerals, which shall be accompanied with proper maps, diagrams and drawings and a collection of specimens to illustrate the same,—and may direct the publication of such maps and drawings as are deemed necessary to

illustrate the same,—and may establish a Geological Museum at some convenient place, in which the said maps, drawings, diagrams and specimens shall be deposited as a Provincial collection, and which shall be open at all seasonable hours to the public, and shall be furnished with such books and instruments as may be necessary for the illustration of the science and the prosecution of the Survey,—and may order from time to time the distribution of the publications relative to the Survey and of duplicate specimens, to scientific institutions in this Province and other countries. 8 V. c. 16, s. 1,—and 19, 20 V. c. 13, s. 2.

3. And further to promote the collection of geological information,—all persons who, after the first day of January, 1858, apply to be admitted as Provincial Land Surveyors, shall be examined in the rudiments of Geology;—And the Director of the Geological Survey shall, with that object, be a member of each of the two Boards of Examiners of persons applying to be licensed as Surveyors, constituted by the *Act respecting Land Surveyors and the Survey of Lands*. 19, 20 V. c. 13, s. 3.

4. For the purpose of attaining an accurate basis from which the geological and topographical features of the country may be ascertained, and for the purpose of connecting together local and partial surveys,—the Director of the Geological Survey shall cause permanent marks in some public buildings, or other marks of a durable description, to be made at several convenient stations in the Province, and shall fix accurately the latitude and longitude and relative levels thereof, as points of reference. 19, 20 V. c. 13, s. 4.

5. All Railway and Canal Companies incorporated after the sixteenth day of May, 1856, shall furnish to the Geological Survey, without charge, certified copies of all plans and sections of their Surveys;—and all such Companies theretofore incorporated, shall furnish such plans and sections of their Surveys upon the demand of the Director of the Geological Survey, and at the cost of the same. 19, 20 V. c. 13, s. 5.

6. The Director of the Geological Survey shall make a report to the Governor, on or before the first day of March in each year, showing, generally, the progress made in the Survey. 19, 20 V. c. 13, s. 6.

7. The due application of the moneys hereby appropriated shall be accounted for in the manner provided by the Interpretation Act, and an account thereof shall be laid before the Provincial Legislature at the next Session thereof. 19, 20 V. c. 13, s. 6.

27-28 VICTORIA—1864

CAP. VIII

An Act to revive and continue for a limited time the provision for the Geological Survey of this Province

(Assented to 30th June, 1864.)

Whereas the period limited in the first section of the Act hereinafter cited, as that during which the sum of money therein mentioned should be annually applied to defray the expenses of the Geological Survey directed by the said Act, hath expired, and it is expedient to revive and continue the said appropriation and the said Survey: Therefore, Her Majesty, by and with the advice and consent of the Legislative Council and Assembly of Canada, enacts as follows:

I. For and notwithstanding any thing to the contrary in the first section of the Act, chapter twenty-seven of the Consolidated Statutes of Canada, intituled: An Act respecting the Geological Survey of the Province, the annual appropriation made by the said section for the purposes of the said Act, shall be and is hereby revived, and shall continue during five years from the first day of January now last past, and thence until the end of the then next Session of the Provincial Parliament, and all the provisions of the said Act, shall apply to the said appropriation as hereby continued; the said Act, with the exception of the provision limiting the duration of the said appropriation, having been and being hereby declared to be permanent.

II. The Governor in Council may attach the said Geological Survey to any Department of the Civil Service, which he may think most expedient, as a Branch of such Department, of which the Director of the said Survey, and his Assistants shall thereupon become Officers while employed on the said Survey; but such Assistants shall continue to be nominated by the said Director subject to the approval of the Governor.

27-28 Victoria—1864.

CHAPTER LXVII

An Act respecting the Geological Survey of Canada

(Assented to 22nd May, 1868.)

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

I. Out of any unappropriated moneys forming part of the Consolidated Revenue Fund of Canada, the sum of thirty thousand dollars shall be annually applied for the term of five years from the first day of July, one thousand eight hundred and sixty-seven, to defray the expenses of the Geological Survey of Canada, during the said term; which sum shall be paid at such times and in such manner as the Governor in Council may direct, subject to the provisions hereinafter made; and any balance remaining unexpended out of the sum appropriated for any one year, may be applied and expended in the next or any subsequent year, in addition to the sum appropriated for such next or subsequent year.

II. The Governor may employ a suitable number of competent persons to make, continue and complete the Geological Survey of Canada, and to furnish a full and scientific description of its rocks, soils and minerals, which shall be accompanied with proper maps, diagrams and drawings and a collection of specimens to illustrate the same, and may direct the publication of such maps and drawings as he may deem necessary for that purpose, and the deposit thereof in the Geological Museum, as a collection for the whole Dominion of Canada, and which shall be open at all reasonable hours to the public, and shall be furnished with such books and instruments as may be necessary for the illustration of the science and the prosecution of the Survey, and may from time to time order the distribution of the publications relative to the Survey and of duplicate specimens, to scientific institutions in Canada and other countries.

III. For the purpose of obtaining an accurate basis from which the geological and topographical features of the country may be ascertained, and for the purpose of connecting together local and partial Surveys, the Director of the Geological Survey shall cause permanent marks in some public buildings, or other marks of a durable description, to be made at several convenient stations in Canada, and shall fix accurately the latitude and longitude and the relative levels thereof as points of reference.

IV. All Railway and Canal Companies over which the Parliament of Canada has jurisdiction, shall, if incorporated after the passing of this Act, furnish to the Geological Survey, without charge, certified copies of all plans and sections of their Surveys; and all such Companies theretofore incorporated shall furnish such plans and sections upon the demand of the Director of the Geological Survey and at the cost of the same.

V. The Director of the Geological Survey shall make and transmit yearly to the Governor, on or before the first day of May, a report shewing generally the progress made in the Survey.

VI. An account of the moneys expended under the authority of this Act, shall be laid yearly before the House of Commons, during the first fifteen days of each session of Parliament.

Statutes of Canada, First Parliament. 31st Vict., Part 2, 1868.

35 VICTORIA—1872

CAP. XXII

An Act to make provision for the continuation and extension of the Geological Survey of Canada, and for the maintenance of the Geological Museum.

(Assented to 14th June, 1872.)

Whereas the period for which an appropriation is made by the Act passed in the thirty-first year of Her Majesty's Reign, Chapter sixty-seven, for the Geological Survey of Canada, will expire on the thirtieth day of June, in the present year, one thousand eight hundred and seventy-two, and it is expedient to make such appropriation for a further

period, with such increase in amount as the extension of the Dominion requires: Therefore, Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

I. Out of any unappropriated moneys forming part of the Consolidated Revenue Fund of Canada, the sum of forty-five thousand dollars shall be annually applied for the term of five years, from the first day of July, one thousand eight hundred and seventy-two, to defray the expenses of the Geological Survey of Canada, during the said term, which sum shall be paid at such times, in such manner, to such persons, and for such purposes relating to the said Geological Survey, as the Governor in Council may from time to time direct, subject to the provisions of the Act respecting the security to be given by officers of Canada (thirty-first Victoria, chapter thirty-seven) which shall continue to apply to the said Geological Survey as heretofore, and any balance remaining unexpended out of the sum appropriated for any one year, may be applied and expended in the next or any subsequent year, in addition to the sum appropriated for such next or subsequent year.

II. The Governor may employ a suitable number of competent persons to make, continue and complete the Geological Survey of Canada, and to furnish a full and scientific description of its rocks, soils and minerals, which shall be accompanied with proper maps, diagrams and drawings, and a collection of specimens to illustrate the same, and may direct the publication of such maps and drawings as he may deem necessary for that purpose, and the deposit thereof in the Geological Museum, as a collection for the whole Dominion of Canada; and the said Museum shall be open at all reasonable hours to the public, and shall be furnished with such books and instruments as may be necessary for scientific reference and for the prosecution of the Survey, and the Governor may, from time to time, cause the enlargement of the Museum, and the distribution of the publications relative to the Survey, and of duplicate specimens, to Scientific Institutions in Canada and other countries.

III. For the purpose of obtaining an accurate basis from which the Geographical and Topographical features of the country may be ascertained, and for the purpose of connecting together local and partial Surveys, the Director of the Geological Survey shall cause permanent marks in some public buildings, or other marks of a durable description, to be made and maintained at several convenient stations in Canada, and shall fix accurately the latitude and longitude, and the relative levels thereof, as points of reference.

IV. The Governor in Council may, from time to time, fix the salaries and pay of the Director and other officers and persons employed in or about the Geological Survey: Provided that such salaries shall be subject to the approval of Parliament.

V. The director of the Geological Survey shall make and transmit yearly to the Governor, on or before the first day of May, a report, showing generally the progress made in the Survey.

VI. So much of the Act cited in the preamble, as is in any way inconsistent with this Act, is hereby repealed.

35 Victoria, 1872.

VICTORIA 39-40

CHAP. 9

An Act to make better provision respecting the Geological and Natural History Survey of Canada and for the maintenance of the Museum in connection therewith.

(Assented to 28th April, 1877.)

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. The Minister of the Interior shall continue to have the control and management of the Geological Survey of Canada, and there shall be a branch of the Department of the Interior known as the Geological Survey Branch, which shall, under the control of the Minister, take charge of and conduct the Geological Survey of the several Provinces and Territories of the Dominion.

2. The objects and purposes of the survey and museum shall be, to elucidate the geology and mineralogy of the Dominion, and to make a full and scientific examination of the various strata, soils, ores, coals, oils and mineral waters, and of its recent fauna and flora, so as to afford to the mining, metallurgical and other interests of the country, correct and full information as to its character and resources.

3. It shall be the duty of the persons in charge of the said survey:—

1. To collect, classify and arrange such specimens as may be necessary to ensure a complete and exact knowledge of the mineralogical resources of the several Provinces and Territories of Canada; to carry on palæontological investigations, to study and report upon the fauna and flora of the Dominion, and to make such other researches as will best tend to ensure the carrying into effect the object and purposes of this Act;

2. To continue to collect the necessary materials for a Canadian museum of natural history, mineralogy and geology.

3. To report from time to time, in such manner and form as the Minister may direct, their proceedings under this Act, and to furnish proper maps, diagrams, drawings and collections of specimens to illustrate the same.

4. The Director of the Geological Survey shall, as soon as may be after the close of each calendar year, make a full report to the Minister, of the proceedings and work of the Survey for the year, and the results thereof, in such manner and form, and with such details, maps, diagrams and drawings as may be requisite to elucidate the same; and the Minister shall cause the same to be laid before Parliament, with such remarks, explanations and recommendations as he may think proper.

5. The Governor in Council may, from time to time, appoint a suitable person, to be the Director of the Geological Survey, with such assistants as may be necessary to carry out the provisions of this Act, and with such salaries or remuneration as the Governor in Council may determine; provided that such salaries shall be subject to the approval of Parliament.

6. The Director and persons appointed to permanent positions in the Geological Survey Branch of the Department of the Interior, shall be considered as being within the provisions of the Act thirty-third Victoria, chapter four, to provide for the superannuation of persons employed in the Civil Service, in certain cases.

7. The Governor in Council, may, whenever he may think fit, direct the removal of the museum, and the officers and others connected with the Geological Survey Branch of the Department of the Interior, to the City of Ottawa.

8. The museum shall be opened to the public from ten a.m. until four p.m., Sundays excepted, and shall be furnished with such books, instruments and apparatus as may be necessary for scientific reference, and for the prosecution of the survey; and the Governor in Council may, from time to time, cause the enlargement of the museum, and the distribution of duplicate specimens to scientific, literary and educational institutions in Canada and other countries.

9. For the purpose of obtaining an accurate basis from which the geological and topographical features of the country may be ascertained, and for the purpose of connecting together local and partial surveys, the Director of the Geological Survey shall cause such topographical, geographical or other measurements or observations to be made, and monuments or marks to be placed, as may be deemed necessary for this purpose.

10. All railway and canal companies over which the Parliament of Canada has jurisdiction, shall, if incorporated after the passing of the Act thirty-first Victoria, chapter sixty-seven, furnish to the Geological Survey, without charge, certified copies of all plans and sections of their surveys; and all such companies theretofore incorporated, shall furnish such plans and sections upon the demand of the Director of the Geological Survey, and at the cost of the Department.

11. Persons employed in one branch of the Department may be directed by the Minister to perform any duty in or with respect to any other branch.

12. This Act shall come into force upon, from and after the first day of July, one thousand eight hundred and seventy-seven; and all former Acts respecting the Geological Survey of Canada shall then be repealed, except only as to rights acquired under or offences against the same.

53 VICTORIA

CHAP. II

An Act respecting the Department of the Geological Survey

(Assented to 16th May, 1890.)

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. In this Act the expression "Department" means the Department of the Geological Survey hereby constituted.

2. There shall be a Department of the Civil Service which shall be called "The Geological Survey," over which the Minister of the Interior shall preside; and the said Minister shall have the management and control of the Department.

3. The Governor in Council may appoint an officer who shall be the Deputy Head and Director of the Department and such other officers, clerks and servants as are required for the proper conduct of the business of the Department, all of whom shall hold office during pleasure, and shall be appointed and classified under Schedule A of "The Civil Service Act," and in accordance with and under the terms of section six of the said Act.

2. Such officers of the Department as are continuously engaged in the prosecution of original scientific work or investigation shall be classified as technical officers, under class (b) of Schedule A of "The Civil Service Act," and the Governor in Council may cause to be prepared a list of such officers of the Department as are considered to be entitled to be thus classified with any designations that may be deemed expedient to indicate the scientific work in which they may be engaged.

4. No person shall, after the passing of this Act, be appointed to this Department under class (b) of Schedule A of "The Civil Service Act," unless—

- (a) He is a science graduate of either a Canadian or foreign University or of the Mining School of London or the Ecole des Mines of Paris or of some other recognized science school of standing equal to that of the said universities and schools, or a graduate of the Royal Military College, and in each case only after having served a probation of not less than two years in the scientific work of the Department; or unless—
- (b) He has served a probation of not less than five years in the scientific work of the Department; or unless—
- (c) He has had experience for the same number of years in similar work, official or otherwise, elsewhere.

5. The duties, objects and purposes of the Department shall be:—

- (a) To make a full and scientific examination and survey of the geological structure, mineralogy, mines and mining resources of Canada and of its fauna and flora;
- (b) To maintain a museum of geological and natural history and to collect, classify and arrange for exhibition in the museum of the Department such specimens as are necessary to afford a complete and exact knowledge of the geology, mineralogy and mining resources of Canada; to collect, study and report on the fauna and flora of Canada; to carry on chemical and palæontological investigations, and to make such other researches as will best tend to ensure the carrying into effect the objects and purposes of this Act;
- (c) To prepare and publish such maps, plans, sections, diagrams and drawings as are necessary to illustrate and elucidate the reports of surveys and investigations;
- (d) To collect and to publish, as soon as may be after the close of the calendar year, full statistics of the mineral production and of the mining and metallurgical industry of Canada; to study the facts relating to water supply, both for irrigation and for domestic purposes, and to collect and preserve all available records of artesian or other wells, and of mines and mining works in Canada.

6. The Deputy Head and Director of the Department shall, as soon as may be after the close of each calendar year, make a summary report, to the Minister, of the proceedings and work of the Department for the year, and shall also furnish final and

detailed reports, to be issued from time to time in such manner and form as the Minister directs; and the Minister shall cause the same to be laid before Parliament, with such remarks, explanations and recommendations as he thinks proper.

7. The Department shall be furnished with such books, instruments and apparatus as are necessary for scientific reference and for the prosecution of the survey; and the Governor in Council may, from time to time, cause the enlargement of the museum, and the distribution of duplicate specimens to scientific, literary and educational institutions in Canada and other countries, and also the distribution or sale of the publications, maps and other documents issued by the Department.

8. The Minister may, for the purpose of obtaining a basis for the representation of the geological features of any part of Canada, cause such measurements and observations and physiographic, exploratory and reconnaissance surveys to be made as may be necessary for or in connection with the preparation of geological maps, sketches, plans, sections or diagrams.

9. Persons employed in one section of the Department may be directed by the Minister to perform any duty in or with respect to any other section.

10. No person employed in or under the Department shall—

- (a) Purchase any Dominion or Provincial lands except under authority of the Governor in Council;
- (b) Locate military or bounty land warrants, or land scrip, or act as agent of any other person in such behalf;
- (c) Disclose to any person, except his superior officer, any discovery made by him or by any other officer of the Department, or any other information in his possession in relation to matters under the control of the Department or to Dominion or Provincial lands, until such discovery or information has been reported to the Minister of the Interior, and his permission for such disclosure has been obtained;
- (d) Make investigations or reports relating to the value of the property of individuals, nor hold any pecuniary interest, direct or indirect, in any mine, mineral lands, mining works or timber limits in Canada.

11. Nothing in this Act shall be construed to invalidate or interfere with the commissions, as assistant directors, heretofore issued under Orders in Council to certain members of the scientific staff.

12. This Act shall be substituted for chapter twenty-three of the Revised Statutes, respecting the Geological and Natural History Survey of Canada, which is hereby repealed.

13. The foregoing provisions of this Act shall come into force on the first day of July, one thousand eight hundred and ninety.

CHAPTER 65

An Act respecting the Department of the Geological Survey

FROM

REVISED STATUTES OF CANADA

1906

VOL. II

SHORT TITLE

2. This Act may be cited as the Geological Survey Act.

INTERPRETATION

2. In this Act, unless the context otherwise requires,—

- (a) "Department" means the Department of the Geological Survey hereby constituted;
- (b) "Minister" means the minister named, as hereinafter provided, to preside over the Department of the Geological Survey;

- (c) "Director" means the deputy head and director of the Department of the Geological Survey. 53 V., c. 11, s. 1.

CONSTITUTION

3. There shall be a department of the Civil Service which shall be called the Geological Survey, which shall be presided over by a minister of the Crown to be named from time to time for that purpose by the Governor in Council.

2. The Minister so named shall have the management and control of the Department during the pleasure of the Governor in Council. 55-56 V., c. 16, s. 1.

4. The duties, objects and purposes of the Department shall be,—

- (a) to make a full and scientific examination and survey of the geological structure, mineralogy, mines and mining resources of Canada and of its fauna and flora;
- (b) to maintain a museum of geological and natural history and to collect, classify and arrange for exhibition in the museum of the Department such specimens as are necessary to afford a complete and exact knowledge of the geology, mineralogy and mining resources of Canada;
- (c) to collect, study and report on the fauna and flora of Canada;
- (d) to carry on chemical and palæontological investigations, and to make such other researches as will best tend to ensure the carrying into effect of the objects and purposes of this Act;
- (e) to prepare and publish such maps, plans, sections, diagrams and drawings as are necessary to illustrate and elucidate the reports of surveys and investigations;
- (f) to collect and to publish, as soon as may be after the close of the calendar year, full statistics of the mineral production and of the mining metallurgical industry of Canada;
- (g) to study the facts relating to water supply, both for irrigation and for domestic purposes, and to collect and preserve all available records of artesian or other wells, and of mines and mining works in Canada. 53 V., c. 11, s. 5.

5. The Governor in Council may appoint an officer who shall be the deputy head and director of the Department and such other officers, clerks and servants as are required for the proper conduct of the business of the Department, all of whom shall hold office during pleasure.

2. Such officers, clerks and servants shall be classified under Schedule A of the Civil Service Act in so far as applicable; and the number and respective rank of such officers, clerks and servants shall, except as otherwise provided by this Act, be determined by the Governor in Council in accordance with and under the terms of the Civil Service Act. 53 V., c. 11, s. 3.

6. Such officers of the Department as are continuously engaged in the prosecution of original scientific work or investigation shall be classified as officers who have special, professional or technical qualifications, under schedule A of the Civil Service Act.

2. The Governor in Council may cause to be prepared a list of such officers of the Department as are considered to be entitled to be thus classified with any designations that may be deemed expedient to indicate the scientific work in which they may be engaged. 53 V., c. 11, s. 3.

7. No person shall be appointed to the Department as an officer having such special, professional or technical qualifications under schedule A of the Civil Service Act, unless,—

- (a) he is a science graduate of either a Canadian, or a foreign university, or of the Mining School of London or the Ecole des Mines of Paris, or of some other recognized science school of standing equal to that of the said universities and schools; or a graduate of the Royal Military College; or,
- (b) he has served a probation of not less than five years in the scientific work of the Department.

2. Any person appointed upon the qualifications mentioned in this section shall be appointed on probation, and he shall not receive a permanent appointment until he has served a probationary term of at least one year, during which probationary period he may be rejected by the head of the Department; but if he is not rejected, and if the Director, at the expiration of the probationary period, signifies to the head of the Department, in writing, that he considers the person so appointed competent for the duties of the Department, the appointment shall thereupon become permanent. 62-63 V., c. 21, s. 1.

TEMPORARY ASSISTANTS

8. When the services of temporary assistants having special professional or technical qualifications are required in the Department, the Minister may, upon the requisition of the Director, employ such number of temporary assistants as are necessary, having the qualifications requisite for appointment as technical officers of the Department under the last preceding section. 61 V., c. 18, s. 1.

9. Notwithstanding anything contained in the Civil Service Act, it shall not be necessary that any person appointed a temporary assistant under the last preceding section shall have passed any examination under the Civil Service Act.

2. Any such person may be paid at the rate of more than four hundred dollars a year, and out of moneys voted by Parliament for the contingencies of the Department, or any other moneys voted by Parliament and applicable to such payment, although such moneys may not have been specially voted for such purpose. 61 V., c. 18, s. 2.

REPORTS

10. The Director shall, as soon as may be after the close of each calendar year, make a summary report to the Minister of the proceedings and work of the Department for the year, and shall also furnish final and detailed reports, to be issued from time to time in such manner and form as the Minister directs.

2. The Minister shall cause the said reports to be laid before Parliament, with such remarks, explanations and recommendations as he thinks proper. 53 V., c. 11, s. 6.

GENERAL

11. The Department shall be furnished with such books, instruments and apparatus as are necessary for scientific reference and for the prosecution of the survey.

2. The Governor in Council may, from time to time, cause the enlargement of the museum, and the distribution of duplicate specimens to scientific, literary and educational institutions in Canada and other countries, and also the distributions or sale of the publications, maps and other documents issued by the Department, 53 V., c. 11, s. 7.

12. The Minister may, for the purpose of obtaining a basis for the representation of the geological features of any part of Canada, cause such measurements and observations and physiographic, exploratory and reconnaissance surveys to be made as may be necessary for or in connection with the preparation of geological maps, sketches, plans, sections or diagrams. 53 V., c. 11, s. 8.

13. Persons employed in one section of the Department may be directed by the Minister to perform any duty in or with respect to any other section. 53 V., c. 11, s. 9.

14. No person employed in or under the Department shall,—

(a) purchase any Dominion or provincial lands except under authority of the Governor in Council;

(b) locate military or bounty land warrants, or land scrip, or act as agent of any other person in such behalf;

(c) disclose to any person, except his superior officer, any discovery made by him or by any other officer of the Department, or any other information in his possession in relation to matters under the control of the Department or in relation to Dominion or provincial lands, until such discovery or information has been reported to the Minister, and his permission for such disclosure has been obtained;

(d) make investigations or reports relating to the value of the property of individuals, or hold any pecuniary interest, direct or indirect, in any mine, mineral lands, mining works or timber limits in Canada. 53 V., c. 11, s. 10; 55-56 V., c. 16, s. 2.

15. Nothing in this Act shall be construed to invalidate or interfere with the commissions, as assistant directors, heretofore issued under orders in council to certain members of the scientific staff. 53 V., c. 11, s. 11.

6-7 EDWARD VII—1907

CHAPTER 29

An Act to create a Department of Mines

(Assented to 27th April, 1907.)

His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. This Act may be cited as The Geology and Mines Act.
2. In this Act, unless the context otherwise requires,—
 - (a) "department" means the Department of Mines;
 - (b) "Minister" means the Minister of Mines.
3. There shall be a department of the Civil Service to be called "The Department of Mines," which shall be under the control and management of the head of one of the present departments of the Government of Canada, who shall be named from time to time for that purpose by the Governor in Council, and who shall be called "The Minister of Mines."
4. The Department shall administer all laws enacted by the Parliament of Canada relating to mines and mining, and shall also have the management and direction of all subjects assigned to it by the Governor in Council.
2. Whenever, under the provisions of this section, the management and direction of any subject is transferred from any other department to the Department of Mines, the Minister of Mines, and the Deputy Minister of Mines shall be substituted for, and have all the powers and perform all the duties of, the minister and deputy minister, respectively, of such other department, as defined and provided by the Acts and regulations relating to such subject.
5. The department shall consist of two branches, one of which shall be called the Mines Branch, and the other of which shall be called the Geological Survey.
6. The functions of the Mines Branch shall be,—
 - (a) to collect and publish full statistics of the mineral production and of the mining and metallurgical industries of Canada, and such data regarding the economic minerals of Canada as relate to the processes and activities connected with their utilization, and to collect and preserve all available records of mines and mining works in Canada;
 - (b) to make detailed investigations of mining camps and areas containing economic minerals or deposits of other economic substances, for the purpose of determining the mode of occurrence, and the extent and character of the ore-bodies and deposits of the economic minerals or other economic substances;
 - (c) to prepare and publish such maps, plans, sections, diagrams, drawings and illustrations as are necessary to elucidate the reports issued by the Mines Branch;
 - (d) to make such chemical, mechanical and metallurgical investigations as are found expedient to aid the mining and metallurgical industry of Canada;
 - (e) to collect and prepare for exhibition in the Museum specimens of the different ores and associated rocks and minerals of Canada and such other materials as are necessary to afford an accurate exhibit of the mining and metallurgical resources and industries of Canada.
7. The functions of the Geological Survey shall be,—
 - (a) to make a full and scientific examination and survey of the geological structure and mineralogy of Canada; to collect, classify and arrange for exhibition in the Victoria Memorial Museum such specimens as are necessary to afford a complete and exact knowledge of the geology, mineralogy, palæontology, ethnology, and fauna and flora of Canada; and to make such chemical and other researches as will best tend to ensure the carrying into effect the objects and purposes of this Act;
 - (b) to study and report upon the facts relating to water supply for irrigation and for domestic purposes, and to collect and preserve all available records of artesian or other wells;
 - (c) to map the forest areas of Canada, and to make and report upon investigations useful to the preservation of the forest resources of Canada;

(d) to prepare and publish such maps, plans, sections, diagrams and drawings as are necessary to illustrate and elucidate the reports of surveys and investigations;

(e) to carry on ethnological and palæontological investigations.

8. The Department shall maintain a Museum of Geology and Natural History for the purpose of affording a complete and exact knowledge of the geology, mineralogy and mining resources of Canada.

9. The Governor in Council may appoint a Deputy Minister, a Director of the Mines Branch, a Director of the Geological Survey, and such other officers and clerks as are required for the proper conduct of the business of the department, who shall be appointed and classified under schedule A of The Civil Service Act, and in accordance with and under the terms of section 6 of the said Act.

10. Such officers of the department as are continuously engaged in the prosecution of original scientific work or investigation shall be classified as technical officers, under paragraph (b) of schedule A of the Civil Service Act; and the Governor in Council may cause to be prepared a list of such officers of the department as are considered to be entitled to be thus classified, with any designations deemed expedient to indicate the scientific work in which they are engaged.

11. No person shall be appointed to the department under paragraph (b) of schedule A of The Civil Service Act, unless he is a science graduate of either a Canadian or a foreign university, or of the Mining School of London or the Ecole des Mines of Paris, or of some other recognized science school of standing equal to that of the said universities and schools, or a graduate of the Royal Military College.

12. When the Deputy Minister reports, for reasons set forth in such report, that assistance of a technical or professional character is required in the department, the Governor in Council may, without reference to any examination, or to the age of the person, if the Minister concurs in such report, temporarily employ such person at such remuneration as is deemed expedient.

13. Any person appointed to the department shall be appointed on probation and shall not receive a permanent appointment until he has served a probationary term of at least one year, during which probationary term he may be rejected upon the report of the Director of the branch in which the temporary appointment has been made; but if he is not rejected, the Deputy Minister may signify, in writing, to the Minister that he considers the person so appointed competent for the duties of the Department, and the appointment may thereupon be made permanent.

14. Persons employed in one section of a branch may be directed by the Minister to perform any duty in or with respect to any other section in the same branch.

15. The Governor in Council may, on the recommendation of the Minister, assign the present officials of the Geological Survey to the branch in which it is deemed desirable that their services shall be utilized; provided that the rate of pay or tenure of office as at present existing shall not be impaired or altered by such assignment.

16. Nothing in this Act shall be construed to invalidate or interfere with the commissions, as assistant directors, heretofore issued under orders in council to certain members of the scientific staff of the Geological Survey.

17. No person employed in or under the department shall, directly or indirectly,—

(a) purchase any Dominion or provincial lands other than for personal residential purposes, except under authority of the Governor in Council;

(b) Locate military or bounty land warrants, or land scrip, or act as agent of any other person in that behalf;

(c) disclose to any person, except his superior officer, any discovery made by him or by any other officer of the department, or any other information in his possession in relation to matters under the control of the department or to Dominion or provincial lands, until such discovery or information has been reported to the Minister, and his permission for such disclosure has been obtained;

(d) make investigations or reports relating to the value of the property of individuals, or hold any pecuniary interest, in any mine, mineral lands, mining works or timber limits in Canada.

18. The Directors of the branches shall, as soon as may be after the close of each calendar year, make summary reports of the proceedings and work of their respective branches for the year, and shall also furnish final and detailed reports, to be issued from

time to time in such manner and form as the Minister directs; and the Minister shall cause the said reports to be laid before Parliament, with such remarks, explanations and recommendations as he thinks proper.

19. The department shall be furnished with such books, instruments and apparatus as are necessary for scientific reference and for the prosecution of the work of the Mines Branch and of the Geological Survey.

20. The Minister may cause distribution to be made of duplicate specimens to scientific, literary and educational institutions in Canada and other countries, and also authorize the distribution or sale of the publications, maps and other documents issued by the department.

21. The Minister may, for the purpose of obtaining a basis for the representation of the mineral, mining and forestry resources and of the geological features of any part of Canada, cause such measurements, observations, investigations and physiographic, exploratory and reconnaissance surveys to be made as are necessary for or in connection with the preparation of mining, geological and forestry maps, sketches, plans, sections or diagrams.

22. Chapter 65 of the Revised Statutes, 1906, is repealed.

P.C. 2165

AT THE GOVERNMENT HOUSE AT OTTAWA

Wednesday, the 5th day of January, 1927

Present: His Excellency the Governor General in Council.

His Excellency the Governor General in Council, on the recommendation of the Minister of Mines, is hereby pleased to designate the Museum branch of the Department of Mines the "National Museum of Canada."

ARCHÆOLOGICAL INVESTIGATIONS IN BERING STRAIT, 1926

By D. Jenness

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The writer spent the summer in northern Alaska in pursuance of the following instructions:

- “(a) to investigate the archæological remains in the vicinity of Bering strait; and
 (b) to investigate the Eskimo dialects spoken in the same region.

In excavating the ancient ruins around Bering strait you will keep in mind two problems:

- (1) The origin of Eskimo culture, whether it arose in Alaska or elsewhere; and
 (2) the possibility that tribes have migrated since Pleistocene time from Asia to America across Bering strait, or from America to Asia. Ruins that may possibly throw light on these problems are to be found at cape Prince of Wales, on Diomedé islands, and on the Siberian shore, at East cape and Utan. Nevertheless, should you discover other ruins in the vicinity that seem likely to yield valuable evidence, you are at liberty to excavate them, subject always to the permission of the proper authorities.

In your linguistic work, which you should be able to carry out concurrently with the archæological, you should aim to augment the report which you have in hand entitled, “A Comparative Grammar and Vocabulary of the Western Eskimo Dialects,” by gathering vocabularies and grammatical forms from any new dialects you may encounter.”

The writer left Ottawa on May 24, and travelling from Seattle by the first passenger steamer of the season, reached Nome on June 12. At Nome he arranged with the Enterprise Steamship Company to travel on its mail schooner, the *Silver Wave*, to Wales, on the east side of Bering strait; the schooner would then call for him a fortnight later and convey him back to Nome, that he might charter a smaller boat belonging to the same company in which to visit Diomedé islands and other places of archæological interest. The mail schooner, after being detained by ice at Teller for four days, landed him at Wales on June 20. It returned from the north on July 6, but, being unable to communicate with the shore on account of a high sea, continued its voyage to Nome without stopping. He thus found himself marooned in Wales until July 25, when the United States Revenue steamer “*Bear*” anchored off the coast, bringing formal permission from the Russian Government for excavations at East cape and Utan, on the Siberian coast, provided that he first reported to the Russian authorities at Petropavlovsk, nearly 1,000 miles to the southward, and subsequently transferred to them all the specimens he recovered. As these conditions made his intended visit to Siberia impracticable, the project was abandoned in favour of an immediate investigation of the ruins on Diomedé islands. Captain Cochran, the commander of the “*Bear*,” courteously conveyed him across the strait, and promised to call

for him twelve days later on his return from Barrow; but on its voyage south the *Bear*, like the mail schooner, encountered a gale in Bering strait and was unable to stop at the Diomedes. After waiting on the islands until August 20, a small launch belonging to the Enterprise Steamship Company crossed over and carried him to Teller. There he was weather-bound for five days, but availed himself of the opportunity to make a short trip inland up Tuksuk river, where he located a pictograph, the only one yet recorded from Eskimo territory. He finally reached Nome on August 29, too late in the season to charter a vessel or to risk visiting other places of interest along the coast. He, therefore, returned south by the first passenger steamer and arrived at Ottawa on September 20.

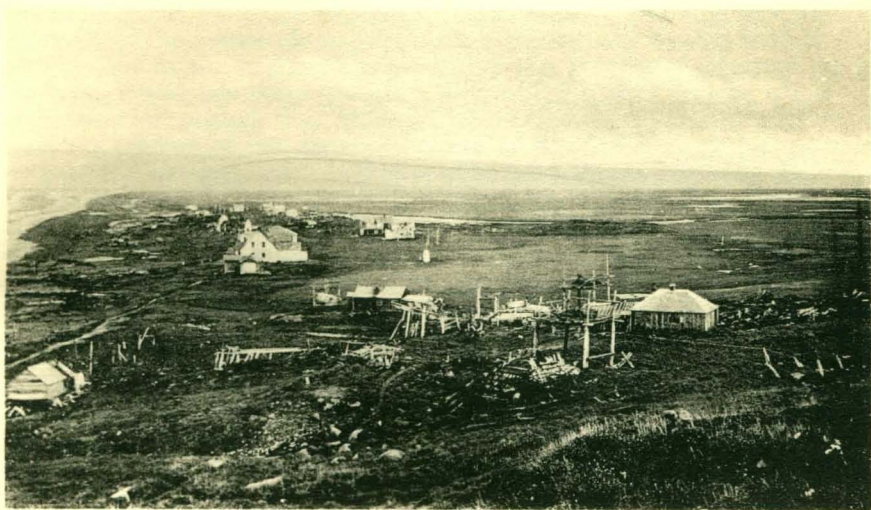
The archæological results of the trip were somewhat disappointing. No new evidences were discovered of very early migrations between Asia and America, and no remains that definitely solve the problem as to whether the Eskimo culture arose in Alaska or elsewhere. However, from some ancient ruins at Wales and on the Diomedé islands there were recovered nearly three thousand specimens of Eskimo tools and weapons that throw considerable light on the early settlement of these places.

In his linguistic work the writer met with more success, being able to gather extensive vocabularies from four distinct dialects. These new notes, combined with the linguistic notes gathered in former years, provide abundant material for the compilation of a comparative vocabulary of the western Eskimo dialects, a vocabulary that should prove of great service to philologists seeking to trace the affiliations of Eskimo with other languages spoken in America and Asia.

ARCHÆOLOGY

Archæological work was begun at Wales. All the native men were absent at the reindeer herds or employed at a tin mine in the hinterland, but through the agency of the schoolteacher, Mr. C. M. Garber, an old man and half a dozen boy scouts were secured as labourers. After a preliminary survey of the ground, excavations were commenced on a mound a few yards behind the present native village. The mound was roughly oval in shape, 75 yards long by 50 yards wide, with a modern graveyard at its west end. Its surface was pitted with rectangular depressions partly filled with water, and here and there the rib of a whale protruded above the ground. Evidently these were old house sites, whale ribs being still employed by the Eskimos for the walls and roofs of their dwellings. Skirting the mound was a creek that expanded lower down into a small lagoon. Numerous sand-bars blocked its outlet to the sea, so that it was impossible to enter the creek from the salt water even in the lightest canoe. Yet the topography of the place suggested—what the traditions of the Eskimos confirmed—that the inhabitants of the mound dwellings were able to paddle their skin boats right up to their doors.

Eight pits were excavated on this mound; five proved to be dwelling houses, and three kitchens. The soil was tundra and free from boulders, but it was frozen solid below the first 6 inches. Artificial methods of thawing it out, such as forcing cold water into the ground through iron pipes, were not available. In some cases it might have been possible to build fires in the pits, although driftwood was exceedingly scarce along the



A. View of Wales, Alaska, looking west towards Siberia, which is visible from the hillside on clear days. The mound on which old house-sites were excavated is seen rising from the tundra immediately behind the village



B. Chukchees leaving Little Diomedé island on the return voyage from Alaska to Siberia.



coast; but a rapid change of temperature destroys bone and ivory, the materials from which most Eskimo specimens are made. The only practical method, therefore, was to expose the frozen soil to the atmosphere and allow it to thaw out naturally. The weather was cold and stormy, the floors of the houses about 3 feet below the surface, so that with the soil thawing out at the rate of 2 inches a day the excavation of even one pit was a long and laborious process. Three of the sites yielded almost no specimens, but enough were gathered from eight pits to give a fairly representative picture of the material culture of the Eskimos at the time this settlement was inhabited. It then seemed advisable to leave the remaining pits for some future investigator, and to examine other ruins in the vicinity.

On the east side of Wales the land slopes rapidly upward, and the last houses lie on a steep bank overlooking the sea. Excavations on the brow of this bank revealed two houses built apparently one on top of the other. The floor of the upper house seemed to be 2 feet 6 inches below the surface of the ground, that of the lower, about 5 feet; but the stratification had been disturbed by slight landslides, so that the layers were not continuous and the true amount of accumulation over the site, uncertain. In another ruin, a few yards away, the floor appeared to be 2 feet 6 inches below the surface, but there also the land may have slipped. The specimens found in these sites, however, seemed to favour antiquities corresponding to their apparent depths.

A more modern ruin, somewhat behind the brow of the bank, was excavated next. Here the logs that formed the roof were still partly intact, the floor boards were only a foot below the surface, and the remains included a glass bead and one or two other specimens that indicated direct or indirect contact with Europeans. Two other house sites on the sandspit in the heart of the present native village seemed to belong to the same period. The villagers assert that their forefathers, harassed by raids from Siberia, once abandoned Wales and fled to Barrow in the extreme north; and the extraordinary number of tools and utensils unearthed in the two ruins on the sandspit certainly indicated a sudden exodus.

A small number of archaeological specimens were purchased from the villagers, who discovered them in rubbish heaps outside their houses, or when digging new cellars for the storage of meat and blubber. Towards the end of the writer's residence at Wales the women and children caused a little annoyance by scratching over at night some of the sites which had been stripped almost to floor-level and then left to thaw out. An attempt to frighten the marauders by placing two human skulls on one of the sites proved unsuccessful; the older Eskimos avoided the place, as they avoid all places that contain human remains; but some of the younger, more sophisticated natives kicked the skulls down the bank and continued their depredations.

In all, 1,820 specimens were gathered at Wales and sent to the Museum for future study and for comparison with specimens from other areas. No full report can be made until this study is completed, but a brief preliminary statement will cover the main conclusions.

The sites belong to two, and in all probability three, periods. Three of the ruins dated from the beginnings of Eskimo contact with European civilization, for they contained a blue glass bead, an iron pipe-cleaner, two gauges for making fish-nets, and three harpoons with iron points. Seven harpoons, however, had points of stone, and all the knife blades were of

stone, so that iron was still very scarce. Now, the Russians reached Anadyr, in northeastern Siberia, in 1649, soon after which date iron must have been fairly plentiful among all the Chukchee tribes in the vicinity. The Chukchee are in close contact with the Siberian Eskimos who cross every summer from East cape to Wales. The first iron probably reached Wales, therefore, within 25 or 50 years of the Russian visit to Anadyr, and the three houses that contained iron harpoon points must have been abandoned about 1700.

The floors of these houses were covered by from 12 to 20 inches of soil, some of which—we cannot tell how much—lay originally on the roofs. The floor of the uppermost house on the bank was about 2 feet 6 inches below the surface, and contained no iron; it dates, probably, from a slightly earlier period, although the evidence is not conclusive. The mound dwellings were certainly much older. Their floors lay at an average depth of 3 feet, of which more than 2 feet must represent the slow accumulation of soil after the caving in of their roofs. The sand-bars that now block the mouth of the creek, damming it back to form a lagoon, also indicate considerable antiquity; for their presence is due to the gradual building out of the coast-line, and since their formation two other bars have developed a short distance out from the beach, making a landing very difficult in rough weather. Furthermore, the mound dwellings showed no traces of iron, pipes, fish-nets, or sealing-harpoons with closed sockets such as appeared in the other houses. Hence they must date from a considerably earlier period, although we cannot estimate their age in years. Their desertion was deliberate, since the inhabitants had carried away most of their possessions; probably it was occasioned by the silting up of the creek-mouth.

The oldest ruin excavated, perhaps, was the lower of the two houses on the bank, with a floor 5 feet below the surface. Very few specimens were found at this level, but a sealing-harpoon seemed to differ slightly from those in the mound dwellings and suggested an earlier type that is known from other parts of Alaska.

The excavations at Wales prove that Eskimo culture underwent remarkably little change in Bering strait for several centuries preceding the European discovery. In the modern graves on the hillsides are soap-stone lamps that have come from the eastward, and triple-hooked grapples for retrieving seals, that were borrowed from the Chukchee; both are recent additions to the material culture of the natives and do not appear in the old ruins. The first contact with Russian civilization, again, brought in iron, fish-nets, pipes, and beads, none of which was known to the older inhabitants. But if we exclude these newer objects, the remains in all the ruins were remarkably similar; with hardly an exception, the implements found in the mound dwellings were indistinguishable from those used by the Eskimos down to the middle of the nineteenth century.

The frequency of body armour in all the ruins bears out the traditions of the natives that they were constantly at war with the surrounding peoples, both in Asia and Alaska. This armour, which consisted of rectangular plates of ivory lashed together like a coat of mail, was apparently unknown to Eskimos outside the Bering Sea area. Unknown outside, too, were the heavy ivory sinkers for fishing-lines, shaped like long plummets of lead, which were found in large numbers at Wales and on Diomed islands. It was interesting to discover that the mound dwellers were

acquainted with seal-nets, snowshoes, and labrets, for these have all been considered by some writers to be recent introductions. Pottery was abundant in most of the ruins, but it was invariably plain, or marked only with the simplest impressions around the rim; there was no trace of the decorated pottery that has been reported from farther south.

Flint and serpentine, especially flint, were surprisingly rare at Wales, and also on Diomedé islands. The sources for both are to the north, serpentine occurring on Kobuk river, and flint at various places north of Kotzebue sound. Both are very common in ruins at Point Hope and at Barrow. Their rarity in Bering strait must be ascribed to infrequent contact with the northern natives rather than to an imperfect appreciation of their value for tools and weapons. This would indicate that in earlier times there was less communication between the various Eskimo tribes along the coast than there is today, although most writers assert the contrary.

One object, and one only, apparently, underwent changes of style at different periods, the sealing harpoon-head, which may, therefore, prove of considerable value for dating the various Eskimo ruins. It is discussed more fully later, when dealing with the archæological specimens from Diomedé islands. Here it is only necessary to say that the three newer houses at Wales, abandoned about 1700, contained three types of sealing harpoon-heads, one with closed and two with open sockets, but that the mound dwellings contained no specimens with closed sockets and only one of the two types with open sockets.

Little Diomedé island was far less favourable for archæological work than Wales. It was formerly a huge crag of granitic rock that contained tabular masses of recrystallized limestone; the limestone weathered, and the crag broke down into a mass of breccia, with steep precipices around the shores. Landing is possible in one place only, on a narrow boulder beach 300 yards long on the southwest side. The native village lies on the slope behind it, and the mass of the island towers above, rising at an angle of about 60 degrees to an altitude of 1,300 feet. The stone dwellings of the Eskimos are built over older dwellings, for space is limited; and wherever a space lies empty, enormous rocks such as are continually sliding down the mountainside conceal all traces of the more ancient ruins. There are rubbish heaps in front of the houses that lend themselves to excavation, but they have all been overturned by the Eskimos, who work the fossilized ivory into ornaments, or sell it to traders at \$2.50 a pound.

The writer excavated three sites on the island, or six houses, for in each case a second house had been erected over the ruins of the first; even the lower houses, however, contained harpoon-heads with iron points, so that none of them dated back more than 200 or 250 years. There may have been still older dwellings underneath, but huge rocks that could be removed only by cranes or blasting prevented the investigations from being carried to greater depths. A large rubbish heap in front of a house that was abandoned less than 50 years ago was also excavated. This heap was of uncertain extent, and had already been ransacked for its ivory to a depth of about 2 feet 6 inches, like all the rubbish heaps on the island. The workmen marked out an area 5 yards by 4, and removed the soil as fast as it thawed out. When the island was left the pit was 3 feet deep, and prolific in specimens of all kinds. Iron, that had been common in

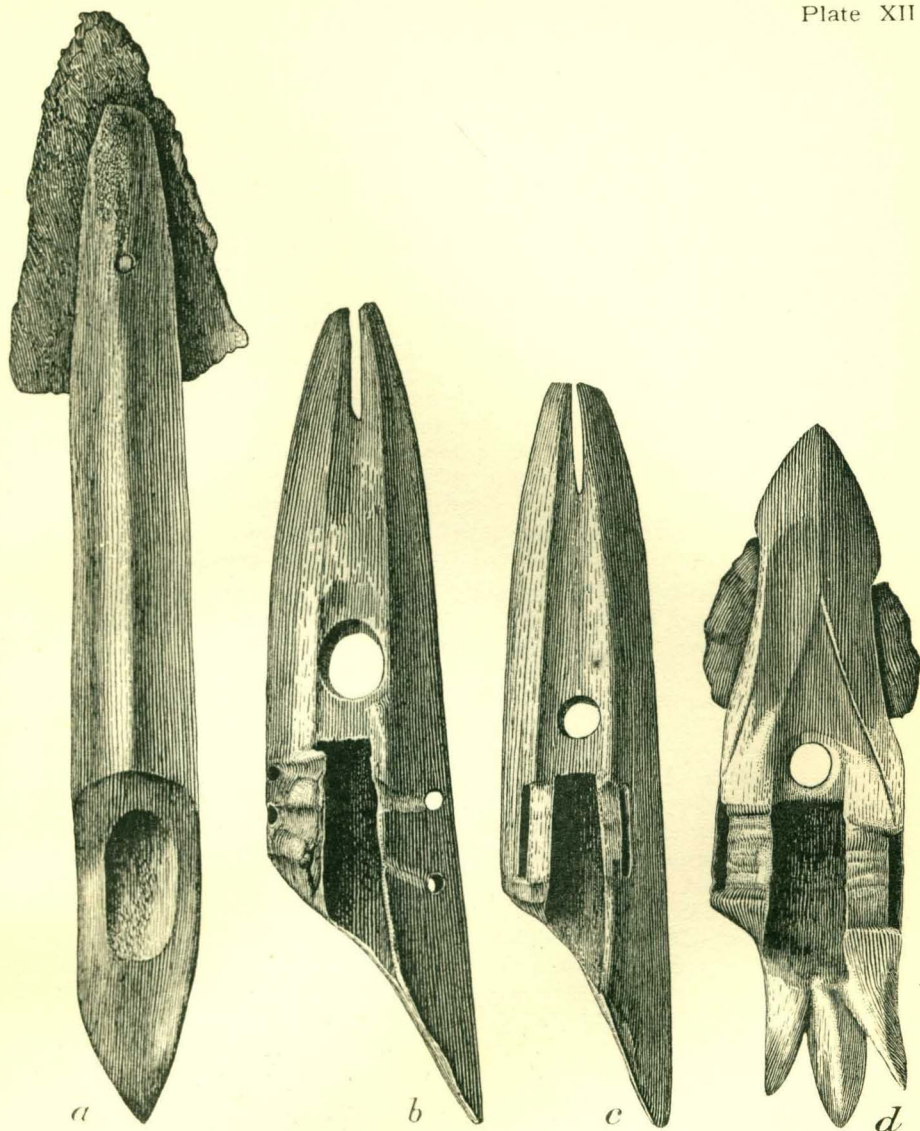
the upper layers, had ceased to appear, but the presence of an occasional harpoon-head with closed socket indicated that even the 3-foot level was formed probably not more than 300 years ago; certainly it was less ancient than the mound dwellings of Wales. The heap appeared to extend much deeper, how much it was impossible to determine; but now that the upper soil has been removed, the villagers will doubtless overturn the lower levels for the sake of the ivory.

Attempts to excavate two other ruins failed owing to the enormous rocks under which they were buried. Portions of their entrances that were uncovered yielded a number of specimens, but the floors of the houses themselves were inaccessible. Two stone houses and a rubbish heap were excavated on Big Diomedé island, 4 miles away; they appeared to date from the same period as the houses excavated on Little Diomedé. On both islands many of the specimens in the houses, even when they lay 2 or 3 feet underground, had decayed so completely through exposure to the air and water permeating the rocks that they fell to pieces on removal; large implements of ivory and bone that appeared firm to the eye crumbled almost to nothing in the hand. But in the rubbish-heaps similar objects were preserved perfectly, because the heaps had no large crevices to admit air and water, and the overlying soil remained frozen throughout the year.

The results obtained from the excavations in Diomedé islands confirmed those of Wales, the history of the two places during the last few centuries having followed, apparently, much the same course. Iron, beads, fish-nets, and pipes reached both places about the same time, roughly 250 years ago, when the aboriginal sealing harpoon-head was just evolving into its present form. Caribou bones were rare or absent in the islands, and more implements were made of walrus ivory, reflecting a slight difference in the economic environment; but in the main the specimens excavated in the two places were indistinguishable.

The sealing harpoon-heads present a very interesting problem. Throughout the Arctic the Eskimos use a harpoon-head with a closed socket that is formed by drilling up the base of the implement. This type, the only form used in modern times, was preceded at Wales and at Diomedé islands by a type with an open socket into which the foreshaft of the harpoon was lashed through a series of holes (either two or three) drilled on each side of the socket. Earlier still, a rectangular slot on each side fulfilled the same function as the drilled holes; or else the edges of the implement were trimmed away for the lashing. Only the two last forms (considered here as one type) were present in the mound dwellings at Wales, whereas the three ruins in that place that dated about 1700 contained specimens of all three types. The rubbish heap on Little Diomedé island, even though it had been disturbed by the natives, showed the succession fairly clearly. In the upper layers there were only closed-socketed harpoon-heads of different varieties; lower down, nearly all had open sockets with drilled holes for the lashings; and at the 3-foot level the open-socketed type with rectangular slots or no holes at all for the lashing began to predominate. Evidently the seventeenth and early part of the eighteenth centuries were transitional periods in Bering strait, during which all three types were in current use.

Slightly modified varieties of these three forms of harpoon-heads are common in Arctic Canada, the open-socketed forms being associated with Thule culture remains. Whether the form with

DEPRUD' HOMME Del^t

Sealing harpoon heads typical of the successive culture strata in northern Alaska. Each type is found with minor variations even in a single site. A. Head of recent type, with closed socket and iron blade, recovered from ruined house dating about 1700, at Wales, Alaska (Cat. No. IX.F. 8730). B. Earlier transitional type with open socket and drilled holes for lashing on the foreshaft. Wales, Alaska (Cat. No. IX.F. 8675). C. Alaskan "Thule" type preceding (B), with open socket and slotted holes for the lashing. Wales, Alaska (Cat. No. IX.F. 8650). D. Oldest known type, with multiple terminal barbs, flint blades inserted in forward section and open socket for foreshaft, in some cases with a hole drilled vertically. Little Diomedé island, Alaska (Cat. No. IX.F. 8687).



drilled holes for the lashings is later there than the other open-socketed form, as in Bering strait, has not yet been determined. The change to the modern closed-socketed type, however, seems to have occurred earlier in Canada than in Bering strait. It was apparently the only type used in Hudson bay in the seventeenth and eighteenth centuries, and one specimen, with several open-socketed forms, was recovered from an old stone house on Victoria island, which was surely two or more centuries older. At Barter island, again, on the Arctic coast of Alaska near the International Boundary, where the writer excavated nearly fifty ruined houses in 1914, every harpoon-head had a closed socket, although these houses antedated all contact with Europeans. From the evidence at present available, therefore, it would appear that this type of sealing harpoon-head first established itself in the central or eastern Arctic, but was rare in Bering strait until comparatively modern times. It may, indeed, have been known there even in ancient times, for the whaling harpoon-head seems always to have possessed a closed socket, and a few sealing harpoon-heads of the same type have every appearance of antiquity; but, broadly speaking, a closed-socketed sealing harpoon-head from any site around Bering strait indicates an antiquity no greater than 300 years, and an open-socketed type not less than 200.

During the stay on Little Diomedé island, the writer saw a very curious harpoon-head unearthed in front of a native's hut, where a cache for meat was under construction. This harpoon-head had three terminal barbs arranged symmetrically, one on each side of the base and one in the middle, an open socket with rectangular slots for the lashings, and two deep slots in the forward part to hold small blades of stone. Similar specimens are known from other places; for example, there is one in the Philadelphia Museum, from Wales, another from the Kuskokwim region, and a third, slightly modified at the front, from the vicinity of Barrow. Now these harpoon-heads, although the most complex, appear to be the oldest yet discovered; they were not found in the mound dwellings at Wales, although they evidently occur in that village; and the specimen unearthed on Little Diomedé island was 8 feet below the surface. The type has not been found outside of Alaska, except on the Siberian shore. Around Barrow the terminal barbs are nearly always cut obliquely, and on one side of the base only, whereas in Bering sea they are usually arranged symmetrically around the base; but the two varieties evidently have a common origin.

The Diomedé Island harpoon-head (*See* Plate XIII), however, was unique in one respect. It was etched with fine scroll-work, concentric circles, and curvilinear designs quite different from the usual Eskimo carving. Similar etchings were present on an ivory object, highly fossilized, gathered from the surface of an overturned rubbish-heap at Little Diomedé island, and still other examples, including two more harpoon-heads, were purchased from the natives (*See* Plate XII). Scroll-work of the same character distinguished a number of specimens purchased by Dr. Ales Hrdlicka, of the Smithsonian Institution, at St. Lawrence island and other places around Bering sea. It was present, too, on a whaling charm purchased by Dr. G. B. Gordon at Nome, and illustrated by him in the *Journal of the University of Pennsylvania Museum*, vol. vii, 1916, p. 61, a specimen, it may be mentioned, practically identical with one obtained by the writer

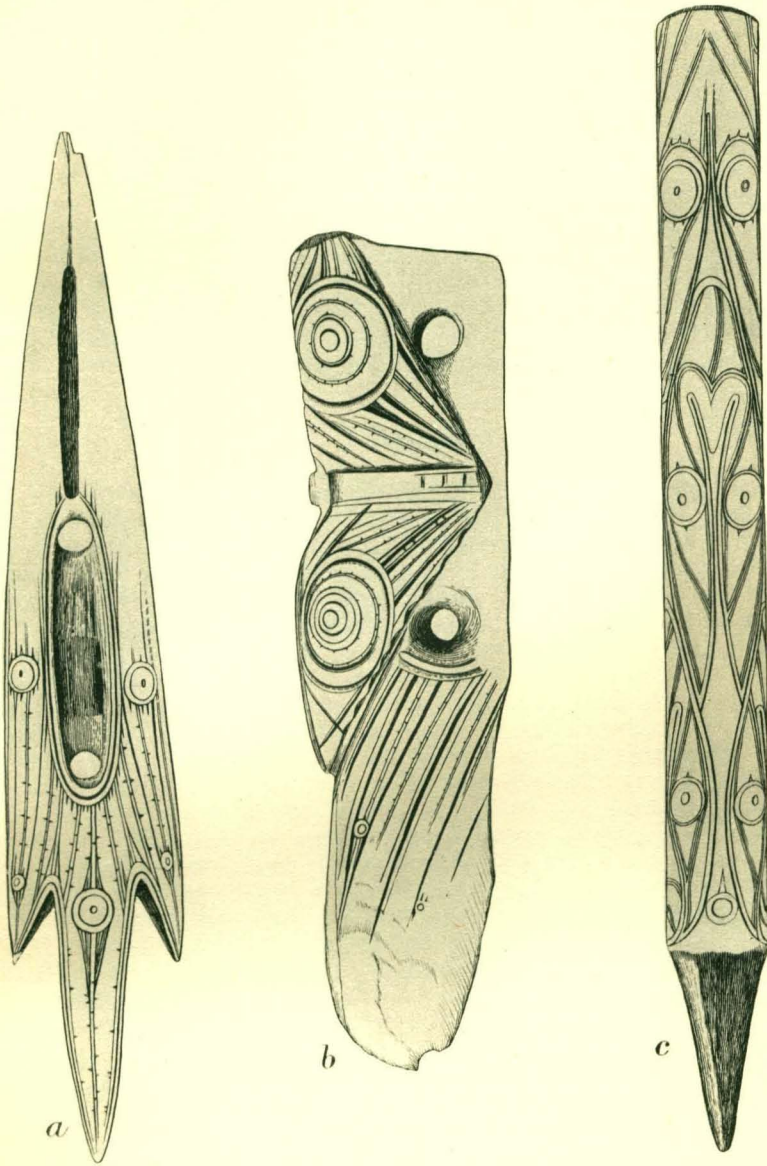
on Little Diomedé island. It is not only the designs on these specimens that are peculiar; many of them differ in form from those found in other parts of the Arctic.

We seem justified, therefore, in concluding that the shores and islands of Bering sea were at one time the home of a distinct and highly developed Eskimo culture, a culture marked by special types of harpoon-heads and other objects that in many cases show the most skilful workmanship, marked too by a very original art, partly geometrical and partly realistic, that suggests in some of its features contact with the Indians of the north-west coast of America, although its roots more probably lie in northeastern Asia. It appears to be the oldest culture yet discovered in the western Arctic, preceding, at least in Wales and on Diomedé islands, the Thule stage as exemplified by the mound dwellings at Wales, and by similar ruins at Point Hope and at Barrow. Its true centre seems to have been Bering sea, but its influence extended northward, and conditioned the form of the earliest known sealing harpoon-head at Barrow. Subsequently it passed away, but perhaps we may still trace its influence in the designs on some later specimens from the region of its old home.

Although the writer's excavations throw little light on any actual migrations of tribes from Asia to America, or from America to Asia, abundant evidence was secured that such migrations are not only feasible, but highly probable. On a clear day—and clear days are not uncommon in the spring and early summer—the inhabitant of Wales, from the hills behind his home, can scan the coast of Asia from East cape to Indian point; and the dweller on the Asiatic shore can view with similar ease the mountain at the back of Wales. The strait is not more than 50 miles wide, and exactly in the middle lie the two Diomedé islands, stepping-stones, as it were, from one continent to the other. Each summer a party of Siberian Eskimo, or of Chukchee, choosing a favourable north wind, puts out to sea in a small skin boat, and in one day crosses to the Diomedes. There it camps, and in one day more crosses to Wales, and so continues along the coast, southeast, if need be, to Teller and Nome, or northeastward to Kotzebue sound. In winter the strong current that runs on the east side of Little Diomedé island usually keeps open a lane of water that prohibits any passage to the mainland over the ice; but sometimes even this freezes over, and the natives pass safely from one continent to the other with their sleds and dog-teams. The traditions of both Chukchee and Eskimo speak of raids by Siberian peoples on the American shore, and the numerous remains of armour in the ancient as well as in the more recent dwellings prove that these raids persisted through many centuries. In historic times a well-known trade route started at Anadyr, where the Chukchee bartered their furs in the Russian mart, passed to East cape, from East cape across Bering strait to the Diomedes and Wales, thence up the coast to Kotzebue sound, where Eskimos gathered from all around to acquire the new goods from over the sea. If Bering strait, therefore, were not a constant barrier to either warfare or trade, still less could it have been a barrier to the migrations of small bands from one continent to the other.

Pictograph

The pictograph discovered on the north bank of Tuksuk river, 17 miles inland from Teller, consisted of fourteen or more figures, each about



Π F PRUD' HOMME Del'

Ivory specimens illustrating the archaic Bering Sea culture and its curvilinear art, from Diomedé islands.
A. Harpoon head (Cat. No. IX.F. 6672). B. Implement of unknown use (Cat. No. IX.F. 6676). C. Harpoon foreshaft (Cat. No. IX.F. 6670).

9 inches high, drawn in black and red on the face of a block of chlorite schist that dipped down to the water's edge. They were arranged, apparently, without connexion with each other, and so did not form a consistent picture; one figure, indeed, had been painted directly on top of another. Several were illegible through weathering; of the remainder the majority represented human beings in various attitudes. The local Eskimos believed that the drawings were made during a war with Siberian natives, and that some of the figures represented battle scenes; but even if the tradition is correct, it affords no clue to the date of the pictograph, since the Siberians have raided this coast for many centuries. After all, the exact interpretation of the figures is of little value. It is significant, however, that this is the only rock painting yet recorded from Eskimo territory, although such paintings are common among many Indian tribes. It is, therefore, one more indication of the close connexion that has existed between the Indians and Eskimos of Alaska since remote times.

Linguistics

The writer gathered vocabularies of about 1,000 words from Wales, and from 300 to 400 words each from East cape, Inglestat in Norton sound, and Nunivak island off the mouth of Yukon river. These will be incorporated in a "Comparative Vocabulary of the Western Eskimo Dialects," which already contains many words from Wales, Barrow, the Mackenzie River delta, and Coronation gulf. Afterwards it should be possible, with the help of Greenland and Labrador dictionaries already published, to work out the main phonetic rules that have governed the changes in Eskimo speech throughout the Arctic, and to reconstruct in certain cases the original stem-words of the language. From Greenland and Labrador to Barrow and Point Hope in Alaska the dialects change but little; a native of the former places could converse fluently, in less than a week, with the inhabitants of the latter. At Wales the changes become more pronounced, and take on some of the features of the East Cape dialect, which is hardly intelligible to the Barrow natives. Some of the peculiarities of the East Cape dialect seem to reappear at Nunivak island, suggesting that the Bering Sea Eskimos may once have spoken a single dialect, slightly varied in different places, but from a larger standpoint forming a unit as contrasted with the dialects to the north and east. On this theory the marked divergences of speech that now occur in certain parts of Bering Sea area would have resulted partly from local developments, and partly from the influence of neighbouring Indian and Chukchee tribes.

No attempt was made to record the speech of the Diomedé islanders, because it appeared to be intermediate between that of Wales and East cape. The dialect of Inglestat was remarkable because it differed very little from the Barrow dialect, although Inglestat lies considerably southeast of Wales. It suggests a movement of the Arctic Eskimos southward, with Inglestat as its final outpost; for immediately to the southwest again, at St. Michael, the language abruptly changes, and the natives of that village understand only with great difficulty the speech of the other.

Conclusion

Viewing all these facts together, the archæological as well as the linguistic, we seem to glimpse a separate division of the Eskimo people living in olden times around Bering sea, one that was distinctive in its dialects, its material culture, and its art. On the one side it was in close contact with the Chukchee and perhaps the Kamschadal tribes of north-eastern Asia, on the other with the Indians of the Yukon and Kuskokwim. Something caused their culture to change, but their dialects persisted and underwent further modifications in different places. Perhaps there was an invasion of tribes from the north, bringing in a Thule culture that had evolved somewhere along the Arctic coast. But our information is too scanty to permit as yet of any elaborate theories. More excavations are needed on both sides of Bering sea, and, in the north, around Kotzebue sound and the mouth of Colville river, to determine the range, the content, and the sequence of each culture stage before speculating on their causes and relationships.

RESTORATION OF TOTEM-POLES IN BRITISH COLUMBIA

By Harlan I. Smith

The writer spent the summer at Kitwanga, B.C., superintending the preservation of the Indian totem-poles along Skeena river. This work was commenced in 1925 under the direction of a committee consisting of Dr. D. C. Scott, Deputy Superintendent General of Indian Affairs, Mr. Charles Camsell, Deputy Minister of Mines, Mr. J. B. Harkin, Commissioner of Canadian National Parks, Mr. E. Sapir and Mr. C. M. Barbeau, of the Museum staff; and the same committee directed the work in 1926, except that Mr. Sapir was replaced by his successor as Chief of the Division of Anthropology, Mr. D. Jenness. The Department of Indian Affairs defrayed all the running expenses, and the Canadian National railways co-operated by supplying considerable quantities of material free of charge and by placing at the writer's disposal the services of a special engineer, Mr. T. B. Campbell.

The initial step was to gain the goodwill and consent of the Indian owners of the poles. This was not easy, for they were unfavourably disposed toward white men in general, and particularly toward Government officials. There were many grievances they could cite, some no doubt real, and some imaginary. The white men had settled on their land and were pushing the Indians more and more to the wall; they had built canneries on the coast that were destroying all the fish; they were cutting all the best timber in the country so that within a few years none would remain for the Indian; they sold whisky in Government liquor stores and put the Indians in jail when they drank it. A few years ago, they had prohibited the erection of totem-poles; why did they wish now to preserve them? Much tact and patience were necessary to answer these and other objections the Indians raised to any interference with their poles, but in the end most of the difficulties were happily overcome.

The engineering work progressed favourably under the able direction of Mr. Campbell. Poles that had decayed at their bases (and they were in the majority), were cut off at ground-level and bolted to new, well-seasoned bases. The fresh portions were then creosoted, and the older parts of the poles treated with linseed oil, since paint cannot be applied satisfactorily over a creosoted surface. All the original poles had been painted, but the colours were almost obliterated through exposure to the weather. They were repainted on the ground, and re-erected in a cement setting capped with plastic gum that reached slightly above the ground-level to prevent the seepage of water between the wood and the cement. The lowering and raising of each pole was accomplished with an A-frame and a winch.

The repainting presented the greatest difficulty. To apply the colours in conformity with ideas derived from European technique would have destroyed the aboriginal character of the poles, and produced a hybrid art. If restored at all the colours should conform to those originally painted on the poles. In many cases the oldest natives alone retained any memory of their former appearance, and even they could reach agreement only after long discussions and arguments. Another problem arose in

connexion with the method of repainting. The weathering of the wood had been accompanied by a fading of the original colours, giving to each pole an archaic and subdued appearance in harmony with the landscape. Only the Indians themselves, who owned the poles and who alone knew the original colours, could be employed for repainting, and they were not experienced in reproducing antique forms; so although they toned down the new colours as far as they were able, they could not avoid a gaudiness in the repainted poles that contrasts unpleasingly with the mellow colours of those still untouched. It should be remembered, however, that new poles were gaudy even in olden days, and that exposure to the weather for one or at the most two years will produce all the fading that should be necessary to restore an archaic appearance. The poles that were repainted in 1925 now appear quite satisfactory in this respect, although they were extremely gaudy immediately after their restoration.

When the operations were begun in 1925 in Kitwanga, three totem-poles had already fallen and most of the remaining fifteen had rotted immediately below the ground-level, so that they were in danger of falling. In that year eight specimens were treated, seven totem-poles and one totem figure, two of which had fallen. Last summer ten specimens were cared for in the same way, nine totem-poles and one totem figure, a gain of 25 per cent, at the same expense. The gain was doubtless due to the experience gained in 1925, to more suitable equipment, and to better relations with the Indians, whose experience with the movement in the preceding year resulted in a more friendly disposition, fewer delays, and even voluntary offers of co-operation.

Ninety per cent of the totem-poles at Kitwanga are now restored. Only two poles remain untouched, and for these the native owner refuses to give his consent. The Indians have given permission to work on eight poles at Gitseyukla, one at Hazelton, four at Hagwelget, and two at the forbidden village of Kitwinkul; it is understood, also, that they agree to the restoration of all the poles at Kispiox.

This work of preserving the totem-poles at Kitwanga has already produced some interesting results. The "Out-of-Doors Totem Pole Museum" (as they have been called) has not only attracted tourists, but stimulated the Indians themselves. In 1925, John Laknitz, a Gitksan Indian, opened beside it a museum of ancient Gitksan costumes, musical instruments, and other objects; he played phonograph records taken by himself of Gitksan songs, and exhibited photographs of some Gitksan portraits painted by Mr. Kihn. His little museum was visited by many tourists, but was closed a year later on the death of its owner. Soon afterwards, however, his father, Jim Laknitz, opened his own house, a much more suitable place. Its large size, its fireplace, smoke-hole, and two large ridge poles with four carved house posts supporting them, are typically Indian features, although the pitch of the roof, the shakes, the lumber, the doors, and the windows are modern in character. Inside are a large number of excellent old Gitksan specimens. Visitors have expressed the opinion that this building should be preserved, because, among all the Indian houses in this part of the country, it perhaps approaches nearest to the old aboriginal type. During the lifetime of its owner it is probably fairly safe except from fire, but after his death measures might be taken to secure its preservation.

Incidental to the work on the totem-poles assistance was given to a representative of the Pathe Motion Pictures in securing information and pictures of the totem-pole work which will further advertise the Canadian National railways. Several moulds showing a mask and details of some of the totem-poles were brought back to Ottawa. The figures reproduced from these moulds are useful as museum specimens, as advertisements in railway offices and depots, and as souvenirs to be used in the same way as animal heads. They may also prove of value for architectural work, since the architect of the new Hudson's Bay Company's store in Winnipeg was recently searching for suitable totem-pole material to decorate the company's restaurant.

ORNITHOLOGICAL INVESTIGATIONS NEAR BELVEDERE, ALBERTA, 1926

By P. A. Taverner

The scene of operations was the vicinity of Belvedere, Alberta, 60 miles northwest of Edmonton and 15 miles west of Busby on the Edmonton, Dunvegan, and British Columbia railway. Our immediate location was at the north end of lac La Nonne near the house of Mr. A. D. Henderson whose interesting ornithological and oological reports had induced us to investigate this particular area. It was largely due to this friendly assistance and advice, based on some twenty-eight years experience in the locality, that the season's work was so successful. Notes on 205 species of birds were obtained and specimens of 164 of them collected.

The writer left Ottawa on May 15, was joined in Winnipeg by C. G. Harrold, and in Edmonton by Hamilton M. Laing, both of whom had been engaged for the season in the capacities of junior zoologists. Mr. Harrold, Mr. Laing, and the writer arrived in camp on the 24th just as a party consisting of Prof. Wm. Rowan, R. H. Rauch, and R. C. Harlow were leaving on an oological collecting trip by wagon to beyond Fort Assiniboine 40 miles directly north on Athabaska river. They returned May 27 with interesting information, much of which was available for this report. Most of the work was done within walking distance of camp, but occasional trips were made in various directions and from July 8 to 16 was spent by a small lake, 6 miles north of Pembina river at Belvedere, that we called Wharton lake. June 24 and 25 were spent on the long point in Beaverhill lake, near Tofield, Alberta, assisting Prof. Rowan and his associates in banding a large colony of Franklin's gulls. The writer left camp for Ottawa on July 26. Harrold remained until the end of September and Laing until October 26.

Lac La Nonne is a fine, open body of water $4\frac{1}{2}$ miles long by $1\frac{1}{2}$ wide. Its shores are fringed with a narrow border of marsh, the dominating species being tule (bulrush, *Scirpus* sp.), and reed-grass (*Phragmites* sp.), making attractive breeding ground for water birds. The lake is deep and the water clear and wholesome. The country about is well wooded with coalescing poplar bluffs growing open and clear with little tangled underbrush. There are few clearings or farms immediately on the lake, but more north across Pembina river and east towards Busby. There are many small lakelets and ponds scattered nearby and occasional muskeg. To the west the country is practically solidly wooded and contains considerable spruce. The party were informed that originally the country was all spruce, but the spruce being killed off by extensive forest fires it has been replaced by poplar that now has grown almost like original forest, the only conifers remaining being in the muskegs and other small spots that the fire missed. It is probably due to this succession of floral, and a persistence of faunal, associations that much of the biological interest of the locality is due. We have here a number of far northern animal forms amidst southern intrusives, making a mixture of life zones distinctly puzzling to a distributionist until it is realized that the Hudsonian elements are relict and the Transition ones recently intrusive.

Two miles southwest of lac La Nonne and across a ridge divide is lake Majeau about the same size as La Nonne, but of entirely different character. It is shallow, with considerable more tule and phragmite growth about its edges and its water is clouded and muddy. There are considerably more water fowl breeding about lake Majeau than on La Nonne, in fact it seems a paradise for grebe, ducks, coots, and similar birds. It was noted that the many little lakelets, ponds, and pot-holes surrounding La Nonne were much more attractive to these birds than the lake itself, and especially that the broods raised in them were more successful. A fair number nested in the marshes of La Nonne, but the broods seen were few and small. On the contrary, Majeau and the small ponds fairly swarmed with fowl and later large broods were seen following their parents all over the surface, or paddling alone in mid-lake in perfect ease and apparent safety. On some of the smaller waters young and old gathered together in their centres in solid black rafts. One factor seemed to be the fish. Lac La Nonne swarms with pike (jackfish) that undoubtedly take heavy toll of downy young. The small lakes contain no such fish, and Majeau, in which pike are said to be common, is so muddy and opaque as to raise the safety factor very considerably in favour of prey pursued by sight.

This was a low year for rabbits, mice, and grouse. It is yet to be determined whether there is a connexion between these different species or not. It is to be noted that the last low year in rabbits on Red Deer river, 1917, was accompanied by a like scarcity of grouse. Almost no rabbits were seen throughout the season, though information was given that they were abundant the year before. The party had strings of traps out for small mammals much of the time, but the returns from them were small indeed. Grouse, both Ruffed and Sharp-tails, were scarce and at a low ebb in numbers.

The following is a briefly annotated list of the birds observed. All the material has not as yet been closely studied and some of the subspecific identifications are left open or are tentative until the various species can be worked over as a whole or a detailed study of the whole region is undertaken.

The nomenclature used follows the A.O.U. check-list of 1910 and its various supplements.

Æchmophorus occidentalis Western Grebe

Common on lac La Nonne in spring where a few are seen through the summer and may occasionally breed. Breeding on lake Majeau in large colonies, associated with Eared Grebe and (formerly) Franklin's gulls. Not seen on any of the smaller lakes.

Colymbus holboelli Holboell's Grebe

Common breeder on all the larger lakes and many of the smaller ones.

Colymbus auritus Horned Grebe

Common breeder on many small ponds and sink-holes.

Colymbus nigricollis Eared Grebe

Fairly common on lac La Nonne in spring, but found nesting only on lake Majeau where large colonies were examined. One of these colonies was far out in the open lake. Nests without cover on piles of floating weed dredged from the bottom.

Podilymbus podiceps Pied-billed Grebe

Rather scarce, but breeding in small numbers on all the large and some of the smaller lakes.

Gavia immer Loon

Common, breeding on some of the smaller lakelets and apparently coming to the larger ones only to feed.

Gavia arctica Arctic Loon

The writer examined a high plumaged specimen taken on Wharton lake by Prof. Rowan and A. D. Henderson, July 6, 1925. It is, of course, *G. a. pacifica*.

Larus argentatus Herring Gull

A. D. Henderson has a skin of a juvenile gull, probably this species, taken on lac La Nonne. Several gulls seen in the autumn on lac La Nonne by Laing and Harrold were attributed to this species, but could not be certainly identified.

Larus californicus California Gull

Single gulls of large size were seen on lac La Nonne through the spring and summer. The only one taken, July 2, was a sub-adult non-breeder of this species.

Larus brachyrhynchus Short-billed Gull

One specimen, taken by A. D. Henderson August 15 on lac La Nonne, and now in our collection. It is a juvenile of the year and seems to be the only record for the species in Alberta away from the large lakes of the north where it breeds regularly.

Larus franklini Franklin's Gull

Fair numbers seen on all the large and many of the smaller lakes. Nests intermittently in the marsh at the south end of lake Majeau. The year previous Henderson states there was a large colony there, but this season, though numbers congregated over the spot at times, it was not occupied for nesting. June 24 and 25 assistance was given Prof. Wm. Rowan and his associates in banding some 5,000 Franklin's Gulls before they could fly, in an immense rookery at Beaverhill lake, southeast of Edmonton. Approximately 5,000 birds were banded at this time.

Larus philadelphia Bonaparte's Gull

This species was one of the interesting items of the locality. It nests in scattered pairs about many of the large and small lakes about Belvedere, northward to the Fort Assiniboine region and probably beyond. The nests are placed on the branches of spruce or tamarack trees adjoining lakes and are well-made structures of moss on a stick base and have a very close resemblance to magnified nests of the Olive-sided Flycatcher. The young seem to take to the open water of the nearby lake nearly as soon as hatched. For a full account of nesting in this district See Henderson, *Auk*, XLIII, 1926, pages 288-294. The Museum is indebted to Mr. R. H. Rauch for a beautifully characteristic nest collected in situ near Fort Assiniboine, now made up as a habitat group on exhibition.

Sterna hirunda Common Tern

From three to four often seen beating about over the waters of lac La Nonne. Henderson reports that the species nests on St. Ann lake 15 miles south of lac La Nonne where he took eggs in 1924.

Chlidonias nigra Black Tern

A very common nester in the marshy edges of the larger lakes and seen commonly on the smaller waters.

Phalacrocorax auritus Double-Crested Cormorant

Occasionally seen in migration on lac La Nonne. One juvenile taken by Laing September 17.

Pelecanus erythrorhynchos White Pelican

Henderson states that he saw a recognizable photograph of one killed on lake Majeau the autumn of 1917. It is reported to have nested formerly on St. Ann lake.

Merginae Mergansers

The party saw, to identify, no Mergansers. However, Henderson reports the American as being seen occasionally, but not known to breed. The Red-breasted as regular on migration and a single breeding record for the species. He has only two records of the Hooded in twenty-eight years.

Anas platyrhynchos Mallard

The commonest breeder. Henderson reports that a flock of twenty-three are wintering (1926-27) in the mouth of the creek outlet of the lake by his house where he is feeding them.

Chaulelasmus streperus Gadwall

Quite common in early summer, scarcer later. Henderson reports having found only a single nest in the locality.

Mareca americana Baldpate

Slightly more common than the preceding. Henderson has found its nest twice.

Nettion carolinense Green-winged Teal

A common breeder.

Querquedula discors Blue-winged Teal

A common breeder.

Spatula clypeata Shoveller

A common breeder.

Dafila acuta Pintail

Rather scarce. Only occasional individuals noted. Henderson reports finding its nest only twice.

Marila americana Redhead

A common breeder.

Marila valisineria Canvas-back

Common breeder on all reedy lakes.

Marila affinis Lesser Scaup Duck

One of the commonest of breeding ducks. The centres of some of the smaller lakes in June and July are often black with masses of young ducks. The majority of these were Scaups.

Marila collaris Ring-necked Duck

Recognized with certainty only once, June 21, on one of the smaller lakes, but several times the party saw birds which they referred to this species and though its nest has never been actually identified they believe that it is a regular though probably scarce breeder.

Glaucionetta clangula American Golden-eye

A common nester. Henderson has several artificial bird-boxes scattered about his place and several of them are regularly occupied for nesting by Golden-eyes.

Charitonetta albeola Bufflehead

A common breeder. It is astonishing how small a hole it will enter for purposes of nesting. Some of the nests occupied by them were old Flicker nests with openings that seemed no larger than normal for that species.

Clangula hyemalis Old-squaw

Reported by Henderson as a regular spring and autumn migrant, but not noted by us.

Oidemia deglandi White-winged Scoter

Large numbers of mixed sexes occupied the open waters of large lac La Nonne on the party's arrival. The first week in July the females seemed to retire from these gatherings and nests with complements of eggs were found. About the same time the males grew scarcer and were seen passing over westward and away from the lake in large, regular flocks as if on passage. After July 26 practically no males were to be seen and only occasional females skulking in the reeds were noted until the migrants arrived in August and September.

Oidemia perspicillata Surf Scoter

Considerable numbers were on the open waters of lac La Nonne on the arrival of the party, but none was seen after May 26. Henderson reports four on a small lake in Fort Assiniboine region June 8, 1925.

Erismatura jamaicensis Ruddy Duck

A very common breeder.

Chen hyperboreus Snow Goose

From fifty to two hundred Snow Geese noted by Laing, October 10 to 13. These were undoubtedly Lessers *C. h. hyperboreus*.

Anser albifrons White-fronted Goose

Noted with question mark by Laing and Harrold September 7. These were almost certainly *A. a. albifrons* as *gambeli* has only been certainly identified from the California coast.

Branta canadensis Canada Goose

Noted by Laing and Harrold under undetermined subspecies September 14 and 28 and as *B. c. hutchinsi* in numbers to four hundred by Laing October 10 to 14. According to Henderson it formerly bred in fair numbers on islands in Pembina river and on lake Majeau.

When the party arrived at lac La Nonne a single swan was observed for a couple of days, but then disappeared. It was not an injured bird for it could fly strongly. Although the probability is that it was a Whistling Swan there are recent records of occasional Trumpeters still breeding in the general area and there are still possibilities of its occurrence. One swan noted by Laing and Harrold September 22. Henderson says "quite common in migration spring and fall."

Botaurus lentiginosus Bittern

A common breeder.

Ardea herodias Great Blue Heron

Only occasional individuals seen on lac La Nonne and observed no other place except where on a small island in lake Majeau there were several nests, four of which were occupied. Henderson says that this rookery has been recently established, dating only from about 1920, and seems to be just about holding its own in point of numbers.

Grus americana Whooping Crane

Henderson says he never saw the species near lac La Nonne, but that he observed three several years ago about 30 miles to the southeast.

Grus mexicana Sandhill Crane

Said to have occurred formerly in Belvedere region, but not to do so now except in migration. A set of eggs and the parent were taken by Prof. Rowan in Fort Assiniboine district in May. The writer examined this bird in the fresh skin, but did not make definite identification as between *mexicana* and *canadensis*. It is probably the former.

Porzana carolina Sora Rail

A common breeder.

Fulica americana Coot

Common breeder about all lakes, large or small. Other marsh nesters show a violent antipathy to the Coot as neighbour, that is probably founded on something more definite than mere whim.

Lobipes lobatus Northern Phalarope

First early migrants recognized July 13 and small numbers occasionally seen or collected to August 23.

Steganopus tricolor Wilson's Phalarope

A not uncommon breeder. R. C. Harlow found a nest in Fort Assiniboine district and a downy young was taken for a habitat group at Wharton lake July 10. Only one seen, August 14, after the end of July.

Gallinago delicata Wilson's Snipe

A common breeder.

Limnodromus griseus Dowitcher

An interesting occurrence was the discovery by Henderson the previous year of this bird breeding in Fort Assiniboine district. This season other nests were taken in the same region by the northern party and a possibly breeding bird was seen in June by Henderson not far from our locality. The party are indebted to R. C. Harlow for a beautifully collected nest in situ of which a habitat group has been made for exhibition in the Museum.

July 10 three appeared on the muddy shores of Wharton lake and were duly collected. At the time it was felt that the date assured these of being of the locally breeding race, but almost immediately afterwards both Baird's and Stilt Sandpipers, undoubted far northern breeders, occurred and raised doubts as to the correctness of the supposition. Birds taken with the nests and most of those taken by the party are of the short-billed type, but the Dowitcher is a very puzzling species and the writer does not feel prepared to decide upon the subspecific identity of these specimens now.

Micropalama himantopus Stilt Sandpiper

One taken at Wharton lake July 15 and singles noted by Laing and Harrold August 14 and 16.

Pisobia maculata Pectoral Sandpiper

One taken at Wharton lake, May 27, and singles noted or taken between July 23 and September 23.

Pisobia bairdi Baird's Sandpiper

Autumn migrants taken July 10 and 12 at Wharton lake. These are adults going into winter plumage. Adult autumn birds are very rare indeed in Canada. The species comes through both the coast and interior in considerable numbers, but as far as collected to date practically all are juveniles of the year. The adults must come very early and pass very quickly, with little or no normal stopping en route, or else must seek the south by a separate route from that of the juveniles. The species was noted again by Laing and Harrold August 14 to 16 when the usual juveniles were collected.

Pisobia minutilla Least Sandpiper

A few individuals noted by Laing and Harrold August 10 to 16. This seems to be a rather rare "Peep" through the western Prairie Provinces.

Ereunetes pusillus Semipalmated Sandpiper

Semipalmated Sandpipers appeared with the early migrant wave of waders at Wharton lake July 14 and were noted there by Laing to August 14.

Limosa fedoa Marbled Godwit

Prof. Rowan is reported to have seen a pair about 10 miles south of camp, July 6, 1925.

Totanus melanoleucus Greater Yellow-legs

June 2, 1925, Henderson found Greater Yellow-legs in Fort Assiniboine district, and took downy young. They were also found there again this year and Prof. Rowan took another downy young. A few single adults were noted on Wharton lake July 10 and 11.

Totanus flavipes Lesser Yellow-legs

Lesser Yellow-legs were breeding in some numbers in the burnt slashings near Wharton lake. Several nests were taken there this spring by Rauch and Harlow, but at the time of the visit to the lake the young were half grown. The party are indebted to Mr. Rauch for a very fine nest in situ and downy young which he presented to the Museum and which have been exhibited as a habitat group. An account of nesting habits near Belvedere is given by J. Fletcher Street, *Auk*, XL, 1923, pages 577-583, 5 Pls. The species was noted until September 17.

Tringa solitaria Solitary Sandpiper

A scarce breeder about Belvedere. Reported by Henderson to have been more common formerly and still numerous in Fort Assiniboine district. Several nests have been found. The latest record for the species was September 6.

Unfortunately in deference to the egg collectors present few undoubted breeding birds were taken. Three specimens taken June 5 and 28, are all *T.s. solitaria*. A considerable series taken after July 2 are *solitaria* and *cinnamomeus* mixed. The writer is strongly inclined to believe that the breeding bird is *solitaria*, but that *cinnamomeus* migrants come in early. This agrees with what exact information is had elsewhere southward along the eastern margin of the foothills.

Bartramia longicauda Upland Plover

Singles seen or taken July 21 to September 9. Henderson reports having found one nest in his experience in the country.

Actitis macularia Spotted Sandpiper

Common in all suitable localities.

Squatarola squatarola Black-bellied Plover

A few reported by Laing and Harrold September 9 to 15.

Pluvialis dominica Golden Plover

One reported by Laing August 27.

Oxyechus vociferus Killdeer

Common breeder.

Charadrius semipalmata Semipalmated Plover

Adults noted from July 14 to 23.

Perdix perdix Gray (Hungarian) Partridge

As the ultimate camp ground was approached from Busby, May 20, two birds were seen by the roadside that Henderson said were the first he had seen in Belvedere region. Since then he reports a covey wintering about his barns. This is the present extreme range for this introduced species in this direction.

Canachites canadensis Spruce Partridge

Said to have been once quite common, now much scarcer, and this year with all the grouse at their low ebb, decidedly rare. Only a single individual was seen and no information was obtained of any others.

Bonasa umbellus Ruffed Grouse

Common breeder, but this year unusually scarce. Of the seven specimens taken none is markedly different from eastern *B.u. togata*.

Lagopus sp. Ptarmigan

Henderson says that he has "credible reports of white partridge" having been seen at Shoal lake, 25 miles north and also at lake Majeau. Of course, the species is doubtful, but *L. lagopus* seems the probability.

Pedioecetes phasianellus Sharp-tailed Grouse

Usually a common breeder, but like other grouse this year quite scarce.

Zenaidura macroura Mourning Dove

Reported by Henderson to be a very scarce summer resident, but he has never found the nest. The party neither saw nor heard them.

Cathartes aura Turkey Vulture

Henderson reports having seen one May 31, 1914, near Belvedere.

Circus hudsonicus Marsh Hawk

Common breeder.

Accipiter velox Sharp-shinned Hawk

A rather scarce breeder. Henderson has found occupied nests but twice. Quite common during autumn migration.

Astur atricapillus Goshawk

A fairly common breeder. All are undoubtedly *A. a. atricapillus*.

Buteo borealis Red-tailed Hawk

A regular and fairly common breeder. Four specimens taken May 26 to July 20, certainly breeding stock, are almost typical *B. b. borealis*, carrying only a faint suggestion of *calurus* tendency in slight barring on tibial plumes and a faint suggestion of barring on tail. Henderson tells us that all the local Red-tails he has seen are practically like these and that the only ruddy or richly coloured bird he has seen in the breeding season had every indication of being an unattached non-breeder. However, beginning August 27 and almost daily throughout September, Laing and Harrold marked birds that they referred to *harlani*. They are both particularly familiar with this form of *borealis* and are undoubtedly correct in their identification, though they took no specimens. Henderson says that dark birds occur in autumn after most of the residents have departed. After a detailed study of the species,¹ the writer concludes that the resident bird here is nearly pure *B. b. borealis* and that *calurus*, *harlani*, and *krideri* can be expected as migrants.

Buteo platypterus Broad-winged Hawk

The commonest nesting hawk in the region, more numerous in the poplar than the spruce sections.

¹Taverner, P. A.: "A Study of *Buteo Borealis*, the Red-tailed Hawk, and Its Varieties in Canada"; Vict. Mem. Mus., Bull. No. 48.

Archibuteo lagopus American Rough-legged Hawk

First noted by Laing and Harrold September 20 and then fairly regularly until October 20. Henderson says that it winters in favourable seasons.

Aquila chrysaetos Golden Eagle

Recorded by Laing and Harrold in late September and through October.

Haliaeetus leucocephalus Bald Eagle

Reported by Henderson as seen occasionally and probably nesting at no great distance.

Falco peregrinus Peregrine Falcon

One seen by Harrold on Pembina river May 26, and several times by Laing in September.

Falco columbarius Pigeon Hawk

One Pigeon Hawk was taken in camp May 28 and the species is reported by Laing and Harrold at various dates in August and to October 18. Another specimen taken August 19. Both these specimens are unmistakable *F. c. richardsoni*. Another of the same form was taken previously by Henderson for Prof. Rowan, so to date it is the only form that has been certainly identified from the region. Henderson has never found it breeding here.

Cerchneis sparvarius American Sparrow Hawk

Common breeder.

Pandion haliaetus Osprey

One seen by Laing September 17. No breeding records for the immediate region.

Asio wilsonianus Long-eared Owl

One taken September 11. Henderson reports it as a scarce breeder having found only five nests in his experience in the region.

Asio flammeus Short-eared Owl

One taken September 3. Henderson regards it as a rare breeder. He has never found the nest himself, but has received circumstantial reports of it and seen it in breeding season.

Scotiaptex nebulosa Cinereous Owl

Though Henderson has taken several sets of this species in the vicinity in the past, this year he saw only a single bird, March 24, but failed to discover a nest. The party neither saw nor heard anything of the species. It was a low rabbit and mouse year which may account for its apparent absence.

Cryptoglaux funerea Richardson's Owl

Though several nests of this owl have been taken in the immediate vicinity in previous years, and it is reported by Henderson to be usually fairly common and often heard in spring, the party did not meet with it

at all and strained their ears in the evenings in vain endeavour to hear a sound that might be attributed to it. Doubtless scarcity of mice had something to do with its absence.

Cryptoglaux acadica Saw-whet Owl

According to Henderson, usually fairly common, but this season scarcer than usual. One nest was found near Wharton lake. When first discovered it contained three young, but a week or so later when the party went to collect nest and young, there was only a single young bird, in the dark *kirtlandi* plumage, in the hollow (an old Flicker in a burnt poplar stub) and two decapitated and partly devoured bodies. The inference is that mice being scarce, the weaker made meals for the stronger. Neither parent was seen. The nest stub was brought in to the Museum for exhibition.

Bubo virginianus Great Horned Owl

The commonest Owl present. Ten specimens taken. Although the writer refers these birds to *B. v. subarcticus*, they are not as light coloured either in average or extreme as is the series of breeding birds from farther south in the province on Red Deer river or in Saskatchewan near the International Boundary.

Surnia ulula Hawk Owl

Seen occasionally throughout the summer. A nest was located in a tall dead stub in the midst of a burnt muskeg slashing May 28, when it contained eggs just hatching. June 14 the young had left the nest, but were still flightless and in the nearby vicinity. Stub and young were collected for a museum group.

Nyctea nyctea Snowy Owl

Reported by Henderson to be an irregular winter visitor, but never numerous.

Ceryle alcyon Belted Kingfisher

Common along the waterways, breeding in the cut banks of Pembina river.

Dryobates villosus Hairy Woodpecker

Common breeder. Nine specimens taken. Of these, seven measure small like *D. v. villosus*, two are large like *leucomelas*, and one shows the lack of white spotting like *monticola*. Evidently there is here a very mixed Hairy Woodpecker population.

Dryobates pubescens Downy Woodpecker

Rather less numerous than the preceding, but seen almost daily.

Picoides arcticus Arctic Three-toed Woodpecker

Rather rare and only seen in the vicinity of spruce or muskeg. Henderson reports having found two nests.

Picoides americanus American Three-toed Woodpecker

Henderson regards this as rather the commoner of the two Three-toed Woodpeckers and has found four nests. The party did not see it through

the summer and it was not until October 23 that Laing took specimens. Not having examined these the writer cannot make subspecific identification.

Sphyrapicus varius Yellow-bellied Sapsucker

Fairly common breeder.

Phloeotomus pileatus Pileated Woodpecker

Rather scarce. Individuals seen from September 6 to 24. Said by Henderson to be a scarce but regular breeder.

Colaptes auratus Yellow-shafted Flicker

Common breeder. The party neither collected nor saw anything to suggest any *cafer* blood in the strain.

Chordeiles virginianus Nighthawk

Common breeder. Not seen until May 28. A large flight was noted June 10. All specimens are straight *C. v. virginianus*.

Archilochus colubris Ruby-throated Hummingbird

Though there were several reports of Hummers none was seen. Henderson has taken one nest in the vicinity and vouches for the species. There is very little definite information as to what species of Hummingbirds occur in western Alberta. At Banff there are both Calliope and Rufus, but it is not known how far they extend and the general status of the Ruby-throated in this province rests largely on popular report, probably correct, but unsupported by authoritative evidence.

Tyrannus tyrannus Kingbird

Common breeder.

Sayornis phoebe Phoebe

Common breeder.

Sayornis sayus Say's Phoebe

One was present about Henderson's farm buildings when the party arrived, but disappeared almost immediately. It was noted again July 31 and observed until September 18. Henderson says it is a common migrant, but does not occur in summer.

Nuttallornis borealis Olive-sided Flycatcher

Not uncommon in spruce and muskeg sections. Henderson reports locating numerous nests.

Myiochanes richardsoni Western Wood Pewee

Common. Seen or heard daily to August 24.

Empidonax flaviventris Yellow-bellied Flycatcher

Fairly common to August 23.

Empidonax trailli Traill's Flycatcher

Quite common from June 3 to September 3. All taken are *E. t. alnorum*.

Empidonax minimus Least Flycatcher

Common. Noted until September 9.

Empidonax wrighti Wright's Flycatcher

Two birds taken June 3 and 12 have the size and wing formula of this species.

Otocoris alpestris Horned Lark

A few singles noted in the more cultivated sections between August 20 and September 11. The single specimen collected September 7 is referred to *O. a. arctica*. Henderson reports it as a migrant, but has no evidence of its nesting locally.

Pica pica Magpie

The only Magpies seen or heard of were a pair that had a nest in a small poplar patch near Henderson's house where they had nested for the past three years. Though they raised successful broods each year and several come about the house commonly in winter, the summer population does not increase.

Cyanocitta cristata Blue Jay

Rather scarce. Only occasional birds were seen or heard. Henderson has never taken its nest.

Perisoreus canadensis Canada Jay

Reported by Henderson as more abundant formerly than now. Occasional families were met, usually in spruce or muskeg. Henderson has found several nests. All specimens are referred to *P. c. canadensis*, though one rather light-coloured bird has a distinct light collar that may be due to fading or wear or to a faint *capitalis* influence.

Corvus corax Raven

Reported by Henderson as an irregular winter visitor. The winter of 1906-07 Ravens were as plentiful as Crows usually are in summer, but they have not been as numerous since.

Corvus brachyrhynchos American Crow

Compared to many other western localities the Crow is only fairly common in the district. It is notable also that it seems to do less damage to the nests of ducks and other similar birds here than elsewhere. The tule beds about the various waters contained many exposed nests and on the prairies would be the constant haunt of Crows, but here no Crows were seen in such localities.

Two specimens, May 25 and June 1. Of nine comparable birds from New Brunswick, Quebec, and Ontario, five are longer winged than these. They are, therefore, identifiable as western Crows, *C. b. hesperis*, with a very slight margin of certainty.

Nucifraga columbiana Clarke's Nutcracker

Henderson reports that several years ago he examined a Nutcracker that had been taken by an Indian near Shoal lake, some 25 miles north. It was the only one he or the Indian had ever seen in the region.

Dolichonyx oryzivorus Bobolink

Henderson reports seeing one May 26, 1923, about 8 miles north of Belvedere.

Molothrus ater Cowbird

Common breeder.

Xanthocephalus xanthocephalus Yellow-headed Blackbird

The least common of the local blackbirds. Rather local. A very few breed along the shores of lac La Nonne and there is a little colony on lake Majeau.

Agelaius phoeniceus Red-winged Blackbird

A very common breeder. I am not prepared at this time to commit myself as to the subspecific identification of these birds.

Sturnella neglecta Western Meadow Lark

Rather scarce immediately about camp where only occasional birds were seen. More common to the east in the better cultivated country.

Icterus galbula Baltimore Oriole

Common breeder.

Euphagus carolinus Rusty Blackbird

A not uncommon nester, probably not quite as numerous as Brewer's Blackbird. All birds after August 11 were in, or were assuming, rusty plumage. Numbers increased from September 9 to October 26, then the records closed.

Euphagus cyanocephalus Brewer's Blackbird

Common nester. Not recorded with certainty after August 24.

Quiscalus quiscula Grackle

Fairly common breeder.

Hesperiphona vespertina Evening Grosbeak

First certainly noted August 30 and present until the close of the record October 26. Two females taken September 27. These are both rather pale birds with the crowns practically unicoloured with the back, typical *H. v. vespertina*.

Pinicola enucleator Pine Grosbeak

Noted by Laing from October 19 until his leaving October 26. Said by Henderson to be common winter visitor, but never seen in summer. Without specimens no subspecific determination can be made.

Carpodacus purpureus Purple Finch

A regular but not very common breeder in the muskegs.

Passer domesticus House Sparrow

A small flock about Henderson's farm buildings, and seen in other similar places.

Loxia curvirostra Red Crossbill

Occasional flocks of Crossbills were seen at various times through the summer, but were so restless that specimens could not be taken. This species was recognized definitely July 20 and 21. Also and until October 26 when the record closed. There is no evidence of breeding.

Loxia leucoptera White-winged Crossbill

Said by Henderson to be an irregular winter visitor.

Leucosticte tephrocotis Rosy Finch

Henderson reports taking a Gray-crowned Rosy Finch *L. t. tephrocotis* for identification several years ago and noted another October 24, 1923.

Acanthis linaria Common Redpoll

First seen October 12 and still present when the record closed October 26. Two specimens are *A. l. linaria*.

Astragalinus tristis American Goldfinch

Fairly common, but more numerous in the better cultivated sections than in the immediate vicinity of the lake. Specimens appear to be straight *A. t. tristis*.

Spinus pinus Pine Siskin

Quite common, especially late in June. One nest the last of May near Wharton lake.

Plectrophenax nivalis Snow Bunting

Noted by Laing October 9 to close of record October 26.

Calcarius lapponicus Lapland Longspur

The day after our arrival at Henderson's, May 21, a single Lapland Longspur was noted close to the buildings, but was not seen again. The first autumn migrant was noted August 23 and the last October 17.

Calcarius pictus Smith's Longspur

Recorded by Laing and Harrold August 24 and small numbers seen until September 9.

Poæcetes gramineus Vesper Sparrow

Not numerous but not uncommon in the more cultivated sections. Last seen September 24. Specimens are easily referable to *P. g. confinis*.

Passerculus sandwichensis Savanna Sparrow

Locally fairly common. Last seen September 24. The writer does not care to make subspecific determination of these birds at this time.

Passerherbulus lecontei Leconte's Sparrow

Very common in every grassy slough. Breeds commonly, but nests difficult to find. Last noted September 27.

Passerherbulus nelsoni Nelson's Sparrow

Not nearly as common as the preceding, probably due to the lack of much suitable habitat. Not seen until June 28 and not certainly identified after September 8.

Zonotrichia querula Harris' Sparrow

Noted or taken by Laing and Harrold September 28 and October 1 and 4.

Zonotrichia leucophrys White-crowned Sparrow

One seen in immediate vicinity of camp the first day or so of camp, but not seen again until September 4, nor after October 4. Of thirteen specimens all but one are *Z. l. gambeli*. The single *leucophrys* was taken September 27.

Zonotrichis albicollis White-throated Sparrow

Common breeder everywhere. The height of the autumn migration was during September and the bulk disappeared after October 1.

Spizella monticola Tree Sparrow

First appeared September 9. Last seen October 21. Specimens well marked *S. m. ochracea*.

Spizella passerina Chipping Sparrow

Abundant everywhere. Last record August 18. Specimens referable to *S. p. arizonae*.

Spizella pallida Clay-coloured Sparrow

Abundant breeder everywhere. Last record August 18.

Junco hyemalis Slate-coloured Junco

Common breeder everywhere. Quite a series collected. They are almost typical *J. h. hyemalis*, but the heads average slightly blacker, perhaps tending towards the Cassiar Junco *J. hyemalis connectens* Coues, 1884, page 378, as revived and redescribed by Swarth from specimens, Stikine river, British Columbia (University of California Publications in Zoology, vol. 24, No. 2, 1922, pp. 243-253).

Melospiza melodia Song Sparrow

Common everywhere until October 4. Temporarily at least, the writer is inclined to refer these specimens to *M. m. juddi*.

Melospiza lincolni Lincoln's Sparrow

Common and nesting in all brushy wastes of second growth.

Melospiza georgiana Swamp Sparrow

Rather scarce and local. Last seen October 2.

Passerella iliaca Fox Sparrow

First seen September 10, last noted September 29. Six specimens, all typical *P. i. iliaca*.

Zamelodia ludoviciana Rose-breasted Grosbeak

A not uncommon breeder. Singing freely as late as July 11. Last seen September 3.

Passerina cyanea Indigo Bunting

This species was a great surprise. Laing took a high plumaged male on the west side of lac La Nonne June 3. This is the westernmost record for the species as it is only a very rare straggler even in Saskatchewan.

Piranga ludoviciana Western Tanager

Fairly common breeder. Not seen after August 24.

Progne subis Purple Martin

A fair number seen in certain limited localities on numerous occasions. Last noted September 2.

Petrochelidon lunifrons Cliff Swallow

Quite common flying over lake La Nonne. A colony nested on the Henderson barns, and it is said to nest abundantly on some of the banks of Pembina river.

Iridoprogne bicolor Tree Swallow

Fairly common, nesting in dead stubs in burns and occasionally in boxes about the Henderson place.

Riparia riparia Bank Swallow

Common everywhere. Probably nesting in the cut banks of Pembina river which was the nearest suitable location.

Bombycilla garrula Bohemian Waxwing

Nests found in Fort Assiniboine region this May, but never discovered nesting in Belvedere area. First seen September 27.

Bombycilla cedrorum Cedar Waxwing

Common breeder, but not seen until June 5 nor after October 1.

Lanius borealis Northern Shrike

Fairly common from October 1 to close of the record October 26. Said by Henderson to winter occasionally. Two specimens slightly lighter coloured than the average eastern birds and with slightly longer wings. The writer is inclined to refer them to *L. b. invictus*.

Vireosylva olivacea Red-eyed Vireo

Common everywhere, seen until September 13.

Vireosylva philadelphica Philadelphia Vireo

Noted and taken numerous times between May 27 and August 23. Of nine specimens, three, May 27, June 3, and August 23, are so brightly yellow as to be recognizable as Philadelphias at a glance, but have minute first primaries like the Warbling Vireo. It seems that this first primary distinction for this species is not as conclusive as has been generally supposed.

Vireosylva gilva Warbling Vireo

Common everywhere, but not as numerous as the preceding. Two specimens, May 24 and August 25, have greener mantles and clearer grey crowns than any other specimens they have been compared with, but they differ just as much from British Columbia *V. g. swainsoni* as they do from eastern *gilva*, in fact in our collection the colours of these two series are indistinguishable. The writer only refers these specimens to *swainsoni* on the basis of slightly more slender bills.

Lanivireo solitarius Solitary Vireo

Rather scarce, but seen in limited numbers well into July and almost daily later to September 4. These are all referred to *L. s. solitarius*.

Mniotilta varia Black and White Warbler

Common from our arrival to September 4. Breeds.

Vermivora celata Orange-crowned Warbler

Noted practically all through the season from May 23 to September 22. Young birds just from nest July 21. Specimens are referred to *V. c. celata*.

Vermivora peregrina Tennessee Warbler

Probably the commonest warbler throughout the summer. Present on our arrival May 21. Last seen September 11.

Dendroica tigrina Cape May Warbler

First seen July 27. Last noted August 9. Seen in Fort Assiniboine district, probably nesting, the end of May.

Dendroica aestiva Yellow Warbler

Common all season. Last seen September 3.

Dendroica coronata Myrtle Warbler

A few seen all through the season. Young in striped plumage taken. Last noted September 28.

Dendroica magnolia Magnolia Warbler

Fairly common at the end of May, but thereafter seen occasionally only in the heavy spruce until August when it became common.

Dendroica castanea Bay-breasted Warbler

Collected May 31 and June 11. Birds just losing the striped juvenile plumage taken August 5. The last seen September 28.

Dendroica striata Black-pollled Warbler

Common to May 31. Occasional singles seen through August, but the bulk of migration the first few days of September. Last seen September 28.

Dendroica virens Black-throated Green Warbler

A few noted in June and July in the heavier spruce.

Dendroica palmarum Palm Warbler

One taken July 23. Quite common first half of September. Henderson reports it a scarce breeder.

Seiurus aurocapillus Oven-bird

Common breeder. Last seen September 12.

Seiurus noveboracensis Northern Water Thrush

In spring only noted May 24 and 25. Not seen through the summer until August 2. Last noted September 10. Henderson reports one nest.

Of seven specimens only two are light enough below to suggest *S. n. notabilis*. The remainder are very richly coloured birds that must be referred to *S. n. noveboracensis*. In series, a large proportion of which are migrants, the writer cannot find any distinct distribution for these forms. Perhaps a breeding series would show a northern and southern range instead of an eastern and western.

Oporornis agilis Connecticut Warbler

One of the common breeding warblers. It did not arrive until June 5, but immediately became common and its song could be heard on almost any open poplar ridge. Contrary to the published account of the only nest found previous to those in this locality, it nests on small, dry, well-drained ridges instead of in the muskeg bog. Its nest is most difficult to find as the male sings at a considerable distance from it and the female sits very close. Several nests were discovered through the summer and young in all stages of plumage were taken. Last noted September 27.

Oporornis philadelphia Mourning Warbler

About as common as the preceding, nests. Last observed September 6. Though we looked carefully for McGillivray's Warbler, none was recognized.

Ceothlypis trichas Maryland Yellow-throat

Common breeder. Last seen September 22.

Wilsonia pusilla Wilson's Warbler

Single individuals May 28 and June 14. Occasional through August to September 13. Eight specimens all very rich yellow below and with wings averaging long—undoubtedly *W. p. pileolata*.

Wilsonia canadensis Canada Warbler

Taken May 31, June 19 and 28, and July 6. Noted in small numbers to August 20.

Setophaga ruticilla Redstart

Common all summer. Last seen September 23.

Anthus rubescens American Pipit

First seen August 25. Very common through September. Only a few seen in October and last date the 15th.

Anthus spraguei Sprague's Pipit

Scarce and only seen in the more open country to the east of the lake. Said by Henderson to breed. Noted twice in August by Laing and Harrold, specimens the 13th.

Dumetella carolinensis Catbird

Rather scarce. A few pairs at wide intervals.

Troglodytes aedon House Wren

Very common about the edges of the woods, but not coming about the houses. Noted until September 23. Without special critical examination the writer refers them to *T. a. parkmani*.

Nannus hiemalis Winter Wren

Not noted by the writer, but Henderson reports it once in early spring and once in autumn. He heard it singing June 18, 1924, near Fort Assiniboine.

Telmatodytes palustris Long-billed Marsh Wren

Said to be usually a very common breeder on lac La Nonne, but this season entirely absent from it. Lake Majeau was the only lake where it was at all common and only occasional pairs were met about other waters.

Ten specimens. Geographically these birds should fall well within the newly proposed subspecies *T. p. laingi* Harper (Occasional papers Boston Soc. Nat. Hist., vol. V, pp. 221-222 (Dec. 1926)). They are slightly lighter as per postulated characters than the central Saskatchewan material cited as intergrading, or than Manitoban birds, but whether they depart far enough from typical *T. p. iliacus* for taxonomic recognition the writer is unable to decide without more typical *iliacus* for comparison. While in this doubt the writer prefers to refer these specimens tentatively at least to *iliacus*.

Certhia familiaris Brown Creeper

Specimens June 19, July 3, August 26, and September 28. A nest was taken in the Fort Assiniboine region by Mr. Rauch and presented to the Museum. Have made no subspecific study of these specimens.

Sitta canadensis Red-breasted Nuthatch

Fairly common in the heavier spruce. Noted through September. Said by Henderson to breed commonly.

Penthestes atricapillus Black-capped Chickadee

Common breeder everywhere. Three specimens have tails 2.05 inches to 2.2 inches, and hence qualify for *P. a. septentrionalis*.

Penthestes hudsonicus Brown-headed Chickadee

Not uncommon in the heavy spruce and muskegs. Specimens from July 4 to September 25. The writer is not prepared to make definite subspecific identification.

Regulus satrapa Golden-crowned Kinglet

A few noted from August 10 on, and daily from September 6 to October 23.

Regulus calendula Ruby-crowned Kinglet

A not uncommon nester in the spruce.

Hylocichla fuscescens Wilson's Thrush

Though reported common, it was only on June 12 and July 1 that we heard the song of this species. One was collected July 13 and others recognized the 26th and 31st. The specimen is too worn and faded to make satisfactory subspecific determination, though *H. f. salicicola* is the geographic probability.

Hylocichla aliciae Gray-cheeked Thrush

A few noted by Laing and Harrold through September. Three specimens taken.

Hylocichla ustulata Olive-backed Thrush

The commonest thrush. Its song blended with that of the Hermit Thrush every fine evening until well into July. Last seen September 23.

Hylocichla guttata Hermit Thrush

Nearly as common as the preceding. Breeds. Last seen October 2.

Planesticus migratorius American Robin

Common breeder.

Ixoreus naevius Varied Thrush

One taken September 27.

Sialia currucoides Mountain Bluebird

Not uncommon in the burnt spruce and slashings, but scarce elsewhere. Migrants came in August 18 and considerable numbers to September 22. Last seen October 2.

COMMERCIAL BENT GRASSES (AGROSTIS) IN CANADA

By M. O. Malte

Illustrations

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The remarkable increase in the popularity of the game of golf during the last ten years or so has, in Canada as well as in the United States, been in a very large measure responsible for an unprecedented demand for turf grasses of high quality, and particularly for grasses most eminently suited for greens. For the latter purpose forms of bent grasses (*Agrostis*) have long been recognized as possessing outstanding merits and, this being the case, special efforts have, during the last few years, been made to supply the market with bent grasses of guaranteed superiority.

Several years ago, the United States Department of Agriculture inaugurated rather extensive experimental work with turf grasses, one of the results being the introduction of the so-called stolon method of green-making, a method whereby a turf is produced, not from seed, but from cut-up stolons or surface runners. The grasses found most suitable for this purpose are certain hardy, durable, quick-growing forms of what is generally called Creeping bent grass. The runners of Creeping bent, which in several of its many forms may reach a length of 3 feet or more, will after being cut up in pieces about an inch long or a little longer, depending upon the length of the internodes, and after being strewn on prepared ground and thinly covered with soil, root freely at the nodes and will, providing the water supply is adequate, in a very short time produce a green far superior to greens grown from seed at present available through the trade.¹

The reliability and consequent popularity of the stolon method have naturally led to a search for suitable forms of Creeping bent of particularly fine texture. This search has revealed that Creeping bent, which so far

¹ This method of propagation is by no means new. It was practised, with slight modifications, in Ireland, over a century ago. Says Richardson (30, p 164):

"In laying down fiorin crops, we neither use *seed* nor *roots*, when we can procure *stolones*, of which every cultivator has a superabundance; and the mode of proceeding is very simple.

"We commence at one end of the prepared area, and scatter *stolones*, at their full length, over a space extending along the fence, and about 3 yards wide.

"We now from the raw ground behind us take up shovelfuls of the loose surface soil, and scatter it over the stolones, so as *nearly* to cover them, and so the business is done for so far; we then take up another breadth of three yards, spread strings over it, and cover them in the same manner."

And on page 126:

"I raised fiorin roots in abundance, from my plots which had luxuriated greatly in the summer. I planted them in drills eighteen inches asunder, trusting that the *stolones*, with whose properties I was now acquainted, would, in the summer, shoot across the intervals, and clothe the whole surface.

"I was right; in May the *stolones* began to project across, and so effectually to cover the new ground, that the rows were soon no longer distinguishable."

has been imported from Europe, occurs in abundance in many parts of Canada, perhaps most plentifully in the Maritime Provinces, and especially in Nova Scotia and Prince Edward Island. Indeed, in certain districts of the former province, it occurs in such abundance and is mostly of such excellent quality that, with judicious selection of stock from the natural supply, a remunerative seed-growing industry, for home consumption as well as for export, could, in the writer's opinion, easily be developed.

Creeping bent, like other grasses, has, however, its limitations. It grows naturally on low-lying land and is rarely found on soil deficient in moisture. As it is less well adapted to dry, sandy, or otherwise more or less sterile ground, it follows that, although it is excellent for greens that can be adequately watered, it is of minor importance for fairways and generally for situations naturally lacking in moisture.

For the latter type of land so-called Rhode Island bent or Browntop is much better suited. This grass, which is related to Creeping bent, grows naturally in rather dry situations. It is a native of Eurasia and Northern Africa, which many years ago was introduced into Canada. At present it is particularly abundant on dry land in the Maritime Provinces, and especially in Prince Edward Island where it grows practically everywhere.

When the Seed Branch, Dominion Department of Agriculture, some years ago inquired where in Canada seed of a turf grass of good quality might be produced in quantity for commerce, the writer was in the happy position of being able to point to Prince Edward Island as probably most suitable for the development of a seed-growing industry based on the harvesting of seed of the Browntop already growing in profusion in that province. The Seed Branch, acting upon the information supplied, has in the last few years made good progress in developing a new seed-growing industry in Prince Edward Island. In 1925 about 17,000 pounds of Browntop seed were harvested there, and for 1926 the crop is estimated at some 50,000 pounds.

In addition, it may be mentioned that a still more valuable turf grass, Velvet bent grass, is now being propagated, under the direction of the Seed Branch, Dominion Department of Agriculture, from seed harvested in Prince Edward Island.

From the above it is clear that unusually great practical interest is at present taken in the commercial bent grasses, and the indications are that they may attain, as sources of revenue to seed growers, still greater importance in the future. In the writer's opinion, however, the success with which seed growing on a commercial scale may be met will, to a very great extent, depend upon the confidence which seedsmen as well as the purchasing public will have in the genuineness and trueness to name of the seed produced. Such confidence can be obtained only if the characteristics of the "varieties" can be precisely defined and if, based thereon, a supply of pure seed, true to name, can be offered to the trade.

At present, tens of thousands of dollars are wasted annually on account of a loose and in many cases quite misleading application of so-called scientific names to commercial varieties of bent grasses. For this the seedsmen must not be criticized too seriously as there exist, as will be seen in the following, very great differences of opinion among taxonomic botanists as to the systematic relationship between the various species and forms,



Figure 1.

Figure 2

Scale 3/8

Figure 1. *Agrostis stolonifera* L. var. *major* (Gaud.) Farwell—Redtop.

Figure 2. *Agrostis tenuis* Sibth.—Browntop, Rhode Island bent.



Scale 27/64
Agrostis stolonifera L. var. *compacta* Hartman—Creeping bent.



differences which are quite natural on account of the perplexing variability of the different species. In the following the writer will endeavour to present, in a critical and analytical form, his conception of the relationship of the various species and varieties of the genus *Agrostis* which are of commercial interest to Canada.

TRADE VARIETIES AND THEIR TECHNICAL NAMES

In most Canadian seed catalogues only three so-called varieties of bent grasses are listed, viz., Redtop, Creeping bent, and Rhode Island bent. Occasionally the names Herd's grass and Fiorin occur, and quite recently the name Prince Edward Island bent has been introduced by a few seedsmen.

In Canada, the name Redtop is generally applied to the tallest and agriculturally most important species of the bent grasses (Plate XIV, figure 1). It grows anywhere from 1 to 3 feet high or more and generally possesses runners or stolons which are either wholly underground or from a subterranean start develop into upright, aerial, leafy shoots. On account of its upright growth and plentiful foliage it is of importance as a hay grass, especially on wet land. Its relative coarseness, however, and in many cases rather pronounced lack of durability, when cut close to the ground, make it not nearly as well adapted to lawns and greens as some of the other bent grasses.

Of thirteen Canadian seed catalogues which the writer has had an opportunity to examine, ten have the name *Agrostis vulgaris* for Redtop; two call it *Agrostis alba*, and one *Agrostis stolonifera*. In "The Seeds Act, 1923," administered by the Seed Branch, Dominion Department of Agriculture, it was originally listed as *A. alba*. In the edition of October, 1926, the name was changed, at the writer's suggestion, to *Agrostis stolonifera* var. *major*. In "Standardized Plant Names", 1923, by Olmsted, Coville, and Kelsey, it is called *Agrostis palustris*, with *A. alba*, as understood by Bailey's Cyclopaedia of Horticulture, as a synonym.

Creeping bent grass, as the name implies, is a grass of a spreading habit (Plate XV). By means of runners or stolons which trail on the surface of the soil and freely root at the nodes it quickly forms a dense and continuous sod. It thrives best on moist land and is particularly well suited for lawns and greens which can be adequately supplied with water. Creeping bent is no uniform variety, in a botanical sense, but under that name are included many more or less sharply defined races of a similar, creeping habit. The majority of the Creeping bent races produce comparatively few and short, scantily leaved stems. It is, therefore, not nearly as valuable for hay as is Redtop, but will, on account of its dense bottom growth, lend itself well to pasture, especially on wet land.

Creeping bent grass appears in Canadian seed catalogues under the name of *Agrostis stolonifera*. "The Seeds Act, 1923", originally used the name *Agrostis stolonifera*, variety. In "The Seeds Act, 1923", edition of October, 1926, it appears, at the writer's suggestion, under the name of *Agrostis stolonifera* var. *compacta*.

Rhode Island bent grass (Plate XIV, figure 2) grows upright like Redtop, but is of a lower stature and of a much finer texture. It is generally rather loosely tufted, with a dense bottom growth of short, leafy shoots. In some of its many races creeping surface stolons are developed, but these

are as a rule only a few inches long and never as luxuriant as in Creeping bent. It, therefore, spreads comparatively slowly and does not form as matted and compact a sod as that produced by the latter. Nevertheless it makes a fine turf and is much superior to Redtop for lawns and greens. It is much less exacting in its demand for moisture than Creeping bent and, as it will thrive even on dry, sandy soil, it has a much wider range of usefulness than the latter.

Rhode Island bent is not handled by many Canadian seedsmen, at least not regularly. When it is, it is listed under the name of *Agrostis canina*. In "Standardized Plant Names" the name *Agrostis capillaris* is applied, with *A. vulgaris* and *A. tenuis* as synonyms.

Herd's grass, as understood when the name is applied to a species of the bent grasses, is the same as Redtop.

Fiorin, apparently a corruption of the Irish "Fiorthan," is an old name used by Dr. William Richardson of Moy, Ireland, in the early part of the nineteenth century, for a bent grass characterized by long, rather coarse, leafy stolons, creeping on the surface of soil and rooting at the nodes, in other words, for a grass belonging to the Creeping bent group. Now the name is in many cases applied indiscriminately both to Redtop and to stoloniferous bent grasses allied to the latter.

Browntop, a trade variety recently put on the market from Prince Edward Island, is botanically the same as Rhode Island bent. It is listed in "The Seeds Act, 1923," under the name of *Agrostis tenuis*.

Prince Edward Island bent is identical with the Browntop of "The Seeds Act, 1923."

Colonial bent is a bent grass grown in New Zealand which during the last few years has been put on the North American market. According to Piper (27, p. 10), "turf and plants grown from this seed show it to be identical with Rhode Island bent." Its close relationship to Rhode Island bent and to the Browntop of the Maritime Provinces is furthermore apparent from its history, concerning which the following information has kindly been given by Dr. A. McTaggart, Assistant Professor of Agronomy, Macdonald College, Que. In a letter of March 16, 1927, Dr. McTaggart writes as follows:

"The history of Colonial bent or Brown Top or Waipu Brown Top (the two latter names are in general use in N.Z.), as far as the growing of it in New Zealand is concerned, is bound up with the history of a settlement of Nova Scotian Highlanders at Waipu, on the east coast of Auckland province north of the city of Auckland. About 70 years ago¹ these people, who had emigrated from Prince Edward Island and from Cape Breton Island and Pictou county, N.S., principally, but who came originally from the Highlands and Islands of western Scotland, built in Canada wooden ships none of which were more than 600 tons. In these vessels they set out, via the cape of Good Hope, with their families for Australia, which country did not appeal to them for some reason or other. They then crossed to New Zealand where they were offered land in Hawkes Bay province (East coast, North island). This land they rejected, owing possibly to the Maori war which was raging at the time. They eventually settled at Waipu, a few miles south of Whangarei, where there was ready access to the sea (their traditional calling), and where there was lumber in the hinterland, but where the soil for the most part was of a poor 'gumland' type—a heavy clay soil said to have been impoverished in the distant past by the Kauri forests that formerly grew thereon. These Canadian migrants before leaving P.E. Island and Nova Scotia had collected quantities of grass for use as material for filling the mattresses upon which they slept on ship-board. Upon landing they took with them these same mattresses for use for a short period in the homes which they hewed out of the Auckland forests. Eventually the bedding was discarded and the seed in the dry grass thereof found its way

¹ Cf. Wallace, F. W.: "Wooden Ships and Iron Men," p. 336. Hodder and Stoughton, Ltd., London and Toronto.



Figure 1.



Figure 2.

Scale 27/64

Figure 1. *Agrostis canina* L.—Velvet bent.

Figure 2. *Agrostis stolonifera* L.—Non-stoloniferous variety with contracted panicle.

into the clay soil, in which new environment it found a congenial home, for it has spread wonderfully in the neighbourhood of Waipu and on the 'gumlands' generally. In the course of time seed came to be gathered from it, the new industry centring around the settlement of Waipu, to such an extent indeed that the grass came to be called in New Zealand Waipu Brown Top. Thus it is readily seen that this grass which we call in Canada Colonial bent (*Agrostis tenuis*) had its origin in the Maritime Provinces of Canada, and, to my mind, is none other than Rhode Island bent or, as we prefer to call it in Canada, Prince Edward Island bent. Possibly change of environment and natural selection have given rise to a strain or strains slightly different from the bent grown today as Prince Edward Island bent in Canada."

In a postscript to the letter quoted above Dr. McTaggart adds:

"I feel that the above can be taken as authentic. The statements contained in the above were made to me from time to time by representatives of Waipu families or by those well qualified to speak of the experience of the Waipu settlers."

Velvet bent, or Brown bent (Plate XVI, figure 1), is a species which so far has not been handled in its pure form by the Canadian trade. According to Piper and Oakley (28, p. 75) "the seed is nearly always found in Creeping bent, sometimes to the extent of 40 per cent of the whole." At present, as has already been indicated, it is being propagated for commerce from seed harvested practically pure on Prince Edward Island. Velvet bent is a more or less loosely tufted grass with short, very narrow-leaved basal shoots and commonly also with creeping surface runners. It grows to about the same height as Rhode Island bent which, to some extent, it also resembles habitually. It produces, however, a much smoother turf and is no doubt the finest of all the bent grasses for lawns and greens. "The Seeds Act, 1923," gives the name *A. canina*. It is not listed in "Standardized Plant Names."

Carpet bent is a bent grass occurring in so-called South German Mixed bent. It produces

"Creeping runners 3 or 5 feet long the first season, making circular mats 5 to 7 feet in diameter, and with relatively few flowering culms. It is by this stoloniferous character that carpet bent is most strikingly distinguished from Rhode Island bent, but the ligules are long and the flowering panicles rather dense" (Piper, 27, pp. 11-12).

From this description it seems apparent that Carpet bent is one of the many forms of Creeping bent. It should be noted that Piper and Oakley do not mention it in the 1923 edition of "Turf for Golf Courses." It is listed, however, in "Standardized Plant Names," with Creeping bent as a synonym, under the name of *Agrostis stolonifera*, and it is largely on that account that it is mentioned here.

THE TAXONOMY OF THE COMMERCIAL BENT GRASSES

It is obvious, from the preceding, that there exists a very confusing instability in the application of technical names to at least some of the most important trade varieties of bent grasses, an instability paralleled by the divergency of opinion, concerning the systematic status of the various forms, which is found in North American floras and other scientific publications dealing with the subject.

Names Used in North American Literature

The species and varieties of bent grasses with which we are concerned belong to two well-defined sections of the genus *Agrostis*, viz.:

Sect. I. EUAGROSTIS Gren. and Godr., Fl. Fr. III, 480, 1856.

Sect. II. TRICHODIUM (L. C. Rich. apud Michx. Fl. bor.-am. I, 41, 1803, pro. gen.) Trin., Gram. Unif. 204, 1824.

To the latter section, which is characterized by the absence of the inner flowering glume or palea, or by the presence of a rudimentary one, 5 to 8 times shorter than the lemma, belongs *A. canina* L., the Velvet bent grass. As *A. canina* is well defined and universally recognized throughout the botanical literature as a distinct species, there is no need of commenting upon it further.

All the other commercial bent grasses belong to the section *Eua-grostis* which is characterized by having an inner flowering glume or palea about half as long as the lemma, or longer. The bent grasses belonging to this section have a rather perplexing range of variation and have, as a result, been interpreted in various ways by North American botanists and students of agricultural botany.

Thus Gray's Manual (32, p. 132) recognizes only one species, with a number of varieties, as follows:

- AGROSTIS ALBA L.—Fiorin or White bent, Redtop.
 “ “ var. VULGARIS (With.) Thurb.—Redtop, Herd's grass of Pa., etc.
 “ “ var. (*A. stolonifera* auth., not L.)—Creeping bent.
 “ “ var. ARISTATA Gray. (*A. stricta* Willd.)
 “ “ var. MARITIMA (Lam.) G. F. W. Mey. (*A. coarctata* Ehrh.)

Britton and Brown (3, p. 203) maintain two species, viz.:

- AGROSTIS ALBA L. (*A. vulgaris* With., *A. alba* var. *aristata* A. Gray, *A. alba* var. *vulgaris* Thurb.)—Redtop, Fiorin, Herd's grass; and *A. MARITIMA* Lam. (*A. coarctata* Ehrh., *A. alba maritima* Meyer), Dense-flowered bent grass.

Henry (10, p. 33) recognizes one species, *A. ALBA* L.—Redtop, with the var. *VULGARIS* Thurb.

Hitchcock and Standley (13, p. 83) include two species, viz.:

- AGROSTIS PALUSTRIS Huds. (*A. alba* of Ward's Flora.)—Redtop; and *A. CAPILLARIS* L. (*A. alba vulgaris* Thurb., *A. vulgaris* With.), Rhode Island bent.

House (15, pp. 98-99) lists the following species and varieties:

- AGROSTIS PALUSTRIS Huds. (*A. alba* of most authors, doubtfully of Linnaeus.)—Redtop; *A. PALUSTRIS* Huds. var. *STRICTA* (Willd.) House (*A. stricta* Willd., *A. alba* var. *aristata* A. Gray); *A. TENUIS* Sibth. (*A. vulgaris* With.)—Rhode Island bent; *A. STOLONIFERA* L.—Creeping bent, Carpet bent; *A. MARITIMA* Lam. (*A. coarctata* Ehrh., *A. alba* var. *maritima* G. F. W. Mey.)—Fiorin, Dense-flowered bent grass.

Wiegand and Eames (42, p. 76) recognize two species and one variety, as follows: *A. ALBA* L.¹ (*A. vulgaris*, in part, and *A. vulgaris*, var. *alba*, of Cayuga Fl.)—Redtop, Bent grass; *A. ALBA* L. var. *MARITIMA* (Lam.) G. F. W. Meyer (*A. palustris* Huds., probably)—Carpet bent grass; *A. TENUIS* Sibth. (*A. vulgaris* of authors; *A. capillaris* L., possibly; *A. alba* var. *vulgaris*, of Gray's Man., ed. 7)—Rhode Island bent grass.

¹ The authors doubt whether this name should be applied and only retain it provisionally.

As will be seen from the above, some floras maintain that the various forms belong to one species, whereas others, going to the other extreme, recognize as much as four separate species. A similar variation of opinion is found in other botanical and agricultural botanical works.

Thus, Macoun (24, pp. 200-1) records *A. VULGARIS* With. (*A. polymorpha* Trin. var. a., *A. hispida* Willd.) and *A. VULGARIS* With. var. *ALBA* Vasey (*A. alba* L., *A. decumbens* Muhl.) with the remark that they are the Redtop and Herd's grass of the agriculturists.

Beal (2, pp. 332-33) describes *A. ALBA* L.—Redtop, Creeping bent, Fiorin—as a very variable species. Quoting Watson, Bot. Cal. 271, 1880, he considers *A. vulgaris* a mere variety: "*A. alba* has an elongated acute ligule, and the panicle contracted after flowering; the form once known as the species *A. vulgaris* has a short truncate ligule, and the panicle more or less spreading".

Hitchcock (11, pp. 25-28) first recognized only one species, with three varieties, as follows: *AGROSTIS ALBA* L. (*A. dispar* Michx., *Vilfa dispar* Beauv., *A. vulgaris alba* Vasey), *A. ALBA VULGARIS* (With.) Thurb. (*A. vulgaris* With., *A. alba minor* Vasey), *A. ALBA ARISTATA* Gray (*A. stricta* Willd., *A. neogaea* Steud.), *A. ALBA MARITIMA* (Lam.) Meyer (*A. maritima* Lam.).

Later, however, Hitchcock (12, pp. 125-29) changed his concept of the bent grasses in question and admitted three main species, viz.: *AGROSTIS STOLONIFERA* L., *A. PALUSTRIS* Huds. (*A. alba* of authors)—Redtop, and *A. CAPILLARIS* L. (*A. tenuis* Sibth., *A. vulgaris* With., *A. alba vulgaris* Thurb.)—Rhode Island bent. Hitchcock furthermore considers that Carpet bent, also called Creeping bent, is a form of *A. stolonifera*. The taxonomic status of Fiorin is not definitely expressed, it being merely stated that "it has been called *A. maritima* Lam. and *A. alba maritima* (Lam.) Meyer".

Clark and Malte (4, pp. 50-52) maintain two species, viz.: *A. STOLONIFERA* L. (*A. alba* L.)—Redtop, Fiorin grass, Creeping bent grass, White bent grass, and *A. VULGARIS* With. No popular name is given to the latter species, but the author's conception of it is that of Rhode Island bent.

Piper (27, p. 3) recognizes three species of the group under discussion, viz.: *A. PALUSTRIS* Huds. (*A. alba* of most botanists)—Redtop, *A. MARITIMA* Lam. (*A. stolonifera* var. *latifolia* Sinclair)—Fiorin, and *A. TENUIS* Sibth. (*A. vulgaris* With.)—Rhode Island bent.

Later, Piper and Oakley (28, pp. 67-71) adopt other names for the same types of Bent grasses, as follows: *AGROSTIS ALBA*—Redtop, *A. STOLONIFERA*—Creeping bent, and *A. VULGARIS*—Rhode Island bent.

From the above examples, to which others could be added, it is apparent, in the first place, that the various forms are rated very differently, from a taxonomic point of view, by different botanists and, secondly, that there exists a very confusing divergency of opinion as to what technical names should be applied. Any effort to try to bring some kind of order out of the existing chaos must, therefore, be directed towards two main objects, viz.:

- (1) To determine the systematic relationship between the various forms, and
- (2) To determine what technical names should be applied.

Species and Hybrids

The term "species" is in many cases applied more or less at random and, as a consequence, in very many cases to systematic units of manifestly widely different rank. In this connexion, however, it is of less importance to argue what the term "species" should or should not imply than to set forth how it is applied, i.e., to make clear what systematic units the writer has in mind when speaking of "species".

From many years of experience in plant breeding, when thousands of forms of wild and cultivated grasses were observed and studied, the writer is convinced that, although the plant breeder obviously must operate with forms separated by minute characters, it is, for purposes of descriptive taxonomic botany, well-nigh necessary to work with comparatively large basic units. In the following the term "species" will, therefore, be used in a rather wide sense. It will be employed to designate groups of forms which, although in several respects differing from each other rather considerably, yet have morphological characters in common which clearly indicate that they are of a very close systematic relationship. In other words, the term species, as here applied, is identical with Lotsy's "Linneon", a term proposed "To replace the term species in the Linnean sense, and to designate a group of individuals which resemble one another more than they do any other individuals" (Lotsy 23, p. 27). It is, of course, obvious that all forms thus included within the boundaries of a "species" or "Linneon" must have some common constant characters separating them from other "species" or "Linneons".

Where one "Linneon" ends and another, closely related one, begins, is often told by Nature herself. A criterion of "Linneons" is that they do not usually intercross and that, when they do, their progeny is as a rule characterized by a high degree of sterility in both the male and female organs. Such products of inter-Linneon crosses, generally termed hybrids in descriptive, systematic botany, are not uncommonly met with in grasses, although, so far, slight attention appears to have been paid to them by North American botanists. Ascherson and Graebner (1) recognize over forty grass hybrids, Neuman (26) has thirty-three, Lindman (18) twenty-five, and in the last edition of "Catalogue of Scandinavian Plants," published by the Botanical Society of Lund, Sweden, not less than forty-four grass hybrids are listed. In the genus *Agrostis* several hybrids are well known, and in all cases their hybrid nature manifests itself by a very high degree of sterility. Thus Holmberg (14, pp. 143-45) mentions four, viz.: *A. stolonifera* x *tenuis*, *A. canina* x *stolonifera*, *A. canina* x *tenuis*, and *A. borealis* x *stolonifera*, none of which has more than 10 per cent of perfectly good pollen. These four hybrids were first segregated and described by Murbeck (25) who fully realized the importance of recognizing them as accidental products of a taxonomic value quite different from that of the true species. As Murbeck's paper, which is written in Swedish, apparently has so far been overlooked by North American students of the genus *Agrostis*, the writer translates from it, as follows:

"When, in the summer of 1895, I desired to attempt a more satisfying critical analysis of the North European forms of *Agrostis* it soon became apparent that such an analysis would not be possible if an exclusively morphological method of investigation were employed and that the reason for this was that production of hybrids played a not unimportant role within the genus

The first task, therefore, became, through careful investigations of the sexual power of reproduction of the forms, to try to determine and to eliminate the hybrid products which, until recognized as such, here as elsewhere might supposedly be a main cause of the difficulties encountered in the classification. This task entailed, it is true, a large amount of work,¹ but at the same time a remunerative one. It became apparent that those types, the pure ancestry of which could not be doubted, always were characterized by a normal power of reproduction, whereas such forms which, on account of their manner of occurrence and morphologically intermediate position, one might be tempted to interpret as hybrid products, also were stamped as such biologically, inasmuch as in them, equally constantly, the formation of embryo as well as the production of pollen capable of effecting fertilization proved either quite abortive or highly reduced.

After thus the hybrid products, without any real difficulty, had been eliminated, and when furthermore a number of so far overlooked differences in the construction of the flower had been found to furnish some exceedingly valuable distinctive characteristics, the different types² stood out with a clearness that left nothing to be desired."

A. tenuis Sibth. (*a distinct species*)

The forms of *Euagrostis* which, as has been pointed out in the preceding, by some North American botanists are considered as belonging to one single species and by others as representing three or even more, are easily divided into two natural groups, separated as follows:

(1) The ligule of the lower and middle leaves elongated, 2-5 mm. long, rounded at apex; palea $\frac{1}{2}$ - $\frac{1}{4}$ shorter than lemma.

(2) The ligule of the lower and middle leaves very short, 0.5-1.3 mm. long, truncate at apex; palea about $\frac{1}{2}$ as long as the lemma.

To the first group belong the forms which by North American botanists have variously been called *A. stolonifera* L., *A. alba* L., *A. palustris* Huds., *A. maritima* Lam., and *A. alba* var. *maritima* (Lam.) Meyer.

To the second group belong the forms which have been called *A. tenuis* Sibth., *A. vulgaris* With., *A. capillaris* L., and *A. alba* L. var. *vulgaris* (With.) Thurb.

As a rule, there is little difficulty in placing a given form of *Euagrostis* with one or the other of these groups, but, on the other hand, specimens are not uncommonly encountered which appear to be quite intermediate and which form, as it were, connecting links between them. These intermediate forms, however, occur erratically and generally speaking under conditions to make them suspected of being more or less accidental products. They invariably display, as Murbeck (1. c.) has shown, and as has been corroborated by later students of *Agrostis*, a very high degree of sterility, with at most 10 per cent of the pollen sufficiently well developed to be capable of effecting fertilization, provided that the anthers opened, which as a rule they do not do, and with no formation of seed at all. The sterility of these morphological intermediates clearly points to their origin as a result of intercrossing or hybridization of individuals belonging to different Linneons. With them eliminated, the *A. stolonifera* and *A. tenuis* groups are sharply defined and distinctly separated by the characters given in the above. The two groups must, therefore, be considered as representing different Linneons. In other words, the forms variously called *A. tenuis*, *A. vulgaris*, *A. capillaris*, and *A. alba* var. *vulgaris*, must be regarded as specifically distinct from the ones belonging to the *A. stolonifera* group.

¹"In order to arrive at full certainty, pollen examinations were made, aside from on living material, on about 1,600 herbarium specimens belonging to the National Museum and to the botanical museums of Lund and Upsala whose collections kindly were placed at my disposal."

²i. e. species in the Linnean sense, or Linneons according to Lotsy's terminology.

They, furthermore, represent one single species, for a long time called *A. vulgaris* With. As, however, Withering's *A. vulgaris* dates from 1796, it must give way to *A. tenuis* Sibth., which was published in 1794.

In 1919, Hitchcock (12, p. 129) applied the name *A. capillaris* L. to this species, and a year later Schinz and Thellung (36, pp. 261-2) did the same.

A. capillaris was described by Linnaeus (21, p. 62) under the section *Muticae* as follows:

"*Agrostis panicula capillari patente, calycibus subulatis aequalibus hispidiusculis coloratis, flosculis muticis.* *Roy. lugdb. 59. Dalib. paris. 23.*

Agrostis panicula tenuissima. *Fl. lapp. 45.*

Gramen montanum, panicula spadicea deliciose. *Bauh. pin. 3. prodr. 12. Scheuch. gram. 129.*

Habitat in Europae pratis.

Panicula vere capillaris, tenuissimisque pedicellis singularis."

Schinz and Thellung (l. c.), arguing in favour of the application of the Linnean name *A. capillaris* to *A. tenuis* Sibth., maintain that, "as H. F. Richter (Cod. Linn. (1840) 77) already has rightly pointed out, there can be no doubt but that the by far nearest and most natural interpretation of the Linnean species is that in the sense of *A. tenuis* (= *vulgaris*)".¹ Now, Richter, in Codex Linnaeanus, p. 77, asserting that *A. capillaris* L., "excl. syn. Fl. lapp.", most certainly is synonymous with *A. vulgaris* With., i.e. with *A. tenuis* Sibth., refers to Roy. Lugd. which is the first citation after the description of *A. capillaris* in Species Plantarum. Royen's diagnosis (35, p. 59) of the species referred to reads as follows: "*Agrostis panicula compressa*" calycibus subulatis aequalibus hispidiusculis coloratis;" that is to say, the diagnosis is of a species of *Agrostis* having a contracted panicle. As *A. tenuis* Sibth. has an open panicle with spreading branches, it seems rather difficult to understand how the latter can so positively, as Richter has done, be identified with the species having a contracted panicle which is described by Royen.

The second citation in Species Plantarum under *A. capillaris* is *Dalib. paris. 23*. To Dalibard's description (5, pp. 23-24), which is a straight copy of Royen's diagnosis in Flora Leydensis, is added a note:

"Idem soboliferum".

Thus, the two first citations under *A. capillaris* L., in Species Plantarum, appear to refer to a species with contracted panicle which may or may not be stoloniferous. Does not this point to some form or forms of the *A. stolonifera* group rather than to *A. tenuis* Sibth.?

The third reference in Species Plantarum is to "*Agrostis panicula tenuissima, Fl. Lapp. 45.*" (19, pp. 26-27). What this really is, is somewhat of a mystery. Smith (39, p. 54) describes and figures as *A. capillaris* L. a specimen which he emphatically asserts is the very same as Linnaeus describes in Flora Lapponica. At the same time he carefully notes that the specimen in question is without locality and that, up to this time, the species which it represents has not again been found by other botanists, although Linnaeus says that it is common in the mountains of Lapland. Indeed, no *Agrostis* of the type figured as *A. capillaris* L. by Smith has up to the present time been found anywhere in Scandinavia. If Smith is correct in what he says about his figure of *A. capillaris* L. being drawn

¹Translation from the German.

²The italics are mine.

from the very same specimen which Linnaeus originally described in *Flora Lapponica*, then the latter species might very well not be a Scandinavian plant at all. Indeed, Grisebach, in *Ledebour* (17 a, p. 439), places "*A. capillaris* L. herb. (Sm. ic. rar. 3, t. 54.)" in Section *Airagrostis* which essentially is South European. This section, as defined by Ascherson and Graebner (1, p. 192), is composed of annual species. Smith (l. c.) is doubtful whether what he describes as *A. capillaris* L. is an annual grass or not, but Sinclair (38, p. 61) definitely states that it is.

Whatever the identity of the plant described in *Fl. Lapp.* and cited under *A. capillaris* in *Sp. Pl.*, it is obvious that it cannot be the same as the plants of Royen and Dalibard which are also cited under *A. capillaris* in *Sp. Pl.*, as the latter have contracted, not at all capillary panicle. Furthermore, if, as Smith asserts, his *A. capillaris* is drawn and described from the original *A. panicula tenuissima* of *Fl. Lapp.*, then the latter, having smooth empty glumes, cannot be identical with *A. capillaris* L. of *Sp. Pl.* which has hispidulous glumes. Finally, Royen's and Dalibard's plants, having contracted panicle, do not agree with *A. capillaris* L. of *Sp. Pl.* which has an open, capillary panicle. For the same reasons it appears that neither the plant of *Fl. Lapp.* nor Royen's and Dalibard's plants cited under *A. capillaris* in *Sp. Pl.* can be identified with *A. tenuis* Sibth. However, if the citations are disregarded, it might be argued that the diagnosis of *A. capillaris* L., as given in *Sp. Pl.*, applies to *A. tenuis* Sibth., and that, therefore, the name *A. capillaris* L. should be retained. But whether the diagnosis of *A. capillaris* L. is applicable to *A. tenuis* Sibth. or not, is not the real point. The point is: Was the description of *A. capillaris* L. in *Sp. Pl.* actually based on the plant known as *A. tenuis* Sibth. If it was, and only then, it might be claimed that, notwithstanding the necessity of excluding the citations, and notwithstanding the discrepancies between the latter, the name *A. capillaris* L. should be retained in the sense of *A. tenuis* Sibth. But there is, in the writer's opinion, room for the suspicion that what is known as *A. tenuis* Sibth. may not at all have been the basis of Linnaeus' description of *A. capillaris*. Perhaps the latter originated as follows:

Linnaeus originally described a species with capillary panicle in *Flora Lapponica*, 1737. In 1740, Royen, in *Florae Leydensis Prodrromus*, described an "*Agrostis panicula compressa calycibus subulatis aequalibus hispidiusculis coloratis.*" This was confused by Linnaeus with his species in *Flora Lapponica*. When, in 1753, he described *A. capillaris* in *Species Plantarum*, he, therefore, copied Royen's diagnosis for that species, but, in order to suit the description to the plant previously diagnosed in *Flora Lapponica*, he altered it so as to read "*Agrostis panicula capillari patente*" instead of "*Agrostis panicula compressa*"

Such an origin of the description in *Species Plantarum* readily explains the discrepancies between the description of *A. capillaris* and that of Royen's plant cited as a synonym, on the one hand, and also the citation of both Royen's plant and that of *Flora Lapponica*, two obviously different species, under *A. capillaris*, on the other. If the description of the latter thus is a composite one, based partly on Royen's plant with a contracted panicle and partly on the plant of *Flora Lapponica* with a capillary one, neither of which is identical with *A. tenuis* Sibth., it follows that the latter cannot be identified with *A. capillaris* L. That Linnaeus really had not the plant called *A. tenuis* Sibth. in mind when he penned the diagnosis of

his *A. capillaris*, is also indicated by the fact that the latter is said to have a *truly capillary* panicle, a characteristic which does not apply to *A. tenuis* Sibth.

In view of the above and in view of *A. capillaris* L. having been so variously interpreted by various authors, e.g., as an *Agrostis* of the *stolonifera* group by Pollich (29, p. 69), Roth (33, p. 32), and Schumacher (37, p. 23), as what is known as *A. tenuis* Sibth. by Hudson (16, p. 31) and Lamarck (17, pp. 59-60), *vide* Gaudin (7, p. 191), and as *A. delicatula* Pourr. by Willkomm and Lange (43, p. 55) and Ascherson and Graebner (1, p. 192), it seems quite justifiable to drop the name *A. capillaris* L. altogether and to apply the oldest indisputable name for the species under discussion, i.e. *A. tenuis* Sibth.

A. stolonifera L. (*one polymorphous species*)

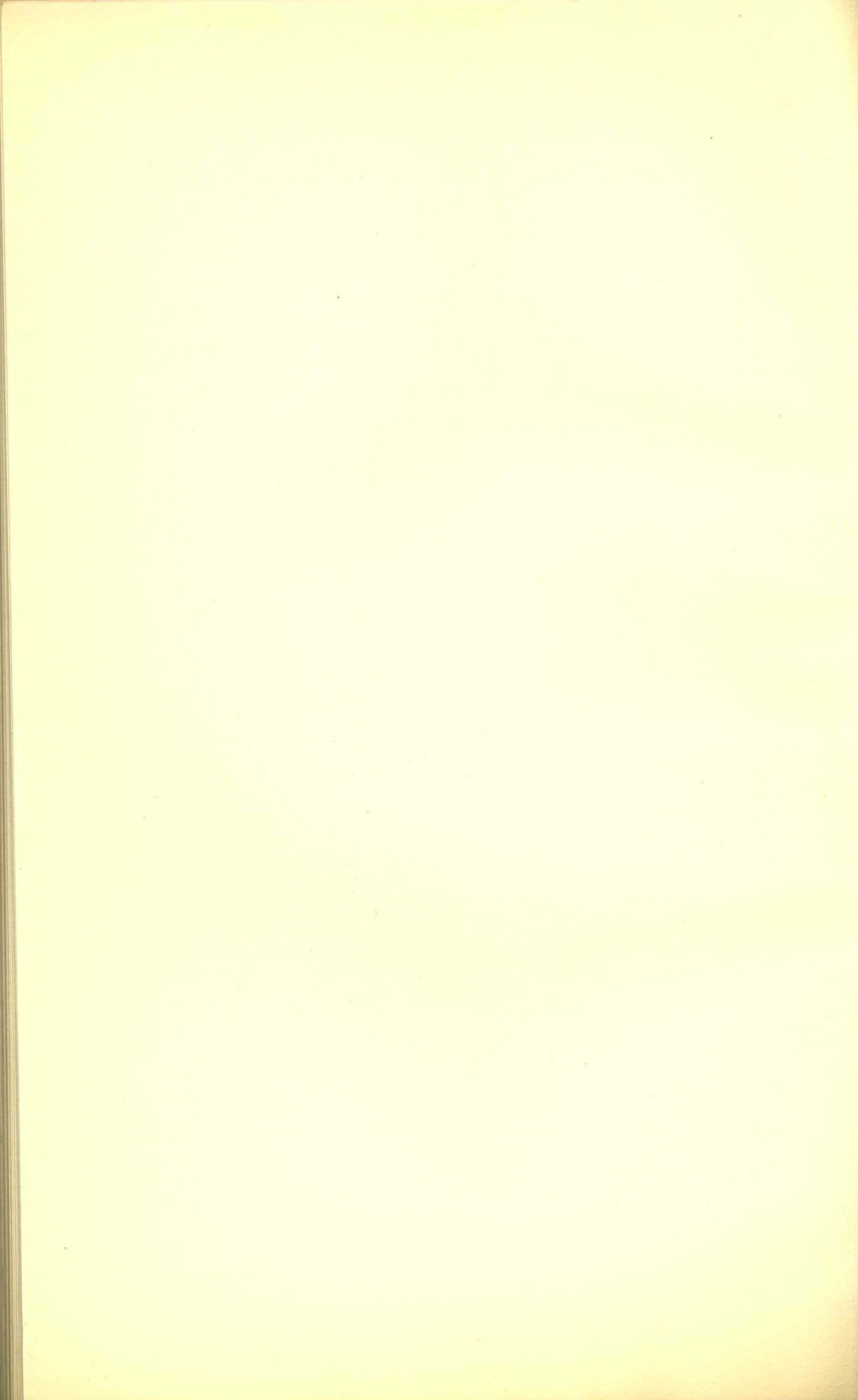
The numerous forms of the *A. stolonifera* group have two constant characters in common, viz.: an elongated ligule, and a palea at least two-thirds as long as the lemma; otherwise they vary greatly, the variability manifesting itself in practically all other characters. As Stebler and Schroeter (40, p. 110) express it, the variations affect:

- (1) Mode of growth:
 - (a) Stolons none, or subterranean only and short; stems neither prostrate nor rooting.
 - (b) Stolons both on the surface of the soil and underground; stems decumbent, the basal part in many cases widely creeping and rooting at the nodes.
- (2) Stature:
 - (c) Plant tall, up to 1 m.; panicle spreading, many-flowered.
 - (d) Plant low.
- (3) Structure of panicle:
 - (e) Panicle with elongated branches, widely spreading during flowering.
 - (f) Panicle with short branches, remaining contracted during flowering.
- (4) Colour of spikelets:
 - (g) Spikelets dark-coloured to purple-blackish.
 - (h) Spikelets purple-reddish.
 - (i) Spikelets greenish.
 - (k) Spikelets yellowish.
- (5) Length of spikelets:
 - (l) Spikelets 2-3 mm. long.
 - (m) Spikelets only 1.5-2 mm. long.
- (6) Presence or absence of awn:
 - (n) Lemma awnless.
 - (o) Lemma awned.
- (7) Spikelets viviparous or with foliaceous glumes.

The highly variable characters mentioned above may be combined in the most perplexing manner, the result being that an exceedingly large number of more or less sharply defined types, intergrading one into another, exist, many of which have been given special names. To give an example, Hegi (9, p. 224), largely following Ascherson and Graebner (1, pp. 172-76), records sixteen varieties and subvarieties from central Europe. This number of forms, sufficiently well defined to have been given names of their own, represents in reality, however, only a very small fraction of the forms which may be encountered in such districts of Europe where the *stolonifera* group is well developed. Thus, some twenty years ago, the writer collected, in one day, not less than seventy-five different forms on



Scale 27/64
Agrostis stolonifera L.—Stoloniferous variety with open panicle.



the shore of the sound between Sweden and Denmark. In Canada, the number of forms which so far have been found is comparatively small, a fact which is quite natural when it is considered that most of the forms of the *stolonifera* group, if not all, are introductions from Europe. Yet, in some districts, for instance on Vancouver island and in the Maritime Provinces, particularly Prince Edward Island, a not inconsiderable number of more or less distinct forms are growing.

In order to determine whether the various forms are to be regarded as species, with the definition given in the preceding, or as varieties of one polymorphous species, it is necessary to ascertain to what extent the characters separating them are to be considered "essential."

The main characters involved refer to the shape of the panicle, the presence or absence of stolons, and the presence or absence of awn on the lemma.

The panicle varies from narrowly contracted and spike-like (Plate XVI, figure 2; Plate XV) to ample and spreading (Plate XIV, figure 1; Plate XVII). Between these two extremes all kinds of intermediate panicle types are found. It should be explained that the types in question refer to shape of the panicle as it remains after flowering, and not to its appearance during flowering time.

The question is now: can the various panicle types be considered of sufficient taxonomic value to be used as species characters alone? In order to answer this question, it is advisable, if not necessary, to examine the question from the standpoint of panicle variation in grasses in general.

As a first exhibit in the argument, as it were, *Dactylis glomerata* L. may be used. This species, as Witte (44, figs. 25-30) has shown, is composed of an exceedingly large number of forms, differing from each other in respect to practically all vegetative characters. Witte figures forms with very narrow, almost spike-like panicles, forms with ascending panicle branches, forms having the main branches horizontally spreading or reflexed, and forms with slender, drooping branches. This tremendous variation of *Dactylis glomerata* is so well known that it seems unnecessary to enter into further details. It may be mentioned, however, that *Dactylis glomerata*, an Old World species and consequently occurring in the largest number of forms there, is also found highly variable in suitable localities on this continent. Such a locality is, for instance, Victoria, B.C., where the writer has observed hundreds of different forms, having a range of variation, as to the construction of the panicle, even greater than that described by Witte.

As a second example may be mentioned *Bromus inermis* Leyss. This species, also an introduction from Europe, which has been studied particularly in respect to variability at the Experimental Station at Fargo, North Dakota, is, like *Dactylis glomerata*, exceedingly polymorphous. The panicle varies from narrow and contracted to ample with widely spreading branches, the various forms belonging, as it were, to two main series, one with the panicle branches one-sided (Plate XVIII, bottom row), and the other with the branches all-sidedly arranged (Plate XIX, bottom row). The forms illustrated in Plates XVIII and XIX were all collected by the writer in 1922 in a small waste place in the city of Ottawa, Ont. Similar variation in the shape of the panicle has been observed by the writer in colonies of *Bromus inermis* elsewhere, e.g. at Saskatoon and Regina in the province of Saskatchewan.

As a third example *Poa pratensis* L. may serve. This species appears in a very large number of forms with panicles of widely different types, as illustrated in Plates XVIII and XIX, top rows. These forms were all collected by the writer in a small, unoccupied block in the city of Hull, Que.

The above examples, which perfectly match the panicle variations in oats, *Avena sativa* L., not only illustrate the variability of the panicle in grass species belonging to different genera, but also the striking fact that the variations run along parallel lines or, as Vavilov (41) has expressed it, that they are homologous.

It should be emphasized that the existence of large numbers of forms, having panicles of different types, in *Dactylis glomerata*, *Bromus inermis*, and *Poa pratensis*, cannot be ascribed to any mysterious influence of cultivation. A similar range of variation, although, as far as it is known so far, perhaps somewhat less extensive, is found in other grasses which have not been subjected to domestication, for instance *Bromus Pampel- lianus* Scribn., *Bromus Hookerianus* Thurb., and related species, *Puccinellia* species, *Poa palustris* L., *Poa compressa* L., and others. Whether a grass is cultivated or not has no other bearing on its variability than that in the former case the closer study of it more readily reveals the existence of the various forms. As Vavilov (41, p. 50) says:

"There is no essential difference in this respect between wild and cultivated plants. Wild Linneons, like . . . *Agropyrum cristatum*, *Agropyrum repens*, . . . *Alopecurus pratensis* . . . studied in detail at Russian Experimental Stations by plant breeders (Roudzinski, Lorch, Jegalov, Bogdan), proved to be no less variable than the cultivated wheats, barleys, oats, and peas. The monotypic nature of many wild Linnean species is kept only as long as they are studied by a few specimens in the herbarium. The individual study in cultures of many samples of the same Linnean inevitably discovers its polymorphic nature."

Whatever the phylogenetic explanation of the parallel or, if you prefer, the homologous variation so commonly found in the family of Gramineae, the outstanding fact of interest in this connexion is that many Linnean species belonging to different genera display a most remarkable similarity in the range and nature of variation in the inflorescence, a similarity which, it seems, decidedly points to a common, general law of variation. From a taxonomic point of view, the recognition of such a law in grasses is of the greatest importance. It means that if certain groups of forms, such as *Dactylis glomerata*, *Bromus inermis*, *Poa pratensis*, *Poa palustris*, and *Poa compressa*, notwithstanding the very wide range of variation in the shape of the panicle found in each of them, are universally recognized as "species" by taxonomic botanists, there should be every reason to exercise great care in basing "species" in general, of panicle-bearing grasses, on the characteristics of the panicle alone, a fact fully realized by, among others, Fernald and Weatherby (6, p. 3), in the study of the genus *Puccinellia*.

The forms of the *Agrostis stolonifera* group display a range of variation which, although not fully as wide, as far as it goes is quite parallel to that of *Dactylis glomerata*, *Bromus inermis*, and *Poa pratensis*. In the circumstances it seems only reasonable that anyone accepting the latter three as species cannot very well, if he is consistent, segregate species within the *Agrostis stolonifera* group on the characteristics of the panicle alone.

The second outstanding character used by some authors to differentiate between "species" within the *Agrostis stolonifera* group is the presence or absence of surface runners or stolons.



Scale 3/8
Homologous variation in panicles.
Top row: *Poa pratensis* L.
Bottom row: *Bromus inermis* Leyss.





Scale 5/16
Homologous variation in panicles.
Top row: *Poa pratensis* L.
Bottom row: *Bromus inermis* Levss.

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Although in some forms no stolons of any kind are present, the majority possess stolons more or less well developed. In many cases they are wholly underground, scaly, and without fully developed leaves, or finally arching upward, breaking through the surface of the soil and developing green leaves at their tips. In other forms the stolons are wholly overground, trailing on the surface of the soil, and rooting at the nodes whenever the character of the ground permits the development of roots, or, as is sometimes the case in rich situations, winding through the bottom vegetation, in some places as much as 6 inches or more above the ground. In still other cases the stolons may be developed in water, growing in long strands generally more or less permanently submerged. In either case the stolons may be simple or branched in various degrees.

With this wide latitude in stolon development, the question is whether the presence of surface stolons should be deemed of sufficient taxonomic importance to serve as a species character. In considering this question it should be recalled that there are grass species outside of the genus *Agrostis* either with or without stolons, perhaps the most conspicuous being *Phragmites communis* Trin. This species as a rule has no stolons, but in some cases it is found with surface runners after the fashion of those occurring in many forms of the *Agrostis stolonifera* group. These runners, when well developed, are trailing on the ground, more or less freely rooting at the nodes, and may reach a length of 20 to 30 feet. When well developed, the stolons, as the writer has had the opportunity to observe in southern Sweden on the shore of the Baltic sea, constitute practically the whole foliaceous part of the plant, the upright stems being suppressed in a seemingly direct ratio to the increase in stolon development. The stoloniferous form of *Phragmites communis* is most strikingly different from the typical one, but, so far as far as the writer is aware, no modern systematic botanist regards it as anything but a mere variety of the species.

As far as the genus *Agrostis* is concerned, it should be remembered that the *stolonifera* group is not the only one in which forms either with or without surface stolons are found. Thus, there are stoloniferous forms both in *Agrostis tenuis* Sibth. and *A. canina* L. These are universally regarded as mere varieties or forms of the species in question.

In view of the above it seems logical to hold the opinion that, as long as the stoloniferous character in such species as *Phragmites communis*, *Agrostis tenuis*, and *Agrostis canina* is regarded at most as a varietal character only, the stoloniferous habit of corresponding forms within the *Agrostis stolonifera* group cannot in itself be considered but a varietal character either.

Concerning the presence or absence of awn on the lemma there are very few modern students of *Agrostis* who consider this character of sufficient value to be regarded as a specific one. The awn in the *stolonifera* group, when present, varies considerably in length and also in respect to insertion. When best developed it is inserted below the middle of the lemma, geniculate, and protruding far beyond the apex of the spikelets. In other cases it is short, straight, and inserted near the tip of the lemma. In many instances, however, plants are found in which only a certain number of the spikelets are awned, whereas others in the same panicle are perfectly awnless. These latter forms are on a par with similar forms of *A. tenuis* Sibth., of which the writer has examined numerous specimens having only certain spikelets awned, the awned spikelets in very many

cases being confined to the end of the panicle branches. When it is further considered that also in *Agrostis canina* L. and other species of *Agrostis* there are found forms either with or without awns, it is obvious, it would seem, that the presence or absence of awns cannot be relied upon as a species character, as is also emphasized by Hitchcock (11, pp. 11-12).

Although, in the writer's opinion, neither the shape of the panicle nor the presence or absence of overground, creeping stolons can alone be deemed of sufficient taxonomic value to be used as a specific characteristic, it may be argued that a certain type of panicle, associated with presence or absence of stolons, may together furnish taxonomically good species characters. Indeed, the so-called *Agrostis maritima* Lam., which is characterized by having a dense, narrow panicle and overground, creeping stolons, is by some North American authors regarded as a distinct species.¹

If a dense, narrow panicle always were associated with the presence of long, creeping, overground stolons, one might be tempted to segregate such forms as *A. maritima* Lam. as distinct species, but that is by no means the case. There exist numerous forms with overground, creeping stolons which have panicles with spreading branches (Plate XVII). On the other hand, forms without stolons exist in which the panicle is contracted and spike-like (Plate XVI, figure 2). That is to say, narrow panicles are not necessarily associated with presence of overground, creeping stolons; neither are open panicles correlated with absence of such stolons. In other words, the shape of the panicle and the stoloniferous habit are characters which are quite independent of each other. They might be combined in various ways, with the result that a large number of what generally are termed intergrading forms occur.

As, furthermore, all the forms of the *A. stolonifera* group are perfectly fertile, producing normally developed pollen and setting seed abundantly, they can no more be rated as distinct species than can for instance the numerous types of *Bromus inermis*, but must be regarded as mere varieties of a single, very polymorphous species.

Nomenclature. Up to quite recently the name *Agrostis alba* L. has commonly been applied to this polymorphous species or to certain elements of it by North American botanists. In 1918, however, Piper (27, p. 4) pointed out that Linnaei "description and references apply partly to wood meadow grass (*Poa nemoralis* L.)" and he, therefore, rejected the name *A. alba* L. A similar stand was also taken by Hitchcock (12, pp. 128-129, footnote) two years later.²

Both Piper and Hitchcock, in discussing the application of the proper scientific name to the various commercial bent grasses, make references to *A. stolonifera* L. Piper maintains that the latter name applies to Creeping bent which he considers specifically distinct from Redtop. He says (27, p. 4, footnote):

"This name (*A. stolonifera* L.), the first binominal given to any grass of the group here discussed, belongs to a plant growing about Upsala, Sweden, there known as Kryp-hven, that is 'Creeping bent.' It is quite intermediate in characteristics between Redtop and Fiorin as determined from authentic Swedish specimens secured from Dr. Carl Lindman, of Stockholm, Sweden,"

¹ It should be noted that in the original description Lamarck (17, p. 61) does not say anything about the stoloniferous habit. Neither does Rouy (34, p. 63). Other authors, however, e.g. Ascherson and Graebner (1, p. 175), Hitchcock (12, p. 129), and Holmberg (14, p. 142), emphasize the presence of long, creeping, overground stolons.

² Already in 1898, Murbeck (25, p. 3) questioned the propriety of using the name *A. alba* L.

This statement, however, is not entirely correct and, therefore, somewhat misleading. In the first place, one might get the impression that *A. stolonifera* L. is a local grass, "growing about Upsala, Sweden." But this is not the case. Linnaeus himself, both in the first (20, p. 23) and in the second edition (22, p. 22) of *Flora Suecica* states that it "Habitat in agris incultis ubique, praesertim Upsaliae" i.e., that it grows everywhere in uncultivated fields, especially at Upsala. As a matter of fact, it is common from the most southern province of Sweden to approximately southern Lapland. Secondly, Piper (l.c.) says that it is known as krypven, that is "Creeping bent." Linguistically, Piper may have had reason to translate the Swedish "kryp-hven"—or "krypven," as the modern spelling is—into Creeping bent, but it is a mistake to identify "krypven" with Creeping bent only, that is to say to apply the name "krypven" only to forms of *Agrostis* having overground creeping stolons. The Swedish name "krypven" is used not only for the latter forms, but also for those upright, non-stoloniferous ones which on the North American continent are commonly called Redtop, as well as for all the forms which are intermediate between the latter and Creeping bent, as may be seen from Neuman (26, p. 774), Lindman (18, p. 75), and Holmberg (14, p. 142).

These Swedish authors, following the lead of Murbeck (25, p. 3), apply the name *A. stolonifera* L. to the polymorphous species which is popularly called "krypven." As the writer also holds the opinion that there is no valid ground, as has been argued in the preceding, for the segregation of any of the numerous forms of the group under discussion as distinct species, and as *A. stolonifera* L. is the oldest valid name given to any element of the group in question, it should be retained for the species as a whole.

Varieties. The most outstanding types within the polymorphous *A. stolonifera* L., constituting the extreme ends of a long and complicated series of intergrading forms, are the so-called Redtop and Creeping bent. As these grasses are of great agricultural and commercial importance it seems desirable that definite varietal names be applied to them.

The Redtop, characterized by an upright, non-stoloniferous habit and by an open panicle with the branches spreading after flowering, has been called *A. palustris* Huds. by Piper (27, p. 3) and Hitchcock (12, p. 128). Whether, however, the name *A. palustris* Huds. is really applicable to Redtop, is rather doubtful. Hudson's original description (16, p. 27) reads: "*Agrostis panicula coarctata mutica; calycibus aequalibus hispidiusculis coloratis, culmo repente.*" That is to say, it is an *Agrostis* with a contracted panicle and a creeping stem. This description, therefore, does not agree with Redtop, but rather with Creeping bent, or Carpet bent, as is also intimated by Wiegand and Eames (42, p. 76).

Anyway, when Redtop is regarded as a variety of *A. stolonifera* L., the oldest varietal name, under the international rules of nomenclature, should be applied. This appears to be var. *major* Gaud., described under *A. alba* Schrader (Gaudin, 7, p. 189). Stebler and Schroeter (40, p. 109) give the following excellent description of *A. alba* var. *major* Gaud.:

"Stolons nul ou seulement sousterrains; tiges dressées, non couchées—radicantes inférieurement; taille haute et panicule étalée. C'est la forme la plus recommandable au point de vue agricole comme étant de toutes la plus productive. . . . À cette form appartient le *red-top* (pointe rouge) des Américains. . . ."

When transferred to *A. stolonifera* L., the name becomes *A. stolonifera* L. var. *major* (Gaud.) Farwell, Mich. Acad. Sci. Rept. 21, 351, 1919.

The Creeping bent of the trade, as has been pointed out in the preceding, is not a monotypic variety, but includes a number of races, all having long stolons which trail on the surface of the ground and root more or less freely at the nodes. The economically most valuable races of Creeping bent and at the same time botanically the most extreme forms of *A. stolonifera* L. have a narrow panicle which becomes contracted and more or less spike-like after flowering. It is to this extreme element of the species that it is desirable to apply a scientific varietal name. The oldest valid varietal name appears to be *A. stolonifera* L. var. *compacta* Hartm.¹ Hartman's description (8, p. 19), which dates from 1832, translated from the Swedish, reads as follows: "*A. stolonifera* L. β . *compacta*: panicle dense, the culm branched, creeping."

SYNOPSIS OF THE SPECIES AND VARIETIES AND THEIR DISTRIBUTION IN CANADA

Key to the Species

1. Palea about half as long as the lemma or longer.
 2. Ligule of the lower and middle leaves 2-5 mm. long, rounded at apex
 1. *A. stolonifera*.
 2. Ligule of the lower and middle leaves 0.5-1.3 mm. long, truncate at apex
 2. *A. tenuis*.
1. Palea minute or wanting
 3. *A. canina*.

1. *A. stolonifera* L.

A. stolonifera L., Sp. Plant, 62, 1753.

A. alba L. of most North American authors; very doubtfully *A. alba* L., Sp. Plant, 63, 1753.

A. vulgaris With., Hook., Fl. II, 239; Pursh, Fl. I, 63; in Macoun, Cat. Can. Pl., pt. IV, 200, 1898, in part; and var. *alba* Vasey, Cat. Grasses U.S., 47, 1885, in Macoun, l.c. 201.

Not *A. stolonifera* L., in Hitchcock, N. Am., Sp. Agrostis, Bul. 68, U.S.D. Agr., 24, 1905.

Not *A. stolonifera* L., in Rydberg, Fl. Ry. Mts., 54, 1917.

Perennial. Loosely tufted or matted, usually with stolons, creeping on or below the surface of the soil. Culms erect, ascending, or decumbent, up to about 1 m. high. Leaves 2-10 mm. wide; the ligule 2-5 mm. long, rounded at apex. Panicle from broadly pyramidal with the branches spreading after flowering to linear with the branches erect and appressed after flowering; varying in colour from dark purple to straw colour and whitish or greenish. Spikelets 2-3.5 mm. long. Lemma 1.5-2.2 mm. long, generally without awn. Palea about two-thirds the length of the lemma or longer. (Mostly nat. from Eur.) A very variable species, the extreme varieties being:

¹ Specimens of Creeping bent with short, contracted panicle and creeping surface stolons, collected by the writer in the vicinity of Ottawa, Ont., were, some time ago, submitted to Mr. Otto R. Holmberg, Editor of the 1922 edition of Hartman's Handbook of the Flora of Scandinavia, who kindly examined them and identified them with *A. stolonifera* L. var. *compacta* Hartm.

Var. **major** (Gaud.) Farw. Redtop.

A. alba Schrad. var. *major* Gaud., Fl. Helv., I, 189, 1828.

A. stolonifera L. var. *major* (Gaud.) Farw., Mich. Acad. Sci., Rept. 21, 351, 1919.

A. palustris Huds., in Piper, Agr. Spec. Bent Grasses, pt. I, Bull. 692, U.S.D. Agr., 3, 1918; and in Hitchcock, Gen. Grasses, United States, Bull. 772, U.S.D. Agr., 128, 1920; very doubtfully *A. palustris* Huds., Fl. Angl., 27, 1762.

Stolons subterranean, scaly, or wanting. Culms erect, tall. Leaves about 4 mm. wide or more. Panicle pyramidal to oblong, generally purplish; the branches spreading or ascending after flowering. Fields, meadows, pastures, roadsides, etc. Common in agricultural districts east of the prairies. Along railways, in waste places in cities and towns, etc., in the Prairie Provinces and the Rocky mountains. Common in southwest British Columbia and settled sections of Vancouver island; Dawson City and vicinity, Y.T.

Var. **compacta** Hartm. Creeping bent, Carpet bent.

A. stolonifera L. β *compacta* Hartm., Handb. Skand. Fl. Ed. 2, 19, 1832.

A. maritima Lam. Dict. I, 61, 1783.

A. stolonifera δ *maritima* Koch., Syn. I, 781, 1837.

A. alba L. var. *maritima* Meyer, Chloris Hanov., 656, 1836.

Probably *A. palustris* Huds., F. Angl. 27, 1762.

Densely matted with long, leafy stolons creeping on the surface of the ground and rooting at the nodes. Culms short, ascending from a decumbent base. Leaves rarely over 3 mm. wide. Panicle oblong—linear during flowering, later becoming contracted with erect and more or less appressed branches, generally straw colour. Salt marshes, wet meadows, shores of rivers and brooks. Common in eastern Canada. Rarer in the Prairie Provinces, though apparently overlooked in many places; collected by the writer in 1925 at Pincher Creek, Alberta (altitude 3,700 feet), Calgary, Alberta (altitude 3,400 feet), Nordegg, Alberta (altitude 4,500 feet), Mountain Park, Alberta (altitude 6,000 feet). Not uncommon in the Victoria-Comox district of Vancouver island, B.C.; Prince Rupert, B.C.

A. stolonifera x **tenuis**

This hybrid, which is intermediate between the two species and characterized by a very high degree of sterility in both the male and female organs, was collected by the writer some years ago at Charlottetown, P.E.I., but unfortunately the specimens were lost.

2. **A. tenuis** Sibth. Rhode Island bent, Browntop, Prince Edward Island bent, Colonial bent.

A. tenuis Sibth., Fl. Oxon., 36, 1794.

A. vulgaris With., Arr. Brit. Pl. Ed. 3, 132, 1796.

A. alba L. var. *vulgaris* (With.) Thurb., in Gray's Man., Ed. VI, 647, 1890.

A. capillaris L. in Hitchcock, Gen. Grasses, United States, Bull. 772, U.S.D. Agr., 129, 1920; very doubtfully *A. capillaris* L., Sp. Pl., 62, 1753.

Perennial. Loosely tufted, in many cases forming more or less compact mats, with or without creeping, overground stolons. Culms erect,

generally from an ascending base, slender, 1-6 dm. high. Leaves 1.5-5 mm. wide; ligule of the lower and middle leaves 0.5-1.3 mm. long, truncate at apex. Panicle ovoid to elliptic, not contracted after flowering, commonly brown-purplish; spikelets 1.8-3 mm. long. Lemma 1.5-2.5 mm. long, generally without awn. Palea about half as long as the lemma. Dry, sandy, or gravelly places. Very common in Prince Edward Island, Nova Scotia, and New Brunswick. Scattered localities in Quebec and Ontario. Not recorded from the Prairie Provinces. Common in the vicinity of Vancouver, B.C., and in southeastern Vancouver island, B.C. (Nat. from Eur.).

Var. *aristata* (Hartm.) Holmb.

A. vulgaris With. var. *aristata* Hartm., Handb. Skand. Fl., Ed. 2, 19, 1832.

A. tenuis Sibth., var. *aristata* (Hartm.) Holmb., in Hartmans Handb. Skand. Fl. 143, 1922.

Lemma of all or some of the spikelets, particularly those at the ends of the branches, with a geniculate or straight awn, generally attached below the middle. Found to the extent of about 10 per cent in practically all samples of commercial Browntop seed harvested in Prince Edward Island, according to Dr. F. T. Wahlen, Seed Branch, Dominion Department of Agriculture.

Nova Scotia: Purcell cove, Halifax harbour, Sept. 2-6, 1901 (C. D. Have and W. F. Lang). New Brunswick: Shediac cape, July 13, 1914 (F. Tracy Hubbard); Eel river north of Bathurst, July 9, 1926, and Youghall, near Bathurst, July 10, 1926 (Malte). Quebec: Petit Saguenay, St. Raymond, Portneuf county, June 30, 1919, and on the old camp, Valcartier, August 19, 1925 (Bro. Marie-Victorin). British Columbia: Cedar hill near Victoria, Vancouver island, June 16, 1887, and May 31, 1893 (John Macoun).

Var. *setulosa* (Murb.) Holmb.

A. vulgaris With. var. *setulosa* Murb. Bot. Not. 1898, p. 7.

A. tenuis var. *setulosa* (Murb.) Holmb. in Hartmans Handb. Skand. Fl., 143, 1922.

The whole outer surface of the lemma with scattered, more or less appressed, microscopical hairs.

This rather unique variety is found in small quantities in practically all commercial samples of Browntop seed from Prince Edward Island. As observed so far, the Prince Edward Island seeds with setulose lemma have always the latter also awned (F. T. Wahlen).

A teratological, viviparous-like form is found in many places in the Maritime Provinces. This form, according to Ascherson and Graebner (1, p. 183), has been described by Pollich (29, p. 69) as *A. sylvatica*.

3. *A. canina* L. Velvet bent.

A. canina L., Sp. Pl. 62, 1753.

Perennial. Loosely or rather densely tufted, forming compact mats, with erect, narrow-leaved shoots, and in many cases, also, with creeping surface stolons. Culms erect or ascending, very slender, 1-6 dm. high. Leaves of the culm 1-2 mm. wide, pale to bluish green, those of the basal shoots capillary; the ligule 2-5 mm. long or more, tapering at the apex. Panicle generally ovoid during flowering, later becoming contracted and

lanceolate, varying in colour from dark purplish to yellowish green. Spikelets 2-3.5 mm. long. Lemma 1.4-2.2 mm. long, generally with a strong geniculate awn, attached near the base. Palea rudimentary or wanting. Anthers about two-thirds the length of the lemma. Meadows, marshes, etc. Rare. (Introd. from Eur.)

Prince Edward Island: Georgetown¹, Kings county, July 22, 1926 (Malte). Nova Scotia: Grand Lake, Sydney, Cape Breton Island, July 5, 1909 (J. R. Churchill).

Var. *pallida* Rehb.

A. canina L. var. *pallida* Rehb. Icon. I, 12, t. XXXIII, fig. 1425, 1834. Spikelets pale greenish or straw colour. Rare.

Prince Edward Island: Georgetown, Kings county, July 22, 1926 (Malte).

Var. *mutica* Gaud.

A. canina L. var. *mutica* Gaud. Fl. Helv. I, 182, 1828.

Lemma awnless or, in a few of the spikelets, with a very short awn.

This variety has so far not been found in Canada, but may occur in Prince Edward Island. It has been collected at Glenwood, valley of Gander river, Nfld., July 11-13, 1911 (M. L. Fernald and K. M. Wiegand).

A. canina L. x tenuis Sibth.

This hybrid has a comparatively short, 1-2 mm. long, ligule which clearly indicates the influence of *A. tenuis* Sibth. The lemma is awned as in *A. canina* L., and the palea about one-third to almost one-half the length of the lemma. At least 80 per cent of the pollen grains are incapable of effecting fertilization. Rare.

Prince Edward Island: dryish border of salt marsh, Wood island, July 29, 1914 (M. L. Fernald and Harold St. John); Borden, July 23, 1920, and Georgetown, July 26, 1926 (Malte).

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¹ First discovered there by officers of the Seed Branch, Dominion Department of Agriculture.

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