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THE OTTAWA NATURALIST.

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ON SOME DYKES CONTAINING "HURONITE."

By ALFRED E. BARLOW, M.A.
Geological Survey Department, Ottawa, Canada.

(Read before the Geological Society of America, Baltimore, Dec. 28th, 1894.)

The name Huronite was long ago given by Dr. Thomson of Glasgow, to certain light-yellowish green masses or crystals which occurred porphyritically embedded in a boulder of diabase found on the shores of Drummond Island, Lake Huron, specimens of which had been sent to him by the late Dr. Holmes of Montreal. Thomson regarded it as a new species and published a description and analysis of it in his Mineralogy of 1836. The occurrence of these crystals was first noticed by Dr. Bigsby in 1820, who writes of the rock containing them in a general way as "greenstone porphyries having a light-colored base and containing crystals of red or white felspar—seldom of both in the same block,"(1) This brief and general description would not have been sufficient for purposes of identification except for the fact that his manuscript report which formed the basis of this paper, (2) was lately presented to the library of the Geological Survey of Canada. In the appendix Dr. Bigsby notes "among the debris of the shore of Lake Huron are porphyries of greenstone with embedded crystals of red felspar or of four or six sided prisms of cream white colour, foliate fracture, cleavage about 60°, yielding to the knife readily, translucent at the edges and of a feel slightly soapy. Their crystallization is seldom well defined, but sometimes remarkably so." This clear and accurate description serves at

(1) Trans. Geol. Soc. London, Vol. 1, p. 205. On the Geography and Geology of Lake Huron, read Feb. 21, March 7 and 21, 1823.

(2) Notes on the Topography and Geological structure of the north-west portion of Lake Huron, addresseed officially to Dr. J. Wright, Inspector of Hospitals in Canada and dated Quebec, Feb. 23, 1821.

*(Communicated by permission of the Director)

once to identify the substance composing these porphyritic crystals with the mineral described later by Dr. Thomson as "Huronite." The source of these boulders was not known and the mineral never found "in situ" until 1881, when Dr. Robert Bell, (1) of Ottawa, in his examination of the country to the north-east of Lake Superior, noticed the occurrence "of a dark grey crystalline diorite (in one place rendered porphyritic by spots of light-greenish yellow felspar) on the neck of land separating Lake Mattawagaming from Lake Wabatongwashene." This rather brief description was altogether inadequate to connect the mineral with the Huronite which had previously been described by Thomson, and it was not until Dr. Harrington, of Montreal, visited the spot on professional business some year later, that the true identity of these "spots" was clearly established. In 1891, Dr. Selwyn, of Ottawa, happened to be at the same locality which is situated between Missinaibi and Loch Alch Stations on the main line of the Canadian Pacific Railway, and he states that the dykes containing the Huronite cut both Huronian and Laurentian strata. During the construction of the Canadian Pacific Railway in 1884, Drs. Girdwood and Ruttan made a collection of the principal rocks met with on the main line from Chalk River westward. This collection, they subsequently presented to McGill University. Among the specimens, was one of a dark green diabase with phenocrysts of a mineral resembling Huronite scattered through it. This specimen had been obtained from a dyke cutting the granitoid gneisses a few miles north-west of Pogamasing Station. The microscopical examination, however, reveals the fact that the original Drummond Island boulder was not derived from either of these localities. Mr. W. G. Miller of the School of Mines, Kingston, who acted as Dr. Bell's Assistant in 1893, mentions the occurrence of a dyke containing Huronite near the contact between the granite and slates (Huronian) at Depôt Lake in the northern part of the Township of Proctor, about fifteen miles north-east of Cook's Mills. From its geographical position and the direction of the glacial striae this would seem to be the most likely source of the Drummond Island boulder, although this cannot be ascertained with certainty as the specimen from the locality

(1) Report, Geological Survey, Canada, 1880-2, part c, p. 4.

was lost. Mr. H. G. Skill, of Cobourg, Ontario, who assisted the writer in 1891, discovered another dyke containing this mineral, about one quarter of a mile north of Murphy Lake, in Timber Limits 90 Algoma District. During the progress of his explorations in the peninsula of Labrador, Mr. A. P. Low, of the Geological Survey of Canada, noticed the presence of Huronite in a dyke cutting Laurentian gneisses about ten miles north of Lake Kawachagami on the portage route between the Rupert and Eastmain rivers and also in two dykes, each about two hundred yards wide, breaking through rocks of Cambrian age, on the west branch of the Hamilton River, fifteen and twenty miles respectively, below old Fort Nascawpee, on Lake Petitsikapow.

Dr. Harrington (private communication) has noticed loose pieces of diabase containing Huronite a few miles beyond Amyot Station. He also mentions the occurrence of a diabase dyke four inches in width, containing phenocrysts of the same mineral, a short distance east of the crossing of the Magpie River, near Otter Station, on the Canadian Pacific Railway.

Prof. N. H. Winchell, of Minneapolis, Minnesota, in his visit to the Lake Huron district, in 1889, made note of "the occurrence at Algoma of occasional very interesting boulders (1605). (1) They contain large and small rounded whitish green felspathic spots which are distributed somewhat like porphyritic crystals but they have not the regular periphery of crystals. They are in a matrix of ordinary diabase of dark green colour and the spots make the rock noticeable, their largest size being somewhat larger than an inch in diameter. Some of the boulders are put in the foundation of the great hotel which the Canadian Pacific Railroad (2) projected at Algoma, and that is where we saw them first. Dr. Selwyn recalled the dyke cutting the Animikie on the high ridge back of Silver Islet, as the only spot where such a rock is in place," Professor Winchell, who visited this place in 1879, has sent me a small chip from a specimen then collected, as well as fragments of the Algoma boulder

(1) The number 1,605 refers to the number of the specimen in the rock series of the Geological Survey of Minnesota

(2) 18th Annual Report, Geological Survey, Minnesota, 1889, pp. 58 and 63.

and a small sample from a dyke near Gunflint Lake, north-west of Lake Superior. The phenocrysts of felspar in the Silver Islet specimen, according to Professor Winchell (1) are distinctly angular and not greenish, but greyish in colour. Under the microscope, these felspar phenocrysts are seen to be a plagioclase towards the basic end of the series (very probably labradorite) which has undergone only incipient alteration, whereas, in general the Huronite shows very great decomposition.

The writer has seen numerous boulders of diabase containing this mineral in the region to the north and north-east of Lake Huron, especially on the shores of Lake Huron from Killarney westward to the mouth of the Spanish River,

During the summer of 1893, the writer also noticed a boulder of dark green diabase, on the west shore of Bear Island on Lake Temagami, with plagioclase phenocrysts, which bore a very marked resemblance to the more altered Huronite. As the felspar seemed so fresh and glassy in places, it was thought an optical examination accompanied by a chemical analysis would throw a great deal of light on the original character and composition of Huronite. Dr. Harrington kindly undertook the analysis of this felspar, which proves it to be labradorite. Under the microscope most of these crystals are quite fresh, although certain portions are more or less clouded by the presence of decomposition products, which it is often difficult to resolve, even with the higher powers of the microscope. Certain of the crystals, however, show the same alteration, only in a lesser degree, as that which characterizes the Huronite.

It will thus be seen that the mineral is by no means so rare as some have supposed, but has, on the contrary, a wide geographical distribution. The sole reason of its not being discovered, "in situ," earlier seems to have been due to the necessarily hurried and imperfect explorations first undertaken through these wild and unsettled districts.

In 1885, Dr. B. J. Harrington, of McGill University, Montreal, decided to undertake an examination of the Pogamasing mineral for purposes of comparison with that contained in the original Drummond

(1) No. 601, 10th Annual Report, Geological Survey, Minnesota, p. 56.

Island boulder, a sample of which was contained in the Holmes collection in the Peter Redpath Museum. In the course of this investigation he discovered some very grave errors in Thomson's description. "The hardness for example is about 5½ instead of 3¼ as stated by Thomson. Instead of being infusible it is distinctly fusible (F about 5) while it contains alkalies the presence of which is entirely ignored by Thomson."(1)

Dana, in an old edition (2) of his mineralogy mentions Huronite under Prehnite, evidently deeming it an allied mineral. In 1889, (3) the same author mentions Huronite along with Weissite and Iberite as a supposed altered form of Iolite (Cordierite). In the same edition (4) he also says "Thomson's Huronite is an impure anorthite-like felspar related to bytownite, according to T. S. Hunt (priv. contrib.), excluding the 4·16 per cent of water the SiO_2 would be 47 per cent of the remainder." Again, in the same edition, Dana states (5) "Huronite, Thomson (Min., I., 384, 1836) considered an altered mineral near fahlunite by T. S. Hunt, occurs in spherical masses in hornblendic boulders in the vicinity of Lake Huron." In the last edition of Dana's Mineralogy (6) the author, Mr. E. S. Dana, places the mineral under anorthite on the authority of Dr. Harrington's paper in the Transactions of the Royal Society of Canada, but Dana is wrong in referring the analysis made by Mr. N. N. Evans, to the Huronite of the Drummond Island boulder, for in reality it belongs to the Huronite found by Dr Girdwood near Pogamasing. Michel-Lévy and Lacroix (7) include Huronite among the decomposition products of Iolite or Cordierite. The failure to assign to Huronite its rightful mineralogical position arose from the fact that it was impossible to ascertain its true nature by chemical analysis. It remained for the microscope to disclose its composite nature and to show its relation to the more widely known "Saussurite."

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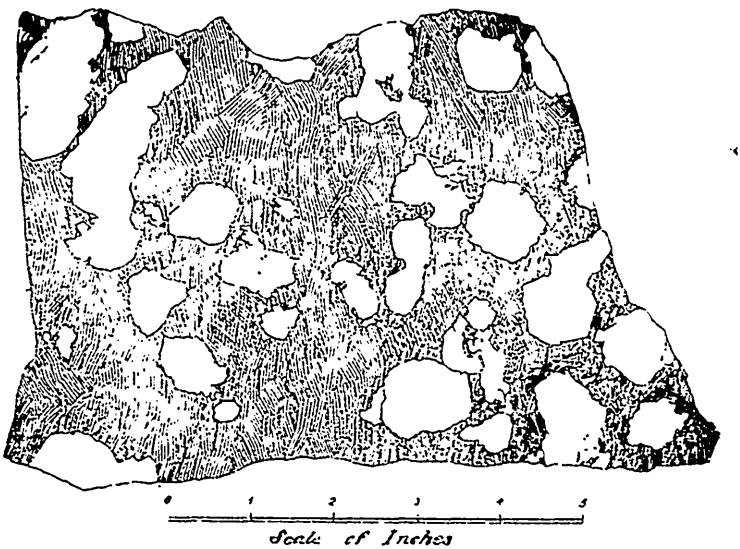
(1) See Trans-Royal Soc. Canada, Section III, 1886, p. 82.
(2) System of Mineralogy, 3rd edition, 1850, p. 313.
(3) See System of Mineralogy, 1889, p. 301.
(4) See Idem. page 34.)
(5) See Idem. page 485.
(6) System of Mineralogy, 1892, p. 340.
(7) Les Minéraux des Roches, 1888, p. 174.



CRYSTALS OF HURONITE IN DIABASE.
(Cat. No. 985, Geological Survey of Canada Museum)
From ¼ mile N. of Murphy Lake, Algoma, Ont.

The name "Huronite" has usually been restricted to yellowish green more or less rounded masses or phenocrysts, which rarely exceed two inches in diameter, embedded in a medium textured dark greenish or greyish groundmass. Many of the smaller and not a few of the larger individuals have an irregular or jagged outline owing to magmatic corrosion and frequently exhibit small arms or bays which have been filled by the invading magma. Occasionally some are seen with a more or less perfect crystallographic outline and many exhibit one or more sharp crystal faces. The mineral is light yellowish-green in colour although portions of the crystals which have undergone less alteration show a very pale flesh red or pink colour as in the case of the Murphy Lake and Eastmain specimens. The crystals weather to an opaque greyish-white forming very conspicuous spots in an otherwise dark coloured rock. Under the microscope the greenish colour is seen to be due to the more or less abundant development of

zoisite, epidote, sericite and chlorite at the expense of the original felspar. Some of the phenocrysts show a more or less perfect cleavage which is noticeably the case in the Eastmain specimen, although in the more hightly altered samples, as those from the vicinity of Missinaibi, little or none can be seen. Occasionally, crystals show macroscopically the lamellation due to polysynthetic twinning, as in some of those in the Murphy Lake diabase, but as a general rule these lamellæ are either absent altogether or so faint that they cannot be detected. The mineral is subtranslucent, varies in lustre from pearly to waxy according to degree of alteration. The hardness varies from 5½ to 6, fusibility about 5, and the specific gravity, according to Mr. R. A. A. Johnston, of the Geological Survey of Canada, varies from 2·725 in the Eastmain specimen to 2 935 in those from Missinaibi. The specific gravity, as would be expected, shows an increase in proportion to the the alteration. The microscopic examination in general reveals the fact that in every case the so-called "Huronite" is really a plagioclase near the basic end of the series which has undergone more or less complete "saussuritization." In most instances the development of zoisite, epidote, sericite, chlorite, etc., at the expense of the original felspar has been so abundant as to leave only traces of the original twinning lammellæ and occasionally to destroy all evidence of this structure. Specimens may be obtained from the large number of slides examined, showing a complete gradation of this decomposition from the pure glassy plagioclase (labradorite) composing many of the phenocrysts contained in the diabase from Temagami Lake to the completed Saussurite or Huronite in the porphyritic individuals of the Missinaibi rock. The matrix in which those phenocrysts are embedded is in general a typical diabase of dark greenish or greyish colour which likewise shows a wide difference in degree of alteration under the microscope. The specimens from Bear Island, Lake Temagami, show a very typical and fresh olivine-diabase. With the exception of some of the crystals of olivine, the rock is remarkably free from decomposition, while in the finer grained portion of the rock from Missinaibi all the component minerals have undergone great alteration. The plagioclase is more or less completely "saussuritized," the augite originally present wholly converted to hornblende (uralite) and the ilmenite replaced by the dull

gray almost opaque variety of sphene known as leucoxene. A strange fact noticed, moreover, is that frequently the less altered phenocrysts of Huronite occur in an exceedingly decomposed diabase as is the case in the Pogamasing and Eastmain specimens, while the more highly altered porphyritic individuals of this mineral are frequently developed in a groundmass more or less remarkable for its freshness. This is noticeably the case in the original specimen from the Drummond Island boulder.

The first stage in the decomposition or "saussuritization" of the plagioclase shows a cloudiness due to the development of a dull, fine grained, more or less opaque material, with a higher index of refraction causing the granules to stand out in relief from the surrounding felspar. In many cases, even in the thinnest sections, this is beyond the highest power of the microscope to resolve into its component mineral or minerals. This is accompanied, or immediately followed, by the development of sericite (hydrated muscovite) in small scales showing characteristic brilliant interference colours. The cleavage planes and fissures are seen to contain large scales and plates of this mineral, while certain other cracks and fissures are filled with chlorite and serpentine resulting from the decomposition of the bisilicates present. The smaller granules now coalesce and form larger masses and individuals of zoisite and epidote, while larger plates and scales of sericite are developed and the original plagioclase is finally replaced by a comparatively coarse grained aggregate consisting of zoisite, epidote, sericite, chlorite, calcite, and felspar. Where the alteration has been extreme, as in the case of the plagioclase originally present in the matrix of the Pogamasing specimen, the lime is more or less completely removed, and the alkaline portion of the plagioclase has crystallized into pure limpid grains of albite which seldom show twinning striations and are accordingly frequently mistaken for quartz with which they are often associated.

The larger phenocrysts very frequently showed a marked difference both in the degree and character of the alteration of their central and peripheral portions. The zoisite and epidote were much more abundant in the zone or belt immediately surrounding the crystals, while muscovite is the prevailing decomposition product present in the cen-

tral portion. In the plagioclase of the matrix the decomposition products are frequently grouped together in the central portion, leaving a comparatively clear and fresh periphery. Certain of the crystals of felspar are quite fresh and glassy, having for some reason escaped the alteration to which most have been subjected.

With the single exception, perhaps, of the plagioclase originally contained in the fine-grained portion of the rock from Pogamasing the decomposition has not been of such extreme character that secondary albite has resulted and in every other instance the clear felspar substance is certainly an unaltered survival of the original individual. The plagioclase of the groundmass is usually in more or less elongated forms, but occasionally mutual interference has produced at times rounded contours. In composition—to judge from the measurements of the angle contained between the maximum extinction of adjacent lamellae —the plagioclase appears to be always near the basic end of the felspar series. Some of the angles obtained are high enough for anorthite, the most basic of the felspars, but generally the angles obtained indicated labradorite as the most frequent source of the Huronite.

PETROGRAPHICAL DESCRIPTIONS.

1. *Locality.*—At Hudson's Bay Co.'s Post, Bear Island, Lake Temagami, District of Nipissing, Ontario. (From a boulder.)

In the hand specimen the rock is a dark green, medium textured diabase in which numerous large phenocrysts of plagioclase are developed. Most of these porphyritic crystals are more or less rounded owing to magmatic corrosion, although occasional individuals exhibit tolerably sharp and perfect crystallographic boundaries. Some of the crystals measure as much as three inches in diameter, but as a rule they vary from one to two inches across. They have in general a greenish tinge, although portions of some of the crystals show a flesh red colour. Most of this plagioclase is remarkably fresh and glassy, but the cleavage planes are very frequently coated with such alteration products as serpentine and chlorite derived from the decomposing bisilicates present in the matrix. The phenocrysts are often seen containing or invaded by portions of the finer-grained groundmass. This matrix weathers brownish or yellowish owing to the oxidation of the iron present, while

the phenocrysts of plagioclase become a dull greyish white, thus rendering the rock very conspicuous. In general the rock bears a very close megascopical resemblance to the diabase originally described as containing the Huronite while the phenocrysts themselves differ only in the degree of alteration they have undergone. The writer regards this diabase as the least altered representative of the series of rocks studied but which, under similar conditions, would have furnished a rock differing but slightly, if at all, from any of the more decomposed specimens first noticed and described as containing "Huronite."

An analysis of a portion of one of the least altered of these phenocrysts of plagioclase, kindly undertaken by Dr. Harrington of McGill University, proves the species to be labradorite. The following are the results:

Silica	54·19
Alumina	28·42
Ferric Oxide	0·77
Ferrous Oxide	0·41
Manganous Oxide	Trace
Lime	10·47
Magnesia	0·52
Soda	4·47
Potash	0·63
Loss on ignition	·59
	100·47

The specific gravity of carefully selected fragments with the bottle was 2 679.

Under the microscope the rock is seen to be a very typical and rather fresh olivine-diabase. In many instances the large phenocrysts are quite fresh and give the extinction angles characteristic of labradorite. Very often, however, irregular areas and patches have undergone considerable "sericitization," the resulting scales of hydrated muscovite being very minute. Occasionally this alteration is carried farther and both zoisite and epidote are present in addition to the sericite as a result of secondary action. At times a narrow border surrounding those crystals exhibits a micro-perthitic structure. A careful examination adduced sufficient evidence to indicate clearly that a more extended alter-

tion of these phenocrysts of labradorite would produce the so called Huronite. The fine-grained portion of the rock in which these crystals have been developed is a fresh aggregate composed chiefly of plagioclase (labradorite), augite and olivine. The ophitic or diabasic structure is very pronounced. The plagioclase is usually idiomorphic forming an interlacing network of lath-shaped crystals, the interstices of which are filled with augite and olivine. The augite possesses the reddish colour and pleochroism so common in diabase, the larger grains showing frequent distortion and occasional dislocation. Both the felspar and augite exhibit undulatory extinction as an effect of pressure. The olivine, as usual, occurs in irregular, more or less rounded individuals, only very rarely presenting sharp crystallographic outline. Commonly, it is rather fresh, showing a colourless or light greenish section with characteristic high relief, rough surface and brilliant interference colours. It is rarely so fresh, however, as to be without traversing fissures filled with more or less opaque alteration products. In many instances the original olivine grain is represented by a greenish or yellowish material, probably serpentine. Small scales or grains of opaque iron ore (magnetite) are associated with this serpentine indicating that they were also a result of the decomposition of the olivine. Less frequently, perhaps, the olivine shows a very interesting and rather unusual alteration to talc, but the resulting scales of this mineral were so small that this could not be ascertained beyond dispute. The talc is of a very pale green colour, slightly pleochroic, and exhibits very brilliant interference colours between crossed nicols. It occurs as a matted or felted aggregate of very minute scales filling the original olivine grain. The talc is usually accompanied by more or less opaque iron ore and occasionally some chlorite. (1) A considerable quantity of biotite is present which in some cases has undergone considerable "bleaching" owing to the removal of iron, while in other cases it is altered to chlorite. Apatite is also a tolerably abundant accessory constituent. The magnetite occurs usually in irregular black grains, most of which have resulted from the decomposi-

(1) Vol. III. Geol., Wisconsin, p. 235.

tion of the olivine. Frequently, however, it occurs in tabular or rod-like forms, which are sometimes arranged in one set of parallel planes only, while in other cases they lie in two sets of planes intersecting one another. These rod-like forms penetrate all the constituents of the rock. In many instances the smaller rod-like forms occur in association with the biotite, and their correspondence in position with the planes of cleavage of this mineral suggests that in these cases, at least, their formation has been due to secondary action ("Schillerization"), involving the elimination of the iron and the development of magnetite along the planes of easy cleavage.

2. *Locality.*—S.E. ¼, N.W. ¼, Section 19, 65, 3, cutting on the Port Arthur, Duluth and Western R.R., just west of the narrows of Gunflint Lake, Minnesota. (1)

Mr. U. S. Grant, who kindly sent me the specimen at Prof. Winchell's request, says: "The rock is from one of the diabase sills (2) in the lower or iron-bearing member of the Animikie. The markedly porphyritic character is only local, the main part of the sill being without phenocrysts. These porphyritic patches are sometimes rather sharply marked off from the main mass of the sill, but they usually pass into the non-porphyritic parts simply by a gradual loss of the large crystals. This sporadic development of large felspar phenocrysts in certain of these Animikie sills is a rather common feature."

Macroscopically the rock resembles very closely the boulder brought from Lake Temagami, being a dark green diabase with phenocrysts of fresh plagioclase which exhibit the polysynthetic twin lamellation very beautifully.

The microscope reveals a rock composed mainly of plagioclase and augite with pronounced ophitic structure. The augite when fresh is of the reddish and slightly pleochroic variety so common in diabase, but it shows abundant alteration to greenish or brownish green hornblende (uralite). The opaque iron ore has the same rod-like development noticed in the examination of the preceding rock. Biotite is present

(1) Specimen No. 951, Geographical and Natural History Survey of Minnesota, collector U. S. Grant, see 22nd Annual Report, p. 82.

(2) Logan hills of Lawson, see Bulletin 8, Minnesota Survey.

and shows considerable "bleaching" and chloritization. The larger phenocrysts, which are probably labradorite, are mostly quite fresh and glassy, but irregular areas are more or less clouded by the development of minute scales of sericite or kaolin. The rock differs from the Temagami specimen in the absence of olivine and the advanced uralitization of the augite

3. *Locality.*—Landing at Silver Islet, north shore of Lake Superior.

Prof. Winchell thus describes this rock (601) : (1) "A coarse porphyritic 'dioryte' in a dyke running parallel to and contiguous, to and passing into (602) a fine grained 'dioryte' in the form of a dyke. The interval of transition is perhaps two feet wide, and the crystals of felspar are scatteringly disseminated through it on the south side, and wholly disappear on the north side. They run in the same direction as the dyke on Silver Islet. The whole is 45 feet wide, but is evenly divided between Nos. 601 and 602 from about a mile north of the 'Landing at Silver Islet.'"

The thin section under the microscope showed an aggregate of plagioclase (labradorite), augite, serpentine and opaque iron ore. The phenocrysts of plagioclase as well as the lath-shaped crystals present in the groundmass show more or less 'cloudiness' due to the development of minute scales of muscovite. Irregular fissures traversing the felspar are filled with yellowish green serpentine derived from that present in the surrounding matrix. The augite, which is quite fresh, has a reddish colour, and is slightly pleochroic. It occurs in irregular grains and areas filling in the spaces between the plagioclase laths. The yellowish green serpentine, which is abundant, is present in areas whose external form and internal arrangement at once suggest its alteration from olivine, which was no doubt originally present. These phenocrysts of labradorite are much fresher than those to which the name "Huronite" has usually been applied, but under similar conditions of alteration there is no doubt that they would become so decomposed as to be indistinguishable from this mineral.

(1) Specimens Nos. 601 and 602, 10th Annual Report of Geological and Natural History Survey, Minnesota, page 56.

4. *Locality.*—Knob or Fault Hill, west branch Hamilton River, 20 miles below old Fort Nascawpee on Lake Petitsikpow, (1) Labrador Peninsula.

The specimen, according to Mr. A. P. Low, is from a dyke cutting the ferruginous limestones and shales of Knob or Fault Hill, a prominent topographical feature, as it rises rather abruptly to the height of 350 feet above the surrounding country. The dyke occupies the summit of the hill, while 200 feet below come in the stratified rocks through which it has been intruded. Neither the width of the dyke nor the nature of its contact with the bedded rocks could be ascertained owing to the accumulation of drift material, but it certainly cannot be much less than 200 yards.

Macroscopically the hand specimen shows a medium textured dark green almost black diabase containing occasional small and imperfect phenocrysts of a light greenish grey plagioclase which has undergone incipient "saussuritization." Under the microscope the rock is seen to be composed of an aggregate of plagioclase, augite, serpentine, and ilmenite. The augite is very fresh, has a light brownish red colour and shows a marked pleochroism. In general its form is allotriomorphic, filling in the spaces between the felspar, but occasional individuals exhibit sharp and perfect crystal boundaries. The plagioclase occurs in more or less elongated lath-shaped crystals which are often somewhat stout and rounded thus producing a rather coarse ophitic structure. Many of the small individuals are quite fresh, but the larger ones show considerable alteration to sericite and epidote. The resulting "saussurite" is in no instance so abundantly developed as to destroy the polysynthetic twinning striæ. The large amount of serpentine noticed in this rock has evidently resulted from the decomposition of olivine originally present. The serpentinization of the olivine is in every instance completed, and only the outline and structure of the serpentine individuals serve to indicate the mineral from which it has been derived. These occasionally show a network of fibrous serpentine which was first produced, the greenish fibres standing perpendicular to the cracks along which they have been developed. Owing

(1) Reference No. 4, A, p. 28, Book II., Low, 21/6/94.

to this parallel arrangement of the fibres, the serpentinous substance gives a faint but definite reaction with polarized light. The meshes of the net-like structure thus produced are filled with more finely developed scales and fibres of serpentine which are nearly, if not, quite isotropic. These decomposed grains are often seen embedded in the fresh augite. The ilmenite occurs in large irregular fragments or in small more or less rounded granules and in both cases shows characteristic alteration to leucoxene. The leucoxene is of the usual opaque grey colour, but sometimes brownish grey, and frequently show, especially in the thinner portions of the slide as also the smaller fragments, the brilliant chromatic polarization of sphene of which it is simply a variety.

5. *Locality.*—¼ mile north of Murphy Lake, Timber Limit, 90, District of Algoma, Ont.

The specimen is from a dyke cutting rocks of Huronian age. The matrix is a normal dark green diabase whose ophitic structure is megascopically apparent. A freshly exposed surface shows the Huronite to be of the usual pale yellowish green colour, while the less altered portions of the crystals have a more or less pinkish or flesh red colour. In many of these individuals a somewhat indistinct cleavage and a rather faint striation due to multiple twinning may be seen. The matrix weathers a brownish colour while the phenocrysts become a dull opaque greyish white thus rendering portions of this rock which have been subjected to atmospheric action very conspicuous.

Microscopically, the Huronite is seen to be labradorite which has undergone more or less "saussuritization." A narrow border usually surrounds these phenocrysts of labradorite which is free from the products of decomposition, but immediately within this rim is a zone or band where the alteration has been extreme and here the resulting zoisite, epidote and sericite replace nearly, if not quite, all of the original felspar. The epidote and zoisite are present in irregular grains or masses, while the sericite, as usual, occurs in scales and plates. All of these alteration products have a more or less definite arrangement. The grains and imperfect crystals of epidote and zoisite are usually elongated in a direction corresponding more or less with the twinning striations

or in a direction nearly at right angles while the scales and plates of sericite have a similar development.

The specific gravity, ascertained by Mr. R. A. A, Johnston, of these porphyritic crystals was 2·758.

The matrix of these crystals is a rather fresh diabase with pronounced ophitic structure and composed chiefly of plagioclase and augite. The plagioclase is idiomorphic and forms an interlacing network of lath-shaped crystals. Occasional crystals are rather fresh and glassy, but usually they exhibit the same alteration as the larger porphyritic individuals, and apparently belong to the same species of felspar (labradorite). The decomposition products aggregate themselves toward the centre of the crystal leaving a somewhat fresh periphery. The augite is in general quite fresh, but occasionally an individual was seen partially altered into green, strongly trichroic hornblende. Twins are common. A considerable quantity of biotite is present which is always more or less altered to chlorite. Ilmenite, an abundant constituent, occurs in irregular grains and only shows incipient alteration to leucoxene. Occasional prisms of apatite were noticed, chiefly developed in the chloritized biotite. The more unaltered portions of the plagioclase show the undulatory extinction due to pressure. Pyrite is also an abundant constituent.

6. *Locality.*—Algoma Mills, north shore of Lake Huron, district of Algoma, Ontario. (1)

The thin section exhibits a rock very similar to the one just described and must be regarded as being derived from a dyke almost analagous in character and composition to that exposed near Murphy Lake.

The phenocrysts of labradorite show the usual alteration into an aggregate composed chiefly of muscovite, epidote and zoisite although considerable portions of some of the crystals are free from these decomposition products. The augite has a light yellowish colour and is only slightly pleochroic. Twins are common, the twinning plane and composition face being the orthopinacoid.

Curved or distorted individuals were often noticed exhibiting the

*From a boulder No. 1605, Geological Survey of Minnesota, series of rocks, 18th Annual report, page 58.

"strain shadows" due to pressure. A good proportion showed an incipient uralitization. The plagioclase of the groundmass has also undergone more or less "saussuritization" and occurs in stout and rounded laths thus producing a rather coarse ophitic structure. The ilmenite present in irregular grains is often fresh but shows occasional incipient alteration to leucoxene. A small amount of chlorite is also present.

7. *Locality*—Shore of Drummond Island, Lake Huron, (from a boulder.)

The slide was made from a fragment, obtained through the kindness of Dr. Harrington, from a duplicate specimen of the original boulder at present in the Holmes collection of the Peter Redpath Museum of McGill University. The first examination and analysis by Dr. Thomson was rather imperfect as pointed out by Dr. Harrington (1) but it has been thought advisable to reproduce the analysis, though imperfect, for purposes of rough comparison. This analysis is as follows:

Silica	45·80
Alumina	33·92
Ferrous Oxide	4·32
Lime	8·04
Magnesia	1·72
Loss on ignition	4.16
	97·96

The specific gravity, according to Dr. Thomson, is 2·8625. Under the microscope the phenocrysts of the so-called "Huronite" are seen to be a decomposed aggregate of zoisite, muscovite, epidote, calcite, chlorite and felspar. Occasionally there is a very narrow border of comparatively unaltered felspar surrounding these individuals, in which traces of the very fine striation, due to multiple twinning, may be observed. Immediately within this band, however, the decomposition products are most abundant, and the original plagioclase is replaced almost altogether by epidote, zoisite and muscovite, their relative abundance being in the order mentioned, while the interior of the crystals is composed mainly of muscovite with a much less proportion of zoisite, epidote and felspar.

(1) Trans. Royal Society of Canada, Section III., 1886, p. 82.

The epidote and zoisite occur in irregular, often somewhat elongated masses or "grape-like" bunches which frequently show a more or less definite arrangemenr in accordance with the structure of the original felspar. Both minerals exhibit their characteristic high relief, the epidote showing brilliant chromatic polarization colours, and yellow to colourless pleochroism, while the interference colours of the zoisite, as usual, are very low, dull bluish to yellowish. The sericite is of a very pale green, and occurs in scales or aggregates of scales and plates, showing customary brilliant polarization colours and parallel extinction. The sericite has, likewise, often a definite arrangement, but sometimes occurs in irregular or matted aggregates. The "saussuritization" of the original plagioclase has been usually so complete, that only traces of the twinning lamellæ can be detected. The matrix in which these crystals are embedded is a diabase, composed essentially of plagioclase and augite. The plagioclase shows more or less alteration, identical in character with that of the larger phenocrysts so that it must have had a similar composition. It occurs as lath-shaped, twin crystals, often consisting of only two lamellæ, which pierce, and are often embedded in the augite. The augite occurs in more or less irregular masses, filling in the interstices between the felspar laths. It is light-brownish in colour, exhibits a faint pleochroism, and the characteristic interrupted cleavages in cross-section. It is partially altered into green trichroic hornblende, and occasionally the alteration has been carried so far that chlorite has resulted. This uralitization has only proceeded to a limited extent, and is confined to a narrow margin surrounding the irregular fissures traversing the augite masses. Occasional twins were noticed, the twinning plane being the orthopinacoid.

Ilmenite is abundant, but almost wholly converted into leucoxene. The fragments have generally jagged and irregular contours, but occasionally, some are seen which possess a rather perfect crystallographic outline. The characteristic alteration along lines parallel to the faces of the rhombohedron produces alternating bands of greyish white leucoxene, and black, unaltered ilmenite. The less altered portions of the plagioclase and the augite show uneven or wavy extinction, the "strain shadows" induced in the latter being especially well marked,

and is a noticeable and interesting feature in connection with the rock. Additional evidence of pressure is furnished by the frequent distortion and even dislocation of both the plagioclase and augite individuals.

8. *Locality.*—About 4 miles N.W. Pogamasing Station, main line, Canadian Pacific Railway, District of Algoma, Ont.

The specimen was obtained from a dyke, cutting the granitoid gneisses of the Laurentian. The phenocrysts of "Huronite" have generally a rude, rounded outline, the largest of which are about two inches in diameter. Many of the smaller ones have irregular or jagged outline, and occasional individuals exhibit some of the sharp faces of the original crystal. The mineral is of the usual light, yellowish-green colour, shows the glistening surfaces of the indistinct cleavage and occasional faint-striæ. It is sub translucent, has a waxy lustre, and a somewhat "soapy" feel. According to Dr. Harrington* "the hardness is $5\frac{1}{2}$

*Trans. Royal Soc. Canada, Sec. III, 1886, p. 82.

or a little over, fusibility about 5, and specific gravity 2·814." An analysis of some of the material composing these phenocrysts was made by Mr. N. N. Evans, of McGill University, for Dr. Harrington, with the following results:

Silica	47·07
Alumina	32·49
Ferric Oxide	0·97
Lime	13·30
Magnesia	0·22
Potash	2·88
Soda	2·03
Loss on ignition	2·72
	101·68

The matrix in which these crystals are developed is a fine-grained dark green diabase, with abundantly disseminated particles of iron pyrites.

Under the microscope the "Huronite" is seen to consist of an aggregate of epidote, zoisite, sericite and chlorite, but in the larger crystals especially, considerable areas of unaltered plagioclase exist which are quite fresh and glassy, and exhibit the twinning lamellæ quite distinctly. The smaller phenocrysts, however, are altogether

decomposed so that there is little or no evidence of the lamellation of the original felspar. The matrix in which these crystals are embedded is an exceedingly decomposed groundmass made up of felspar, epidote, chlorite, hornblende and zoisite, with larger individuals of augite in a more or less advanced stage of uralitization. The alteration to hornblende is mainly marginal and has proceeded very unevenly, the core of unaltered augite, having thus a ve.; irregular outline. The augite has a brownish colour and exhibits the characteristic interrupted cleavages in cross-section. The larger individuals are all twinned, the twinning plane being the orthopinacoid. The rock is so decomposed that the original ophitic structure is nearly, if not quite, obliterated. Very little trace, if any, remains of the original plagioclase of the ground mass, and instead small areas or fragments of a water-clear unstriated felspar (albite?) are present which are evidently secondary, as they contain minute embedded needless of the secondary epidote. This water clear secondary felspar has evidently been developed at the expense of the original plagioclase. (1)

A considerable amount of ilmenite was originally present, but is now almost altogether decomposed to leucoxene. This greyish white translucent mineral occurs in masses which are generally irregular or have a rude rhombic outline, and frequently exhibits the very characteristic alteration along lines or zones parallel to the faces of the rhombohedron. The thinnest section shows the mineral to be made up of an aggregate of minute rounded grains with a high index of refraction and showing brilliant interference colours. (2)

9. *Locality.*—10 miles north of Lake Kawachagami, on the portage route between the Rupert and Eastmain rivers, in the peninsula of Labrador, Geo. Survey of Canada, Eastmain River. (3)

Macroscopically a dark greenish grey gabbro with yellowish green phenocrysts of plagioclase. The phenocrysts have a tolerably sharp, through irregular outline, the larger ones being over an inch in diameter.

Under the microscope the rock is seen to be composed mainly of plagioclase, augite and ilmenite. In places a coarse ophitic structure can

(1) Teall, British Petrography, p. 230.

(2) Notes on the microscopic structure of some rocks of the Quebec Group—Frank D. Adams—Geo. Survey, Canada, Report Progress, 1880-82, p. 16, A.

(3) Reference No. 1, p. 12, Book II, 12/7/92, Low.

be seen and the specimen doubtless represents the "granitoid" structure so characteristic of the centre portion of most diabase dykes which nearer their margin exhibit the typical ophitic structure. The larger phenocrysts show a marked alteration. Most of the sections of these crystals are made up of innumerable minute scales and fibres of light greenish sericite arranged parallel to the polysynthetic twinning lines, and therefore even where the alteration has proceeded farthest the direction of the very fine striation may still be ascertained. Zoisite and epidote have also been developed the former usually in more or less elongated prisms or lath-shaped crystals, occurring either isolated or in irregularly disposed groups. The epidote is present in irregular grains or associated with calcite filling certain fissures in the crystals. Some portions of the crystals which had escaped alteration had a distinctly reddish colour and revealed the fine twinning striæ. The crystals are precisely similar to those decribed by Thompson as "Huronite." The specific gravity of these crystals, according to Mr. R. A. A. Johnston, is 2·725 The augite has undergone more or less complete uralitization, although in most cases cores of unaltered material remain. During this process a certain amount of epidote present in the slide has been formed. The plagioclase of the matrix shows the same alteration or "saussuritization" as the larger phenocrysts, the decomposition products aggregating themselves towards the centre leaving a comparatively fresh periphery. Ilmenite is a rather abundant constituent and occasionally shows incipient alteration to leucoxene. Apatite is very abundant. The interlamination of quartz and felspar, known as granophyre, is present in considerable quantity.

10. *Locality* near Missinaibi Station, on the main line of the Canadian Pacific Railway, District of Algoma, Ont.

The specimen examined was obtained by Dr. Selwyn from one of several dykes which cut both the Huronian and Laurentian rock exposed in this region. It is a medium grained dark greyish green diabase whose ophitic structure is megascopically apparent. The porphyritic crystals vary from a pale greyish green to a light yellow green, weathering to a light grey on exposed surfaces. Very frequently they have tolerably good crystallographic boundaries, although in most cases

especially in the smaller individuals they have a rather irregular outline. The specific gravity of these crystals ascertained by Mr. R. A. A. Johnston was 2·935.

Under the microscope these phenocrysts show a very advanced stage of alteration and the original plagioclase is now replaced by an aggregate of muscovite, zoisite, epidote, felspar and calcite. There is little or no trace left of the original twinning lamellae. The plagioclase laths present in the enclosing matrix show a similar alteration, although not to so large an extent. The augite originally present is now replaced by hornblende (uralite) and often the alteration has proceeded so far that chlorite has resulted. These resulting products of decomposition fill the original allotriomorphic individuals of augite. These individuals as now present usually exhibit a deep green border of strongly trichroic hornblende, while the interior is occupied by an aggregate of interlacing fibres of light green hornblende with more or less chlorite. Traces of the characteristic interrupted cleavages of augite are present in occasional grains, but no unaltered cores now remain. The resemblence to other uralitic hornblende is, however, unmistakable. (1) The hornblende also bears a close resemblence to that present in the rock just described (No. 9) in which cores of the original augite are still present. The ilmenite present is more or less altered to leucoxene showing brilliant polarization colours (compare No. 8 ante). A considerable amount of biotite of a light brown colour on account of the "bleaching" it has undergone shows rather brilliant interference colours. The biotite has also been altered in many cases to chlorite. Granophyre structure was also noticed.

11. Locality.—Lake Petitsikapow, about 15 miles below old Fort Nascawpee. West branch Hamilton River. Labrador Peninsula. (2)

The dyke from which the sample was taken, according to Mr. Low, is 200 yards in width, coarsely crystalline in the centre where the porphyritic individuals of Huronite are often three-fourths of an inch in diameter. The dyke breaks through and alters sandstones, limestones

(1) Williams' Appendix I., Part F., Annual Report, Geological Survey of Canada, Vol. V., 1889-90, p. 60.

(2) Reference No. 4, p. 3c, Pk. II. Low, 23/6/94.

and shales of Cambrian age, running almost parallel to their strike. The specimen was taken from near the middle of this dyke, and shows macroscopically a dark greenish grey, rather coarse grained diabase, in which are embedded numerous phenocrysts of altered greenish felspar (Huronite). The crystals of "Huronite," though much smaller than usual, are on the other hand much more abundant, so that it is often difficult to obtain even a small chip of the finer groundmass, in which they are embedded. The felspar of both the larger porphyritic individuals and those present in the groundmass show great alteration, although the polysynthetic twinning lamellæ may still be recognized. The decomposition products are mainly sericite and epidote. The specific gravity of these phenocrysts according to Mr. Johnston, is 2.773. The augite when fresh (which is rarely the case except in very minute fragments), is of a reddish colour, and shows distinct pleochroison. A great deal of chlorite is present. The ilmenite occurs in irregular grains as well as fragments, which have a more or less perfect crystallographic outline and occasional perfect rhombohedra were noticed. The alteration to leucoxene is very characteristic, this resulting form of sphene frequently exhibiting its characteristic brilliant chromatic polarization in thin sections. (1) Besides these larger fragments small rounded grains of a brownish grey translucent mineral occur with high index of refraction, and show brilliant interference colours. These occasionally show small granules in the centre of unaltered titanic iron ore, and thus reveal their derivation. Apatite is very abundant, and occurs in colourless prismatic needles which are frequently bent, cracked and broken. Pyrite is also a rather abundant accessory constituent.

(1) Page 16 A, Report Geological Survey of Canada, 1880-2.

HUNTING THE BARREN GROUND CARIBOU.

By FRANK RUSSELL, of the State University of Iowa.

Vague rumors had reached Fort Rae concerning the whereabouts of the "deer" during the last week of October, but it was not until the first of November that a party left the post to hunt them.

A few years ago the Barren Ground Caribou appeared about the fort regularly upon All Saints Day. They were often killed from the buildings, and throughout the winter might be found near the post. In 1877 an unbroken line of caribou crossed the frozen lake near the fort, they were fourteen days in passing and in such a mass that, in the words of an eye witness, "daylight could not be seen" through the column. They are now seldom seen within several miles of Rae.

The "Fort Hunter," Tenony, with seven of his followers was just starting upon a seventy-five mile journey toward the north on the evening of the first, when I learned of his intentions, and after agreeing to furnish a few "skins" of flour, tea, and tobacco, and to pay a skin a day for a dog driver it was settled that I might accompany them into the hunting grounds where another chief, Naohmby, had objected to my going three months before, on the ground that all the game would desert the country if pursued by a naturalist.

I loaded my sled with thirty white fish, three days provisions for the dogs, and fifteen pounds of "dry meat" for the "boy," while I shared alternately with each of them during the trip, the rank, "hung fish" driving me to dried meat and the leathery slabs compelling me to return to the fish.

As the "brigade" only intended getting clear of the fort that evening I preferred to remain and make an early start the next day. We left the fort at daylight on the second, Yahty running before my dogs. Our course was northward for twelve miles, to the end of the Northern Arm of the Great Slave Lake, whence a channel a hundred yards in width called Willow River continues for half a mile before expanding into a small lake extending toward the northeast and connecting by a number of "schnys" with Lac Brochet. Following the eastern shore of the small lake, we crossed a short portage and traversing a narrow

channel for a couple of miles reached Sah-kah-tohn-tooh, the Lake of the Bear's Shoulder. This body of water must exceed twenty-five miles in length.

We did not succeed in overtaking Tenony but encamped near the end of the lake with an Indian, who, with his ten year old son and three miserable "giddies"—Indian dogs—was also in quest of the caribou. He carried a powder horn differing from any that I saw in the North. It was made by boring or burning out a section of the bram of a caribou's antler. He would smilingly beg for tea and tobacco, not becoming in the least disheartened by repeated refusals. I was glad to escape his importunities by leaving camp at 4 a.m. The brisk trot of our well-fed team soon carried us out of reach of the yells of the giddies as the lash was unsparingly applied in his efforts to keep up with the "Mollah" who had such quantities of "lee tea" and "tobah."

Passing a couple of miles of short portages we reached another large lake called by the Dog Ribs, Quem-tah-Tooh, the Lake of the White Rock, where we found Tenony encamped.

The Indians had been aroused by their dogs greeting our approach with barks and howls and were huddled behind a roaring fire with their blankets, once white, now a dirty gray, thrown over their shoulders, their hands outstretched toward the welcome blaze while they guarded the few frozen fish which were thawing and burning at their feet. Behind them a confused mass of dog harness, wrappers, and flat sleds formed a barrier to keep out a score or more of giddies which were crowding about the camp and fighting for an advantageous position from which to watch for the few bones that escaped their master's teeth. After "drinking tea" we followed the lake shore toward the northwest where a range of granite hills, called Sah-me-t'ie-kfwa, rose high above the general level of the somewhat rugged country about them.

When close to the hills we discovered a small band of caribou toward which the dogs started at their best pace, barking and straining at their collars, and urged to greater exertion by the men who shouted "Ayee ecwoh, m'nitla" (There are the caribou, now, go!). The alarmed caribou were dashing about in all directions yet managing to keep out of range though several shots were fired before they entered the tim-

ber. Around us rose the precipitous snow covered mountains through a gap of which a large stream entered the lake, its cascades giving off clouds of vapor. High above us a bald eagle wheeled in majestic flight with white head and crissum flashing in the light of the rising sun. Cutting our way through a brulé we reached another lake upon which there was an abundance of fresh tracks. An hour later I left the others and started down the lake with the boy before the dogs. Three or four bands of caribou, perhaps fifty in all, soon came out upon the ice. Yahty ran toward the nearest of them followed by the dogs which dashed past him at full cry as soon as they discovered the caribou. I was seated upon the sled while Yahty ran, holding the sled line in a cloud of snow which trailed out behind like the tail of a comet.

The caribou stood motionless until we were within a couple of hundred yards before making off; they soon stopped, side on, to survey their pursuers, snuffing the air for a moment; they would throw back their heads and leap high in the air, and again dash away at a swift run, passing patches of smooth ice without a miss step.

The drifts were small, but the snow was well hardened making a rough surface for the swift flying sled. Just as I would be about to pull the trigger after taking hasty aim a sudden lurch would nearly dislodge me from my seat and perhaps send the muzzle of the rifle skywards. I succeeded in killing two and breaking a fore leg of another which ran with undiminished speed, in fact led the band as they entered the timber and so escaped.

Placing a row of pine boughs at intervals of fifteen or twenty yards quite across an arm of the lake we concealed ourselves on shore, and waited the appearance of the caribou. Only one band approached our barrier which they followed some distance, but did not venture to cross; they turned away before coming within range, but the following day we were more successful in employing this, a common device of the Dog Ribs.

That evening we feasted until a late hour upon the first caribou meat of the season. Several heads were skinned and hung from poles before the fire by the mitten cords of the owners and willow hooks. As soon as the outside was roasted the jaw was turned back and the tongue, one of the choicest bits of all, slightly cooked. The dogs were

well fed for the first time in months; we gave them the quarters only, and cracked the long bones for the marrow which, raw or roasted, is one of the greatest of Dog Rib luxuries. Look down in pity upon "the savage and his marrow bones" if you will, but you might perhaps relish that same marrow if you had "hustled" for those bones yourself as I had done, or you might after running fifty miles pass your plate a second time for bouillon made of blood carried to camp in a caribou's stomach. Even the tendons were eaten and the feet also, after roasting them until the hoof could be knocked off.

Although I lived some time with the Dog Ribs and spent over a year in their territory, I never knew of their eating the contents of the caribou's stomach as do the Eskimos. The unborn calf, the udder of a milk-giving cow, the tongue, the marrow and back fat are the parts held in highest esteem.

Tenony fulfilled his promise of returning after "five sleeps," but marched fifty miles against a heavy gale of wind upon the sixth day to do it.

The caribou came but little nearer during the winter of 1893-84. I made three other trips in search of them and travelled five hundred miles in all, driving my own dogs after the first hunt with Tenony. Out of a large number secured, I selected eight choice specimens, and during the winter obtained the skin of an albino, for the museum of the State University of Iowa. Albinism is of rare occurrence among the Barren Ground Caribou. One of the oldest Dog Ribs assured me that he had never seen a "white deer."

Authorities differ as to the time when the antlers are cast.

The new horn begins to grow late in April and the velvet is not all cleared off until November. The old males shed their antlers in December. While in the Barren Ground in March and April, I saw large numbers of both sexes with antlers, and on the 5th of April I killed a buck, four or five years of age, still bearing them. At that season we saw thousands of caribou in the vicinity of Bathurst Inlet, which had evidently wintered there and not approached the woods as in former years.

It is said that only the females reach the sea coast where they drop their young in June. Yet I have seen both male and female caribou wading in the shoal water of the Arctic Ocean south of Herschel Island in July.

TOWN BIRDS.

By W. A. D. LEES.

(Read before the Ottawa Field Naturalist's Club, 14th March, 1895.)

After a year or two with little opportunity to be in the woods or on the waters where birds are most commonly found, one has not much to report of their doings, and hence I am constrained to-night to confine my remarks to "Town Birds." Everyone of us may see something of these as he goes about the city on his daily business, and to one who has not given the subject much attention it is astonishing what a number of species are found even in the busiest streets.

For the student of birds, as well as for those who have only a very casual acquaintance with them, there is always something new in store, even among the town birds. Seven years ago yesterday, near the corner of Maria and Metcalfe streets when I was only beginning, as they say with children, to "take notice" of birds, I came upon a flock of Purple Finches (I think the other name of Red Linnet, is a better one) and was thrilled by the brilliant colour of their plumage, which to my unpractised eye seemed as if stained by the rowan berries upon which they were feeding. Less than a month ago, at the same street corner, I saw my first flock of those erratic winter visitants the Bohemian Waxwings, and I do not think that either the lapse of years, or the number of birds I have come to know since those first red linnets, in any degree lessened the thrill of pleasure with which I welcomed another new acquaintance to the list of my bird friends.

The rowan trees along the streets and in public and private grounds, when in fruit, give us many opportunities of seeing birds which, like these Waxwings, visit us from the far north. Most of you will remember how, some ten years ago, the Pine Grosbeaks came down in such numbers, and were so apparently indifferent to the presence of man, that they might almost be taken by hand as they fed upon the berries dropped by their hungry comrades in the trees, upon the snow beneath.

Almost every neglected vacant lot with its crop of weed seeds attracts in due time its roving flock of Redpolls, or their near relatives the Goldfinches, for these latter often spend the winter with us, escap-

ing, in their sober garb of olive brown, the observation of those who only know them in the brilliant black and gold of Summer. Pine Siskins too may be looked for whenever and wherever the white cedars have cones, in the seeds of which they seem especially to delight, and wherever such small game abounds, one has not far to seek their handsome and voluble but deceitful enemy the Shrike. Hawks too are more or less common according to the food supply, and my note-book gives me both winter and summer records of the Sparrow Hawk in the busiest parts of the city.

A hawk was captured alive last fall at the City Hall square, and kept some time in confinement, but proving an undesirable pet, it passed from one owner to another and at last made its escape. I did not ascertain its species, but a remarkably tall legend connected with its final disappearance might readily suggest the possibility of its having been a Fish-hawk.

Even such a man-hater as the Ruffed Grouse, or as we commonly, but I believe incorrectly, call him, the Partridge, occasionally pays the city a visit, and has been known to fly through the glass of a window and land on the dining room table, a place to which, under the stringency of the present game laws, he usually finds his way by a less direct route, and, I might add, under a different name from either of the above.

Turning now to the summer birds, many are almost too common to need mention: such, for instance as the omnivorous and belligerent House Sparrow, for whom the name English, or even European, is now more of a misnomer than ever, since he has annexed the whole American continent. The Robin and the Song Sparrow may be heard and seen in all parts of the city, and the Night Hawk and Chimney Swift, in their season, are familiar objects to all who even glance upward. One of the former seated on a flat roof forms the subject of a very good photograph, edited (if I may use the term) by one of our members, who was quick enough to take advantage of the situation from the back window of a Sparks Street studio. Tree Swallows and Purple Martins are only a little less common, both species being regular summer boarders at the Albion Hotel, which has long since ceased to entertain other guests

than these occupants of its sky parlors. Many a period of enforced waitting in an unattractive court room across the street has been pleasantly relieved by these same birds. From the windows of the same building I have often caught other little glimpses of bird-life without, which were in pleasing contrast with the glimpses of man-life to be had within. Here I have seen amongst others, Chipping Sparrows, Yellow Warblers, Warbling Vireos, Downy Woodpeckers, and Cedar Waxwings; a pair of the last industriously ridding the ash trees of caterpillars, and so close that I could easily distinguish the red wax-like appendages to the wing-tips, from which the bird takes it name. These birds are in due season also industrious fly-catchers, working in exactly the same way as the true *Tyrannidæ*, and so it is a question if, after all, they do not earn a right to at least some of the fruit they so greedily consume.

Amongst other birds more or less common in busy parts of the city may be named Bluebirds, Vesper Sparrows, and Savanna Sparrows, and even that handsome Woodpecker, from whose thirty or more names the American Ornithologist's Union has chosen "Flicker," appears in my note-book as a town bird.

That surprises are often in store for the observer of town birds is shown by such records as those of a Brown Creeper climbing a telegraph pole at the corner of Elgin and Queen streets, a Red-breasted Nuthatch on another telegraph pole at the corner of Elgin and Nepean streets, and a Wood Peewee in the back-yard of a Sparks street hardware store.

It will be noticed that in the above paper I have made no mention of the various small patches of wood-land in outlying parts of the city, such as those about Patterson's Creek, the old race-course, McKay's bush, and the like, where nine-tenths of all the birds that visit the district may be noted by a careful observer, while the Lovers' Walk and Major's Hill Park, in the very heart of the city will furnish records of many of the rarest and most retiring of our wood-birds. Neither have I mentioned another favorite haunt of the birds on Sussex street where the very shyest of them are so tame that they never leave their perches, even on the nearest approach of man. I mean the Geological Survey Museum.

JAMES DWIGHT DANA.

James Dwight Dana, one of the fathers of American Geological Science, died at his home in New Haven, Conn., Easter Sunday, the 14th day of April, 1895. He was born at Utica, N.Y., February 12th, 1813, and was therefore in his 83rd year. He graduated at Yale when only twenty years of age, and evinced great aptitude for the natural sciences and mathematics. For two years he was teacher of mathematics in the U.S. Navy. He is next seen as assistant to Prof. Silliman at Yale College. In 1838 he published "A System of Mineralogy," which won for him the admiration of the scientists of two continents as mineralogist and geoloist. In 1838, he sailed for the Southern and Pacific Oceans, with Lieut. Wilkes, in charge of the squadron, whose expedition lasted four years. "*A Report on Crustacea*," 1852-4. "*Report on Zoophytes*," 1846; "*Report on the Geology of the Pacific*, 1849; besides "*Science and the Bible*," in Bibliotheca Sacra, published in 1856-7, occupied his time during the 15 years which followed his return from the Wilkes expedition. In 1885 Dana succeeded Prof. Silliman as Prof. of Natural History and Geology at Yale. His first "Manual of Geology" was published in 1863—this was followed by a "Text Book of Geology for Schools and Academies," 1864, and latterly "Corals and Coral Islands" in 1872. In this year he was awarded the *Wollaston* gold medal by the Geological Society of London. He was elected President of the American Association Adv. Science for the first time in 1854, and was an honorary, corresponding or active fellow of nearly all the Geological Societies of Europe und America. His contributions and numerous writings in Silliman's Journal as one of its editors, in the Trans. Acad. Nat. Sc. of Philadelphia, in the Proc. Amer. Acad. Sc. and Arts and in numerous other channels are too well known to be commented upon in a passing sketch like this. He had just completed the last edition of his "Manual of Geology" which had been used so extensively as a text book in the colleges and universities of America and Europe. His was a life of genuine usefulness to his generation.

NOTES, REVIEWS, AND COMMENTS.

Geology.—BAILEY, PROF. L. W., M.A., Ph. D., F.R.S.C.—"*Preliminary Report on Geological investigations in south-western Nova Scotia.*" Being Report Q. of Vol. VI., Annual Report, Geological Survey of Canada, 1892-93, published 1895, 21 pp.

Pending the publication of Dr. Bailey's final report addressed to the Director of the Geological Survey of Canada, the preliminary report here referred to has been published and forms part of the 6th Annual Report of the Geological Survey. The delineation of the **granite areas** in South-Western Nova Scotia, the South and Blue Mountains, Tusket Wedge, the Barrington area, the Shelbourne and Port Mouton areas are given and the reader is referred to **Sir Archibald Geikie's** descriptions of South-Eastern Ireland as applying, almost word for word, to the granites of South-Western Nova Scotia. The **Cambrian Succession**, as seen in Queen's Co., is carefully described and the possible existence of pre-Cambrian rocks pointed out. As to the **Devonian System** our knowledge was still incomplete. On pp. 14 and 15, a brief summary of the palæontological results obtained by Dr. Ami after examining the collections in the Peter Redpath Museum and in the possesion of the Geological Survey is given. Most of the collections from Nictau point to **Eo-Devonian** time. The **Triassic** and **Post-Tertiary** system are next discussed, and the economic minerals receive considerable attention.

MATTHEW, G. F., Dr., M.A., F.R.S.C., "*Early Protozoa*," "The American Geologist"—Vol. XV., No. 3, pp. 146-153, March, 1895.

In this paper the author reviews Mr. L. Cayeux's paper describing certain so called Pre-Cambrian Radiolaria. No less than 45 different kinds of rhizopods have been described and are figured on one plate.

Mr. Cayeux's microscopic slides were examined both by Dr. G. J. Hinde, of London, England, and by Dr. Rüst, of Hanover, Germany. These two gentlemen, whilst not agreeing with his (Cayeux's) conclusions, admitted that the forms were organic."

WINCHELL, W. H., PROF.—"*The Stratigraphic base of the Taconic or Lower Cambrian.*"—"The American Geologist," Vol. XV., No. 3, pp. 153-162, March, 1895.

This contains a general sketch of the history of geological investigations, both in Great Britain and America, regarding the base of the fossiliferous series—of the lower Cambrian. The views held by Sedgwick, Murchison, Dr. Hicks, by Barrande in Bohemia by Sir Archibald Geikie are freely quoted—whilst in America those of Dana, Logan, Walcott, Selwyn, Ells, Van Hise and others are also cited. Director Howley's work in Newfoundland is likewise referred to, as well as Dr. Matthew's researches in New Brunswick.

TAYLOR, FRANK B.—"*The Second Lake Algonquin.*" The American Geologist, Vol. XV., No. 3, pp. 162-179, March, 1895.

This contains the concluding article by Mr. Taylor on the above subject as elaborated from data obtained in the North Bay and surrounding district around Lake Nipissing in Canada.

"The attitude of the deformed plane;" the order of changes in Niagara and Lake Algonquin, the St. Clair Flats, evidence of recent elevation and tilting in contiguous regions—all are elaborately discussed. Mr. Taylor sums up his conclusions regarding the rise and fall of the waters in the straits and lake of Nipissing—of Superior and Lake Erie. The suggestive facts mentioned point," naturally, "to a correlation with the eastward uplift which deformed the Nipissing plane with the elevation of the north-eastern barrier of Lake Ontario and of the deposits of the Champlain submergence, in the Champlain, Lower St. Lawrence, and Hudson Bay areas.

GIRTY, GEO. H.—*Development of the corallum of Favosites Forbisi, Var. occidentals.*"—The American Geologist, Vol. XV., No. 3, pp. 131-146, March, 1895.

Mr. Girty, who has carried on his researches at Yale, under Dr. C. E. Beecher, describes *five* stages in the growth of the corallum of the above species. He carefully describes the interstilial cells or buds which can appear only when divergence of the older corallites permits—usually "in the angles where the older corallites meet."

Favosites spinigeurs, Hall, and *F. conicus*, Hall, both Silurian corals, have also received attention and study for comparison, likewise *F. hemisphericus*. Mr. Girty observes the noticeable fact that the initial corallite in Favosites gives rise to buds which are (1) *four* in number, and (2) all on one side (dorsal) of the corallum. *Favosites* presents an

interesting form for the study of mural pores and their relations. The affinities of this genus are likewise discussed and seem to point to Aulopora and Romingeria—rather than any other genera of the *perforata* excepting Michelinia and Pleurodictyum. The first stage of Pleurodictyum and of Favosites is an auloporoid stage represented by the initial cell.

Geology of Aylmer—On the 27th of March, 1895, one of our members, Mr. T. W. E. Sowter, delivered a lecture on the "**Palæontology** and **Geology** of **Aylmer** at the Academy. The lecture proved to be very interesting and was illustrated by a large suite of specimens consisting of rocks and fossils, some new to science. We are pleased to state that we expect to receive a paper from Mr. Sowter on the above subject for the pages of the NATURALIST in the near future.

Zoology—*Tunicata of the Pacific Coast of North America.*

1. Perophora annectens, n. sp. By WILLIAM E. RITTER. Proc. Cal. Acad. Sc., Vol. IV, Part I, pp. 36-85, Plates I. II. and III., figs. 1-39. Sept., 1894.

This is an interesting and exhaustive biological study of one of those interesting species of tunicates which abound along the rocky coasts and shores of the North American Pacific. The species here described for the first time is from Monterey Bay, California. The author gives first a general summary of our knowledge of simple and compound ascidians, and points out that with the result of his researches, the importance of this old classification becomes "*nil.*"

Perophora Hutchinsoni, from Australia, and *P. viridis* from the New England coast of North America are the latest forms brought under Wiegmann's genus established in 1835. Then follows a diagnosis of the species with a general description dealing with the mode of occurrence of the ascidiozooids in their colonies. Their histological characters are very ably described. This form is a particularly favorable one to study owing to its wonderful transparency. The *test* and the origin of its cells receives special attention. The results of Ritter's work confirm those of Salensky and Kowalevsky on the same subject, showing that the cells of the tunicate test are not derived from the ectoderm but from the mesoderm. Dr. Ritter says: "I believe this to be due to the fact that the cellulose substance of the test is here being formed.. I have no evidence that the matrix or cellulose portion of the test is produced as a secretion of the mesodermal cells imbedded in it.....

Selensky also regards the processes present as having to do with the formation of the cellulose substance."

The musculature, the pharyngeal apparatus, interesting notes on the parasites of the tentacles, the branchial basket proper, the endostyle, the sub-neural gland, the digestive tract and its parasites, each received a share of careful description. Then the reproductive and circulatory systems are discussed. The movements of the heart and the character of the blood cells are also noted, some new light being thrown on the latter although Roule has arrived at very similar results from his researches on the simple ascidians from the Coast of Provence, France. Three plates accompanying the paper. The figures were nearly all outlined by the author with the aid of an Abbé camera lucida.—H. M. AMI.

Zoology—VERRILL, A. E.—*Distribution of the Echinoderms of North-eastern America.*—Amer. J. Sc. & Arts, Vol. XLIX, 3rd Ser., No. 290, pp. 127-140, February, 1895, also *ibid*, No. 291, pp. 199-212, March, 1895, New Haven, Conn.

The following species of Echinodermata from Canada and other British possessions in North America are recorded in these interesting papers by Prof. Verrill.

ASTERIOIDEA.

No.	Genera & Species.	Author.	Locality.	Remarks.
1	Pontaster hebitus.	Sladen.	Nova Scotia and Newfoundland.....	Banks off the coast.
2	Pseudarchaster intermadius.... ..	Sladen, ...	Nova Scotia.....	A circum—polar species.
3	Ctenodiscus crispatus.....	Dub. and Koren	Bay of Fundy.....	
4	Psilaster Floreæ .	Verrill.....	Banks off Nova Scotia..	Taken by Gloucester fishermen.
5	Pentagonaster granularis	Perrier.	Banks off Nova Scotia..	Taken by Gloucester fishermen.
6	Hippasteria phrygiana..	Agassiz.....	Bay of Fundy, Nova Scotia.	On hard bottoms.
7	Tremaster mirabilis	Verrill.....	Banks off Nova Scotia and Newfoundland...	
8	Solaster endeca....	Forbes.....	Bay of Fundy, banks off Nova Scotia..... ...	In 40 to 150 fathoms.

ASTEROIDEA—*Continued.*

No.	Genera & Species.	Author.	Locality.	Remarks.
9	Solaster Syrtensis..	Verrill.....	Banquereau, Nova Scotia.....	45 to 80 fathoms.
10	Solaster Earlii.... (allied to S. Dawsoni Ver. from coast of Brit. Col.	Verrill.... .	Banks off Nova Scotia and Newfoundland....	From 170 to 300 fathoms.
11	Cros aster papposus	Müll and Troschel ..	Bay of Fundy, Newfoundland	An arctic species.
12	Pteraster pulvillus.	M. Sars....	Bay of Fundy, banks off Nova Scotia and Newfoundland	
13	Pteraster militaris..	Müll and Troschel ..	Bay of Fundy.....	Common, 10 to 50 fathoms.
14	Cribrella pectinata	Verrill.....	Bay of Fundy.....	Shallow water.
15	Cribrella sanguinolenta.....	Lütken.....	All along the eastern coast	On hard bottoms, ranges to Greenland.
16	Pedicellaster typicus	M. Sars ...	Gulf of St. Lawrence...	Ranges to the Arctic Ocean.
17	Stichaster albulus..	Verrill.....	Bay of Fundy, and off coast of Nova Scotia..	Common, ranges to Greenland.
18	Asterias vulgaris...	Stimpson MSS.....	Bay of Fundy, Labrador.	Belongs to the cold areas.
19	Asterias stellionura	Perrier.... .	Banks off Nova Scotia..	40 to 300 fathoms.
20	Asterias enopla.... (a new species)	Verrill.....	Off Nova Scotia.....	53 to 100 fathoms.
21	Asterias polaris....	Verrill.... .	Anticosti, Gulf of St. Lawrence, Labrador .	Large and abundant on she Labrador coast.
22	Leptasterias tenera.	Verrill.....	Bay of Fundy, Newfoundland	Possibly L. Compta
23	Leptasterias Groënlandica	Verrill.. . .	Gulf of St. Lawrence, Bay of Fundy.....	Ranges to the Artic Ocean.
24	Leptasterias littoralis.....	Verrill.....	Coast of Nova Scotia, Gulf of St. Lawrence..	
25	Hydrasterias ophiodon....	Sladen....	Off Halifax.....	Collected in 1,250 fathoms by the "Challenger."
26	Odinia Americana.	Verrill. ...	Banquereau, Nova Scotia.....	Attains a great size.

H. M. A.

CLUB NOTES.

Annual Meeting—At the Annual Meeting of the Ottawa Field Naturalists' Club held on Tuesday, March 19th, 1895, the following members were present: Dr. G. M. Dawson, C.M.G., F.R.S., president, in the chair; Dr. R. W. Ells, Messrs. R. B. Whyte, W. Hague Harrington, T. C. Weston, A. G. Kingston, Walter R. Billings, T. J. MacLaughlin, Frank T. Shutt, D. B. Dowling, Maurice Panet, R. H. Campbell, Andrew Halkett and H. M. Ami.

The Sixteenth Annual Report of Council for 1894-95, was read by the Secretary, Dr. Ami, and showed that the Club was in a flourishing condition.* The following were then elected members of the council for 1895-96, to which is added the name of the patron of the club, the standing committees of Council and leaders.

Patron:

THE RT. HONOURABLE THE EARL OF ABERDEEN,
GOVERNOR-GENERAL OF CANADA.

President:

MR. F. T. SHUTT, M.A., F.I.C.

Vice-Presidents:

Mr. A. G. Kingston. Dr. H. M. Ami, M.A., F.G.S.

Librarian:

Mr. S. B. Sinclair, B.A.
(Normal School.)

Secretary:

Mr. Andrew Halkett.
(Marine and Fisheries Dept.)

Treasurer:

Mr. D. B. Dowling, B.A.Sc.
(Geol. Survey Dept.)

Committee:

Prof. E. E. Prince, B.A., F.L.S.
Mr. James Fletcher, F.L.S., F.R.S.C.
Mr. W. F. Ferrier, B.A.Sc., F.G.S.
Miss A. Shenick, B. Sc.
" G. Harmer.
" A. M. Living.

Standing Committees of Council:

Publishing: Dr. Ami, Prof. Prince, Mr. Dowling, Mr. Kingston, Mr. Ferrier.
Excursions: Mr. Kingston, Mr. Dowling, Dr. Ami, Miss Shenick, Miss Living.
Soirees: Prof. Prince, Mr. Sinclair, Mr. Fletcher, Mr. Halkett.

Leaders:

Geology: Dr. Ells, Mr. Ferrier, Dr. Ami.
Botany: Mr. Whyte, Prof. Macoun, Mr. Craig.
Entomology: Mr. Fletcher, Mr. Harrington, Mr. MacLaughlin.
Conchology: Mr. Latchford, Mr. Halkett, Mr. O'Brien.
Ornithology: Mr. Kingston, Miss Harmer, Mr. Lees.
Zoology: Prof. Prince, Mr. Whiteaves, Mr. Small.

Excursions—The Excursion Committee and Council of the Club have before them an interesting series of excursions for the summer. The first general and spring excursion of the Club is to take place on the afternoon of **Saturday**, the **18th** of May, when **Chelsea**, on the outskirts of the Laurentide Hills, will be visited. It is needless to describe

*Full report published in the April number of the OTTAWA NATURALIST, pp. 15 to 18.

the attractive features of the locality. Leaders in Botany, Geology, Entomology, Ornithology etc., will be present and a profitable as well as an enjoyable time is expected. The excursion (special) train will leave the **C.P.R.** (Union) **Station,** Ottawa, at **1.30** p.m., returning, leave Chelsea at **6.30** p.m. Full round trip **tickets** can be obtained from members of the Excursion Committee or of Council at the station or previously—at the following rates:

Members - - - - -	30 cents.
Non-members - - - - -	40 "
Children - - - -	half price.

Sub-excursions—At a joint meeting of the Council and Leaders of the Ottawa Field Naturalists' Club, held in the Normal School, 26th April, 1895, it was unanimously agreed "That sub-excursions be arranged for Saturday afternoons, as in former years. Sub-excursion parties will assemble at the **City Post Office** beginning Saturday, **May 4th,** at **2.15 p.m.** sharp—where leaders in different branches of the Club's work will be in attendance. Interesting localities within easy reach of the electric car system will be visited, and special opportunities afforded to those who desire to study the **flora** and **fauna** of Ottawa and its environs.

Fees—The new Treasurer elect, Mr. D. B. Dowling, Geological Survey Department, Ottawa, calls the attention of the members of the Club to the date which he has taken the trouble to place on the address slips informing each member of the time of expiring of his or her subscription. As the **Naturalist** cannot be published without funds, a prompt payment of the fees now due by members of the Club, will enable the publishing committee to carry on its work with greater facility and success. Membership fee, comprising subscription to **Ottawa Naturalist,** only **one dollar.**

The Ottawa District—For purposes of Natural History and for more exactly defining the limits of the phrase "Ottawa District," it was unanimously agreed at the last Council meeting of the Ottawa Field Naturalists' Club to limit the territory included, to that which is comprised within a circle whose centre is **Ottawa,** with a radius of **thirty miles.**

Meteorological Observations—The members of the Ottawa Field Naturalists' Club are particularly indebted to Mr. R. F. Stupart, the new Superintendent of the Dominion Meteorological Service at Toronto, for a most valuable abstract of observations which we publish in this number of the NATURALIST.

Ottawa Camera Club—At the first meeting of the Council of the Ottawa Field Naturalists' Club, held since the annual meeting, it was unanimously agreed to extend an invitation to the members of the OTTAWA CAMERA CLUB to attend our excursions at reduced members' rates.

Frequency of the Different Winds from Observations at 7 a.m., 2 and 9 p.m., Ottawa, 1894.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
January	7	9	23	0	3	5	22	8	16
February	2	3	17	0	8	12	12	10	20
March	6	6	14	5	6	13	23	9	11
April	9	8	12	5	11	9	16	5	15
May	8	9	13	7	15	10	9	10	12
June	3	3	8	3	11	21	24	8	9
July	4	4	4	3	13	21	16	5	23
August	17	6	7	6	8	15	8	12	14
September	1	4	12	7	11	10	16	6	23
October	1	8	20	7	9	15	20	5	8
November	7	4	17	4	8	11	24	10	5
December	5	3	23	2	8	16	16	12	8
Year	70	67	170	49	111	158	206	100	164

Heaviest snow storm of year, 29th January. Amount, 22 inches.
Coldest day of year, 24th February. Mean Temp., 13.85.
Last snow, 24th March.
First thunder storm, 4th April.
Last Frost, 15th April.
Heaviest rain storm of year, 20th June. Amount, 1.64 inches.
Warmest day, 19th July. Mean Temp., 77.80.
First frost of season, 26th September. Thermometer, 29.5.
First snow of season, 14th October. Not measurable.
Last thunder storm, 16th October.
First measurable snow, 5th November. Amount, 1.5 inches.
First record below zero, 26th December.

Abstract of Meteorological Observations at Ottawa for the Year 1894.

	MONTH.												YEAR.
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Average height of barometer at 32 and reduced to sea level	30.170	30.162	30.048	30.076	29.951	29.930	29.978	30.022	30.076	29.946	30.045	30 125	30.044
Highest barometer	30.808	30.008	30.461	30.486	30.429	30.265	30.318	30.232	30.587	30.322	30.849	30.642	30.908
Lowest barometer	29.450	29 586	29.488	29.580	29.472	29.417	29.653	29.740	29.585	29.227	29.412	29.457	29.227
Monthly and annual ranges	1.358	1.322	0.973	0 906	0.957	0.848	0.664	0.492	1.002	1.095	1.437	1.185	1.681
Average temperature of air (Fah.)	12 97	11.06	31.20	45.99	55.46	65.95	68.03	61.79	59.65	47.31	29.43	21.33	42.51
Difference from average	+2.63	-1.34	+8.30	+8.21	0.00	+0.25	-1 09	-5.69	+1.75	+2.71	-2.37	+4 22	+1.55
Highest temperature	41 0	38.5	54 2	73.4	83.8	91.0	93.0	89.6	82.3	65.5	51 6	45.8	93.0
Lowest temperature	-16.2	-25.7	3.5	13.0	35.5	36.2	47.0	42.0	29.5	33.8	1.5	-24 5	-25.7
Monthly ranges	57.2	64.2	50.7	60 4	48.3	54.8	46.0	47.6	52.8	31.7	50.1	70.3	118.7
Average maximum temperature	22.76	21.73	38.66	57 01	65.89	76.44	79.80	73.30	71 38	55.55	55.65	27.86	118.7
Average minimum temperature	2.97	-0.50	23.37	35.20	44.90	55.69	58.05	51.84	49.54	40.97	23.05	13.55	118.7
Average daily range	19.79	22.23	15.30	21.81	20.98	20.75	21.71	21.46	21.84	14.59	12.61	14.31	18.95
Average pressure of vapour	0.076	0.073	0.167	0.242	0.298	0.251	0 519	0.405	0.417	0.276	0.133	0.113	0.270
Average humidity of the air	83	83	90	74	67	78	73	72	79	83	76	85	79
Average temperature of dew point	12.4	10.7	30.0	39.4	44.9	60 2	60.1	53.1	53.9	42.8	24.7	21.0	79
Amount of rain in inches	0.55	0 03	1.05	0.77	3.46	5.36	3.57	1.46	2.01	3.60	1.40	0.48	23.74
Difference from average	-0.20	-0.37	-0.11	-0.81	+1.10	+1.35	+1.10	-1.77	-0.59	+0.90	-0.04	-0.18	+0.39
Number of days of rain	5	1	8	3	15	12	16	9	11	14	6	4	106
Amount of snow in inches	33.0	6.5	6.0	.....	.....	.....	.....	.....	.....	*	9.5	15.0	70.0
Difference from average	+10.8	-16.7	-8.7	-5.2	*	.....	.....	.....	.....	-1.0	-0.1	-8.6	-29.5
Number of days of snow	15	81	7	.....	.....	.....	.....	.....	.....	1	11	13	58
Percentage of sky clouded	59	63	63	47	56	59	46	66	63	68	78	73	62
Number of days completely clouded	6	5	5	2	4	4	1	3	5	6	11	11	63
Average velocity of wind (mile)	7.29	7.85	7.75	7.42	7.23	4.90	4.35	4.55	4.64	7.11	8.88	8.89	6.74
Number of auroras	0	2	1	2	0	1	0	1	1	0	1	0	9
Number of thunder storms	0	0	0	2	2	3	6	3	1	1	0	0	18
Number of fogs	0	1	1	0	0	0	0	1	1	2	0	0	9

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