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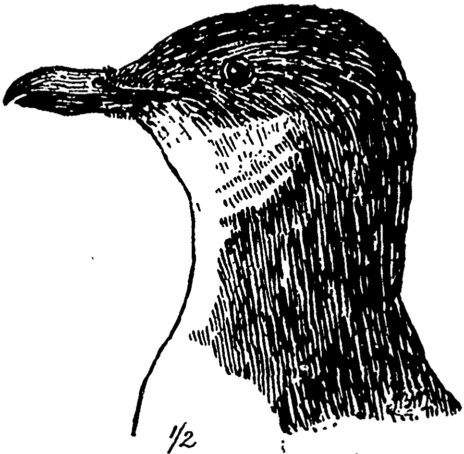
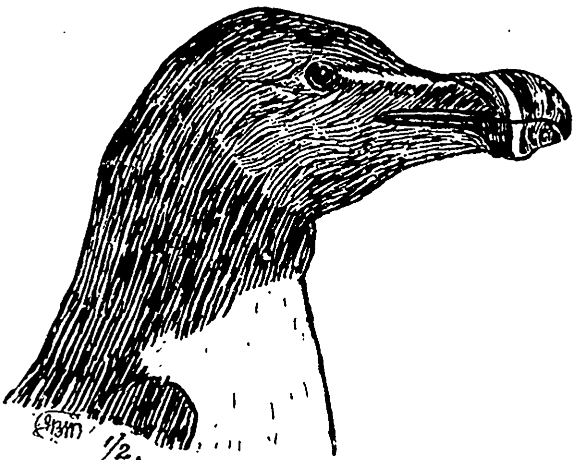


BRUNNICH'S MURRE. (YOUNG)



RAZOR-BILLED AUK. (ADULT)

FIGURES OF TWO SPECIMENS IN THE MUSEUM OF THE NATURAL HISTORY SOCIETY OF MONTREAL.

THE

CANADIAN RECORD

OF SCIENCE.

VOL. VI. JANUARY, 1895. No. 5.

Remarkable Flight of Certain Birds from the Atlantic Coast up the St. Lawrence to the Great Lakes.

By E. D. Wintle.

Two most remarkable flights of Brünnich's Murres up the St. Lawrence River to the Great Lakes occurred in November, 1893, and in November, 1894, which are unprecedented with this species as far as we have any record of such occurrences. It is not uncommon for solitary individuals of various species of sea birds to wander up the St. Lawrence to the Great Lakes, but when large numbers are found so far inland, as in the case of the Murres, there must be some cause for such an unusual visitation, But it is a difficult matter to assign the true cause, although, as a rule, scarcity of food is thought to be by ornithologists the cause of unusual visitations of birds from their natural habitats. If scarcity of food was the cause of the Murres spreading so far inland, the unfortunate birds which survived the fusillade of guns must have died of starvation before the following spring, as the stomachs of several which were shot and examined did not contain any food, so that we must presume their natural food was not discovered by them in the fresh waters which they visited so foolishly, and they do not appear to have sufficient instinct to return to salt water, as numbers of them were caught alive on the ice when the water began to freeze over for the winter. They appeared to be very tame, keeping near the shores of the rivers and lakes. Some of them went up the St. Francis River as far as Sherbrooke, and the Richelieu to Lake Champlain, also up the Ottawa to the City of Ottawa; but the bulk of them appeared to have followed up the north shore of the St. Lawrence to Lake Ontario, as far as Toronto and Hamilton. Many of them were shot on the lake near Toronto. It seems strange that these birds should remain inland during the winter, to be frozen and starved to death, when we consider that it would have been an easy matter for them to return by the rivers to the sea to their natural waters; but they appear to have totally lost themselves on our inland waters, and the only reason I can assign for their unusual lack of natural instinct is, that they were all young birds, for the bills of those that were shot were not as long as those of adult birds. The fact of these birds apparently being all young birds would suggest an interesting habit in the life history of this species, and one which, I believe, has not been noticed heretofore, namely, the adult birds separating themselves from their fledged young, or, on the other hand, the latter flocking together in the fall of the year without the former's company. Another cause for the remarkable inland flight of these young Murres during the past two years in succession, might have been two unusually prolific breeding seasons, during which the young birds, seeking for food, followed the high tides up to Three Rivers, where, having followed the course of the St. Lawrence so far up it is possible, they were actuated thereby to continue further inland up to the Great Lakes, when, if they had sufficient instinct to return down the

St. Lawrence to their natural habitat, they would have become confused by finding the river frozen over, and therefore would remain on any open water they could find—lost, and finally starved to death for lack of their natural salt-water food. The food of the Murres, according to Audubon, consists of small fish, shrimps and other marine animals, and they swallow some gravel also. The specimen of Brünnich's Murre now in the possession of the Natural History Society of Montreal, is a young bird, being one of those which took the remarkable flight inland mentioned in this article. Brünnich's Murre, Uria lomvia (Linn), belongs to the Order Pygopodes—the Diving Birds—(Sub-order Cepphi), Family Alcidæ—the Auks, Murres, etc. (Sub-family Alcinæ), Genus Uria (Brisson). There are two species and two sub-species of Murres recognized as North American Birds, the first two inhabiting the North Atlantic coasts, and of the two sub-species, one is found on the Pacific coast of North America, and the other one on the coasts and islands of Behring's Sea. In general appearance the Murres closely resemble one another, both in size and plumage. Habitat of Brünnich's Murre is the Arctic Ocean and coasts of the North Atlantic, south, in winter, to New Jersey; breeding from Gulf of St. Lawrence northward. (*See Ridgway's Manual of North American Birds.*)

Unusual Occurrence of Razor-Billed Auk at Montreal.

By E. D. Wintle.

David Denne, Esq., has been kind enough to draw my attention to the taking of the Razor-Billed Auk in the vicinity of Montreal, and on further enquiry I learn that four were observed, on the 10th of November (1893), swimming about on the river at St. Lambert, one of which was shot by a man named Leclaire. I saw this specimen after it was mounted, and, judging by its bill, which is not fully developed, it is a young bird, as the bill of the adult, as seen in the specimen in the collection of this Society, has grooves, crossed about the middle by a white bar, whereas, the bill of the young is smaller, without grooves, and lacks the white bar. I believe this is the first record of the Razor-Billed Auk occurring in the district about Montreal. This species is the only one of its genus found in North America. It is common in the Gulf of St. Lawrence, and breeds there on the Bird Rocks in company with the Murres, a closely allied species, and as the latter bird, in November, 1893, passed up the St. Lawrence river in remarkable numbers, it is very likely that a few of the former species were induced to follow them far inland, out of their natural habitat. The Razor-Billed Auk, Alca torda (Linn), belongs to the Order Pygopodes—the Diving Birds (Sub-order, Cepphi), Family Alcidæ—the Auks, Murres, etc., Genus Alca Linnœus. Their habitat stretches along the coasts of the North Atlantic, south, in winter, to southern New England, breeding from Eastern Maine northward. (*See Ridgway's Manual of North American Birds.*)

Notes on Special Migrations.

By J. B. Williams.

There are several instances of irregular migrations on record, which are worthy of notice in connection with the two described in Mr. Wintle's paper.

Their cause has been usually ascribed either to a great increase in numbers, or to a sudden scarcity of food.

The migrations of the Leming (*Mus lemmus*) in Lapland, which occur every ten or twelve years, are probably examples of the first, while the descent of Antelopes from the interior of Africa to the cultivated districts around Cape Colony, which, before the country was explored, used to take place every three or four years, was, perhaps, an example of the second of these causes, though neither of them seem sufficient to explain some of the special bird migrations.

Pallas' Sand Grouse (*Syrrhaptes paradoxus*) visited Europe in great numbers in the summer of 1863, and again, twenty-five years later, in 1888. On both occasions many of them reached the British Isles, and a few of those that came in 1888 remained and reared young in the summer of 1889. A climate, however, so different from their native one in the deserts of Tartary, was not likely to suit them, and I believe none of them survived the change for very long.

An immense flock, numbering thousands, of the Rose-Colored Pastor (*Pastor roseus*), a bird allied to the starling, came from the bird's native haunts in Armenia, and visited Bulgaria in the summers of 1877 and 1889. They were very tame and could easily be caught, but as they fed mainly on grasshoppers, they were regarded rather as a blessing, and were thus saved from much persecution.

The Evening Grosbeak (*Coccothraustes vespertina*), a bird which usually resides in the North-West and Rocky Mountain district, came east in numerous flocks during the winter of 1890. They reached Toronto about the middle of January and Montreal about the end of that month. Some flocks went south of the Great Lakes and visited Pennsylvania and New York States. Others went on to the New England districts, where they had never before been seen. Nearly all of them returned to the North-West in March or April, though it was said that a few lingered until the middle of May, but there has been, as yet, no repetition of the visit.

The Pine Grosbeaks (*Pinicola enucleator*), some of which visit Montreal nearly every winter, accompanied the

Evening Grosbeaks in unusual numbers in this migration of 1890, though they probably came from the North rather than the West. Flocks of both birds were seen in many places feeding together on the berries of the same mountain ash tree, and all of them were remarkably tame and unsuspicious.

Notes on Recent Canadian Unionidæ.

By J. F. Whiteaves.[1]

The present paper is intended as a contribution to our knowledge of the geographical distribution of the Unionidæ in North America. It consists of a list of all the species from Canadian localities that are now represented in the museum of the Geological Survey at Ottawa, and is based almost exclusively upon specimens that were either collected by members of the Survey staff or presented by friends interested in its museum. So far as the writer is aware, however, the *Unio tenuissimus* of Lea, which was collected by Dr. G. M. Dawson in 1873, in the Souris River, Manitoba, is the only species of Unionidæ known to occur in Canada that is not represented in the Survey museum. Specimens of most of the nominal species of *Anodonta* and of a few of the more difficult species of *Unio* enumerated in this list have been kindly compared by Mr. Charles T. Simpson, of the United States National Museum, with Dr. Lea's types of North American Unionidæ now preserved in that institution, and identified as correctly as the small number of shells sent from each locality and the incompleteness of his studies of the family would permit. The nomenclature employed throughout this list is that which is now in general use among students of this group in North America, as it is still quite uncertain which of the earlier names of Rafinesque,

[1] Communicated by permission of the Director of the Geological Survey Department.

Lamarck and others, will ultimately have to be retained for some of these shells.

ANODONTA, Lamarck, 1879.

ANODONTA BENEDICTII, Lea.

Specimens which appear to have been identified with this species by Dr. Lea have already been recorded by Dr. R. Bell[1] as having been collected by himself, in 1860, at Batch-ah-wah-nah Bay, Lake Superior; in the St. Mary River, near Sugar Island, and on the north shore of Lake Huron, at Lacloche Island. Professor Macoun has recently (1894) collected it at Rondeau, near Point aux Pins, on the Ontario side of Lake Erie, and a few specimens, which Mr. Simpson thinks are probably referable to *A. Benedictii*, were collected by Dr. R. Bell, in 1883, at Lake Winnipeg, between Fort Alexander and Elk Island. Mr. Simpson is inclined to believe that *A. Benedictii* may be only a variety of *A. ovata*, Lea.

ANODONTA DECORA, Lea.

Eight full grown specimens and one immature shell of a very large *Anodonta*, which Mr. Simpson refers to *A. decora*, were collected by Mr. Law, of Chatham, at Rondeau, Ontario, and presented by him to the Museum of the Survey, through Professor Macoun, in 1884. One of the adult shells from this locality, a fairly average specimen, measures 6.6 inches in length, 4 inches in height and 3.1 inches in breadth or thickness. The umbones of each are remarkably ventricose and prominent. The test is rather thick, the hinge line short, and the cardinal angles are rounded in front and obtusely angular behind. The writer has long been under the impression that these shells could be identified with the typical form of *A. grandis*, Say, as they do not correspond at all well with Lea's figures or measurements of *A. decora*,

1 In Canad. Nat. and Geol., Vol. VI., p. 269.

the "breadth" or, as it would now be called, the length of which is stated to be 3.9 inches. The recent receipt from Mr. Simpson of outline drawings of specimens from Dr. Lea's collections, labelled "*A. decora*, from the canal at Cincinnati, Ohio," has, however, convinced the writer of the correctness of Mr. Simpson's determination, though it is very generally believed that *A. decora* is not more than a mere variety of *A. grandis*.

ANODONTA EDENTULA, Say. (*A. undulata*, Lea, et auct.. but possibly not of Say; *A. Pennsylvanica*, Lamark, and *A. areolata*, Swainson.)

Dr. R. Ellsworth Call has expressed the opinion that *A. edentula*, Say, is peculiar to the Mississippi drainage system, and *A. undulata*, Say., to those waters that drain into the Atlantic, but the writer has never been able to see any tangible difference between these two shells. In a recent letter to the writer, Mr. Simpson says, "*Anodonta undulata* is no doubt the small form which we have here in the Potomac. Though Say gives no locality, he speaks of it as 'thin and fragile, length near half an inch; breadth seven-tenths.' The figure fairly well represents our shell. This may run into *A. edentula*, but I have never yet been able to connect it with that. The material in Lea's collection, under the name of *A. undulata*, Say, is merely a form or forms of *A. edentula*."

Under one or the other of these names this shell has previously been recorded as having been collected in Lake Matapedia, P.Q., by Dr. R. Bell in 1857; in a small lake in the valley of the Riviere Rouge, P.Q., by W. S. M. D'Urban, in 1858; in the St. Charles River, near Quebec city, by the writer, in 1861, and at Brome Lake, P.Q., by Mr. R. J. Fowler, in 1862.

More recently, it has been collected by Dr. R. Bell in 1883, at Lake Winnipeg, between Forts Alexander and Simpson, and by Professor Macoun, in 1894, in Ontario, at Rondeau, on Lake Erie, and in the east and west branches of the Grand River at Galt and Ayr.

In another letter to the writer, Mr. Simpson makes the following remarks upon this species, "The so-called Anodontas of which this is the type, have more or less perfect cardinals and occasional vestiges of laterals. They group with *Margaritana Elliotti*, *M. Spillmani*, *M. R*[illegible]*neliana*, etc. The genus *Margaritana* is a medley of forms, which, for the most part, are more nearly related to various groups of *Unio* than to each other. I believe that *Margaritana* should be merged into *Unio*, and with it the Anodontas of the *edentula* group."

ANODONTA FERUSSACIANA, Lea.

L'Orignal Creek, Ottawa River, Dr. R. Bell, 1855 (as *A. pavonia*, Lea). Ponds at the Mile End, Montreal, Dr. R. Bell, 1858, and J. F. Whiteaves, 1862.

ANODONTA FLUVIATILIS, Dillwyn. Sp. (*A. cataracta*, Say.)

Several specimens of this common eastern species, which has previously been recorded as occurring at many localities in the Province of Quebec and neighbourhood of Ottawa, were collected by Dr. R. Bell, in 1883, at Flying Post Route, 100 miles north-east of Michipicoten, and, in 1889, from a small lake near Proudfoot's north and south line, in the Sudbury district of Ontario. A single specimen, which may be referable to this species, was collected by Professor Macoun, in 1884, at White Fish River, north of Lake Superior.

ANODONTA FOOTIANA, Lea.

Specimens which are said to have been identified with this species by Dr. Lea were collected by Mr. W. M. S. D'Urban, in 1858, from three small lakes tributary to the Riviere Rouge, P.Q. Since then, specimens, which Mr. Simpson refers to *A. Footiana*, have been collected in

Ontario, by Professor Macoun, in 1884, at White Fish River, north of Lake Superior, and at Lake Hannah, on the Nepigon River: by Dr. A. C. Lawson, in 1886, at Rainy Lake; by Mr. W. Spreadborough, in 1894, from the Muskoka River, near Georgian Bay; and in Manitoba, by Dr. R. Bell, in 1883, at Shoal Lake, Red River. Mr. Simpson also is of opinion that specimens collected by Mr. R. J. Fowler in the Lachine Canal at Montreal, in 1863, and referred by the writer to *A. Lewisii*, Lea, are young shells of *A. Footiana.*

ANODONTA FRAGILIS, Lamark. (*A. lacustris*, Lea.)

This shell was apparently first collected in Canada by Mr. D'Urban in 1858, associated with *A. Footiana*, in three small lakes in the valley of the Riviere Rouge, and identified shortly afterwards by the late Dr. Isaac Lea with the *A. fragilis* of Lamarck. Specimens collected by Professor Macoun in 1885, from a lake six miles up the Beescie River, Anticosti, were identified with *A. fragilis* by Mr. F. R. Latchford, of Ottawa, and similar shells have long been known to occur at Meach's Lake, near Ottawa. Some of these Anticosti specimens were sent to Mr. Simpson, who thinks that they are essentially similar to shells labelled *A. fragilis* in Dr. Lea's collection, but cannot see how these latter are to be distinguished from *A. lacustris*, Lea, and does not pretend to be always able to separate *A. fragilis* from *A. fluviatilis.*

ANODONTA IMPLICATA, Say.

Lake Winnipeg, between Fort Alexander and Elk Island, Dr. R. Bell, 1883; and Souris River, near Roche Percée, Dr. A. R. C. Selwyn, 1890; a few specimens from each of these localities, which have been identified with this species by Mr. Simpson. It had previously been recorded as occurring in the St. Charles River, near Quebec, where it was collected by the writer in 1861.

ANODONTA MARRYATTANA, Lea.

Lake Hannah, Nipigon River, and east side of Lake Nipigon, Ontario, Professor Macoun, 1884; and Fairford River, Manitoba, J. F. Whiteaves, 1888; as identified by Mr. Simpson.

ANODONTA NUTTALLIANA, Lea. (*A. Oregonensis*, Lea.)

Okanagan Lake, B.C., A. J. Hill, 1882: two specimens of the variety *Oregonensis*. Near Victoria, V. I., James Fletcher, 1885, and Rev. G. W. Taylor, 1889. Nicola Lake, B.C., Dr. G. M. Dawson, 1889; three specimens of the typical form and one of the variety *Oregonensis*. Salmon Arm, Shuswap Lake, B.C., Dr. Dawson, 1894: several examples of both forms of the species. Stream entering Clayoquot Sound, V. I., at Stubbs Island, W. Spreadborough, 1894.

ANODONTA OVATA, Lea.

Coulée No. 5, Vermilion River, Alberta, J. B. Tyrrell, 1886.

ANODONTA PEPINIANA, Lea.

Specimens which Mr. Simpson refers to this species were collected by Dr. R. Bell, in 1883, from the Winnipeg River, Manitoba, and in 1886, from the Attawapishkat River, in the Severn district, which now forms the eastern part of Keewatin. Two left valves of a shell which may be referable to this species were collected by Mr. J. B. Tyrrell, in 1884, at the Lake of the Woods. Mr. Simpson is of the opinion that *A. Pepiniana* may be merely a variety of *A. Simpsoniana*, Lea.

ANODONTA SIMPSONIANA, Lea.

In Ontario this species was collected by Dr. A. R. C. Selwyn in 1883, at Black Bay, Lake Superior; by Prof. Macoun, in 1884, at the north end of Lake Nipigon, in

1885, at Port Dover, Lake Erie, and in 1890, at Port Colborne, on the same lake.

In Manitoba it was collected by Dr. R. Bell in 1878, at the outlet of Lake Winnipeg and from Lake Winnipeg between Fort Alexander and Elk Island. It occurs, associated with *A. Marryattana*, Lea, in the Fairford River, and is the only species of *Anodonta* that the writer was able to find in Lake Manitoba (in 1888).

In the district of Saskatchewan one perfect specimen was collected by Dr. R. Bell, in 1882, at Buffalo Lake, near Methy Portage.

Mr. Simpson, to whom the writer is indebted for the identification of specimens from most of these localities, is convinced that *A. Dallasiana* and *A. Kennicotti*, of Lea, are both synonyms of *A. Simpsoniana*.

Anodonta subcylindracea, Lea.

Widely distributed in the provinces of Quebec and Ontario, from Lakes Metapedia and St. John to the eastward, to creeks, rivers and bays at the east end of Lake Superior and north side of Lake Erie to the westward. Mr. Simpson, however, regards *A. subcylindracea* as a mere synonym of *A. Ferussaciana*, Lea.

MARGARITANA, Schumacher, 1819.

Margaritana calceola, Lea. (*M. deltoidea*, Lea.)

Lake Erie, at Port Dover, Professor Macoun, 1890. Grand River, at Belwood, Ontario, J. Townsend, 1892. East and west branches of the Grand River at Galt and Ayr, Professor Macoun, 1894.

Margaritana complanata, Barnes.

Manitoba. Upper Assiniboine River, Dr. R. Bell, 1874; Souris River, Dr. A. R. C. Selwyn, 1882 and 1884; Shoal River and near Elk Island, Lake Winnipeg, Dr. R. Bell, 1883; Swan River, J. B. Tyrrell, 1887, and Assiniboine River, J. B. Tyrrell, 1884.

Keewatin. Nelson River, Dr. R. Bell, 1878.

Saskatchewan. Shell River (township 50, range 2 and 3, west of third Initial Meridian) north of the north Saskatchewan, O. J. Klotz, 1890.

Alberta. Battle River, three miles above Grattan Lake, J. B. Tyrrell, 1885.

MARGARITANA MARGARITIFERA, L.

From the Province of Quebec this species has already been recorded as having been collected by Dr. R. Bell (in 1857) in the Green and Rimouski rivers, at Lake St. John and both the Metapedia Lakes, and by the writer, (in 1861) in the River St. Charles, near Quebec City. More recently it has been collected in that province by Dr. H. M. Ami, in 1883, in the Assumption River, near Rawdon; by N. J. Giroux, in 1892, at the Lac de la Ferme, Riviere du Loup, en haut, and in that river; also by A. P. Low, in 1894, in the Romaine River.

In British Columbia, small and thin but characteristic specimens were found by Dr. G. M. Dawson, in 1885, in small streams entering Malaspina Strait, on the mainland side; also, in 1890, in Kakwous Lake, the source of the Bonaparte River, at an altitude of about 4,000 feet.

MARGARITANA MARGINATA, Say.

The small and typical eastern form of this shell is common in the province of Quebec and in eastern Ontario. A few specimens of the large western variety known to students of the Unionidæ as *M. truncata*, Say (M. S.) were collected by Professor Macoun, in 1894, at Galt and Ayr, from the east and west branches of the Grand River.

MARGARITANA RUGOSA, Barnes. (? = *M. costata*, Rafinesque, sp.)

This species is widely distributed in the provinces of

Quebec and Ontario. In the latter province unusually large and thick specimens, measuring five inches and a half in length by three inches in height, were collected by Prof. Macoun, in 1894, in the east and west branches of the Grand River, at Galt and Ayr. The species has been recorded by Dr. G. M. Dawson as occurring, though rarely, in the Roseau River, Manitoba.

MARGARITANA UNDULATA, Say.

St. Lawrence River, at Montreal and Quebec, J. F. Whiteaves, 1861. Near Ottawa City, G. C. Heron, 1879.

UNIO, Philipsson, 1788.

UNIO ALATUS, Say.

Widely distributed throughout Ontario. The most easterly locality at which it has been collected is the Ottawa River at L'Orignal, as recorded by Dr. R. Bell, in the Canadian Naturalist and Geologist for June, 1859 (Vol. IV., p. 219). In Manitoba it has been collected in the Red River by Dr. G. M. Dawson, in 1873, and by T. C. Weston, in 1884.

UNIO BOREALIS, A. F. Gray.

A pair of specimens of this species, from the Ottawa River, at Duck Island, the typical locality, was presented to the museum of the Survey by Mr. F. R. Latchford, of Ottawa, in 1886.

UNIO CANADENSIS, Lea.

Two specimens, from the Ottawa River, near Ottawa, which are believed by the donor to be referable to this enigmatical species, were presented to the Museum of the Survey by Mr. Latchford, in 1893.

UNIO CIRCULUS, Lea. (? = *U. subrotundus*, Rafinesque.)

Lake Erie, at Kingsville, Ontario, J. McQueen, 1880, two specimens. Thames River, at Chatham (several specimens) and Detroit River, below Sandwich, Ontario (one specimen), Professor Macoun, 1894.

UNIO COCCINEUS, Lea.

Grand River, Cayuga, Ontario, Professor Macoun; one "fairly typical specimen," (C. T. Simpson).

UNIO COMPLANATUS (Solander ?) Lea. (*U. purpureus*, Say.)

Abundant in Nova Scotia, New Brunswick, Quebec and Eastern Ontario. Collected by Dr. R. Bell, in 1859, in creeks, rivers and bays on the north shore at the east end of Lake Superior, along the entire north shore of Lake Huron, also in the St. Mary River. Lake Nipissing, Dr. A. R. C. Selwyn, 1884 (whence it had previously been recorded by Dr. Bell, in 1859). Montreal River, Lake Temiscaming, Ontario, Dr. R. Bell, 1887.

UNIO CORNUTUS, Barnes. (? = *U. reflexus*, Rafinesque.)

Grand River, Cayuga, Ontario, Professor Macoun, 1890; a perfect and fresh left valve.

UNIO ELEGANS, Lea. (*U. truncatus, as of Rafinesque.*)

Thames River, at Chatham (Ontario), Professor Macoun, 1894; one dead but perfect specimen.

UNIO ELLIPSIS, Lea. (? = *U. olivarius*, Rafinesque.)

Ottawa River, opposite L'Orignal, R. Bell, 1854, and near Ottawa, G. C. Heron, 1879 (as *U. olivarius*, Rafinesque). St. Lawrence River, at Montreal, R. Bell, 1858, and near Quebec, J. F. Whiteaves, 1861. Missisaugi River, on the north shore of Lake Huron, Dr. R. Bell, 1860. Lake Erie, at Port Colborne, and Detroit River, near Windsor, Professor Macoun, 1885.

UNIO GIBBOSUS, Barnes. (? = *U. dilatatus*, Rafinesque.)

This species, which has long been known to be abundant in the St. Lawrence and Ottawa rivers, has recently been collected by Professor Macoun in Lake Erie, at Port Colborne, in the Grand River at Cayuga, and its two branches at Galt and Ayr, also in the Detroit River, at Windsor.

UNIO GRACILIS, Barnes. (? = *U. fragilis*, Rafinesque.)

Collected by Professor Macoun, in 1885, from Lake Erie, at Port Colborne, and the Grand River, at Cayuga; in 1890, at Port Dover, Ontario, and in 1894, in the River Thames, at Chatham.

UNIO LACHRYMOSUS, Lea. (Probably = *U. quadrulus*, Rafinesque.)

In Ontario, Professor Macoun collected specimens of this species in the Grand River at Cayuga, in 1885, and in the Thames River, at Chatham, in 1894.

In Manitoba it was found to be abundant in the Red River, by Dr. G. M. Dawson, in 1873, and Professor J. Fowler has presented to the museum of the Survey a specimen, which he collected at Emerson in 1887.

UNIO LIGAMENTINUS, Lamarck.

Grand River, at Caledonia, Ontario, J. Townsend, 1885, and at Cayuga, Professor Macoun, 1890. Thames River, at Chatham, Professor Macoun, 1894. Roseau River, Manitoba, Dr. G. M. Dawson, 1873, and Assiniboine River, at Millwood, J. B. Tyrrell, 1888.

UNIO LUTEOLUS, Lamarck.

Common almost everywhere in Canada east of the Rocky Mountains, though its exact range east of Ontario is a little uncertain, owing to its close resemblance to *U. radiatus*. Dr. Lea, in 1862, records it as occurring in Great Slave Lake, Lake Athabasca, and near the mouth of Moose River, Hudson's Bay. In Manitoba it was collected by Mr. J. B. Tyrrell, in 1887, from the Swan River;

in 1888, from the Assiniboine, and in 1889, from the Red Deer River. It appears to be the only *Unio* in Lake Manitoba, where it was collected by the writer in 1888, and from the Fairford River. In Alberta, Mr. Tyrrell collected it, in 1885, in the Blind Man, Battle and Medicine Rivers.

UNIO NASUTUS, Say.

Two fine specimens of this species, from Toronto Bay, were presented to the museum of the Survey, by Mr. Latchford, in 1886, and since then numerous specimens of it were obtained by Professor Macoun (in 1894) at Rondeau, on Lake Erie.

UNIO NOVI-EBORACI, Lea. (Perhaps = *U. iris*, Lea.)

Grand River, at Cayuga, Professor Macoun, 1890; one perfect specimen. Thames River, at Chatham (two specimens) and Detroit River, below Sandwich (one specimen), Professor Macoun, 1894.

UNIO PHASEOLUS, Hildreth. (? = *U. fasciolaris*, Rafinesque.)

Detroit River, at Windsor (one specimen) and Lake Erie, at Port Colborne (two specimens), Professor Macoun, 1885. Lake Erie, at Kingsville, Ontario (one specimen), J. T. McQueen, 1890, and Thames River, at Chatham (one specimen), Professor Macoun, 1894.

UNIO PRESSUS, Lea.

Boulder River, one of the upper branches of the Attawapishkat River, west of James Bay (in lat. 52° 30′ and long. 87° 30′), Dr. R. Bell, 1886; a perfect and fresh right valve. West branch of the Grand River, at Ayr, Ontario, Professor Macoun, 1894,a slightly distorted but living shell. This species has long been known to be common in the Rideau Canal and river, near Ottawa, where it was first noticed by the late E. Billings, about the year 1856 or 1857.

UNIO PUSTULOSUS, Lea. (?= *U. bullatus*, Rafinesque.)

Grand River, Caledonia, Ontario, J. Townsend, 1885; one specimen. Thames River, at Chatham, Professor Macoun, 1894; two specimens.

UNIO RADIATUS (Gmelin), Lamarck.

No new localities are to be recorded for this common eastern species, which has long been known to range from Nova Scotia to at least as far to the westward as Ottawa.

UNIO RANGIANUS, Lea. (Perhaps a var. of *U. perplexus*, Lea.)

Lake Erie, at Kingsville, Ontario, J. T. McQueen, 1890; one perfect specimen of the shell of the female.

UNIO RECTUS, Lamarck.

Common in the St. Lawrence and Ottawa rivers, and in western Ontario. In Manitoba, it was collected by Dr. G. M. Dawson, in 1873, from the Roseau River, and by Mr. J. B. Tyrrell, in 1888, in the Assiniboine River at Millwood.

UNIO RUBIGINOSUS, Lea. (?= *U. flavus*, Rafinesque.)

In Ontario this shell has been collected by Professor Macoun, in 1890, in the Grand River at Cayuga, and in 1894, in the Thames River, at Chatham. In Manitoba, it was found by Dr. G. M. Dawson, in 1873, in the Red and Roseau Rivers, and by Dr. R. Bell, in 1883, in Lake Winnipeg, between Fort Alexander and Elk Island.

UNIO SUBROTUNDUS, Lea.

Grand River, Caledonia, J. Townsend, 1885, one specimen, which "approaches *U. ebenus*" (C. T. Simpson). Port Dover, Lake Erie, a specimen "which approaches *U. solidus*, Lea," (C. T. Simpson), and Rondeau, Lake Erie, one specimen, Professor Macoun, 1894.

UNIO TRIANGULARIS, Barnes. (? = *U. triquetr*, Rafinesque.)

Collected by Professor Macoun, in 1885, at Port Colborne, Ontario, and in 1894, at Rondeau and in the Thames River at Chatham.

UNIO TRIGONUS, Lea. (? = *U. undatus*, Barnes.)

Port Dover, Lake Erie, Professor Macoun, 1890, two perfect but worn specimens, which were identified with this species by Mr. Simpson.

UNIO UNDULATUS, Barnes. (? = *U. costatus*, Rafinesque.)

Ontario. Sable River, at Thedford, Mr. Bissell, 1883, per Dr. H. Ami. Grand River, Caledonia, J. Townsend, 1885. Lake Erie, at Port Colborne, and Detroit River, at Windsor, Professor Macoun, 1885. Grand River, at Cayuga, Professor Macoun, 1890, and Thames River, at Chatham, Professor Macoun, 1894.

Manitoba. Black River, Lake Winnipeg, Dr. R. Bell, 1883, two specimens, with the umbonal regions much eroded. Emerson, Professor J. Fowler, one specimen of a small form which approaches *U. plicatus* (Le Sueur, MS.S.) Say.

UNIO VENTRICOSUS, Barnes. (*U. occidens*, Lea, female, and *U. subovatus*, Lea, male: ? = *U. cardium*, Rafinesque.)

Common in the St. Lawrence and Ottawa rivers and throughout Ontario. In Manitoba it has been collected in the Red and Roseau Rivers by Dr. G. M. Dawson, in 1873, and at Lake Winnipeg, between Fort Alexander and Elk Island, by Dr. R. Bell, in 1883.

OTTAWA, November 30th, 1894.

CONTRIBUTIONS TO CANADIAN BOTANY.

By JAMES M. MACOUN.

V.

THALICTRUM VENULOSUM, Trelease.

In thickets, Seven Persons' Coulee, Medicine Hat, Assa.; Crane Lake, Assa.; Cypress Hills, Assa., 1894. (*John Macoun*, Herb Nos. 2952, 2953, 2954.[1]) Our only records between Lake Manitoba and the Rocky Mountains.[2]

RANUNCULUS ABORTIVUS, Linn.

Lake Petitsikapau, Hamilton River, Labrador, 1894. (A. P. Low, Herb No. 4331.) Most northern record for Eastern Canada.

RANUNCULUS HISPIDUS, Michx.

Our only specimens of this plant are from Wesley Park, Niagara, Ont. (*John Macoun.*)

RANUNCULUS COOLEYÆ, V. & R.

Mount Rapho, Lat. 56° 13′, Long. 131° 46′. Alt. 3,800 ft. July, 1894. (*Otto Klotz* and *H. W. E. Canavan.*) Only Canadian record. First collected near Juneau, Alaska, by Miss Grace Cooley, in 1891.

ACTÆA SPICATA, Linn, var. RUBRA, Ait.

Lake Michikamau, Labrador, 1894. (*A. P. Low.* Herb. No. 4331.) Northern limit in Eastern Canada

NYMPHÆA PYGMÆA, Ait.

New stations for this rare plant are Loon Lake, C. P. Ry. east of Port Arthur, Ont., and Petobi Brook, Gull Bay, Lake Nepigon, Ont., 1894. (*Wm. McInnis.*)

1 Whenever herbarium numbers are given, they are the numbers under which specimens have been distributed from the heibarium of the Geological Survey of Canada.

2 The geographichl limits given in these papers refer to Canada only.

BARBAREA VULGARIS, R. Br.

Lake Petitsikapau, Hamilton River, Labrador, 1894. (*A. P. Low.* Herb No. 4340.) Not before recorded from Labrador.

VIOLA PALUSTRIS, Linn.

Ashuanipi branch of Hamilton River, Labrador. (*A. P. Low.* Herb. No. 4343.) Not before recorded from Labrador.

CERASTIUM VISCOSUM, Linn.

C. glomeratum, Thuill.

Burrard Inlet, B.C., and many places in vicinity of Victoria, Vancouver Island. (*John Macoun.*) Not found anywhere in Eastern Canada, all references but one, under *C. viscosum*, in Prof. Macoun's Catalogue of Canadian Plants going with *C. vulgatum.*

CERASTUM VULGATUM, Linn.

C. viscosum, Macoun, Cat. Can. Plants, Vol. 1., page 77, in part.

Widely distributed throughout Eastern Canada. Revelstoke, B.C. (*John Macoun.*) North of Finlayson Lake, B.C., Lat. 59°. (*Dr. G. M. Dawson.*)

CERASTIUM NUTANS, Raf.

Sproat, Columbia River, B.C., 1890. (*John Macoun.*) Cherry Creek, east of Lake Okanagan, B.C. (*Jas. McEvoy.*) Only British Columbia stations.

CERASTIUM ARVENSE, Linn., var. OBLONGIFOLIUM, H. & B.

C. oblongifolium, Torrey; Macoun, Cat. Can. Plants, Vol. I., p. 77.

A narrow-leaved form of this variety was collected at Truro, N.S., by Prof. Macoun, July, 1883. Only station east of Ontario.

CERASTIUM ALPINUM, Linn.

Arctic America, from Labrador to Alaska. References under var. *Fischerianum,* Macoun Cat. Can. Plants, Vol. I., p. 498, go here. This variety is confined to the Pacific Coast.

CERASTIUM ALPINUM, Linn., var. BEERINGIANUM, Regel.

Arctic America, and on many of the higher Rocky Mountains.

STELLARIA AQUATICA, Scopoli.

The only stations for this species in Canada are Stratford, Ont. (*Burgess*). Roadsides and ballast heaps, Nanaimo, Vancouver Island, 1893. (*John Macoun.*)

STELLARIA NITENS, Nutt.

Dry slopes, Agassiz, B.C.; Kamloops, B.C., 1889. (*John Macoun.*) Not before collected on mainland of British Columbia.

STELLARIA LONGIPES, Goldie, var. LÆTA, Wats.

S. longipes, Goldie, var. *Edwardsii,* T. & G.; Macoun, Cat. Can. Plants, Vol. I., pp. 76 and 498, in part.

From New Brunswick and Labrador to British Columbia and throughout Arctic America. Our herbarium specimens are from Petitcodiac, N.B. (*Brittain.*) Pack's Harbor, Labrador. (*Rev. A. Waghorne.*) Ford's Harbor, Labrador; Digge's Island, Mansfield Island and Nottingham Island, Hudson Bay. (*Dr. R. Bell.*) Lat. 62° 03′, Long. 103° 15′. (*J. W. Tyrrell.*) Summit of South Kootanie Pass, Rocky Mts. (*Dr. G. M. Dawson.*) Saddle Mountain, Banff, Rocky Mts.; Kicking Horse Lake, Rocky Mts., alt. 8,000 feet; Stewart's Lake Mountain, B.C. (*John Macoun.*) Mountains at Roger's Pass, Selkirk Mts., alt. 7,500 ft.; Mount Queest, Shuswap Lake, B.C., alt. 6,500 ft. (*Jas. M. Macoun.*)

STELLARIA LONGIPES, Goldie, var. EDWARDSII, Wats.

From Labrador to British Columbia and northward to the Arctic regions. Our only specimens of this variety are from Quesnelle, B.C.. (*John Macoun.*)

STELLARIA GRAMINEA, Linn.

In sandy woods, Fort George, Hudson Bay. (*Jas. M. Macoun.*) Probably indigenous. Only record north of Nova Scotia.

STELLARIA ULIGINOSA, Murr.

This species is confined to the Atlantic slope and is not of as wide distribution as is given it by Prof. Macoun, Cat. Can. Plants, Vol. I., pp. 75 and 497. Our specimens are from Hunter's River, Prince Edward Island, and Point Pleasant, near Halifax, N.S. (*John Macoun.*)

STELLARIA BOREALIS, Bigel. var. COROLLINA, Fenzl.

S. borealis, Bigel. var. *alpestris,* Gray; Macoun Cat. Can. Plants, Vol. I., p. 74.

Dr. Robinson places the eastern limit o. this variety at Lake Superior. We have, however, specimens from Brackley Point, Prince Edward Island. (*John Macoun.*) Lake Mistassini, N.E.Ter. (*Jas. M. Macoun.*) The only western reference for this variety given by Prof. Macoun is Yale, B.C. Later collections show it to be a common plant in many parts of the Northwest and British Columbia, and especially abundant wherever collections have been made on Vancouver Island.

STELLARIA CRASSIFOLIA, Ehrh.

S. gracilis, Rich., Macoun Cat. Can. Plants, Vol. I, p. 75.

Pelly Banks, Lat. 61°, Yukon District. (*Dr. G. M. Dawson.*) Not before recorded west of the prairie region.

STELLARIA HUMIFUSA, Rottb., var. OBLONGIFOLIA, Fenzl.

Blinkinsop Bay, B.C., 1885. (*Dr. G. M. Dawson.*) Not before recorded from Canada. Referred to *S. uliginosa*, by Prof. Macoun, Cat. Can. Plants, Vol. I, p. 497.

STELLARIA OBTUSA, Engelm.

Near MacLeod's Lake, B.C. (*John Macoun.*) South Kootanie Pass, Rocky Mts. (*Dr. G. M. Dawson.*) The only Canadian stations.

ARENARIA CILIATA, Linn. var. HUMIFUSA, Hornem.

Cerastium trigynum, Macoun Cat. Can. Plants, Vol. I., p. 498 in part.

Stellaria humifusa, Macoun Cat. Can. Plants, Vol. I., p. 498 in part.

Mount Albert, Gaspé, Que. (*Allen. Porter.*) Lake Mistassini, N.E.Ter. (*Jas. M. Macoun.*) Specimens collected at Kicking Horse Lake, Rocky Mts., and on the summit of Mount Aylmer, Banff, Rocky Mts., alt. 8,300 feet, have been doubtfully referred here by Dr. Robinson.

ARENARIA CONGESTA, Nutt., var. SUBCONGESTA, Wats.

Gravelly banks, Lewis River, Lat. 62°, Yukon District. (*Dr. G. M. Dawson.*) Not before recorded west of Alberta.

ARENARIA SAJANENSIS, Willd.

A. arctica, Macoun, Cat. Can. Plants, Vol. I., p. 71.

A. biflora, Wats., var. *obtusa*, Wats.; Macoun, Cat. Can. Plants, Vol. I., pp. 71 and 496.

A. verna, Macoun, Cat. Can. Plants, Vol. I., p. 496 in part.

A. verna, var. *rubella*, Macoun, Cat. Can. Plants, Vol. I., p. 72 in part.

Mount Albert, Gaspé, Que. (*Porter. Macoun.*) These specimens were referred to *A. arctica* and *A. verna*, var. *rubella*, by Prof. Macoun. Cape Chudleigh, Hudson

Strait. (*Dr. R. Bell.*) Referred to *A. verna* by Prof. Macoun. Common on mountains throughout British Columbia.

According to Dr. Robinson *A. arctica*, Stev., is not found in British America.

ARENARIA STRICTA, Fenzl.

A. Michauxii, Hook., Macoun, Cat. Can. Plants., Vol. I., pp. 72 and 496.

Dr. Robinson makes Minnesota the western limit of this species. It is not uncommon in the Rocky Mts. near the line of the Canadian Pacific Railway, our specimens being from several stations in and near the National Park at Banff.

SAGINA OCCIDENTALIS, Wats.

Gordon Head and Cedar Hill, Vancouver Island. (*John Macoun.*)

SAGINA LINNÆA, Presl.

Mount Aylmer, Rocky Mts., alt. 8,300 ft.; Kicking Horse Lake, Rocky Mts., alt. 8,000 ft.; Roger's Pass, B.C.; between Sproat and Nelson, B.C.; Burrard Inlet, B.C.; Nanaimo, Vancouver Island. Herb No. 19. (*John Macoun.*) Summit of South Kootanie Pass, Rocky Mts.; Queen Charlotte Islands. (*Dr. G. M. Dawson.*) Mountains north of Griffin Lake, B.C.; Mount Queest, Shuswap Lake, B.C. (*Jas. M. Macoun.*)

S. CRASSICAULIS, Wats.

Gordon Head, Esquimault, and Goldstream, near Victoria, Vancouver Island; Comox and Nanaimo, Vancouver Island. (*John Macoun.*)

Note.—The references under these three species are in part in addition to those given by Prof. Macoun under *S. occidentalis* and *S. Linnæa*, Cat. Can. Plants, Vol. I., pp. 79 and 499, and the arrangement now given is intended to take the place of that in the catalogue.

HYPERICUM CANADENSE, Linn.

In sandy soil at Kamloops, B.C.; wet ground, Sproat Lake, Vancouver Island. (*John Macoun.*) Not before recorded west of Alberta.

MALVA PARVIFLORA, Linn.

M. borealis, Macoun, Cat. Vol. II., p. 313.

Specimens of this plant were collected on ballast heaps at Nanaimo, Vancouver Island in 1887, by Prof. Macoun, and called *M. borealis.* It was again found by him at the same place in 1893 (Herb. No. 46) and correctly determined by Prof. Greene.

MALVA ROTUNDIFOLIA, Linn.

Waste places at Beacon Hill, Vancouver Island, 1893. (*John Macoun*, Herb. No. 47.)

SIDALCEA MALVÆFLORA, Gray.

Common at Revelstoke. (*John Macoun.*) Not before recorded from interior of British Columbia.

MALVASTRUM COCCINEUM, Nutt.

On dry soil, 7 miles from the mouth of Deadman River, near Kamloops Lake, B.C. (*Jas. McEvoy.*) Not before recorded west of the prairie region.

LINUM LEWISII, Pursh.

A white-flowered procumbent form of this plant was collected in Lat. 56° on the west side of Hudson Bay, by Jas. M. Macoun, in 1886. No plants with blue flowers were seen.

GERANIUM ERIANTHUM, DC.

Alice Arm, Observatory Inlet, B.C,. July 7th, 1893. (*Jas. McEvoy.* Herb. No. 60.) Southern limit.

GERANIUM PUSILLUM, Linn.

Agassiz, B.C. (*Macoun.*) We have no other record of this plant between Ontario and the Pacific Coast.

GERANIUM RICHARDSONI, Fisch. & Mey.

In open woods at Botanie, near Spence's Bridge, B.C., Alt. 3,500 ft. (*Jas. M. Macoun.*) Not before recorded west of the Rocky Mountains.

LIMNATHES MACOUNII, Trelease.

First collected by Prof. Macoun at Victoria, Vancouver Island, in 1875. Found again by him in May, 1893, in abundance in ditches and swampy places near Victoria. No other stations for this species are known.

FLŒRKEA PROSERPINACOIDES, Willd.

Wet places near springs, Casselman, Ont., in flower, May 14th, 1891. (*John Macoun.*) Only record from Eastern Ontario.

OXALIS CORNICULATA, Linn.

On ballast heaps, Nanaimo, Vancouver Island, 1893. (*Macoun,* Herb. No. 54.) Only record from British Columbia.

OXALIS CORNICULATA, L., var. STRICTA, Sav.

In dampish spots near Indian Head, Assa., 1892. (*W. Spreadborough.*) Not before recorded west of the Red River.

IMPATIENS PALLIDA, Nutt.

Anstey Creek, Shuswap Lake, B.C., 1889. (*Jas. M. Macoun.*) Agassiz, B.C. (*John Macoun.*)

CEANOTHUS SANGUINEUS, Pursh.

Sicamous and Revelstoke, B.C., 1889. (*John Macoun.*) Eastern limit.

RHAMNUS PURSHIANA, DC.

In woods at Revelstoke, Columbia River, B.C. (*John Macoun.*) Eastern limit.

ACER SACCHARUM, Marshall.

A. saccharinum, Wang., Macoun Cat. Can. Plants, Vol. I, p. 99 in part.

A. saccharinum, Wang., var. *nigrum*, T. & G.; Macoun Cat. Can. Plants, Vol. I., p. 99.

Bark gray; internodes mostly slender and elongated, commonly glossy and reddish.; buds gray, conical, slender and acute: petioles, little dilated at base, not concealing the mature buds, without stipules; leaves, thin, typically large (usually 4 to 7 inches broad), flat, dull, usually light green above, the lower surface grayish, glabrous to pubescent, or exceptionally quite hirsute when young, isodiametric, truncate at base to slightly cordate with an open sinus, or broadly cuneate, rather deeply 5-lobed, except for some smaller 3-lobed leaves near the ends of the branches, with typically narrow sinuses, the three larger lobes with parallel sides or dilated upwardly and each with a slender apical acumination often sinuously bidentate on the sides, and two similar lateral acuminations, or the lateral lobes merely sinuate on the upper margin, the smaller outermost lobes mostly sinuously 1 to 2 toothed on the lower margin; fruit, large (6 to 10 mm.), the outer lines of the large wings (8 to 12 x 16 to 28 mm.), nearly parallel or spreading to something less than a right angle.

From Nova Scotia to Lake Superior.

ACER SACCHARUM, var. BARBATUM (Michx.), Trelease.

A. saccharinum, Wang.; Macoun, Cat. Can. Plants, Vol. I., p. 99, in part.

Bark, gray to almost black; internodes often shorter and stouter, commonly dull but reddish; buds gray, pubescent or dark, conical ovoid, often obtuse; petioles as in the last and without stipules; leaves firm, of medium size (usually about 4 in. broad), flat, somewhat glossy and of various shades of green above, pale or glaucous and downy to glabrous beneath, mostly broader than long, cordate with shallow open basal sinus to truncate, 3-lobed, with very open round sinuses (the upper margin of the lateral lobes often spreading nearly in a straight line), the lobes sinuously narrowed from the base to a single acumination, or the median line sometimes dilated by a pair of blunt shoulders, one or two similar dilations also on the lower margin of each lateral lobe, and exceptionally developed into short complementary lobes; fruit as in the last.

This tree ranges in the United States from Connecticut to Missouri and Michigan, and probably grows in many parts of Eastern Canada. Specimens intermediate between this variety and *A. saccharum* from Belleville, Ont. (*John Macoun*), and Niagara Falls, Ont. (*Jos. Schrenk*) have been referred here by Dr. Trelease. These are the only Canadian specimens of this variety in our herbarium.

ACER SACCHARUM, var. NIGRUM (Michx. f.), Britton.

Bark, nearly black; internodes, stout, sometimes short, dull, buff; buds, dark, ovoid, often obtuse; petioles dilated at base so as, usually, to cover the buds, with adnate triangular or oblong foliaceous stipules; leaves soft but of heavy texture, large (usually 5 to 6 in. broad), with drooping sides, dull and dark green above, clear green and usually persistently downy below, isodiametric, the larger deeply cordate with often closed sinus, 3 to 5-lobed, with shallow broad sinuses from which the lobes are undulately narrowed to an acute or acuminate point, rarely with short lateral acuminations; fruit, as in the last.

Ranges in the United States from New York to Missouri and Michigan, but not known certainly to occur in Canada, though frequently reported.

Note.—These descriptions of the several forms of Sugar Maples have been reprinted from Dr. Trelease's Monograph in 5th Annual Report of Missouri Botanical Garden, and space is given to them as they change very materially our knowledge of these trees, and by printing the descriptions in full it is hoped that Canadian botanists will be led to carefully observe the sugar maples in their vicinity.

RHUS GLABRA, Linn.

R. glabra, L., var. *occidentalis*, Torrey; Macoun, Cat. Can. Plants, Vol. I., p. 505.

Deer Park, Lower Arrow Lake, B.C.; Kamloops, B.C., and Spence's Bridge, B.C. (*John Macoun.*) Only references west of Ontario.

RHUS COPALLINA, Linn.

Rocky hillsides at Lansdowne, Ont. (*Rev. Chas. Young.*) Very rare in Canada.

LUPINUS ARCTICUS, Wats.

Additional stations for this species are Upper Liard River, Lat. 60°, Yukon District; forks of Stikine River, B.C. (*Dr. G. M. Dawson.*) Fifty miles below Lower Ramparts, Mackenzie River. (*R. S. McConnel.*) Fort Good Hope, Mackenzie River. (*Miss E. Taylor.*) Specimens collected at Medicine Hat in flower, May 31st, 1894, have been referred here by Dr. Robinson. (*John Macoun*, Herb. No. 4190.)

SAXIFRAGA TOLMÆI, Torr. & Gray.

On Mount Head, alt. 4,200 ft., Lat. 56° 05′, Long. 131° 09′, 1894. (*Otto Klotz* and *H. W. E. Canavan*, Herb. No. 4197.) First authentic record for Canada.

TILLÆA SIMPLEX, NUTT.

In mud in a mill pond at Mount Stewart, Prince Edward Island, 1888. (*John Macoun.*) New to Canada.

ŒNOTHERA MICRANTHA, Horn.

On ballast heaps at Nanaimo, Vancouver Island, 1893. (*John Macoun*, Herb. No. 249.) Introduced from the south. New to Canada.

PHACELIA HISPIDA, Gray.

On ballast heaps, Nanaimo, Vancouver Island, 1893. (*John Macoun*, Herb. No. 654.) Introduced from the south. New to Canada.

KRYNITZIA AMBIGUA, Gray.

On ballast heaps at Nanaimo, Vancouver Island, 1893. (*John Macoun*, Herb. No. 672.) Introduced from California. New to Canada.

AMSINCKIA BARBATA, Greene, Erythræa, Vol. II., No. 12. p. 192.

Stout and coarse, erect or decumbent, the branches loosely floriferous throughout, all excepting the uppermost pedicels subtended each by a broad ovate-lanceolate amplexicaul foliaceous bract; sepals 4 or 5 lines long, nearly linear, without rufous or fulvous pubescence, but densely white-hirsute along the margins, sparsely hispid with whitish bristles an the back; corolla small; nutlets ovate-acuminate, closely muricate-tuberculate, without transverse rugosities, but with an elevated and toothed dorsal ridge.

Collected at Cameron Lake, Vancouver Island, 15th July, 1887,. by John Macoun. Type specimen in the herbarium of the British Museum. Distributed by Prof. Macoun as *Amsinckia lycopsoides.*

ZANNICHELIA PALUSTRIS, Linn.

In the Spullamacheen River at Enderby, B.C., 1889. (*Jas. M. Macoun.*) Not before recorded west of the Saskatchewan.

NAIAS FLEXILIS, Rostk. & Schmidt.

Enderby, B.C., 1889. (*Jas. M. Macoun.*) Kamloops, B.C. (*Jas. McEvoy.*) Revelstoke, B.C. (*John Macoun.*) Not before recorded from interior of British Columbia.

ZOSTERA LATIFOLIA, Morong.

Z. marina, Macoun, Cat. Can. Plants, Vol. II., p. 90, in part.

Burrard Inlet, B.C.; Esquimalt, Vancouver Island, (*John Macoun.*)

PHYLLOSPADIX TORREYI, Wats.

Amongst rocks below half-tide, Stubb's Island, west coast of Vancouver Island, 1893. (*W. Spreadborough*, Herb. No. 4502.) New to Canada.

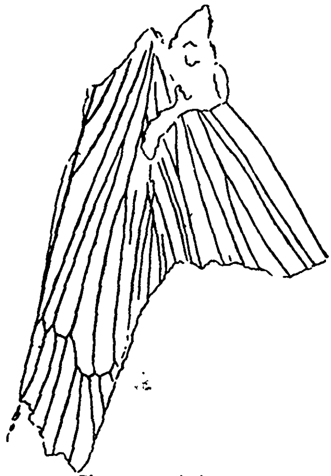
BECKMANNIA ERUCÆFORMIS, Host., var. UNIFLORA, Scrib.

Sea's Farm, near Victoria, Vancouver Island, 1893. (*John Macoun.*) Not before recorded west of the Rocky Mountains. Perhaps introduced.

A CADDIS-FLY FROM THE LEDA CLAYS OF THE VICINITY OF OTTAWA, CANADA.

By SAMUEL H. SCUDDER.

The few insects that have been hitherto found in the Leda clays or in similar horizons in America have all been Coleoptera. The present specimen, of which a figure is here given, enlarged six diameters, is a caddis-fly, one of the Neuroptera. It was found by Dr. Henry M. Ami, of the Geological Survey of Canada, in the nodules of Green's Creek, near Ottawa, and sent me for examination. It is of a glistening, dark, smoky brown color, with black veins which are followed with some difficulty, especially where two wings overlap. The clearest and most important part of the neuration is in the upper portion of the fore-wing; but unfortunately it exhibits in full only the principal cells. These are enough to show that it is a caddis-fly, and that it falls near, if not in the genus Phryganea proper, but it differs in important points from all the species I have examined in the Museum of Comparative Zoology at Cambridge, containing the large collection of the late Dr. Hagen. The differences consist principally in the great length of the thyridial area and of the median cellule, so that the distal termination of the lower cellules is much farther removed from the base of the wing than is that of the upper. It represents a tolerably large species, the preserved fragment being 10 mm. long, and the probable original length of the forewing at least 15 mm. It may be called *Phryganea ejecta.*



Phryganea ejecta, n. sp.

On the Norian or "Upper Laurentian" Formation of Canada.

By Frank D. Adams, M.A.Sc., Ph.D.

(Translated from the German by N. J. Giroux, Esq., C.E., of the Geological Survey of Canada.)—*Continued.*

The Structure of the Morin Anorthosite and a Comparison of the same with the Structure of Certain Rocks in other places.

If a large smooth weathered surface of anorthosite, as it is found in the "Roches Montonnées" throughout the Morin area, be examined, leaving out of consideration for

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the present the arm-like extension and that part of the main area adjacent to it, it will be noticed that the rock which is coarsely granular and of a deep violet colour, has not the regular structure which we find in a typical granite, but exhibits a more or less irregular structure. At times this is scarcely noticeable, but at other times it is very distinct, and is due to the fact that the bisilicates and iron ores are much more abundant in some parts of the rock than in others. The portions richer in bisilicates form either very large irregularly-bounded spots, which appear here and there, or a large number of small spots. In some cases they occur abundantly in the rock, while in others they are entirely wanting. The coloured portions are sometimes so arranged that instead of irregular spots they form undulating stripes, whose direction is sometimes sufficiently continuous to give a kind of strike to the rock. In other cases, however, they are irregular. Between these spots or stripes, which are comparatively rich in bisilicates, and badly defined against them lies the chief mass of the rock. It contains only very little and sometimes even no bisilicates, and in it there lie large broken crystals of plagioclase, often heaped up in certain places or especially numerous in certain directions. In intimate connection with this irregular distribution of the constituents of the rock, and sometimes also quite independent of it, there occur local variations in the size of grain which are likewise exhibited in spots or stripes. The accompanying drawing (see Fig. 1), made from a photograph, represents a weathered surface of a variety which is unusually rich in coloured ingredients. An irregular structure produced by one or

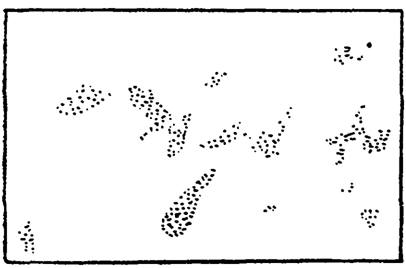

Fig. 1.

other of the above-mentioned causes is exhibited more or less distinctly by the rocks of all the anorthosite areas that have been investigated; but it is not confined to these, since it has been observed in many gabbros and basic plutonic rocks allied to them in districts widely separated from one another.

Dr. Geo. H. Williams, for example, says, in his treatise on "The Gabbros and Associated Hornblende Rocks occurring in the neighbourhood of Baltimore, Md.,"[1] on p. 25: "The most striking feature in the texture of the unaltered Gabbro is the repeated and abrupt change in the coarseness of the grain which is seen at some localities. It was undoubtedly caused by some irregularity in the cooling of the original magma from a molten state, for which it is now difficult to find a satisfactory explanation. The coarsest grained varieties of the Baltimore Gabbro occur in the neighbourhood of Wetherville, and there these sudden changes in texture are most apparent. Irregular patches of the coarsest kinds lie imbedded in those of the finest grained without any regard to order. In other cases a more or less pronounced banded structure is produced by an alternation of layers of different grains or by such as have one constituent developed more abundantly than the others. Such bands are not, however, parallel, but vary considerably in direction and show a tendency to merge into one another as though they had been produced by a motion in a liquid or plastic mass."

Similar and very coarse-grained portions are also found in the gabbro-diorite which is quarried at Kühlengrund, near Eberstadt, in Hessen, a rock which is otherwise quite massive and of an even texture. Other occurrences might easily be adduced.

The most remarkable example which I have observed, and especially notable for the reason that it shows the transition from a perfectly normal massive rock through

[1] G. H. Williams, Bulletin 28, U.S. Geol. Survey.

one showing those irregular coarse-grained patches to one with an imperfect banding like that observed in the Morin area, is found in the Saguenay anorthosite area along River Shipshaw, which, coming from the north, empties into the Saguenay about seven miles above Chicoutimi.

Along this stream many large smooth surfaces or "Roches Montonnées" of anorthosite are exposed which has been superficially etched by the atmospheric agencies and whose vegetable growth has completely been removed by forest fires, so that the structure of the rock is excellently displayed. This series of exposures is limited on the north by a colossal dyke of gabbro, nearly half-a-mile wide, and which cuts the anorthosite, enclosing fragments of it. The exposures can be studied for a distance of eight miles in a straight line down the Shipshaw River to a point which is three miles distant from its mouth in the Saguenay.

At first the rock is coarsely granular, and over the whole extent of the large exposures is quite massive and of uniform composition. It is exposed thus for about half-a-mile, and then spots or patches, which must be designated as very coarse-grained, commence to appear. In these coarse-grained portions the individual grains are an inch or more in size, while they are much smaller in the rest of the rock. Both show a very distinct ophitic or diabase structure, that is to say, the plagioclase occur in lath-shaped forms whose interstices are filled up with augite. The structure continues for four miles, with, in places, an additional irregularity caused by local variations in the relative proportion of certain of the constituents. There are, for example, considerable exposures where the rock consists entirely of plagioclase, while in other places much diallage is present in masses as much as 1½ foot in diameter. Large masses of almost pure plagioclase or diallage also occur in places in the normal rock.

After an interval of one mile, where outcrops are wanting, we come to another set of exposures extending over one mile, with well-developed ophitic structure, as before, except that the rock is irregularly striped or banded. This results from the fact that the above-described irregularities in grain and composition are no longer exhibited in spots, but in long undulating stripes, into which the former are drawn out, as described by G. H. Williams, in the passage quoted on page . Farther down stream these stripes assume by degrees an almost parallel position, so that the rock exhibits a distinct strike, while at the same time the ophitic structure gradually disappears. Here then is a case where a rock of undoubted eruptive origin perfectly massive and with a well-developed ophitic structure gradually changes into a striped rock, the banded structure being produced by variations, not only in size of the grains, but in the relative proportion of the constituents.

This coarse banding, which is a common structure in many parts of certain anorthosite areas, was formerly considered as an indication of imperfect bedding. But from the above-mentioned facts, it is evident that it was probably produced by movements in a granular, eruptive rock.

The next question which presents itself is, whether this structure originated in a movement before the rock was completely crystallized, or whether it was developed after consolidation. In the exposure above described, facts were found, by repeated and careful study in the field, which point to a movement while the rock was in a molten state. The irregularity in the size of the grains is of primary origin, and was certainly not produced by pressure. The stripes or irregular bands do not assume a definite direction from the start, but wind about at first as if the mass had moved when in a pasty condition, and only became more evenly arranged when, for some reason, the movement was determined in a definite direction.

This is the most probable explanation of the facts, and is furthermore supported by the absence of lines of motion or fracture, and as far as can be ascertained by a careful microscopic investigation, also by the absence of those minerals which are generally found along such lines in rocks that have been squeezed. No clear proof of any dynamic action is observable.

We find, moreover, elsewhere, similar striped and banded structures in certain basic intrusive masses which certainly have not been affected by pressure. The theralite from Mount Royal, at the foot of which lies the city of Montreal, is an example of this. This theralite breaks here through the flat-lying silurian limestone of the Trenton age, and probably forms the nucleus of an old palaeozoic volcano.

Although it cannot be maintained that the striped and irregular banded structure which is so often found in various basic rocks is never produced by dynamic action, it may yet be shown that it often results from movements in the mass before consolidation. It is probable that the structure usually originates in this way; but cases are rare where the conclusion that the structure results from dynamic action is quite excluded. It may be here also remarked that no satisfactory reason can be assigned for the sudden alterations in the size of grain which we so often observe in gabbros and allied rocks. This can hardly be accounted for by irregular cooling, as the temperature must have been practically the same in adjacent parts of the magma. The cause may perhaps be looked for in the great abundance of moisture in certain places. If such be the case, however, we must reject the theory so frequently held that the presence of "agents mineralisateurs" exerts a slighter influence in the crystalline development of basic magmas than on that of the acid ones in which such an alteration in the size of the grain does not usually occur to such an extent.

In carefully examining the anorthosite rocks of the Morin area we usually, if not invariably, observe in con-

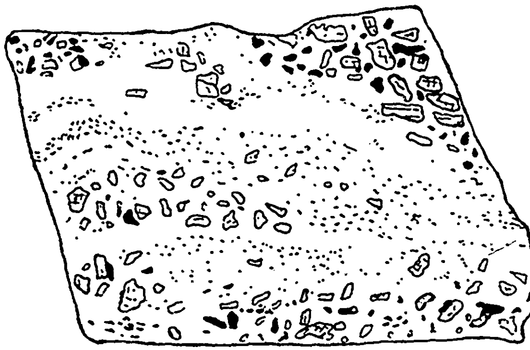

Fig. 2.

nection with the striped and irregularly banded structure a peculiar fracturing or granulation in the constituents of the rock. This structure is frequently very well exhibited on large weathered surfaces. The accompanying sketch (Fig 2) of an exposure near the village of St. Marguerite shows this phenomenon. The banding is still distinct, but in nearly every part of the area the rock itself, even where no striping is visible, presents this peculiar brecciated structure. Fragments of plagioclase, and ot her constituents lie in a kind of ground mass, which consists of smaller grains. The apparently porphyritic elements

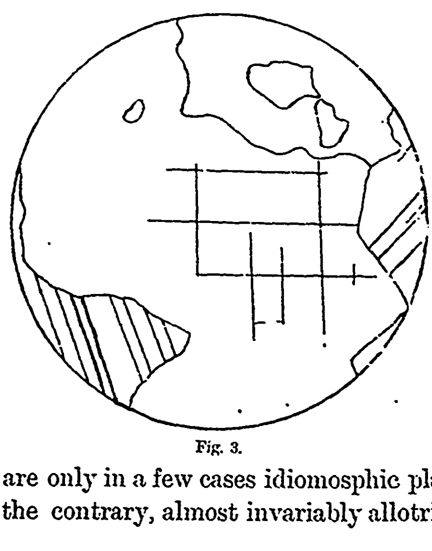

Fig. 3.

are only in a few cases idiomosphic plagioclases, but are, on the contrary, almost invariably allotriomorphic fragments of this mineral. In some places these fragments of crystals make up the greater part of the rock, while elsewhere they are very rare. The larger individuals can often be observed in the very act of breaking up, in which case the fragments are but very little separated from one another. In a microscopical investigation we hardly find a hand-specimen of a coarse granular variety which does not show to a certain degree the clastic structure, and in studying a large number of hand-specimens, we can follow step by step the transition from a rock which exhibits no cataclastic structure to one which consists almost entirely of broken grains in which there remain scarcely any traces of the original individuals.

Fig. 4

Fig. 5.

Figures 3, 4 and 5 are made from microscopical photographs of sections which were taken from three different places in the area; they show the progress of the granulation as seen under the microscope.

A very remarkable fact which was mentioned in speaking of the composition of these anorthosites is that the large fragments of crystals have a deep violet colour, while the broken material is white. The contrast is observed with especial distinctness on a weathered surface or in a thin section under the microscope. The difference of the colour is due to the fact that the small inclusions which abound in the large plagioclase individuals are wanting in the granulated portion of the rock. They have evidently gathered themselves together into small masses of titanic iron ore, which are enclosed in the broken plagioclase, but are not found in the large individuals. The contrast of these colours is so marked that in a section containing plagioclase in both conditions, we can predict at once under the microscope, from the colour exhibited, how much of it is in a granulated condition and how much is not, even before the structure has been actually brought out by means of polarized light.

This seems at first sight to point to a complete recrystallization of the granulated parts, but there are no facts which make this probable. The feldspar does not change its composition. In many sections we can actually observe the origin of the fine grained material from the outer portion of the larger individuals. This process begins in an irregular extinction of a part of the periphery, which is followed by the breaking off of the fragments. It is also observed that so soon as a fragment is separated from the larger mass it becomes colourless. It would seem then, that the granulation in some way or another gives free scope to the agent by which the accumulation of the material of the small inclusions into the larger masses is brought about. This question we shall consider again in considering the anorthosites of the Saguenay River.

Wherever we find an anorthosite, as in a portion of the Morin area, which is composed entirely of finely granular material, it can hardly be distinguished by its appearance from white granular limestone, if, as is generally the case, it is almost pure plagioclase.

The peculiar white granular variety of the anorthosite with comparatively few large individuals, forms in the Morin area, the greater part of the above mentioned arm-like extension at its south-east corner. In this the anorthosite protrudes from the drift in every direction in hundreds of smooth white bosses, which give a very peculiar appearance to the country. It is also met with and largely developed in the Saguenay area and other anorthosite areas in the Province of Quebec. It was furthermore described by Dr. Albert Leeds[1] as occurring in the county of Essex, New York; by Vogelsang[2] in Labrador, as well as by other observers, and may therefore be considered as being present to a certain extent in most of the areas of this kind of rock. In the Morin anorthosite area (and the same applies to the Saguenay area), we find the most granular varieties near the sides and especially on the east side, as if the pressure had been exerted from that direction. In the arm-like extension of the Morin area, this fine granular variety is quite clearly seen. and since the district is easily accessible by roads and pathways, its structure and other characters may be studied with comparative ease. This arm has an average breadth of nearly six miles, and is of a nearly equal width throughout. At the southern end, before it is covered by the unconformable Cambrian beds, it becomes a little broader, owing to the fact that it has been split longitudinally by a wedge of gneiss. As has been already mentioned, it runs into the gneiss parallel to the stratification or foliation of the latter, so that it appears here as if it formed an instratified layer.

The white granular anorthosite, moreover, is in this off-

1 A. Leeds, Notes upon the Lithology of the Adirondacks. 13th Annual Report of the New York State Museum of Nat. Hist., 1876.

2 Vogelsang, Sur la Labradorite coloriée de la Côté du Labrador, Archives Néerlandaises III, 1868.

shoot everywhere more or less distinctly foliated, as the bisilicates and the iron ores are arranged in more or less distinct parallel streaks or strings (Figs. 6 and 7). The latter are evidently nothing else than the rounded spots rich in bisilicates which are shown in fig. 1, which, however, are drawn out by a movement in the rock. The fragments of plagioclase and the portions of the rock, distinguished by the difference in their size of grain, are likewise arranged in the same direction. We most clearly see this foliation where the bisilicate and iron ores are comparatively abundant. In places where these ingredients are wanting, as is often the case, and where the rock presents an almost even size of grain, it resembles a white marble and no traces of foliature can be seen even in a weathered surface. In general, however, the foliation is quite distinct, and runs parallel to the longer direction of the arm, that is to say, to the strike of the gneiss. Like the gneiss itself, the apophysis dips towards the west and is therefore overlain on the west side by the gneiss, but the angle of the dip is very different in different places. In some places it is almost horizontal, in others it dips at high angle. Along the western limit of the arm the strike is very regular and uncommonly well developed. It is well seen near New Glasgow, but it

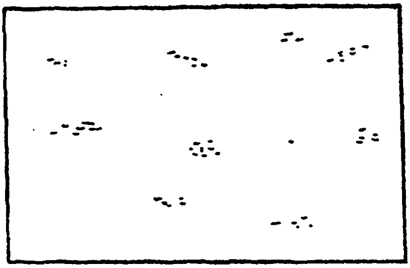

Fig. 6.

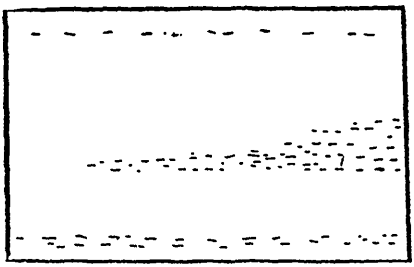

Fig 7

is especially distinct at the same contact a little further to the north on the road between the villages of Chertsey and Rawdon. The rock here shows in an exposure of considerable size, a very fine foliated structure due to an alternation of thin bands of pure plagioclase with others of pyroxene. The pyroxene layers might better be denominated leaves, since they are very thin and appear in cross sections often as mere parallel lines. The latter, as well as the plagioclase layers, frequently show in thin sections under the microscope, grains or fragments of large individuals, with tails of small broken granules, which extend in both directions from them, producing the foliated structure. This progress of granulation can be seen with astonishing distinctness; for, as just mentioned, the large crystals can be observed in the very act of breaking up. In doing so, they often break along certain lines, in which the broken material is arranged. It can furthermore be observed quite frequently that these grains are the remnants of very large fragments which were broken apart almost exactly in the direction of the foliation. They are thus often very narrow but of considerable length. It even happens sometimes that such fragments are twelve times as long as they are wide.

At the upper end of the arm, where it passes into the main area, the foliation becomes much less distinct, and the rock gradually assumes the finely brecciated, irregular streaked structure whose character and origin have been already referred to. When the main area is finally reached, definite strike ceases, except in a few places quite near the limits.

A cataclastic structure which is similar in many respects to that which we have described, and in which the grains of plagioclase are twisted and broken, and likewise exhibit the granulation on their periphery, is found in some of the distinctly striped hand-specimens of the theralite of Mount Royal as above mentioned. We must here consider them as the result of a movement which took place before complete consolidation, and as an example of what Brögger[1] designates as "protoclastic structure." It is here, however, found only locally, and is not noticeable in many sections of the rock. Yet its occurrence is of interest for the reason that it proves that its mere existence is not always an infallible sign that the rock has been exposed to great pressure, and has been crushed.

Although in the anorthosite this granulation, with its accompanying phenomena, are without doubt caused by the pressure to which the rock had been subjected, the effects of this pressure are quite different from those generally observed.

In a foliated structure caused by shearing, as Lehmamm and others have so excellently shown, in many instances the breaking takes place along certain lines. Along these lines or stripes, which sometimes are quite wide, and at others quite microscopical in size, the rock is finely broken up, so that it forms what Heim calls "Rutschmehl" in cases where it has not again become thoroughly compacted. Between these shearing planes we often find comparatively few indications of pressure. Especially along the lines of movement, and when these are absent, through the whole rock, in places where extensive dynamic effects have occurred, certain peculiar alterations in the constituents of the rock are observed.

Of these the following deserve special mention:—The alteration of the pyroxene into hornblende and of the plagioclase into a mixture of zoisite, albite, and other minerals, which is known under the name of saussurite. As far as could be ascertained no undoubted case has as yet been observed among the crushed gabbros and associated rocks where uralite and saussurite have not been found.

[1] Brögger, die Mineralien der Syenitpegmatitgänge der südnorwigischen Augit und Hephelin--Syenite. Zeitschr, für Kr. Bd., 16, 1890, p. 105.

These Canadian anorthosites, on the contrary, show with the cataclastic structure the following peculiarities:—

1. This structure occurs not along definite lines, but throughout the rock.

2. Where it occurs there is neither saussurite nor uralite. However granular the plagioclase may be, no trace of saussurite can be seen. In like manner, no uralite is detected, even though the granulation of the pyroxene is so far advanced that only the smallest remnants of the original individuals remain. Now and then some small grains of compact hornblende occur with the pyroxene in the neighbourhood of the contact with the gneiss, exactly as in many normal gabbros. But even these are by no means invariably present; the finely foliated rock, consisting of alternate layers of unaltered pyroxene and plagioclase, while remnants of the large individuals of both are constituents, from which the granulated portion has originated are still seen. The only place in which saussurite occurs is, as above mentioned, near New Glasgow. It forms here, like epidote, strings and veins, which have no relation with the foliation of the rocks, but represent small crushed zones, which have originated at another much later period. These very occurrences show most distinctly how different the products of the normal dynamic agencies are from the structure now under consideration.

3. In the main portion of the area, the granulation is not accompanied by foliation, and we can observe in the large weathered surfaces, plagioclase individuals which are in the act of breaking in every possible direction. It is evident, therefore, that they were not acted upon by forces, such as would result from movements in a mass of a more or less pasty consistency. In the arm-like extension from the south-east part of the area where the rock, as already mentioned, is often distinctly foliated, this foliated structure originated, as shown by a careful study,

from the movement in one direction of a mass, whose colored ingredients are irregularly distributed, and especially concentrated in some places (see fig. 1). The more or less rounded spots where the colored ingredients are abundant, became pulled out into irregular, ill-defined streaks, and parallel to these run portions of the rock, which still contain large numbers of the fragments of plagioclase crystals.

The most probable explanation of these phenomena is that the movements were caused by pressure.

1. When the rock was still so far beneath the surface of the earth, and so weighted down by the overlying beds that breaking and shearing with the movement of the resulting masses was impossible. The alterations in the character of the mass were probably induced very slowly, the constituents were granulated, and the small broken parts moved one over another. This granulation progressed with the duration and intensity of this movement to a certain point. Such a motion would present certain resemblances to that of a very tough pasty mass.

2. While the rock was still very hot and perhaps even near its melting point. This would explain why pyroxene, which, according to the experiments of Fouqué and Michel-Lévy, represents the stable form of the molecule at a high temperature, is not easily changed into amphibole, which represents the more stable form at a low temperature, as is usually the case in crushed and pulverized rocks. It is perhaps owing to the same cause that no saussurite is formed; still, the conditions necessary to the formation of these minerals are so little known that opinions on this point cannot be ventured upon as yet.

The Anorthosite Beds Interstratified with the Gneiss and Alternating with it.

We find in many places in the neighbourhood of the Morin area, as was already mentioned, anorthosite bands alternating with the gneiss. Their width varies from one to several hundred yards, and their length from one-half to eight English miles. Some of the larger bands are represented on the accompanying map. The character of the anorthosite varies somewhat in the different bands, but on the whole it resembles that of the Morin area. In general these bands are sharply defined against the gneiss, with the exception of that near St. Jérôme, where the surrounding anorthosite appears to gradually pass into the gneiss. As distinguished from that of the main mass, the anorthosite of these bands often contains more or less hornblende, biotite and garnet. In one place scapolite also appears in considerable quantity, probably as a product of the alteration of plagioclase, as in the case of the well known spotted gabbros of Norway. These anorthosite bands, moreover, present a more or less distinct arrangement of the constituents in the direction of their long axis.

Under the microscope the above described granulation of the constituents is seen excellently developed. Together with these anorthosite bands which have the character and the appearance of eruptive rocks, we find in many places in the Laurentian gneiss, particularly on the east side of the Morin mass, interstratified layers of a dark pyroxene gneiss which gradually passes into the ordinary gneisses. These have quite a different appearance from anorthosite, being much richer in coloured constituents. They contain augite, hypersthene and plagioclase in quantity, very often biotite, hornblende, a little quartz, and considerable quantities of an untwinned feldspar which probably consists mostly of orthoclase. We also meet these so-called "basic gneisses" in many other widely separated districts of the Laurentian, but neither these nor the anorthosite bands have been as yet thoroughly examined from a mineralogical standpoint. In a report on the district to be published before long by the Geological Survey of Canada they will be more fully discussed.

RESUMÉ OF THE RESULTS OBTAINED FROM A STUDY OF THE MORIN AREA.

The Morin area is a large eruptive mass of anorthosite, that is to say, of a gabbro very rich in plagioclase. This breaks through Laurentian rocks, and cutting off the different members of the formation. It contains inclusions of gneiss, sends out off-shoots into the gneiss, and is surrounded in many places by a zone, which exhibits many characteristics of a contact zone. The mass shows in many places an irregular arrangement of the ingredients and often variations in the size of grain, a peculiarity often noticed in allied plutonic rocks. It exhibits, moreover, a peculiar and unusual kind of cataclastic structure, which, where it occurs in a very marked manner, induces a schistosity in the rocks. This structure is caused by pressure, acting under peculiar conditions. This schistosity is by no means a proof of an original sedementary origin, and it is likewise evident that all other arguments for the existence of a large independent sedementary complex of which the anorthosite is supposed to form part, are inconclusive. The gneisses and the limestone with which it is said to alternate really belong to the Grenville series. and the apparent interstratification of the anorthosite is the result of intrusion. The anorthosite, moreover, is unconformably overlaid by flat lying unaltered beds of Cambrian age (Potsdam and Calciferous) and, like the Laurentian rocks through which it cuts, must have already possessed the characters which it now exhibits in Cambrian times.

III.—THE SAGUENAY AREA.

As far as we now know, the largest area of anorthosite rocks is the one situated about the region of Lake St. John, where the Saguenay river has its source. This river, which is famous for the remarkable character of its scenery, flows throughout its whole course in a deep gorge in Laurentian rocks, and empties into the St. Lawrence River about 120 miles below the city of Quebec. The southern limit of the anorthosite in question is about 100 miles north of that city. It embraces an area of not less than 5,800 square miles, and is almost completely covered with forest, being one of the wildest districts of the Dominian of Canada. The southern corner of the area is level and inhabited. Here the rocks have there been carefully investigated, whilst towards the north explorations were made only on the three rivers Peribonka, Little Peribonka, and Shipshaw, which run parallel to the longitudinal direction of the area, one on each side of it, and one through the centre. The rocks have been traced along these rivers considerably more than 100 miles north of the southern limits of the area. The Peribonka was explored to its forks, while the Shipshaw and Little Peribonka were followed up through the rough mountainous country to their sources without reaching the northern limit of the anorthosite area. Mr. Low, however, found no more anorthosite on his exploratory trip to Lake Mistassini, during which he crossed[1] the head waters of the Peribonka and examined the district directly to the north of the one investigated by myself. But he did find some on the Betsiamites and afterwards on Rat River, a tributary of the Mistassini. We therefore know within narrow limits the course of its northern boundary. The Shipshaw and the Little Peribonka, which flow respectively on the east and west side of the area, are several times crossed by the contact of the anorthosite with the gneiss; they consequently mark the breadth of the former. We thus possess a good general knowledge of the extension of the area. The only previous geological examination of the district was that made by Richardson, which was cursory and confined to

[1] Low, on the Mistassini Expedition. Report of the Geological Survey of Canada, 1885, D.

the southern part of the area. The results were published in the Report of the Geological Survey of Canada for the year 1857. Abbé Laflamme likewise gives a brief description of a few exposures in the Geological Survey Report for 1884. Richardson gives a general description of the anorthosite of the southern part of the area, but his statements concerning the western limit as well as his estimate concerning its extension towards the north are erroneous. He, however, pointed out in his work the resemblance of the character of these rocks to those of other parts of Canada, and thus increased by one the number of such areas already known in other parts of the Laurentian.

The anorthorsite of this "Saguenay area," as we shall call it, consists, like that of the Morin area, of a basic plagioclase. The latter is sometimes labradorite, sometimes bytonite. Augite, hypersthene, and at times also hornblende and biotite are other constituents; they are in every respect identical with the corresponding minerals of the Morin area, and therefore require no special description. The rock is of medium grain, but the coarseness of grain varies considerably and often quite abruptly from place to place. The crystals of the coarse granular varieties frequently increase in size till the plagioclase individuals reach a foot or more in diameter.

A difference between this anorthosite and that from the Morin area consists in the fact that the former often contains olivine. This mineral occurs often in considerable quantity, so that there results a plagioclase-olivine rock or Troctolite, in which all other iron-magnesia compounds are wanting, with the exception of those forming the zones of corrosion at the contact of the olivine with the plagioclase. These zones, which occur so frequently in the gabbro, have nowhere else been observed in a more perfect development. Even in the field, an orange weathering constituent invariably surrounded by a narrow green rim was frequently observed. Having prepared thin sections and examined more carefully the nature of these zones, attention was drawn to them in a short paper.[1] They have also been studied by a number of other investigators.[2] The examination of a large number of additional hand-specimens from this area has, however, brought to light many additional facts concerning this remarkable phenomenon.

The most massive variety of anorthosite in the whole area is found on the east shore of Lake St. John, one to two miles south of the head of the Saguenay River, where it forms large exposures.

Although the same irregularity in the size of grain as well as in the proportion of the constituents, which so often presents itself in gabbros and other basic rocks, appears in many places, yet nothing like banding in the rocks could be discovered. Distinct sets of cracks cutting the anorthosite cause it to split up into small cubic blocks, as in the case with granite and other plutonic rocks.

On the examination of thin sections under the microscope, olivine and feldspar are seen with the above-mentioned zones around the former. Some small grains of horneblende, ilmenite and pyrite are likewise generally present. Like the olivine, the plagioclase is quite fresh and contains no products of decomposition. It has a specific gravity of 2.70 to 2.71. The maximum extinction was determined in many thin sections and showed 32½° on either side of the twinning line. The mineral is, therefore, bytonite. It is almost black, being filled with the

[1] Adams, Notes on zones of certain silicates occurring about the olivine in anorthosite from the Saguenay District—Am. Nat., Nov., 1885.

[2] J. G. Bonney, Troktolite in Aberdeenshire—Geol. Mag., Oct., 1885. J. H. Hatch, Notes on the Petrographical characters of some rocks collected in Madagascar, Q.J.G.S., May, 1889. J. W. Judd, Chemical Changes in Rocks under Mechanical Stresses.—Journ. Chem. Soc., London, May, 1890. A. E. Törnebohm, Uber die wichtigeren Gabbro- und Diabas-Gesteine Schwedens. Neues Jahrb. für Min, etc., 1877, 383. G. H. Williams, Peridotites of the Cortlandt Series.—Am. Jour. of Sc., Jan, 1886.

minute inclusions above described. While one can observe the cataclastic structure in the anorthosite in other parts of the area, here there is scarcely a sign of pressure. Broken individuals were never observed, and the feldspar showed only in a few sections an occasional irregular extinction. In most of the sections no trace of pressure is discoverable. It is, moreover, 12 miles from the nearest contact with the surrounding gneiss. The zones around the olivine are very wide and perfectly developed. The olivine seldom shows approximate crystal forms; it either occurs in single individuals or in aggregates, which in that case, form larger grains. A single individual forms at times a very irregular elongated strip. The olivine crystallized before the plagioclase and became enclosed in the latter. Notwithstanding that a considerable number of thin sections were examined, the two minerals were never found directly in contact, every grain of olivine being invariably completely surrounded by a double zone of other silicates and thereby separated from the plagioclase.

The first zone around the olivine is colourless, or nearly so, but often shows a weak pleochroism in green and red colours. It is formed of many small individuals which are closely grown together, and are elongated in a direction at right angle to the surface of the olivine. It often shows the two sets of cleavages crossing at right angles, which are characteristic of pyroxene, and in sections, perpendicular to an optic axis, the revolving bar of a biaxial crystal is seen.

The individuals being so small and the cleavage is very imperfect, it is very dificult to determine accurately the character of this pyroxene. Similar zones, however, are found in hand-specimens from other parts of the area in which the crystals of the inner zone are developed on a larger scale. In these the parallel extinction, trichroism of red, green and yellowish colours, and also the other optical properties point to a rhombic pyroxene, which mineral occurs in the anorthosites of this as well as in those of other areas.

The outer zone, that is to say, the one bordering on the plagioclase, consists of a bright green actinolite in very thin needle-shaped crystals, which form a rim around the pyroxene, from which they project in a radiating manner into the feldspar. This zone is considerably wider than the pyroxene zone, and the actinolite individuals always stand perpendicular to the surface of the latter. The mineral is frequently more massive near the pyroxene than it is farther away from it.

In a hand specimen from the north shore of Lake Kenogami the hornblende of the outer zone is full of small inclusions of spinel. These have a dark green colour, are isotropic, have a high index of refraction and no cleavage. They occur mostly in portions of the horneblende zone nearest the pyroxene. We find them at times in the form of grains, but generally in peculiarly bent sheaf-like forms, resembling the quartz in fine-grained pegmatites or granophyres. These are arranged within the horneblende crystals or between them in a direction perpendicular to the surface of the inner pyroxene zone. This spinel often occurs in the horneblende in lines parallel to the surfaces of the prisms, while some small individuals fork in such a manner that they run parallel to the two prismatic cleavages. A quite similar case was described by Lacroix as occurring in the olivine-norite of the Heias mine near Tredestrande, in Norway.[1] In this rock the olivine is surrounded by a double zone, the inner one consisting of hypersthene and the outer one of amphibole, in which occur scattered grains of green spinel, which frequently give rise to a kind of pegmatitic (granophyric) structure. According to Becke[2] the kelyphite which

[1] Lacroix, Contributions à l'étude des Gneiss a Pyroxene et des Roches à Wernerite. Bull. soc. min. Fr., Avril, 1880, p. 149.

[2] F. Becke, Min. u. Pet. Mitth., VII., p. 250.

forms similar zones around the garnet of some peridotites consists likewise of a mixture of spinel and amphibole.

The olivine and the minerals which form the zones around it are quite differently orientated; the width of the zones, as we observe them in the thin sections, has no definite relation to the size of the grains of olivine, especially as it varies greatly with the direction in which the crystal is cut. The zones have apparently originated from the interaction of the molecules of silicate of lime of the plagioclase and of the basic silicate of magnesia and iron of the olivine, giving rise to silicates of intermediate composition, that next to the olivine being a more acid silicate of magnesia and iron, which is followed, nearer to the plagioclase, by an acid silicate of lime and magnesia. The edges of the original grains of olivine are evidently the sharp lines which separate the rhombic pyroxene from the hornblende, and the latter undoubtedly penetrates the plagioclase. On the other hand one can often observe the augite starting from this line and growing into the olivine, especially where the olivine remaining has the form of a narrow wedge-like grain which runs out into a line, on either side of which can be found the pyroxene individuals.

The opinion has been expressed that these zones were produced by dynamic forces which have acted upon the rock. This may be so elsewhere, but here there are no facts which favor this view.

They are well developed, even in places where the rock, as above mentioned, is quite massive, and there are no facts observed which point to dynamic action. They are found just as well developed in other parts of the anorthosite area, which likewise show no trace of dynamic action. They certainly occur in some localities in the district under consideration accompanied by a cataclastic structure, but this must necessarily be the case if the zones existed before the development of the structure. A single case of their occurrence unaccompanied by phenomena of pressure has more weight than a hundred where distinct signs of pressure are found, since the latter may have been developed subsequently; nor can they be considered as contact phenomena, since they are found everywhere about the olivine wherever the latter occurs in the rock. The occurrence above described is, for example, as already mentioned, 12 miles distant from the nearest contact with the gneiss. Lacroix has also pointed out this phenomenon in some French olivine gabbros which he investigated. It would seem therefore, that their origin is to be referred to the influence of the plagioclase magma upon the olivine before complete solidification. The so-called opacite rims which occur about the hornablende and biotite in so many eruptive rocks are evidently phenomena of a somewhat analagous nature.

In many places in this anorthosite area ilmenite deposits were found, some of them of considerable extent. The largest of these is on the north shore of the Saguenay and about 15 miles in a straight line from Lake St. John, where it forms a series of low hills. The ore contains also olivine and plagioclase irregularly distributed through it, and forms three irregular, bands, which are intimately associated with a rock resembling diabase. The most easterly of these three iron ore bands has a width of not less than 80 paces. Judging from its mode of occurrence and composition this iron ore is in all probability of igneous origin, as in the case of the iron ore of the Morin area, which has been already described, the well known ores of Taberg in Sweden, as well as those of Cumberland, Rhode Island.[1]

We here find again all the structural varieties that were described in the discussion of the Morin area, namely: The massive rocks with a uniform size of grain, the massive rocks with variations in the size of grain

1 M. E. Wadsworth, Bull., Mus. Comp. Zool., Harvard, May, 1881.

from place to place, the brecciated variety with a white granular ground mass in which are enclosed irregularly shaped fragments of dark blue plagioclase with some streaks of pyroxene, but without distinct banding, and more rarely, the streaked and distinctly banded varieties. All these occur and pass into one another. The perfectly banded and schistose varieties occur, indeed, only exceptionally, yet one can observe indications of banded structure in most places if large exposures are examined. The more granular varieties occur principally on the east side, exactly as in the Morin area. On Lake Kenogami, at the south-east corner of the area, cliffs of the granular white anorthosite occur which attain a height of 400 feet or more, and which, through the entire absence of pyroxene and iron ore, appear like great cliffs of marble.

It must here be observed that during the process of granulation by which the large plagioclase individuals were crushed into the granular ground mass, no alteration took place in the chemical composition of the mineral. The material acquired a much lighter colour through the loss of the inclusions, but the composition of the feldspar was not changed. This is evident from the fact that the difference in the specific gravity of the two feldspars, which was determined in the anorthosite of Mount Williams, on the Shipshaw River, near the eastern limit of the area, amounted only to 0.015. The large dark-coloured fragments of crystals were naturally a little heavier on account of the numerous dark inclusions which they contain. Both feldspars were labradorites.

The same fact was established still more clearly by analyses made by Sterry Hunt of both crystals and the ground mass of another anorthosite from the Chateau Richer area. These will be given in the table at the conclusion of this paper, under Nos. I., II. and III. It will be observed that the composition and the specific gravity of the two are identical. Leeds showed the same to be true in an anorthosite of Essex county, New York, and Sachsse[1] in a "Flaser-gabbro" from Rosswein, in Saxony, but the material analysed in these two cases was not quite pure.

The gneiss which immediately surrounds the area has a uniform character, and contains no crystalline limestone as in the Morin area. It has, in fact, an older appearance, and Logan would probably have classed it with the the lower or fundamental gneiss of the Ottawa division. This gneiss has, irrespective of local deviations, a strike of N. 20° to 60° E. Along the southern limit of the area it strikes directly towards the anorthosite and is cut through or overlaid by the latter. The line of contact of the anorthosite with the gneiss forms a series of large curves, which are interrupted at times by straight lines. The latter most probably indicate faults. On the east and west sides of the area the line of contact crosses several times the Little Peribonka and the Shipshaw respectively, so that it repeatedly cuts the direction of the strike of the gneiss. What deserves notice is the fact that when the anorthosite (which is mostly massive and has for that reason no strike) shows any indication of streaked or foliated structure (and examples of this structure are clearly exhibited on the east side of the area where the granular anorthosite is principally found with broken fragments of plagioclase) this is identical in direction with the strike of the gneiss, and is not affected by the intersecting line of contact. This is no longer true, however, in the central portion of the area, through which the Peribonka flows, in the northern portion of its course, often between cliffs 1,000 feet high. Wherever the anorthosite exhibits a strike in this part of the area, a thing which only exceptionally occurs, this differs from that of the gneiss as well as from that of the anorthosite on either side, being N.

1 R. Sachsse, Uber den Feldspathgemengtheil des Flasergabbros von Rosswein.—Ber. d. naturf., Ges. in Leipzig, 1883.

40° to 80° W., and on the upper part of the Peribonka, N. 10° to 20° W. The fact that the strike of the gneiss and that of the anorthosite near the limit of the area coincide, notwithstanding that it is crossed several times by the line of contact, can easily be explained as caused on the east and the west side by a series of cross faults, if it be assumed that the foliation of the anorthosite here originally coincided with the direction of the boundary. It is almost certain that such faults exist. The condition of things, however, at the southern boundary where the contact may be more accurately investigated, but where, unfortunately, the foliation of the anorthosite and of the gneiss is mostly very indistinct, rather points to the fact that this conformity is the result of a pressure, which was exerted upon the anorthosite in a direction almost at right angles to the ordinary strike of the gneiss. The greater predominance of the granulation on the east side of the area suggests that the pressure came from that direction. The less definite indications of foliation or streaked structure which were observed here and there in the usually massive anorthosite of the interior of the area, and which do not coincide in direction with that of the gneiss and anorthosite about the edge of the area, probably belong to the original structure, due to movements in the magma before consolidation. This view is supported by a series of larger exposures of anorthosite at the east end of Lake Tschitogama. The rock there is distinctly striped, bands of plagioclase almost free from bisilicates alternating with others in which the latter are quite abundant. The bisilicates are disposed in elongated masses or in short dashes which are parallel to one another, but have a different direction from that of the

Fig 8

bands, generally forming with the latter an angle of about 60° (see fig. 8). In another place nearly a quarter of a mile distant, the banding was horizontal and the foliation of the bisilicates perpendicular. In these cases both the original rude banding, the result of movements in a heterogeneous magma, as well as the subsequent foliation of the bisilicate masses, resulting from pressure, are to be observed in the same exposures.

In a large area covered by forest, such as this, the actual line of contact cannot usually be seen, but where they can be observed, both rocks are cut through by pegmatite dykes; indeed, the gneiss itself often appears to send out an arm-like extension into the anorthosite as if it were an intensive rock and had not been broken through by the anorthosite. As it has been shown that the granulation of the anorthosite in all probability originated when the rock was still very hot, it is quite possible that these arm-like offshoots are portions of the gneiss which were pressed into cracks in the anorthosite while the latter was in a more or less plastic condition. This explanation is supported by the remarkable fact which is observed in hundreds of cases in different parts of the Laurentian, that wherever orthoclase gneiss and amphibolite alternate with one another, and the whole mass is squeezed, the bands of amphibolite without exception break apart into fragments, between which the gneiss is pressed. A species of breccia is thus formed, which may be followed in the direction of the strike into a regular series of alternating and undisturbed bands. Under the influence of pressure, probably accompanied by intense heat, the basic rock is always more brittle than the acid one.

The gneiss may indeed, often result from a later eruption, since it is almost massive, as already mentioned, and belongs in all probability to the lower or Ottawa gneiss, in which much intrusive material undoubtedly exists.

In some places on the south and west contact and between the typical anorthosite and the gneiss there occurs a dark basic gneiss similar in appearance to the supposed contact product of the Morin area.

In this great Saguenay area, therefore, the supposed "Upper Laurentian" consists of an enormous mass of gabbro, norite and troctolite with plagioclase preponderating, presenting the same structural varieties as those found in the Morin area. Like the latter it probably owes its unconformity to its igneous origin, and finally, as in the Morin area, the anorthosite is overlaid by horizontal unaltered beds of Cambrian age, so we find also in many places upon the anorthosite of the Saguenay area small areas of horizontal unaltered Cambro-Silurian limestone and shales of Trenton and Utica age. The fact that these are in no wise altered by the anorthosite proves clearly that the latter is much older.

Where to find "Amœbae" in Winter.

By W. E. Deeks, B.A., M.D.

Nothing will try the patience of a person more than to be compelled to search over a great many slides, and then often in vain, in the attempt to find a single *Amœba* for demonstration purposes.

Circumstances such as these induced the writer to try and find the conditions under which they flourished, and might without difficulty be found.

During the summer season they can be readily obtained by scraping the under surface of a floating weed or in the superficial ooze along the bottom of any fresh water pond. During the winter this climate necessitates aquaria, and of these a certain amount of care is necessary to keep them in a living condition, whence they can be quickly obtained. The conditions necessary are: First, a proper temperature. That most suitable for them is between 45° and 70° F. Along with them are usually found the *Heliozoa*, the stalked *Ciliata* and some of the *Flagellata*. If the temperature is raised to about 80° F., the *Amœbae* quickly disappear and in their place countless numbers of the free-swimming *Ciliata* make their appearance. The water also becomes putrid. The method at present adopted of securing and keeping them during the winter months is the following:—In the Autumn the superficial ooze from some fresh water pond is skimmed and placed in a dish, the mouth of which is covered almost completely to prevent too rapid evaporation. Along with the ooze some decaying vegetable matter and also some living water plants. Of these I prefer *Anacharis*, although *Chara* and some other common forms will do. A considerable quantity of this is necessary to keep the water fresh.

The aquarium is then placed in a bright place where there is plenty of light (though preferably not direct sunlight), and in a cool place, best about 60° F. This then can be left any length of time, and when they are required, by squeezing a little of the decaying vegetable matter on a glass slide, I have never failed to find one or more of these interesting creatures.

The conditions then, required, may be thus summarized:

1. Some decaying vegetable matter.

2. A sufficient amount of plant life to keep the water from becoming putrid.

3. A sufficiently low temperature which will also prevent the bacteria of putrefaction from developing too rapidly.

By observing the above conditions one will seldom fail to find *Amœbae*.

The New Director of the Geological Survey.

The recent appointment of Dr. G. M. Dawson as director of the Geological Survey of Canada, as successor to Dr. A. R. C. Selwyn, will give universal satisfaction, and the Government of Canada are to be congratulated on having secured one of the ablest geologists as well as administrators to conduct this most important branch of the public service. His long connection with the department, both as assistant director, and, in the absence of Dr. Selwyn, as acting director, will enable him to understand perfectly the requirements of the office. The scientific staff of the department regard the appointment as a well-deserved and fitting promotion, and feel sure that under his able and energetic management the Survey's sphere of usefulness will be enlarged, and, at the same time, its already eminent scientific standing fully maintained. The mining community in general may rest assured that the practical part of the Survey's work will not be neglected, as Dr. Dawson has ever evinced a deep interest in economic geology.

Dr. George Mercer Dawson, C.M.G., F.R.S., A.R.S.M., F.G.S. (L. & A.), etc., etc., was born at Pictou, N.S., August 1st, 1849, and is the eldest son of Sir J. William Dawson, late principal and vice-chancellor of McGill University. He was educated at McGill College and the Royal School of Mines, London, where he was admitted as an Associate in 1872. He obtained the Duke of Cornwall's Scholarship, given by the Prince of Wales; also the Edward Forbes Medal in Palæontology and the Murchison Medal in Geology. His marked scientific zeal and ability early attracted the attention of European geologists, and in 1873 he was appointed as geologist and naturalist to Her Majesty's North American Boundary Commission. As such he investigated the geology and natural resources of the country between the Lake of the Woods and the Rocky Mountains in the vicinity of the 49th parallel.

The report in connection with this work appeared in 1875, and at once attracted world-wide attention. In July, 1875, he accepted a proffered appointment to the Geological Survey of Canada. His field work has been mainly confined to the North-West Territories and British Columbia, in which district his name has become a household word. The many valuable reports on these regions are to be found mainly scattered through the reports of the Geological Survey or in the various Scientific Journals of Canada, Great Britain and the United States. In 1892 he was awarded the Bigsby Medal by the Geological Society of London, "as an acknowledgment of eminent services in the department of geology, irrespective of the receiver's country." His more recent work in connection with the Behring Sea matter is so fresh in the mind as to need only a passing mention. Suffice it to say that for these eminent services the Imperial Government rewarded him with a C.M.G.

The latest honour, his appointment to the directorship of the Geological Survey, is but a fitting tribute to a man who has devoted his whole life and talents to the cause of science. His whole heart is in the work, and his scientific co-laborers feel that Canada has given a just reward to one of her most eminent sons.

Proceedings of the Natural History Society.

Montreal, Jan. 28, 1895.

The third monthly meeting was held this evening, Dr. Wesley Mills, President, in the chair.

The minutes of meeting of November 26th were read and approved.

The minutes of special meeting of Council of December 22nd and of the regular meeting of January 21st were read.

The Librarian reported that a large number of exchanges had been received and that nearly all the volumes of Proceedings of Scientific Societies had been completed ready for binding.

J. Gentles, L.D.S., was proposed as an ordinary member by F. W. Richards, seconded by E. T. Chambers. On motion of George Sumner, seconded by the Rev. Dr. Campbell, the rules were suspended, and Mr. Gentles was elected by acclamation.

Moved by the Rev. Dr. Campbell, seconded by George Sumner, and resolved: That the Natural History Society has heard with great regret of the death of the son of Dr. B. J. Harrington, one of its most valued members, and a Past President of the Society, and does hereby extend to Dr. Harrington and his family its sympathy in their sad bereavement.

A paper by Mr. E. D. Wintle, on an unusual occurrence of the Razor-Billed Auk at Montreal, and a second on a remarkable flight of certain birds from the Atlantic Coast up the St. Lawrence to the Great Lakes, was read by Mr. Williams.

Mr. Williams communicated some remarks on Special Migrations of animals.

The Rev. Dr. Campbell moved, seconded by Mr. E. T. Chambers, a vote of thanks to Mr. E. D. Wintle for his interesting paper and to Mr. Williams for his communication.

Dr. Mills then read a communication on The Scientific Societies of America and the work they are doing.

MONTREAL, Feb. 25th, 1895.

The fourth monthly meeting of the Society was held this evening, Dr. Wesley Mills, President, in the chair.

The minutes of last meeting were read and approved.

The minutes of meeting of Council of February 18th were read.

Prof. John Craig was proposed by the Rev. Dr. Campbell, seconded by Dr. Wesley Mills, as an ordinary member. On motion of Rev. Dr. Campbell, seconded by George Sumner, the Secretary was instructed to cast one ballot for the election of this member.

A fine eagle from Agassiz, B.C., was presented by Herbert W. Sheam, of the same place. On motion of the Rev. Dr. Campbell, seconded by Mr. Williams, the thanks of the Society were tendered to the donor.

Mr. E. T. Chambers, the Librarian, reported the usual number of exchanges, among which were a number from La Plata.

A paper on Dimorphism and Polymorphism in Butterflies was then read by Mr. H. H. Lyman. It was moved by Mr. Kearley, seconded by J. S. Shearer, that the thanks of the Society be accorded to Mr. Lyman for his valuable paper.

A paper entitled "Additional Remarks on the Flora of the Island of Montreal," was then read by the Rev. Dr. Campbell. Moved by Edgar Judge, seconded by J. M. M. Duff, that the hearty thanks of the Society be given to the Rev. Dr. Campbell for the communication. Carried.

Book Notices.

From the Greeks to Darwin, an Outline of the Development of the Evolution Idea.—By Henry Fairfield Osborn, Sc.D., Da Costa Professor of Biology in Columbia College, Curator of the American Museum of Natural History. MacMillan & Co., New York and London, 1894. Price $2.00.

The present work is the outcome of studies which Professor Osborn has been carrying on for a few years past, and should be welcomed as an attempt to select the men who have been potent factors in the development of the evolution idea and to define the part played by them. The work is divided into six chapters: *The Anticipation and* Interpretation of Nature; Among the Greeks; The Theologians and Natural Philosophers; the Evolution of the Eighteenth Century; from Lamarck to St. Hilaire; and Darwin.

To choose rightly was no easy task, and a few names have been omitted that might well have been added to the illustrious list.

Throughout, the author has treated his subject with that conspicuous impartiality which has characterized all his writing on Evolution, and has attempted to correct many prevalent misconceptions.

Dr. Osborn seems to think that the idea of evolution has not only run through the ages, but that the idea of each age has some genetic connection with that which preceded and succeeded it. While this may be in a measure true, and in certain instances undoubtedly is, yet we doubt if it be so to the extent the author of this work seems to believe. There are many passages, however, in which a view somewhat at variance with this is set forth; but he speaks of a "chain," and of such ideas constituting a chain. That certain ideas of evolution did constitute a short chain there seems no doubt; but what influence, we would like to ask, had Greek notions of evolution on Darwin? It is well known that Darwin never did drink deep of Greek literature. We should say that the evolution idea was a purely independent and spontaneous growth in Darwin's own mind, and to connect his ideas in a relation of effect and cause with those of the Greeks or any others except in the most indirect way, seems to us an error.

It is undoubtedly most interesting to follow the varying phases and fortunes of the evolution idea, but to attempt to bind these ideas together into a chain and say that each link is genetically related to the other is more than is warrantable. But, as before noted, there are passages which would seem to indicate that this is not Dr. Osborn's intention, but we think that this might have been more clearly stated, as certainly the general impression left by the book is as we have indicated.

The work is scholarly, yet readable, and is rendered attractive by the manner in which the printer and publishers have done their work. It deserves and will not fail to be widely known.

WESLEY MILLS.

AMPHIOXUS AND THE ANCESTRY OF THE VERTEBRATES.—By Arthur Willey, B.Sc.

This volume makes one of a beautiful and valuable series of works known as the Columbia University Biological Series, and is an indication of the activity, tendencies and scope of the new biology. Amphioxus, on account of its peculiar position in the animal scale has long been of extraordinary interest.

The author's work is divided into five main parts as follows:

I. Anatomy of Amphioxus, which is preceded by an introduction from the pen of Professor Osborn.

II. Anatomy of Amphioxus (continued).

III. Development of Amphioxus, which is further sub-divided into embryonic development, larval development, general considerations, Amphioxus and Ammocœtes.

IV. The Ascidians, including structure of a simple Ascidian, development of Ascidians, metamorphosis of Ciona intestinalis.

V. The protochordata in their relation to the problem of vertebrate descent.

This outline of the ground covered will show how complete the work has been made.

The book is well printed and admirably illustrated by a large number of cuts. The outcome of the entire series of studies on this subject, of absorbing interest to the biologist who believes in evolution, is stated in the final paragraph of the book, which we quote entire: "For the present we may conclude that the proximate ancestor of the vertebrates was a free-swimming animal intermediate in organization between an Ascidian tadpole and Amphioxus, possessing the dorsal mouth, hypophysis and restricted notochord of the former, and the myotomes, cœlomic epethelium, and straight alimentary canal of the latter. The ultimate or primordial ancestor of the vertebrates would, on the contrary, be a worm-like animal whose organization was approximately on a level with that of the bilateral ancestors of the Echinoderms."

WESLEY MILLS.

ABSTRACT FOR THE MONTH OF JANUARY, 1895.

Meteorological Observations McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY.	THERMOMETER. Mean.	Max.	Min.	Range.	BAROMETER. Mean.	Max.	Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew point.	WIND. General direction.	Mean velocity in miles perhour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. of Possible Sunshine.	Rainfall in inches	Snowfall in inches.	Rain and snow melted.	DAY
1	12.57	17.2	7.0	10.2	30.0735	30.124	30.032	.092	0662	85.3	9.2	W.	4.9	7.7	10	2	15	....	Inap.	Inap.	1
2	9.92	17.9	5.0	12.9	30.1765	30.207	30.115	.092	.0540	78.3	4.7	S.W.	13.7	3.8	10	0	87	....	0.1	0.01	2
3	19.22	23.2	9.0	14.2	30.1453	30.213	29.977	.236	.0890	83.7	15.7	S.	12.2	10.0	10	10	00	....	Inap.	Inap.	3
4	12.03	26.8	— 5.0	31.8	30.0677	30.370	29.826	.544	.0708	80.8	7.3	S.W.	24.9	2.8	10	0	85	....	0.6	0.06	4
5	— 7.18	0.3	—12.7	13.0	30.4748	30.527	30.400	.127	.0252	81.7	—11.7	W.	3.7	2.3	10	0	81	....	....	....	5
SUNDAY. 6	.....	12.7	— 8.9	21.6	. ..	......	......	...	.....	....	....	N.	12 9	....	...	.	00	....	4.0	0.40	6... ....SUNDAY
7	20.77	27.2	10.6	16.6	29.9938	30.085	29 940	.145	.1100	96.0	19.8	N.	1.4	10.0	10	10	00	0.12	....	0.12	7
8	25.27	29.2	17.5	11.7	30.2918	30.423	30 183	.240	.1230	89.2	22.5	W.	3 3	9 2	10	5	00	....	0.1	1.01	8
9	9.13	27.5	3.5	24.0	30.5407	30.615	30.498	.117	.0553	83.2	6.7	W.	11.2	4.3	10	0	71	....	....	....	9
10	9.55	20.5	2.0	18.5	30.4305	30.637	30.039	.598	.0598	83.2	5.2	N.	16.0	8.3	10	0	00	....	3.2	0 32	10
11	28.77	33.2	16.4	16.8	29.7382	29.806	29.616	.190	.1488	93.8	27.0	S.W.	14.8	8.8	10	3	00	0.16	0.1	0.17	11
12	30.65	34.8	25.9	8.9	29.9263	29.964	29.881	.083	.1458	85.3	26.5	S.W.	14.9	4 0	10	0	82	....	....	....	12
SUNDAY....... 13	.....	37.2	26.2	11.0	....	......	......	....	....	....	....	N.E.	24.5	....	....	.	17	....	1.3	0.13	13... ......SUNDAY
14	16.13	28.0	5.8	22.2	29.7632	29.910	29.608	.302	.0727	78.2	10.7	S.	17.2	8.5	10	1	00	....	0.2	0.02	14
15	20.70	24.9	12.0	12.9	29.9595	29.993	29.911	.082	.0883	78 3	15.5	S.	14 7	6.8	10	0	21	....	Inap.	Inap.	14
16	28.37	32.6	22.2	10.4	29.8588	29.954	29.790	.164	.1242	79.7	23.0	S.W.	17.0	9.8	10	9	00	....	0.1	0.01	15
17	18.38	31.5	8.5	23.0	29.9495	30 110	29.826	.284	.0768	74.5	11.8	W.	18.0	5.7	10	0	48	....	....	....	16
18	6.05	11.8	2.5	9.3	30.0855	30.172	29 978	.194	.0410	71.5	— 1 5	W.	10.0	1.7	10	0	97	....	....	....	17
19	7.50	14.6	— 0.7	15.3	30.1113	30.223	30.003	.220	.0507	82.2	3.2	W.	13.6	0.2	1	0	79	....	....	....	18
SUNDAY....... 20	.....	20.8	7.2	13.6	....	......	......	....	.....		....	W.	13.2			..	94	....	....	....	20..........SUNDAY
21	19.68	32.5	6.0	26.5	29.7067	30.030	29.309	.721	.0963	83.3	15.7	N.E.	14.3	8 0	10	0	00	0 52	....	0.52	21
22	30.72	35.8	26.5	9.3	29.3392	29.367	29.316	.051	.1527	87 8	27.7	W.	11.6	10.0	10	10	00	0.56	2.6	0.76	22
23	19.60	29.2	12.8	16.4	29.4427	29.530	30.359	.171	.0862	80.5	14 5	W.	15.4	6.2	10	0	76	....	0.1	0.01	11
24	3.28	16.5	0.0	16.5	29.7908	29.985	29.608	.377	.0370	73.7	— 3.7	S.W.	19.8	3.3	10	0	89	....	Inap.	Inap.	24
25	2.38	7.7	— 3 5	11.2	30.2172	30.282	30 122	.160	.0378	79.2	— 3.0	S.W.	15.4	1.3	8	0	96	....	...	....	25
26	11.00	19.5	2.5	17.0	29.4618	29.927	29.200	.727	.0667	91.0	8.7	E.	19.0	10.0	10	10	00	....	9.4	0.94	26
SUNDAY........27	.....	26 8	13.2	13.6	....	......	......	....	.....	....	....	S.W.	32.2	....	....		26	....	2.3	0.20	27 ....SUNDAY
28	11.07	15.3	6.3	9.0	30.0007	30.060	29,915	.145	.0602	83.3	7.0	S.W.	28.0	2.5	10	0	75	....	....	...	28
29	10.22	15.9	4.8	11.1	29.8727	29.968	29 811	.157	.0573	83.3	6.0	S.W.	10.4	4.0	10	0	51	....	....	...	29
30	16.72	25.7	9.6	16.1	29.9220	30.028	29.876	.152	.0797	85.0	13.2	S.W.	13.6	8.3	10	0	00	...	0 8	0.08	30
31	9.45	16.1	6.2	9.9	30.2448	30.301	30.172	.129	.0548	82.3	5.2	S.W.	10.5	1.5	9	0	51	....	....	....	31
....Means	14.89	23.00	7 69	15 31	29.9846	30.105	29.863	.241	.0789	82.8	10.6	S. 70¼° W.	14.59	5.9	9.6	2 2	40.0	1.36	24.9	3.76	Sums ....
21 Years means for and including this month......	11.93	20 46	3.99	16.46	30.0533	.....	......	.329	.0725	81.2	....	......	....	6.3	..	..	¶30.2	0.85	29 2	3.61	21 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles..............	812	947	460	337	815	4110	3156	216	29
Duration in hrs	66	56	30	22	68	226	229	18	
Mean velocity...	12.30	16.89	15.33	15.31	11.99	18.19	13 78	12.00	

Greatest mileage in one hour was 39 on the 27th. Greatest velocity in gusts 48 miles per hour on the 4th, 13th and 27th.

Resultant mileage, 5398.
Resultant direction, S. 70¼° W.
Total mileage, 10853. Lightning on 22nd.

*Barometer readings reduced to sea-level and temperature of 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 14 years only.

The greatest heat was 37.2° on the 13th; the greatest cold was —12.7° on the 5th, giving a range of temperature of 49.9 degrees.

Warmest day was the 22nd. Coldest day was the 5th. Highest barometer reading was 30.637 on the 10th. Lowest barometer was 29.200 on the 26th, giving a range of 1.437 inches. Maximum relative humidity was 99 on the 11th and 26th. Minimum relative humidity was 62 on the 24th.

Rain fell on 4 days.
Snow fell on 18 days.
Rain or snow fell on 20 days.
Lunar halos 2, on 8th and 9th.
Solar halos, 4, on 15th, 21st, 24th and 29th.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1895.

Meteorological Observations McGill College Observatory, Montreal, Canada. Height above sea level, 187 feet. C. H. McLEOD, *Superintendent.*

DAY.	THERMOMETER. Mean.	Max.	Min.	Range.	BAROMETER. Mean.	Max.	Min.	Range.	†Mean pressure of vapor.	‡Mean relative humidity.	Dew point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. of Possible Sunshine.	Rainfall in inches	Snowfall in inches.	Rain and snow melted.	DAY
1	16.48	27.2	1.2	26.0	30.1768	30.227	30.142	.085	0797	82.3	12.0	S.W.	16.4	5.5	10	0	52	....	0.3	0.03	1
2	16.92	23.3	8.0	15.3	30.1812	30.305	30.128	.177	.0778	80.0	12.0	W.	14.2	0.8	10	0	30	....	0.8	0.05	2
SUNDAY.........3	.....	9.2	— 1.9	11.1	....	.....	....	...	.....	....	....	S.E.	8.4	....	....	..	59	....	....	....	3.........SUNDAY
4	5.05	14.2	— 1.7	15.9	29.9130	30.087	29.803	.284	.0437	78.3	— 0 8	S.E.	12 0	6.7	10	0	00	....	0.2	0.02	4
5	—12.38	1.5	—16.3	17.8	29 9733	30.002	29 934	.068	.0197	81.3	—16.8	S.W.	37.9	0.0	00	0	100	....	....	....	5
6	—13 33	— 6.8	—19.8	13.0	29.9187	30.003	30.853	.150	.0200	85.0	—16.5	W.	29 0	4.8	10	0	70	....	0.3	0 03	6
7	— 8.95	— 5.8	—13 1	7.3	29.8163	29.914	29.557	.357	.0255	89.8	—11.2	W.	11.9	5.3	10	0	87	....	...	.	7
8	— 0.23	6 5	— 7.6	14.1	29.0143	29.375	28.832	.543	.0422	96.2	— 1.0	N.	43 0	10.0	10	10	00	....	16.0	1.58	8
9	6.90	12.8	— 3.0	15.8	29.2785	29.424	29.165	.259	.0585	96.2	6.3	S.W.	38.8	10.0	10	10	00	....	2.0	0.20	9
SUNDAY...... 10	.....	19.0	1.3	17.7	......	.....	......	....	. ..	....	....	W.	24.8	....	....	..	94	....	....	....	10 ....SUNDAY
11	18.60	25.8	8.8	17.0	29.9767	30 040	29.891	.149	.0947	92.5	16.7	W.	22 0	5.7	10	0	36	....	0.2	0.02	11
12	22.77	26.1	19.3	6.8	29.7752	29.868	29.690	.178	1018	83.5	18.8	W.	15.3	7.3	10	2	70	....	....	..	12
13	23.47	27.2	20.8	6.4	29 6272	29.725	29.572	.153	.1110	88.0	20.7	W.	12.4	9.7	10	8	00	....	0.4	0.04	13
14	19.28	25.2	15.8	9.4	29.8695	30 050	29.685	.365	.0927	88.2	16.7	W.	32 5	3 2	10	0	100	....	0 3	0.03	14
15	19.35	22.5	15.0	7.5	30.1653	30.258	30.045	.213	.0922	87 7	16.7	S.W.	17.3	6.3	10	0	58	....	Inap.	Inap.	15
16	24 02	29.5	16.9	12.6	29 8008	30.047	29 637	.410	.1178	90.7	21.5	S.W.	26.4	6.2	10	0	57	....	Inap.	Inap.	16
SUNDAY.......17	.....	30.6	20.2	10.4	....	......	......	....	.....		....	S.W.	15.3	....	...	..	74	....	....	....	17...........SUNDAY
18	28.32	34.3	21.5	12.8	29.7363	29.840	29.658	.182	.1450	91.7	26.3	S.	14.1	9.5	10	0	21	....	....	....	18
19	28.93	32.8	24.5	8.3	29.7022	29.730	29.671	.059	.1413	88.7	26.0	S.W.	17.6	6.7	10	0	00	....	0.2	0.02	19
20	19.50	23.4	15.2	8.2	29.6477	29 710	29.528	.182	.0893	84.7	15.8	S.W.	20.7	0.8	3	0	84	....	Inap.	Inap.	20
21	27.70	34.9	17.2	17.7	29.2308	29.456	29.158	.298	.1390	90.5	25.3	S.	21 4	8.8	10	3	00	....	0.5	0.05	21
22	8.72	26.5	3 1	23.4	29.8073	29.992	29.556	.436	.0547	84.2	4.7	W.	25.1	4.0	10	0	68	....	....	....	22
23	3.22	9.4	— 2.7	12.1	30.1757	30.347	30.056	.291	.0415	83 5	— 1.3	S.W.	17.8	0.0	0	0	99	....	....	....	23
SUNDAY........24	.....	24.8	3.0	21.8	.....	......	......	....	.....	...	....	S.W.	20.1	....	....		53	....	....	...	24 ....SUNDAY
25	26.27	37.2	18.2	19.0	29.7716	29.920	29 617	.303	.1340	93.2	24.5	S.W.	23.5	9.8	10	9	00	Inap.	3.5	0.35	25
26	10.33	20.1	4 0	16.1	30.2078	30.295	30 050	.245	.0557	79 7	5.3	S.W.	22.0	0.2	1	0	100	....	....	....	26
27	20.13	28.8	7.3	21.5	29.9062	30.150	29.707	.443	.0998	87.2	17.2	S.W.	9.9	6.3	10	0	00	.	....	....	27
28	29.68	37 2	23.0	14.2	29.4747	29.671	29.372	.299	.1607	96.8	28.8	S.	7.8	10.0	10	10	00	Inap.	...	Inap.	28
	.....	....	....	....	....	......	......	....	.....	....	....	....	....	...	..	..	..		....	....	
	.....	....	....	....	....	......	.....	....	.....	....	....	....	......	. .	..	..	..	....	....	....	
	....	....	....	....	....	......	......	....	.....	....	...	....	....	...	..	..	..	....	....	....	
....Means	14.20	21.34	7 08	14 26	29.8003	29 935	29.680	.255	.0853	87.50	1 15	S. 63¾° W.	20.62	6.0	8.50	2 17	46.9	0.00	24.7	2.45	Sums ....
21 Years means for and including this month	15.84	23 69	6.79	16.90	30.0365	.....	......	.303	.0880	79.33	....	......	....	5 9	..	..	¶41.7	0.78	22 5	2.94	21 Years means for and including this month..

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles............	906	....	12	273	907	6722	4764	276	
Duration in hrs .	45	....	2	29	62	275	225	19	15
Mean velocity...	20.1	....	6.0	9.4	14.6	24.4	21.3	14.5	

Greatest mileage in one hour was 56 on the 8th.
Greatest velocity in gusts 60 miles per hour on the 8th.

Resultant mileage, 9970.
Resultant direction, S. 63¾° W.
Total mileage, 13860.
Average mileage per hour 20.62.

*Barometer readings reduced to sea-level and temperature of 32° Fahrenheit.

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 14 years only.

The greatest heat was 37.2° on the 25th and 28th; the greatest cold was —19.8° on the 6th, giving a range of temperature of 57.0 degrees.

Warmest day was the 19th. Coldest day was the 6th. Highest barometer reading was 30.347 on the 23rd. Lowest barometer was 28,832 on the 8th, giving a range of 1.515 inches. Maximum relative humidity was 100 on the 8th.

Minimum relative humidity was 51 on the 5th.

Rain fell on 2 days.

Snow fell on 15 days.

Rain or snow fell on 16 days.

Auroras were observed on 1 night on 14th.

Lunar halos 4, on 3rd, 4th, 7th and 8th.

Lunar corona 1, on the 6th.

Fog on 1 day, 28th.

Solar halos, 6 days, 3rd, 4th, 5th, 17th, 18th and 22nd