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MARL DEPOSITS IN ONTARIO, QUEBEC, NEW BRUNSWICK AND NOVA SCOTIA.[1]

By R. W. ELLS, LL.D., F.R.S.C.

THE MARL DEPOSITS OF EASTERN CANADA.

The presence of shell-marl in the provinces of Ontario and Quebec, at many widely separated points, has long been known, and many localities where this material occurs have been described in the Reports of the Geological Survey from a very early date.

Value of marl deposits

The chief value attributed to this substance was for many years supposed to be confined to its use as a fertilizer for soils lacking in calcareous matter, since it furnished a ready kind of lime, easily applied, and showing good results in regard to the cultivation of certain crops where its application was carried out with proper judgment.

Within the last few years, however, marl has been found to be especially adapted to the manufacture of the best grades of cement, when mixed with a proper proportion of clay. Large manufacturing establishments have been already established at several points and others are in process of construction, more especially in the province of Ontario, where large and valuable deposits of marl occur at many places. Among these may be mentioned the great works at Marlbank, a few miles north of Belleville, and at Strathcona, about five miles northwest of Napanee, where the manufacture of high-grade Portland cement has been prosecuted on a large scale for several years.

Manufacturing plants for cement

The demand for marl deposits conveniently situated near to railway lines or other means of shipment has increased

[1] Published by permission of the Director of the Geological Survey of Canada.

very largely. Enquiries are frequently made as to the existence of these deposits, and in order to present in a readily accessible form such information as is available from the published reports of the Geological Survey, some of which are long out of print and others not convenient for reference, the present paper has been prepared. While it is not maintained that the subject has been exhaustively treated, since the information relative to the occurrence of this substance increases from year to year as the scope of the Survey's operations is extended, the present paper will incorporate all available information on the subject in regard to its occurrence in the provinces of Ontario, Quebec, New Brunswick and Nova Scotia, taken from the published reports of the Geological Survey and from other sources of information, brought down to the present time.

Sources of information re "marl"

Fresh-water marl occurs usually in marshes and shallow lakes, and generally contains the shells of several species of fresh-water mollusks. In the Geology of Canada, 1863, a good description of the mode of occurence and physical characters of this material is given, which may be here quoted. "Although belonging to the present geological period, this marl is not always of recent formation; inasmuch as the beds of it are sometimes overlaid by peat, or by a soil supporting a growth of large trees. At other times however, the marl covers the bottom of shallow lakes or ponds, and is evidently in the process of deposition. It appears to be formed by the waters of springs highly charged with lime, which is at first held in solution as bicarbonate but is deposited when these waters come to the air. It is thus similar in its origin to the deposits of calcareous tufa, which occur in many places where such calcareous springs flow over earth, rocks and vegetation, instead of falling into lakes or marshes. The presence of carbonate of lime is a necessary condition of the development of shells, and various species of mollusca abound in such waters. These by their remains, which often form a considrable portion of the deposits, give to them the name of shell-marl, which is frequently applied. This substance is white and earthy in its aspect, and, unless mingled with clay, is a nearly pure carbonate of lime, which from its finely divided state is well adapted to serve as a dressing for such soils as are deficient in

Mode of occurrence and origin

calcareous matter. When calcined, marl yields a nearly pure and very white lime, well adapted for mortar and for other uses. In many parts of Vermont large quantities of lime are thus manufactured. The marl is moulded in the shape of bricks which are dried and burned in a kiln."

"When pure, marl may be used as a substitute for prepared chalk or whiting in cleaning metals and for similar purposes. In many parts of the country it is commonly employed by the people for whitewashing their buildings. It has also been used for the production of carbonic acid gas in the manufacture of soda-water and other aerated waters in place of the pulverized chalk or marble dust which is generally employed."

Uses of marl

Marl deposits are numerous in many of the lake bottoms throughout the province of Ontario. They are also found at various points in the province of Quebec, though, as a rule, such deposits are not so large as in the former province. Further east in New Brunswick this material also occurs at several points around the Bay des Chaleurs, and also near the city of St. John, but the occurences are still less abundant than in Quebec, while in Nova Scotia shell-marl, in so far as at present known is comparatively rare, It may, however, be remarked in connection with the maritime provinces that many lakes which should naturally contain marl are supplied with extensive deposits of infusorial earth, this material being very abundant in the lakes which are scattered throughout the Cobequid mountain range in Nova Scotia, and also in the eastern portion of the province including the island of Cape Breton. In New Brunswick, also, large and valuable deposits of infusorial earth have long been known to occur in the southern and east portions of the province. This material has recently come into considerable demand and several large lake-deposits have been quite extensively worked, the output being principally shipped to points in the United States.

Distribution

The successful manufacture of Portland cement, which in Ontario is destined apparently to utilize many of the large deposits of fresh-water marl found in the province, depends upon the proper admixture of the marl with certain proportion of clay. These materials after mixing thoroughly are burned, and the resulting compound very finely ground, the success of the operation

Portland Cement

being due to a very careful series of experiments which have been carried on for some years till the proper adjustment of materials and the right degree of burning and subsequent reduction to an almost impalpable powder has been reached.

ONTARIO.

Among the largest deposits of the marl, some of which have already been utilized on an extensive scale, may be mentioned the following localities: At Marlbank in the township of Hungerford, on the line of the Bay of Quinte railway the great works of the Deseronto Cement Co. are located. The raw material is derived from the beds of White and Dry lakes, the deposit extending over several square miles and having a depth in places of at least 20 feet. Large works in connection with this company are also located at Strathcona, formerly Napanee Mills, which is about five miles northwest of the town of Napanee, the capacity of the plant being over 100,000 barrels annually.

Localities of Marl deposits

Marlbank

Another very important deposit is situated in the bottom of Shallow Lake, Keppel township, county of Grey, about nine miles from Owen Sound on the west side of Georgian bay. The property here comprises nearly 600 acres, the marl having a thickness of from one to six feet, with an average depth of four feet, underlaid by clay with a thickness of two feet.

Another large deposit is found in Williams lake in the township of Holland, in the same county, near the line of the Toronto, Grey and Bruce Ry., and also near Durham which is also convenient to railway communication.

Williams Lake Grey Co.

Marl also occurs on lots 25 and 26, ranges VII and VIII, Flos township, Simcoe county, but the thickness and extent of the deposit is not yet definitely known, though apparently quite large. This area lies a short distance to the southeast of Georgian bay.

Large deposits of excellent marl are found in the counties of Peel and Dufferin. In the first-named county a deposit in the fourth and fifth concessions of the township of Caledon, in close proximity to the railway, is reported as covering about 350 acres with an average

Peel and Dufferin Co's Caledon

depth of 13 feet, overlaid by a deposit of peat from two and a
Orangeville half to six feet in thickness. This is near Orangeville
East Garafraxa station. In Dufferin county on lot I, range B, East Garafraxa, there is a deposit of marl extending over at least 20 acres with a depth of six feet. Large plants are contemplated for working these areas.

Peterborough Further east, at Lakefield, near Peterborough, there is
Buckley's Lake an area of marl lands amounting to about 800 acres, at what is known as Buckley's Lake, where the marl deposit is reported to be 20 feet deep. Large areas of excellent peat are in close proximity, and the district is connected by rail with the town of Peterborough.

Sheffield Tnp. The deposit at Marlbank has already been referred to;
White Lake but in the township of Sheffield other large areas of marl have been reported which should be of value. Among these may be mentioned the following—In White lake and on the brook flowing from it to Beaver lake, as also on the fifteenth and sixteenth lots of the second concession, and on the twelfth lot in the third and fourth concessions. The deposit on the first named is stated to extend over at least 200 acres with a thickness throughout the greater portion of at least ten feet, the bottom of the deposit not being reached, having a thin covering of soil with a luxuriant growth of grass.

The second of these deposits extends over an area estimated at from 300 to 400 acres, but the thickness was not ascertained. It is covered by an accumulation of peat with a thickness of four feet or more in places.

Storrington. In the township of Storrington, about ten miles north
Loughborough Lake of the city of Kingston, there is a large deposit of marl occupying the bottom of Loughborough lake, more especially the southeastern portion. The depth of water is not great, and the marl extends over many acres of the lake bottom, but the thickness was not tested, though the extent of the deposit is apparently very large. The marl is also found in the bottoms of many of the lakes between this place and White lake in Olden township. The Loughborough lake deposit can be easily removed by dredging, and the locality is little more than a mile from the present line of the Kingston and Pembroke railway, while by hauling from Bat-

tersea village on the south side of the lake to the shore of Dog lake, two miles distant, communication can be made with the Rideau canal.

Belleville — Near the city of Belleville marl also occurs, but no data are to hand regarding its extent. It is presumably not so extensive as the Sheffield deposits.

Yonge Tnp. Athens — In the township of Yonge, near the village of Athens, and in close proximity to the line of railway from Westport to Brockville, there are several deposits of marl which have never been exploited. One of these is on lot 13 range VIII., and is said to occur over an area of at least 25 acres, with an ascertained depth of seven to fifteen feet. The material is also reported as occurring on lots 7, 8 and 9, range IX, in the bottom of Mud lake, and possibly at other points in the vicinity.

South Elmsley, Bass Lake — In the township of South Elmsley it is found underlying portions of Bass lake, with a thickness of three to four feet, but the exact extent of the deposit is uncertain. This place is but a short distance from the foot of the Rideau lake at Oliver's Ferry.

Wilberforce Mink Lake — In the township of Wilberforce, near the Bonnechére river, and about three miles from the line of the Canadian Pacific railway between Douglas and Eganville, is Mink lake. This lake has an area of over 1,000 acres, the marl being visible at many points and probably occupying most of the bed of the lake. The thickness of the deposit has been proved to be at least nine feet in places and may be much greater in parts of the lake basin. The area can be easily drained so as to expose a large surface of the deposit.

McNab Tnp. White Lake — In the township of McNab the lower end of White lake shews a large area of the marl, extending over some 700 acres, and ranging from five to seven feet in depth. The area could be readily drained so as to expose a large body of the material, but the distance from the town of Arnprior and railway communication is about eight miles. It is about the same distance to Glasgow station on the Canada Atlantic.

Ross Tnp. Green Lake — In the township of Ross, several deposits are found in connection with a chain of lakes which extend southeast from Muskrat lake, near Cobden village. On one of these,

known as Green lake, on lot 13, range IV, about one mile north of the line of the Canadian Pacific railway, the marl is found along the shores of the lake, in one place with an exposed extent of five acres, and a depth of from five to twelve feet, and also along the southeast shore of the lake over a space of ten acres, having about the same thickness. On lot 15, range II, in another small lake the marl is found banked up four to five feet near the outlet, extending for several hundred yards, and probably underlying the water of the lake. In several others of this chain of lakes, which extends across into the township of Horton, there are indications of marl, but the extent of the deposits has not been determined. The locality probably represents an old valley of the Ottawa river extending from Pembroke eastward.

Westmeath

In the township of Westmeath, on lots nine and ten, east front B, shell-marl is seen all round the shores of a small lake, but the depth and extent of the deposit are unknown.

Emerald Lake Temiskaming District

On Emerald lake, about five miles west of Opimika narrows, Lake Temiskaming, there is a deposit of marl of unknown depth, but of considerable thickness, since the bottom could not be found on sounding with a long pole. Though the lake is of small size the amount of the marl will here be of importance.

Lanark

Among other places where the material is found in this province but where the extent of the deposits have not been determined, may be mentioned, lot 13, range IV, Lanark Co., six

Chalk Lake Reach Tp. Ont. Co.

acres and seven feet deep; Chalk lake, lots 1 and 2, range I, and lot 1, range II, township of Reach, Ontario Co., in a lake of 75 acres with a marl bottom, the thickness of which is considerable but not definitely stated; White

White Lake Huntingdon Tp., Hastings Co.

lake, on lots 18 and 19, range IX, Huntingdon, Hastings Co., the deposit extending out under the waters of the lake, the extent unknown, but found to be 30 feet thick in

Eramosa Wellington Co.

places; Eramosa branch of Green river, Eramosa township, Wellington Co, the extent of the deposit unknown but reported to be at least three feet thick with a cover-

Artemisia Tp. Grey Co.

ing of three feet of peat; and in Artemisia township, Grey Co., where it occurs over an area of at least 12 acres, with a depth of at least seven feet.

Sebastopol Tp Clear Lake

In the township of Sebastopol, at the lower northwest end of Clear Lake, near the outlet, there is a large quantity of marl, the depth of which has not yet been proved, and it occurs also in several small lakes adjacent. This locality is about eight miles from the Canada Atlantic railway at Eganville.

MacKay Lake New Edinburgh

On the shore of Hemlock or MacKay lake in New Edinburgh, Ottawa, marl has long been known to exist, extending over 100 acres or more with a depth of at least five feet. The deposit is, however, largely covered with soil and forest growth, but has been locally used to some extent in the manufacture of white bricks.

The localities mentioned for the province of Ontario do not profess to describe the occurrences of marl for all portions of the area. Doubtless many deposits occur at various localities, the details of which have not yet reached this Department, but sufficient has been stated to show that the material exists over a great area and frequently in very large and economic quantities.

West Hawksbury

In the vicinity of the Ottawa river, on lot 18, range IV, west Hawksbury, there is a deposit the extent of which has not been definitely determined, but it is known to extend over an area from five to ten acres, with a proved depth of 2 to 4 feet, and covered with peat for four feet. It has been locally used as a fertilizer by the settlers in the vicinity.

PROVINCE OF QUEBEC.

In the province of Quebec, marl deposits, while not so widely distributed as in Ontario, are also found at points from the western limit to the peninsula of Gaspé.

Argenteuil near Lachute

In the township of Argenteuil, lot 3, range I., marl is found occupying the basin of a lake, in depth from five to thirteen feet, overlaid by about nine feet of peat. The area of the overlying peat is about 22 acres. On the same lot, another peat-bog with an area of half a mile from east to west and a breadth of 150 yards occurs underlaid by marl which has a depth of 12 feet. The locality is not far from the line of the Canadian Pacific railway at Lachute.

Wentworth Tp Eagle Nest Lake

On lot 22, range VIII, Wentworth township, marl is reported as occurring in the bed of Eagle Nest lake, which is a short distance south of 16-Island lake, the quantity not

being stated, but apparently considerable. The nearest shipping point to this place is the line of the Montford Colonization railway near the latter lake. It is also reported as occurring in a small lake on lot 5, range IV, Harrington township, but at present this locality is too far removed from railway communication to be practically available.

Vaudreuil Point à Cavagnol, Ottawa River.

In the seigneury of Vaudreuil, at Point Cavagnol on the lower Ottawa, a bed of marl extends over at least twenty acres, the thickness being apparently from a foot to a foot and a half. It has been locally used to some extent as a fertilizer. Small deposits of excellent marl are also known to

Montreal

exist in the vicinity of Montreal, as at Thornberry in the rear of Montreal mountain, and on the St. Pierre river, between Montreal and Lachine, which are overlaid in part by beds of peat. The extent of these deposits has not yet been definitely determined, but a company for the manufacture of cement has been established at Pointe Claire.

East of the St. Lawrence

In the area east of the St. Lawrence river a small deposit of marl has been long reported as occurring near the foot of Yamaska mountain, near the junction of the road to Granby, with that leading to St. Pie, the thickness of the material being stated to be one foot, and extending over about seven acres.

St. Armand

In the township of St. Armand on lots 156 and 157, about one mile southeast of Phillipsburgh, it is also found in a small lake with a thickness of seven feet, and extending, as far as known, over thirty to forty acres. This locality is in close proximity to the Phillipsburgh branch railway, and also to the shore of Missisquoi bay, through which the Chambly canal passes. The deposit here rests upon a bed of marine shells. In the township

Stanstead

of Stanstead it also occurs in a small lake bottom on lots four and five, ranges X and XI, with an area of 20 acres and a reported thickness in places of 30 to 40 feet. This is within a short distance of the village of Stanstead Plain.

A small deposit of marl has recently been reported by Mr. Obalski as occurring near the village of Beauport, a few miles east of Quebec city, and also at Lake a la Peinture in the township of Neigette, but the extent of these deposits is not stated.

Gaspé
Matane

In the eastern part of the province of Quebec marl has been reported as occurring on the south side of the St. Lawrence at a point about five miles below the mouth of the Matane river. The deposit extends over an area of 60 to 70 acres and has a depth of one to two feet, and another deposit occurs at the upper end of the lower Metis lake, the extent of which has not been stated.

Bay des Chaleurs
New Carlisle
New Richmond
Blue Lakes

In the peninsula of Gaspé several important deposits of this substance are found, especially along the north side of the Bay des Chaleurs. All of these are but a short distance from the line of railway running from Metapedia to Paspebiac. Among localities in this area may be mentioned several lake bottoms lying to the north of the village of New Carlisle and in a narrow valley about two miles distant from this place, in all of which and around their margins the marl occurs with a depth of from one to six feet. Further west it is also found in lake bottoms a short distance north of the village of New Richmond near the Great Cascapedia river, and in what are known as the Blue lakes to the west of that stream, the bottoms of which are apparently filled with this substance. The depth and extent have not been determined, though the quantity appears to be considerable. The latter place is in the Irish settlement.

ANTICOSTI.

On Anticosti island deposits of excellent marl were reported by Mr. James Richardson from his exploration of this area in 1856, as occurring at several widely separated points. He states that "the bottoms of all the lakes and small ponds examined, with the exception of such as were surrounded by peat, were more or less covered with it. Marl lake at the northwest extremity of the island near the West point lighthouse, showed a deposit of about 90 acres, with a considerable thickness, which however was not definitely ascertained, and the brook which empties this lake carries down with it to the shore a large quantity of marl as a sediment where it was spread out along the beach for a considerable space."

Another locality noted was about three miles west of South-west Point, where marl was observed along the bank of a brook and

extending inland for a fourth of a mile. It had a thickness of about one foot, and was covered with peat. In a lake about half a mile inland it was seen to cover an area of about 200 acres but the thickness here was not ascertained; and near South Point, which is near the southeast end of the island, about twenty-six miles west of Heath Point, it was also seen along the shore, resting upon the rocks and covered with a deposit of peat about ten feet thick.

NEW BRUNSWICK.

Baydes Chaleurs Charlo River

In the province of New Brunswick shell-marl in so far as yet known is rarely seen. In the northern portion around the Bay des Chaleurs it occurs on the shore at Belledune underlying peat, the quantity apparently not being very large, and also at Charlo river in the bottom of a small lake where the marl is said to have a depth of nine feet. This deposit has been locally used to some extent as a fertilizer.

Lawlor's Lake St. John.

In the southern part of the province, marl occurs at several points. The most important of these apparently is in the bed of Lawlor's Lake, which is about five and a half miles from St. John city on the line of the Intercolonial railway. The marl has been exposed by a partial drainage of this lake, the deposit apparently underlying the whole of the lake basin, but is apparently thickest at the two extremities, especially the eastern, where the depth of the marl is reported as two feet. In places this deposit is associated with peat. In the western part marl has been found in the bed of a small lake a short distance above Burnshaw Brook on the right bank of the Tobique river.

NOVA SCOTIA.

Canaan near Kentville.

In Nova Scotia no deposits of special economic value have as yet been reported with the exception of an area on the South Mountain ridge at Canaan to the south of the village of Kentville. This has been locally used as a fertilizer for some years and has been to a large extent exhausted. The beds of many of the lakes, especially on the range of the Cobequid mountains as well as in portions of Cape Breton are filled with large deposits of infusorial earth, as is also the case with several lakes in eastern New Brunswick.

ON THE NEPHELINE ROCKS OF ICE RIVER, BRITISH COLUMBIA.[1]

BY ALFRED ERNEST BARLOW, M.A., D.Sc.

In the May number of the *Geological Magazine* appears an article on a "Sodalite Syenite (Ditroite) from Ice River Valley, Canadian Rocky Mountains" by Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., &c.[2] In referring to the work previously done on rocks from this locality, Prof. Bonney was evidently ignorant of the fact that the occurrence of an igneous complex at this place was pointed out by the writer in an article read before the Royal Society of Canada in May, 1900, an abstract of which appeared in *Science*, N.S., Vol. XI, No. 217, page 1022. At the time it was intended by Dr. Dawson that the writer should pay a special visit to this locality in order to study the relations of the various types in the field, collecting sufficient and suitable material for further study in the laboratory. Pressure of other work, however, has not only prevented this, but also the publication of the details of some of the interesting phenomena observed in the specimens already available. In view of the publication of Prof. Bonney's interesting paper, it is considered advisable to give immediate publication to some of the general results of the detailed petrographical examination of the rock specimens furnished to the writer by the late Dr. G. M. Dawson, in February, 1900. These were collected on August 13th, 1884 by Dr. Dawson, while engaged in a geological reconnaissance of this portion of the Rocky Mountains, but in the hurry necessarily attendant on such preliminary work, only the morning of that day was devoted to the examinations of their fields relations They were obtained from exposures along and in the vicinity of the Ice river a branch of the Beaverfoot river in British Columbia. The area covered by these rocks as outlined by Dr. Dawson on the reconnaissance map of part of the Rocky Mountains, published in 1886, comprises portions of the Otter-tail, and Vermilion Ranges. The northwestern edge of the mass

[1] Published by permission of the Director of the Geological Survey of Canada.

[2] *Geol. Mag.*, New Series, Decade IV., Vol. IX., No. V., May, 1903, pp. 199-206.

is believed to come within about four miles of the Canadian Pacific Railway between Ottertail Crossing and Leanchoil stations. Thence with an approximate width of two miles it extends for a distance of about sixteen miles, the strike of the belt gradually bending around in this interval from southeast to east. As far thus as our present knowledge goes, the area underlaid by these rocks is about thirty-two square miles.

The hand specimens which were made the subject of examination and study, were of necessity collected rather hurriedly, and were chosen simply as representative of the several varieties of igneous rocks seen to occur at this locality. It is therefore a very agreeable surprise to find that the material thus selected at a time when magmatic differentiation was very little understood, should illustrate a passage so complete that no appreciable gap occurs unrepresented by specimens from the most basic ijolite containing 36,988 per cent. of silica to sodalite syenite or foyaite with 53,638 per cent. of silica. A large number of thin sections were prepared from the material at command as it was believed that considerable information would be gained by their study under the microscope regarding the phenomenan known as magmatic differentiation, which it is confidently believed is so well represented at this locality. Perhaps one of the most significant developments in petrographical geology during the last few years has been the enunciation of the principle, that no sharp line of delimitation exists between what has hitherto been regarded as the main types of families of igneous rocks, but that these merge by insensible gradations into one another. Many of the prëexisting gaps have of very recent years been so well bridged by hitherto unknown species that it is now certain that at no very distant date, such sequences will be practically perfected by the recognition and description of the various transitional types now lacking. Repeated and conclusive observations have likewise shown that no considerable area of igneous rocks occurs without furnishing some proof of this diversity in composition, so that at the present time it is considered the exception rather than the rule, to meet with any extended rock exposure which does not give some evidence of such gradation of one rock type to another.

These facts bearing so intimately on the genesis of igneous rocks have caused the formulation of the hypothesis known as magmatic differentiation. This hypothesis or phenomenon may be briefly described as the division or differentiation of a more or less viscous or molten magma or fused mass of rock, into chemically and mineralogically diverse parts, which on cooling, yield correspondingly diverse types of rock. It would be manifestly unwise in this connection to enter into a discussion of this very generally accepted hypothesis, as the conditions attending the crystallization or consolidation of a large body of magma are now believed to be much more complex than at first supposed. Moreover, our knowledge regarding these conditions and the several processes which are no doubt involved, is so vague and incomplete, that no full or satisfactory explanation has yet been offered of this phenomenon. All petrologists of repute are, however, agreed on the main fact that magma differentiation furnishes the only reasonable explanation of the facts observable in regard to the mode of occurrence or field relations of these rocks. In the present instance it will doubtless be sufficient to state that mineralogically the exposures at Ice river furnish abundant proof of their intimate relation to one another, and their derivation from the same magma. This strong disposition towards differentiation is a marked feature of nepheline syenite and kindred eruptives, and it is very reasonable to suppose from the studies already undertaken that nowhere in the world is it better exemplified than by these British Columbia outcrops.

The following rather distinct types of rock have been recognized in the hand specimens collected by Dr. Dawson, which with the intermediate or transitional forms, exhibit a rather perfect gradation throughout the series.

I. A rock composed mainly of hornblende, pyroxene and nepheline, together with sphene, which although accessory, is so abundant as almost to characterize the rock. Occasional thin sections show small individuals of anorthoclase, but as a rule no felspar is present (Ijolite).

Macroscopically the hand specimen representative of this type is a black glistening rock made up chiefly of the darker coloured minerals (hornblende and pyroxene) with a very subordinate

amount of interstitial lighter coloured material (nepheline). It is sprinkled all through with comparatively large and conspicuous phenocrysts of honey-yellow sphene.

II. A rock composed of hornblende, pyroxene and nepheline with a very little felspar (anorthoclase or microperthite). This last mineral, however, is in such small quantity that it must be regarded as distinctly accessory (Ijolite, transition type).

This rock is much lighter in colour and evidently less basic in composition. It is irregularly mottled or spotted, owing to the segregation of the coloured minerals leaving areas composed chiefly of the lighter coloured nepheline.

III. A rock composed essentially of hydronephelite (ranite) biotite and ægirine. The hydronephelite is evidently secondary, resulting from the alteration of nepheline originally present, so that the rock may be considered as a biotite-ægerine-ijolite. It is of a delicate pale red colour and might be readily mistaken at first sight as an ordinary red syenite.

IV. A rock made up of nepheline and felspar (chiefly microperthite but also albite and a little oligoclase) in nearly equal proportions with a smaller quantity of pyroxene, hornblende and biotite and also abundant and comparatively large porphyritic sphenes (Nepheline Syenite).

V. A rock composed mainly of felspar (chiefly microperthite and albite) and sodalite with a little nepheline, biotite, augite and ægirine (Sodalite Foyaite or Syenite).

VI. A rock composed mainly of granular cancrinite and ægirine very much squeezed. The cancrinite is evidently secondary and derived from nepheline, which is also present. Sodalite also occurs. (Canrcinite Syenite.)

Besides these, which may be regarded as the integral and important members of the parent plutonic, there are dykes of Nepheline-Syenite-Pegmatite, and Tinguaite. These, which are regarded as practically contemporaneous and differentiates of the same magma, apparently cut the main mass in all directions, filling up cracks formed during its cooling. The pegmatite is composed chiefly of microperthite (made up often of three felspars, orthoclase, microcline and albite) with varying amounts

of sodalite, nepheline and ægirine. Secondary calcite is rather abundant, while some clear isotropic areas with delicate cubic cleavage, are probably analcite. Some small colourless needles in radiating groups are probably rosenbuschite, according to Dr. Washington. A pale brownish-yellow isotropic mineral is probably perofskite but possibly pyrochlore. Very often comparatively large, brilliantly striated cubes of pyrite are present in this coarse facies. The tinguaite dykes present no unusual features.

It is thus evident that under these headings (I & II) we have varieties of the exceedingly rare type of rock for which the name Ijolite was proposed in 1891 by Ramsay and Berghell.[1] At present this species is known to occur at only three localities, Mt. Iliwaara in Finland, Kaljokthal in the Kola Peninsula in Arctic Russia, and at Magnet Grove, Arkansas, U.S. Its true nature was first suspected by Rosenbusch and proved by Ramsay, but it remained for Dr. Washington to describe its true relations and position with regard to the other associated nepheline-bearing intrusives.[2] As far as can be ascertained, however, the occurrences at Ice River are far more complete and satisfactory, for purposes of study, than any of the localities mentioned. Felspar, which is absent from the European occurrences, is abundantly present at Ice river, while plagioclase, which is unknown in Arkansas, is represented by albite, oligoclase and anorthoclase at the British Columbia locality. The Ice river types are of special interest from the greater proportion of ferromagnesian minerals present than in the occurrences of Kola or Magnet Cove, and are remaskable in that hornblende (barkevekite) largely replaces the pyroxene of the others. They are really a new variety, hornblende (barkevekite) ijolites. The titanite which replaces in part at least the garnet of the others, is also a marked feature. Garnet or Schorlomite, however, is also present at the Ice river, and Mr. F. G. Wait has analyzed a specimen of this mineral which was handed to him by Dr. Hoffman.

The silica contents in the specimen represented under (I) was ascertained by Prof. N. N. Evans, of McGill University, and this was as before stated 36,988, but a complete analysis was made of the variety (II).

[1] Geol. Foren Förhandl. Stockholm, 1891. Bd. 13, 4aft, 4 pp. 300-312.
[2] Bull. Geol. Soc. Am., Vol. 11, 1900, pp. 389-416.

For purposes of comparison the following table of analyses are given of the ijolites from the various localities at present known.

Analyses of ijolites from several localities.

	1	2[1]	3[2]	4[3]
Si O_2	39.250	41.75	42.79	46.63
Al_2 O_3	16.012	17.09	19.89	15.03
Fe_2 O_3	4.313	6.35	4.39	5.91
Fe O	9.640	3.41	2.33	5.09
Mg O	4.242	4.71	1.87	3.47
Ca O	13.423	14 57	11.76	11.23
Na_2 O	4.917	6.17	9.31	8.16
K_2 O	2.256	3.98	1.67	1.96
H_2 O (ignit)	0.797	0.62	0.99	0.35
H_2 O (110°)		0 28		
Ti O_2	4.019	0.58	1.70	1.12
Mn O	0.349	trace	0.41	trace
P_2 O_5	0.905	1.09	1.70	....
	100.123	100.60	98.81	99.57

1—Ijolite, Ice river, British Columbia.
2— ,, Magnet Cove, Arkansas, U.S.A.
3— ,, Mt. Iiwaara, Finland.
4— ,, Kaljokthal, Umptek, Kola.

The hydronephelite which is such an important mineral constituent of the biotite-ægirine-ijolite was separated by means of Thoulet's solution, the specific gravity of the powder thus ascertained varying from 2.243—2.275. An analysis of this powder was made by Mr. R. A. A. Johnston, which shows it to have the composition given under 1 in the following table.

Analyses of Hydronephelite and Ranite.

	1[4]	2[5]	3[5]
Si O_2	42.80	38.99	39.21
Al_2 O_3	28.50	33.62	31.79
Fe_2 O_3	0.34	....	0.57
Ca O	1.90	0.07	5.07
Na_2 O	14.33	13.07	11.55
K_2 O	0.30	1.12	....
H_2 O	10.81	12.98	11.71
	98.98	99.85	99.90
Spec. grav...	2.243—2.275	2.263	2.48

[1] Bull. Geol. Soc. Am., Vol. 11, 1900. No. IV, p. 399.
[2], [3] Rosenbusch: Elem. Gesteinlehre, p. 180.
[4] Ann. Rep. Geol. Surv. Can., Vol. XII, p. 13R.
[5] Dana's Mineralogy. 1892, p. 609.

1. Analysis of Hydronephelite from Ice river.
2. Analysis of Hydronephelite from Litchfield, Me., U.S.A.
3. Analysis of Ranite from the Island of Läven.
   (also called Lämo) Langesund fiord, Norway.

Brögger has shown that the last mentioned mineral includes part of what has passed under the name of spreustein.

Schorlomite, a mineral closely analogous in composition to garnet and which may be regarded as a titanium-rich melanite, also occurs at the Ice river locality in association with these nepheline rocks. The mineral, according to Mr. F. G. Wait, of the Geological Survey of Canada, "is massive without cleavage; the colour velvet-black, here and there tarnished blue, and occasionally with pavonine tints; that of the streak, hair-brown; the lustre is vitreous; it is brittle; the fracture is irregular, occasionally subconchoidal; it is opaque; fuses quietly at 3 to a black enamel; has a hardness of 6.5 and a specific gravity at 15.5C. of 3.802. Its analysis afforded him the results under 1 of the following table:

	1[6]	2[7]	3[7]	4[8]
SiO_2	25.77	29.24	29.08	25.66
TiO_2	10.83	18.14	18.54	22.10
Al_2O_3	3.21	1.72	1.44	....
Fe_2O_3	18.59	22.61	22.01	21.58
Fe O	.....	.....	.....	.....
Ti O	8.23	.....	.....	.....
Mn O	0.76	1.17	0.83	.....
Mg O	1.22	0.46	....	.....
Ca O	31.76	26.25	26.79	29.78
Sn O	.....	0.87	0.87	.....
	100.37	100.46	99.56	99.12

1 —Analysis of Schorlomite from Ice river.
2 & 3—Analysis of Iiwaarite from Mt. Iiwaara, Finland.
4 —Analysis of Schorlomite from Magnet Cove, Arkansas, U.S.A.

[6] Ann. Rep. Geo. Surv. Can., Vol. XII, p. 12R.
[7] Ramsay & Berghell: Geol. För. Förh. Stock. Vol. XII, 1891, p. 305.
[8] Dana's Mineralogy. 1892, No. 1, p. 448.

ON THE GENUS *ARCTOPHILA*, RUPR.

By THEO. HOLM.

(With one plate.)

The old genus *Colpodium* of Trinius was founded upon two species : *monandrum* and *Steveni*, which by Trinius himself were considered as "species facie dissimiles", and they are indeed so unlike that Robert Brown a few years later segregated the former as *Phippsia algida*, *R.Br.*, and retained the latter only as a *Colpodium*. To the latter genus was furthermore referred *C. latifolium* R Br., although Robert Brown was not certain about the real affinity of this species with those of Trinius and especially not with *C Steveni* and *compressum*. At present Robert Brown's species *latifolium* is generally placed under Grisebach's genus *Arctagrostis : A latifolia* (R. Br.) Griseb.

While *Colpodium* of Trinius was adopted by Grisebach with the omission of *C. monandrum* (*Phippsia*), the genus was nevertheless augmented with certain species, placed as a section "*Arctophila*" in contrast to *C. Steveni* and its natural allies, representing the section "*Eucolpodium.*" By including the species of *Arctophila*, Rupr., the genus *Colpodium* became actually an aggregate of incongruities, as it had been before with *Phippsia* and *Arctagrostis*. By Bentham the genus was finally restricted to the section *Eucolpodium*, while *Arctophila* became transfered to *Graphephorum* Desv., next to *Glyceria* R. Br. ; another disposition was made by Hackel, who followed Grisebach by placing them both (*Eucolpodium* and *Arctophila*) as sections of the original genus *Colpodium*, and characterized as having the "spikelets one—to two-flowered etc." This same classification is, also, followed by Beal in his lately published monograph of North American Grasses, with the same erroneous characterization, erroneous, because it was originally intended for *Colpodium* alone in the sense of Trinius.

Three species are enumerated by Beal as representatives of the genus (*Colpodium*) in North America : *C. fulvum* (Trin.) Griseb., *C. pendulinum* (Laestad.) Griseb., and *C. mucronatum* (Hack.) Beal Considering the fact that *Colpodium* in the sense of Trinius was originally intended for both *C. Steveni* and *Phippsia algida*,

it seems difficult to find any good ground for admitting species of so little affinity as those of *Arctophila*, and still crediting the genus to Trinius. And the species of *Arctophila* have themselves been transferred from one genus to another. Thus we find them as members of *Poa*, *Glyceria*, *Graphephorum* and finally of *Colpodium*.

Considered by themselves the species of Ruprecht's *Arctophila* constitute an excellent little genus, and we might cite Ruprecht's own words, when he proposed the genus in his "Flores Samojedorum cisuralensium":

"*Arctophila* a *Catabrosa* (*airoide*) praesertim differt glumarum conformatione et longitudine, hac nota etiam et insuper valvulis ecostatis a *Glyceria* R Br. recedit. *Atropis* Trin. (*P. distans*) *Catabrosæ* quoad glumas proxima, spiculas habet (saltem in statu virgineo) lineares, fere teretes; in *Arctophila* nostra semper ex ovato-oblongæ vel lanceolatæ. E conditione glumarum generum series fortasse sequens: *Dupontia*, *Arctophila*, *Poa*, *Atropis*, *Catabrosa*, *Thippsia*, *Coleanthus*. Conjunctioni *Arctophilæ* cum *Poa* obstant: valvulæ dorso concavæ vel saltem minus compressæ; flosculi lana numquam cincti, nec ad nervos dorsales sericei, sed ad callum more *Avenacearum* pilis rigidis brevibus obsiti; valvula inferior apice vix integerrima, sed margo plerumque irregulariter denticulatus et erosus, saltem crenulatus et apex sæpe obtusus vel truncatus; habitus etiam nobilior colore fulvo paniculæ sæpe intermixto; spiculæ majores plerumque et flosculi demum patuli, remotiusculi."

The species that are best known are: *Arctophila fulva* (Trin.) Rupr., *A. pendulina* (Læstad.) Ands. and *A. effusa* Lge., especially the first of these since the Greenlandish plant, *A. effusa*, was for many years considered identical with *A. pendulina* by Fries, Grisebach and several other authors.

Both *A. fulva* and *A. pendulina* possess spikelets with as many as six or seven flowers, at least the spikelets fully developed, but it is not uncommon to find two or three-flowered spikelets upon the basal rays of a panicle in which all the others are from five- to seven-flowered. Typical *A. pendulina* has usually 5- to 7- flowered spikelets, as figured in Flora Danica, and the species differs in this respect from *A. effusa*, in which the number of flowers does not exceed three, and there are often only

two. The empty glumes are relatively longer and more acute in *A. fulva* (Fig. 2.) than in *A. pendulina* (Fig. 1.) and *A. effusa* (Fig. 3.); the flowering glume is also narrower and longer in *A. fulva*. We might state, moreover, that the base of the spikelets seems to afford an additional character by being more or less acute in *A. fulva* and *A. pendulina*, but obtuse in *A. effusa*, during the anthesis; this character follows the relative number of flowers in the spikelet, thus where more than three or four flowers are developed, the spikelets are generally acute at base, but obtuse, where a smaller number is present as for instance in *A. effusa*. The panicle of *A. effusa* is erect with the capillary rays deflexed, while the whole inflorescence is nodding in the two other species.

In regard to the geographical distribution of these species, *A. fulva* has been reported from a number of places in arctic Russia and Siberia, but the only specimens which we have seen from North America were collected at Muckelung River in British Columbia and on the west coast of Hudson Bay, Lat. 56.; the specimens from the former locality were by Beal, referred to *A. pendulina*, but they do not agree with this species, of which we have studied typical material from arctic Europe.

A. fulva occurs in Lapland under two forms: *maxima* and *minima*, as recorded by Brotherus, but in accordance with Nylander none of these are referable to the type, but represent his var. *Lapponica*: "panicula laxa ramis undique sparsis, pendulis, flexuosis, spiculis 2-5 floris versicoloribus, valvulis basi pilorum fasciculo barbati."

In regard to *A. pendulina* no definite geographical range can be given at present since Grisebach included *A. effusa* in this species, and since Kjellman in reporting *A. effusa* from the Siberian coast refers to both Lange's *A. effusa* and Grisebach's *Colpodium pendulinum* as synonyms; we only know for certain that it occurs in arctic Europe in the places recorded by Hartman and Hjelt, while we have not, so far, seen any specimens from this continent.

The third species *A. effusa* is known from the west coast of Greenland, Spitzbergen and Arctic Siberia; the plant from Spitzbergen formerly considered as a distinct species: *Colpodium*

Malmgreni Ands., is now generally refered to *A. effusa* as "*forma depauperata.*"

While thus *A. fulva* and *A. pendulina* are the only species recognized by Grisebach, seven others have been described previously by Ruprecht, but merely refered to as synonyms in Flora Rossica; they were collected on the island Kolgujew and on the Russian coast near Kambalnitza and Bjelaja. Judging from the diagnoses and figures in the work of Ruprecht, cited above, it seems very unsafe to include all these species under *A. fulva* and *A. pendulina*, and we have thought it worth while to insert his diagnoses in this paper, in order to give as complete as possible a representation of the genus. These seven species of Ruprecht are described as follows:

Poa (*Arctophila*) *deflexa.*

Differt a *Poa* s. *Arctophila Laestadii* (*Glyceria pendulina* Laest. e loco classico! et Herb. norm, Suec. !) spiculis latioribus, flosculis majoribus, acutioribus, radiis paniculæ rigidioribus et culmo plerumque duplo tenuiori.

Poa (*Arctophila*) *trichoclada.*

Proxima *P. Læstadii*, sed differt habitu triviali, panicula densiflora, forma spicularum magis ovata, flosculis infimis longioribus, aliter coloratis; semiverticillis radiorum infimorum vix callosis, densius floriferis. A. *Poa deflexa* diversa: radiis paniculæ minus strictis, fere squarrosulis, culmo (et quoque rachi) intra paniculam triplo crassiore, ultra lineam fere lato; spiculis bilinealibus et minoribus, subtrifloris et c.

Poa (*Arctophila*) *fulva* Trin.

Poa (*Arctophila*) *latiflora.*

Habitus *P. fulvæ*, sed differt statura minore 6-9 poll., panicula rigidiore, apice non nutante; spiculis latioribus, basi minus attenuatis, apice multo obtusioribus (ob flosculos fere truncatos) trifloris tantum, hinc etiam brevioribus, vix ultra 1½ lin. longis.

Poa (*Arctophila*) *parcilantha.*

Similis quidem *P. trichocladæ et deflexæ*, sed radii infimi magis contracti, a basi fere spiculis obsessi, non refracti. Culmus 15-20 poll., crassus, nodis 3 exsertis; folia plana ut in antecedentibus; spiculæ variegatæ, 3 lin., 4 floræ, flosculus infimus 1½ lin., superiores duo remotiusculi; panicula erecta.

Poa (*Arctophila*) *remotiflora*.

Culmus ½-1 pedalis, minus crassus ac in præcedentibus, nodo uno alterove exserto; folia præced. angustiora, ad summum lineam lata, flaccidiora, complicata; panicula apice erecta, radii infimi semiverticillati, divaricati et unus sæpe deflexus; longiores ultra medium nudi; spiculæ 3-3½ lin. longæ, 3-4 floræ: flosculi satis remoti, erecti, acutiores quam in reliquis specc. hujus sectionis, pedicellis partialibus (jam flosculi secundi) visilibus.

Poa (*Arctophila*) *similis*.

Valde similis quoad habitum *P. arcticæ* R. Br. et commutatu facilis, differt vero: spiculis subbifloris, e fulvo et purpurascenti variegatis; flosculo secundo longius pedicellato, basi setulis (nec lana) obvallato, dorso et lateribus glabro, ecostato, glumisque angustioribus, longioribus. *A. P. remotiflora* (quacum promiscue? crescit) diversa: statura minori: 3-5 pollicari, nodis omnibus obtectis; radiis infimis geminis vel ternis; spiculis minoribus, vix bilinealibus et c. Vix var. hujus esse crederem.

Poa (*Dupontia?*) *scleroclada*.

Transitus quasi inter *Arctophilas* et *Dupontias*; habitus plane idem ac *P. latifloræ*, *remotifloræ* et rel.; folia eadem, nodus unus alterve exsertus. Spiculæ sequentis, sed gluma quælibet flosculo suo distin te brevior. Culmus 12-15 pollicaris, radii infimi paniculæ semiverticillati, patuli, unus interdum deflexus ut in *P. remotiflora*, cujus habitu gaudet, sed tota panicula multo rigidior est, spiculæ crassiores, majores, color fulvus magis prædominans; spiculæ interdum 4-floræ cum rudimento.

The genus seems to be rare in North America, but has been collected in various parts of Alaska and on the adjacent islands, besides in the British provinces, mostly south of the arctic circle. These specimens have been generally identified as *A. fulva* or *A. pendulina*, but as stated above, the former is not with certainty known except from Muckelung River and the Hudson Bay region, while we have seen no specimens of the latter from this continent. A very peculiar plant was collected on the arctic coast near Point Barrow by Dr. Murdoch (1883) and having been submitted to Professor Hackel for identification, it was at once distinguished from all the others and described as *A. mucronata* Hack. As indicated by the specific name the midrib of the flowering glume is produced

into a short mucro, while in all the other known species, the midrib does not protrude beyond the apex of the glume. The species shows in all other respects a close resemblance to *A. effusa*, being of low stature with very broad leaves, thick culm, with the branches of the loose-flowered panicle deflexed and, furthermore, by the spikelets being two-flowered and rounded at the base. Hackel (in litteris) placed it nevertheless under *Arctophila* even if it be somewhat anomalous in this genus on account of the mucro, but as stated by him, it would be still more anomalous in *Colpodium* Trin. (as understood by Bentham), because there the midrib never reaches the top of the undivided glume. It would seem as if this interesting addition to the genus *Arctophila* would warrant its final segregation altogether from *Colpodium* of Trinius, but strange to say, it is placed together with *A. fulva* and *pendulina* as a true *Colpodium* by Beal, in his lately published Monograph of the North-American *Gramineæ*.

And besides this species of *Arctophila* with the flowering glume mucronate, there is, still, another and even more interesting type, hitherto undescribed, which we found in the herbarium of the Canadian Geological Survey, which had been collected on Mansfield Island, north of Hudson Bay by Dr. Robert Bell. In this species the flowering glume is distinctly awned, not simply mucronate, a fact that excludes the plant absolutely from *Colpodium*, while it may be well understood as an *Arctophila*, and placed next to *A. mucronata*. It constitutes a species distinct from this not only by the presence of a true awn, but also by the larger number of flowers in the spikelet, the slender culm, much narrower leaves and by an altogether more graceful habit ; we have designated the name *A. trichopoda* to this species, and a full description and illustration will be published at an early date in a work upon the Hudson Bay Flora.

The discovery of this well marked species induced the writer to study some more material of the genus as represented in North America, and our investigation has resulted in the separation of three other species, which appear to us as very distinct from those previously described ; they had been identified as *A. fulva* and *A. pendulina*.

These new species are:

ARCTOPHILA GRACILIS (Figs. 3 and 4.)

Rhizome wanting: culm glaucous, slender, glabrous, the internodes longer than the leaf-sheaths: leaves glaucous, glabrous, the sheaths split to about the middle: ligule lacerate; leaf-blade flat, very narrow, much longer than the internode, erect: panicle relatively long and narrow, the almost capillary rays semiverticillate: the basal and several of the upper ones deflexed, giving the plant somewhat the aspect of *Poa sylvestris* Gr.: spikelets glaucous, quite numerous near the end of the branches with capillary pedicels, two to four-flowered: empty glumes very unequal, obsoletely three-nerved, acute: flowering glume relatively narrow, the apex obtuse and erose, three-nerved, longer than the bidentate, glabrous palea: rhacheola hairy at the joints: stamens and pistil as in *A. fulva*.

Very characteristic by its narrow panicle, the narrow leaves and glaucous hue.

Collected by Dr. R. Bell in bogs and swamps north of Lake Superior; in flower July 1883.

ARCTOPHILA FRIZOIDES. (Fig. 8.)

Rhizome robust, stoloniferous: culm glabrous, about 60 cm. in height, the upper internodes longer than the leaf-sheaths the basal shorter: leaves glabrous, the sheaths split to about the middle; ligule large, almost entire, leaf-blade flat, quite broad, much longer than the internode, erect: panicle nodding, very short, but broad, the rays semiverticillate, two or three together, drooping, very slender: spikelets pale green with a slight tinge of purple, mostly four-flowered, quite numerous in proportion to the small panicle, broadly ovate, on very slender pedicels: empty glumes subequal, the lower one-nerved, the upper three-nerved: flowering glume rather broad, obtuse, erose, nerveless, longer than the palea: rhacheola, stamens and pistil as above.

Recorded as *A. fulva*, but very distinct from this and the others by the short and broad inflorescence with its drooping, broadly ovate spikelets, rendering the plant the aspect of a *Briza*.

Collected by James M. Macoun on St. Paul Island, Behring sea; in flower August 1892.

ARCTOPHILA CHRYSANTHA. (Figs. 6 and 7.)

Rhizome stoloniferous, somewhat robust: culm glabrous, about 30 cm. in height, the upper internodes very little longer than the leaf-sheaths, the basal shorter: leaves glabrous, deep green, the sheaths closed from above the middle: ligule almost entire: leaf-blade flat, relatively narrow in the upper leaves, much longer than the internodes, erect: panicle rich-flowered, nodding, somewhat contracted, the slender rays three to five in the basal verticils: spikelets numerous, small, yellowish-brown, shining, short-peduncled to nearly sessile, two- to three-flowered: empty glumes variable in length, both five-nerved in fully developed spikelets, broad and slightly acute: flowering glume relatively broad with the acute apex entire or minutely erose: rhacheola, stamens and pistil as in the other species.

Identified as *Colpodium fulvum*, from which it, however, is very distinct by the characters mentioned above. Collected by J. B. Flett in swamps near sea-shore, 16 miles west of Nome City, Alaska; in flower Aug., 1900.

These species of Arctophila may naturally be classified in two sections:

I. *Macrostachyæ*.

Spikelets, when fully developed, five- to seven-flowered, the base acute during anthesis.

A. fulva, *A. remotiflora*, and *A. pendulina*.

II. *Brachystachyæ*.

Spikelets two- to four-flowered, the base obtuse during anthesis.

A. brizoides, *A. chrysantha*, *A. deflexa*, *A. gracilis*, *A. latiflora*, *A. mucronata*, *A. pœcilantha*, *A. scleroclada*, *A. similis* and *A. trichopoda*.

Brookland, D.C., April, 1902.

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EXPLANATION OF PLATE NO. 1.

Fig. 1—Spikelet of *Arctophila pendulina*.

,, 2— ,, *A. fulva*.

Figs. 3 and 4—Spikelets of *A. gracilis*.

Fig. 5—Spikelet of *A. effusa*.

Figs. 6 and 7—Spikelets of *A. chrysantha*.

Fig. 8—Spikelet of *A. brizoides*.

OOLOGY.

NOTE ON THE NESTING OF THE NORTHERN RAVEN (*Corvus corax principalis*) IN CANADA.

By J. F. WHITEAVES.

The Museum of the Geological Survey has recently acquired a full and perfect clutch, of five eggs, of the Northern Raven, from Mr. R. W. Tufts, of Wolfville, Nova Scotia, who took them, on the 22nd of March last, from a nest in the Gaspereau Valley. The label accompanying these eggs states that the nest from which they were taken and which was not disturbed, is placed in a "large hemlock about fifty feet from the ground," that it is "composed of sticks and lined with wool and coarse grass stems," that it had been "repaired year after year," and that the five eggs were "one-third incubated" when taken. These eggs are unusually small for the species, an average one measuring 48.5 x 32.5 mm. Evidently, Mr. Tufts writes, they were laid by old birds, which may account for the small size of the eggs. The nesting place, he adds, has been occupied for a number of years, and there is a large accumulation of material there. Prior to the receipt of this clutch, there were, in the same Museum, seven eggs of the Northern Raven, two from Nova Scotia and five from the Mackenzie River District, but no complete and perfect set. The two from Nova Scotia are two-fifths of a clutch of five eggs taken at Truro, in 1897, by or for Colonel T. J. Egan, of Halifax, three of which were broken. The two remaining are unusually large, one of them measuring 54 x 34.5 mm. The other five were brought to the Museum by Mr. J. W. Tyrrell, and are labelled "Raven's eggs, found on Artillery Lake, May 24th, 1900, by C. Fairchild." Artillery Lake, it may be mentioned, is north-east of Great Slave Lake, and Mr. Fairchild was Mr. Tyrrell's assistant in his explorations of the Barren Grounds between Great Slave Lake and Hudson Bay. Three of these eggs were, unfortunately, slightly damaged in transit. All of them are end-blown, and it is not stated whether they are from the same nest or not. By their coloration they could quite easily be separated into two sets, one of two eggs and the other of three. An average one measures 51 x 35 mm.

Ottawa, May 19, 1902.

ORNITHOLOGICAL NOTES FROM KINGSTON, ONT.

Two rather important finds have been made at Kingston this spring, and we are now in a position to speak positively regarding some of the birds, we were quite certain bred here regularly. From the fact that from time to time, I came across long-eared owls—*Asio Wilsonianus*—in the early summer, I inferred that these nocturnal birds bred in the vicinity. During the winter I saw one, and this spring came across a pair in Rockwood grounds. On April 30th, a boy told me that owls were breeding at the back of Rockwood property, and I began to investigate the problem as thoroughly as possible. On May 5th, a lad informed me that he had found five white eggs in a last year's crows' nest in a pine tree. Examination proved that the bird was a long-eared owl, and the eggs were in different stages of incubation, but none far advanced. In this case the owl left the nest directly, and did not remain near by when disturbed. Three of the eggs measured were, in inches :—1.60 x 1.28 ; 1.62 x 1.32 ; 1.66 x 1.27.

On April the 28th, in the same locality, another lad found a nest of the long-eared owl containing five eggs. The owl was much disturbed, and flew but a short distance to a small pine where it snapped its beak, and in many ways showed its resentment. Next day the lad returned to the nest and found only four eggs, which are now in the possession of Mr. Edwin Beaupré. These are somewhat larger than those in my set. In this case the nest was one left by the crows last year, and is only about twelve feet from the ground, in a stunted clump of pines near the edge of the marsh.

MERGANSER AMERICANUS.—On April 10th, Mr. Edwin Beaupré, in company with Rev. C. J. Young, investigated an eagles' nest on one of the Thousand Islands, in the vicinity of Kingston. While descending the tree, Mr. Beaupré looked into a cleft and discovered three fresh duck eggs, presumably those of the *Merganser Americanus*. These he took, and as mergansers were seen near the island, and the eggs were of large size, there was little reason to doubt the correctness of the opinion. On April 18th, the cavity in the tree was again examined, and beyond four or five apparently fresh feathers, there was nothing to make one suspect that the birds had not abandoned the nest. Twelve days after-

wards, (April 30th) Mr. Beaupré and I again went to the tree and not only found the merganser at home, but making a futile endeavor to cover no less than eighteen eggs.

The bird (female) was most reluctant to leave the nest, in fact would not flush until stirred up by Mr. Beaupré, with a dip net. The eggs were quite fresh. There were three interesting points in connection with this find, first, the early date of nesting; second, the number of eggs; and third, the absence of feathers. As a matter of fact the eggs were simply deposited on the rotten wood at the bottom of the hollow. Several pairs of mergansers were about the island, and no doubt two birds had deposited eggs in the same tree. We are certain, too, that the other trees were occupied by mergansers from what we saw, but having no desire to disturb them did not investigate further.

FALCO PEREGRINUS ANATUM.—A third find of some importance was made by Mr. Edwin Beaupré and myself on May 8th. On a cliff in a lake in Leeds County, we found the peregrine falcon breeding. The eggs were on a ledge of rock in an almost inaccessible cliff, a hundred and twenty-five feet in height. The ledge was seventy or seventy-five feet above the water, and we had great difficulty in reaching the nest, but finally succeeded and obtained a series of interesting photographs As may be imagined it was a decidedly inconvenient spot for the practice of photography, but the results were most satisfactory and give an excellent idea of the appearance of the eggs in the nest, which was little more than a depression in the earth that had accumulated there. Fortunately the camera used was of the long bellows variety, otherwise it would have been quite impossible to make a satisfactory exposure. The eggs, two in number, had been sat upon, probably a week. When we reached the cliff the female flew off the nest, and being joined by her mate, a vigorous protest was made against the intrusion of the investigators. Near the nest the remains of a flicker were found, and it was evident that small birds formed the chief part of the food. We were much impressed by the graceful and free movements of the magnificent birds, and were lost in admiration when watching them sweeping and sailing around the cliffs. As soon as we were two hundred yards from the cliff the female bird at once returned to the ledge.

These birds are known to have nested in this particular rock for fifteen years, and are said to be the only pair about the lake.

C. K. CLARKE, M.D.

EXCURSIONS.

During April and May the Club held the following sub-excursions.

April 19th. About one hundred and seventy-five members and friends of the Club visited Aylmer, *Epigæa repens* was abundant.

May 3rd. Beaver Meadow, Hull, was visited and although the day was chilly and threatening about fifty attended. Several species of plants were collected.

May 10th. Rideau Park, Billing's Bridge, was chosen as the Club had not collected there for some years. Between forty and fifty were present. The severe frost of the previous night destroyed many plants, but a few species were found unharmed. A small collection of Utica fossils was also made.

Excursions had been arranged for April 12th and 26th but rain prevented their being held.

It is seldom that an excursion is as entirely satisfactory as that of the first general excursion of the Ottawa Field Naturalists' Club to Chelsea on Saturday, May 17th. The weather was perfect, being neither too hot nor too cold, and the scene of the outing afforded plenty of interest, not only for botanists and geologists, but also for those who simply wanted to enjoy nature. The only thing that was lacking was bird life. As Mr. A. G. Kingston explained to the company, when the time for speech-making came, one can see just as many birds in the city, during the migrating season, as in the country, and in either case, the afternoon is not the time when they are most in evidence.

The party included nearly all the students of the Normal School, accompanied by Dr. Sinclair, Miss Keyes and Miss Bolton and numbered about three hundred. On arriving at Chelsea at two o'clock, wraps and lunches were deposited in one of the cottages of the "deserted village," formerly occupied by the employees of Gilmour's mills, and then the company broke up into smaller groups, which scattered far and wide and spent the afternoon according to individual inclination. Dr. Fletcher conducted a party of botanists, and a detachment of small boys went geologizing along the railroad track with Mr. W. J. Wilson. The clearing in Gilmour's grove was appointed as the place of *rendezvous*, and shortly before seven the company reassembled to listen to speeches by Prof. Macoun, Mr. Kingston, Mr. Jas. Ballantyne, Dr. Fletcher and Dr. Sinclair.

Dr. Sinclair referred to the natural beauties of Chelsea, which he considers unsurpassed in the world, and Dr. Fletcher said a few words about the plants that had been found. Mr. Wilson spoke

of the geology of the district, and exhibited specimens of marine shells which are found in large quantities in the clay banks. They were laid down just after the glacial period, their age being placed between 7,000 and 90,000 years, and precisely the same species may be found living in the ocean to-day.

The proceedings were enlivened by the signing of the "Maple Leaf" by the Normal students, and everyone joined in "God Save the King" at the close. The party returned to town at about half-past eight.

CORRESPONDENCE.

The Editor OTTAWA NATURALIST.

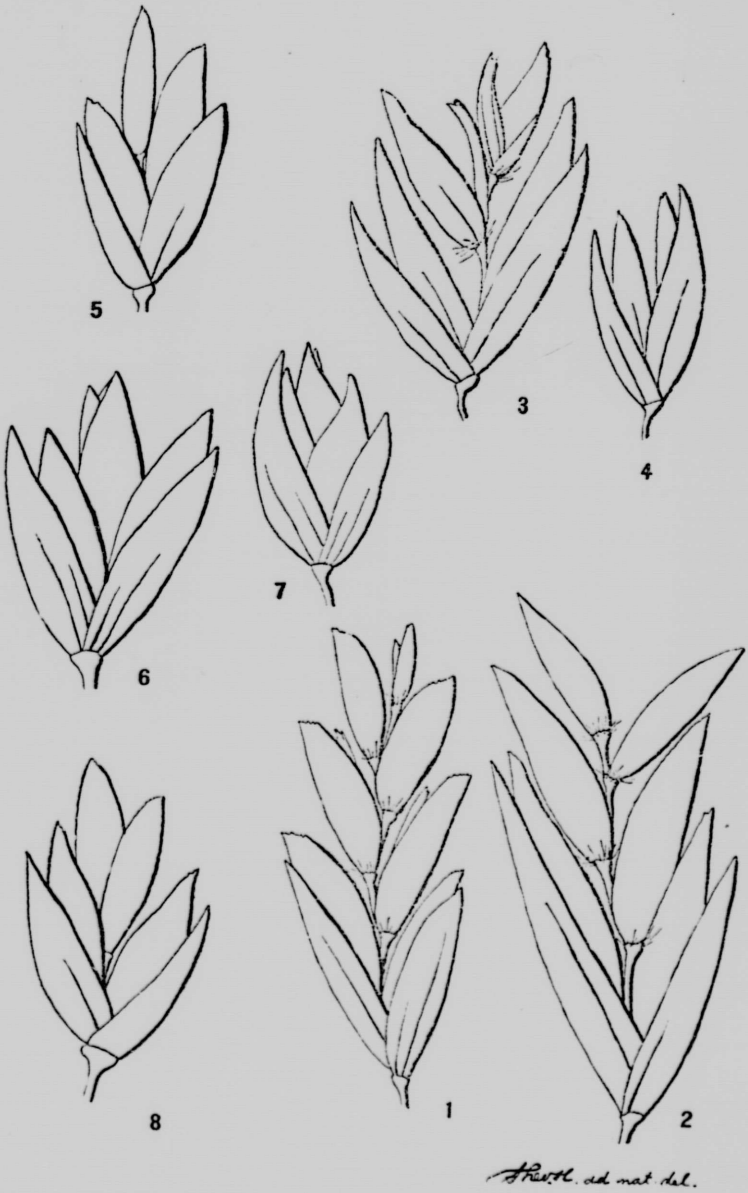
In what appears to be a comprehensive and fair review of the work done at the Canadian Biological Station there was, in the last number of THE NATURALIST an oversight which should not be left uncorrected. Referring to Dr. Fowler's list of plants published in the report under consideration the reviewer says: "As Dr. Fowler's list stands it adds little or nothing to the very excellent reports already published by Dr. G. U. Hay, Mr. J. Vroom and other New Brunswick botanists."

While it is quite true that Dr. Fowler's list adds little to our knowledge of the flora of New Brunswick the reviewer forgot, or did not know, that Dr. Fowler's work in New Brunswick was pioneer work and that it is to his published lists that we still look for information. Such a local list was probably wanted for the report or it would not have been published. The younger New Brunswick botanists have done, and are doing good work, but no reference to what has been done botanically in New Brunswick can fairly be made in which any name takes precedence of Dr. Fowler's.

Yours truly,

JOHN MACOUN.

Ottawa, May 13, 1902.



To illustrate Dr. Holm's paper on Arctophila.

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