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THE

CANADIAN RECORD

OF SCIENCE.

VOL. VI. OCTOBER, 1895. No. 8.

CONTRIBUTIONS TO CANADIAN BOTANY.

By JAMES M. MACOUN.

VIII.

AQUILEGIA JONESII, Parry.

High slopes of Sheep Mountain, Waterton Lake, Rocky Mountains, Lat. 49° 05′, July 29th, 1895. (*John Macoun*, Herb. No. 10,029.) New to Canada.

BERBERIS NERVOSA, Pursh.

Not rare in deep, moist woods in Trinity Valley, between Mabel Lake and Enderby, B.C., 1895. (*Jas. McEvoy.* Herb. No. 10,133.) Not before recorded east of Yale, B.C.

BERBERIS AQUIFOLIUM, Pursh.

In open thickets, Waterton Lake, Lat. 49° 05′, Rocky Mountains, 1895. (*John Macoun.* Herb. No. 10,267.) Eastern limit in Canada.

PAPAVER PYRENAICUM, L.

A single specimen collected by Dr. G. M. Dawson in the South Kootanie Pass, Rocky Mountains, 1883. Re-discovered in 1895 by Prof. John Macoun on Sheep Mountain, Waterton Lake, Rocky Mountains, alt. 7,500 feet, Lat. 49° 05′. Herb. No. 10,269. New to America.

LESQUERELLA LUDOVICIANA, Wats.

Specimens collected at Medicine Hat, Assa., by Prof. John Macoun, in 1895, (Herb. No. 10,308) are the only specimens in our herbarium that can be referred here. The pubescence of the oblanceolate radical leaves is conspicuously stellate.

LESQUERELLA LUDOVICIANA, WATS., var. ARENOSA, Wats.

Vesicaria Ludoviciana, Macoun, Cat. Can. Plants, Vol. I., p. 54, in part, and Vol. I., p. 490.

From Western Manitoba to the Saskatchewan. The reference under *L. Ludoviciana*, Wats., var. *arenosa*, Wats., Macoun Cat. Can. Plants, Vol. II., p. 305, should go with *L. arctica*, Wat.

SISYMBRIUM VIRGATUM, Nutt.

In gravel amongst bushes, Police Point, Medicine Hat, Assa. In fruit May 31st, 1894. Herb. No. 3,069; prairies, 12-Mile Lake, Wood Mountain, Assa., June 6th, 1895. Herb. No. 10,007; meadows, Sucker Creek, Cypress Lake, Assa., 1895. Herb. No. 10,006. (*John Macoun.*) New to Canada. The Canadian specimens have longer pedicels and pods and are more paniculately branched than those from the Rocky Mountains in the United States, but Dr. Robinson, who examined our specimens, has been unable to detect a single significant or constant character to separate the plants from the two regions.

ARABIS DRUMMONDII, Gray; Macoun, Cat. Can. Plants, Vol. I., p. 43, in part.

A. Lyallii, Macoun, Cat. Can. Plants, Vol. I., p. 43; and Vol. I., p. 487, in part; J. M. Macoun, Can. Rec. Science, Vol. VI., p. 145.

From the Cypress Hills, Assiniboia, west to the Gold Range in British Columbia. Our specimens are from Cypress Hills, Assa.; Sheep Mountain, Waterton Lake, Rocky Mountains; mountains north of Devil's Lake, and at Kicking Horse Lake, Rocky Mountains. (*John Macoun.*) Maple Creek, Assa.; Toad Mountain, Kootanie Lake, B.C.; Mount Queest, Shuswap Lake, B.C. (*Jas. M. Macoun.*) Rocky Mountains. (*Drummond.*)

ARABIS LYALLII, Wats.

Our specimens of this species are from West Summit of North Kootanie Pass. (*Dr. G. M. Dawson.*) Shore of Waterton Lake, Rocky Mountains; mountains north of Devil's Lake, Rocky Mountains. (*John Macoun.*) Lookout Mountain, Big Bend of Columbia River, B.C. (*Prof. Coleman.*)

VIOLA HOWELLII, Gray.

V. canina, L. var. *sylvestris,* Macoun, Cat. Can. Plants, Vol I., p. 63 in part.

V. canina, L. var. *longipes,* Macoun, Cat. Can. Plants, Vol. I., p. 493 in part.

In woods, New Westminster, B.C.; Cedar Hill, Shawnigan Lake and Nanaimo, Vancouver Island. (*John Macoun.*) Vancouver Island (*Streets,* vide Syn. Fl. North Am. Vol. I., p. 202.)

VIOLA ORBICULATA, Geyer; re-described and figured in Contr. from U.S. Herbarium, Vol. III., No. 4, p. 214.

V. sarmentosa, Macoun, Cat. Can. Plants, Vol. I., p. 493 in part.

V. sarmentosa Dougl. var. *orbiculata,* Robinson, Syn. Fl. N. Am., Vol. I., p. 199.

Western Summit of North Kootanie Pass, Rocky Mountains; Dean or Salmon River, B.C. (*Dr. G. M. Dawson*) Kicking Horse Lake, Rocky Mountains; summit of Selkirk Mountains, B.C.; Revelstoke, B.C.; mountains near Ainsworth, Kootanie Lake, B.C. (*John Macoun.*) *Viola sarmentosa* Dougl. seems in Canada to be confined to the Coast Range and Vancouver Island, all our specimens from the interior being plainly V. *orbiculata,* Geyer. The two plants have always been separated in our herbarium, though all were named *V. sarmentosa.*

ARENARIA CONGESTA, Nutt.

Open prairies. Sweet Grass Hills, Alberta, just north of the International Boundary, 1895. (*John Macoun.*) Not before recorded from Canada.

CLAYTONIA MEGARRHIZA, Parry.

Additional references for this species are: summit of Saddle Mountain, Banff, Rocky Mountains; summit of Sheep Mountain, Waterton Lake, Lat. 49° 05′, Rocky Mountains, Herb. No. 10,091. (*John Macoun.*)

HYPERICUM KALMIANUM, L.; Macoun. Cat, Can. Plants, Vol. I., p. 84.

On a small rocky island in the Ottawa River, Township Clarendon, Pontiac Co., Que. In flower July 24th, 1895. (*Robt. H. Cowley.*)

NEMOPANTHES CANADENSIS, DC.

Banks of west branch of Nottaway River, N.E. Ter., 1895. (*Dr. R. Bell.*)

LUPINUS PUSILLUS, Pursh.

L. Kingii, Macoun, Cat. Can. Plants, Vol. I., 103.

Dry sand hills, five miles west of the northern elbow of the South Saskatchewan; Crane Lake, Assa., Herb. No. 4,068; Police Point, Medicine Hat, Assa., Herb. No. 4,069; South of Wood Mountain, Assa.; Many Berries Creek, Milk River, Assa., Herb. No. 10,412; Milk River, Assa., Herb. No. 10,414. (*John Macoun.*) Along the Belly River, Alberta. (*Dr. Geo. M. Dawson.*)

LUPINUS MINIMUS, Dougl.; Macoun, Cat. Can. Plants, Vol. I., p. 103.

Summit of Sheep Mountain, Waterton Lake, Lat. 49° 05′, alt. 7,500 ft., July 31st, 1895. (*John Macoun*, Herb. No. 10,413.) The only authentic Canadian record, as it is doubtful whether it was found by Douglas north of the boundary.

CICER ARIETINUM, L.

Vicia (?), Macoun, Cat. Can. Plants, Vol. I., p. 512.

In dry soil at Chinaman's Ranch, above Spence's Bridge, Thompson River, B.C., Aug. 1883. (*Jas. Fletcher.*) Introduced in wool at Wingham, Ont., 1891. (*J. A. Morton.*) A native of Bengal.

SPIRÆA BETULIFOLIA, Pall.

Peel's River, Mackenzie River Delta, July 14th, 1892. (*Miss E. Taylor.*) Specimens from Qualco Lake, B.C., collected by Dr. G. M. Dawson, are doubtfully referred here. These are the only specimens of this species in our herbarium.

SPIRÆA LUCIDA, Dougl.; Pittonia, Vol. II., p. 221.

S. betulifolia, Macoun, Cat. Can. Plants, Vol. I., p. 126, in part.

Common in thickets and on hillsides, from the Rocky Mountains westward. Our specimens are from Kootanie Pass, Rocky Mountains. (*Dr. G. M. Dawson*) Valleys of the Rocky Mountains. (*Drummond*) Waterton Lake, Lat.

49° 05′, Rocky Mountains; Bow River Pass and Kicking Horse Lake, Rocky Mountains; Sproat and Deer Park, Columbia River, B.C.; Sicamous, B.C.; Spence's Bridge, B.C. (*John Macoun.*) Red Deer, Alberta. (***H. H. Gaetz.***)

SPIRÆA ARBUSCULA, Greene, Erythæa, Vol. III.. p. 63.

S. betulifolia, Pall., var. *rosea*, Gray; Macoun, Cat. Can. Plants, Vol. I., p. 513.

In woods and thickets at the summit of the Selkirk Range, B.C. (*John Macoun. Jas. Fletcher.*)

NEILLIA OPULIFOLIA, Wats.

Banks of West Branch of Nottaway River, N. E. Ter., 1895. (*Dr. R. Bell.*)

POTENTILLA OVINA.

P. dissecta, var. *pinnatisecta*, Macoun, Cat. Can. Plants, Vol. I., p. 517.

Low, tufted, the multicipitous ligneous caudex partly subterranean and clothed with the persistent bases of the leaves; leaves 1½ to 4 inches long of from 4 to 7 pairs of pinnæ, these parted into 2 or 3 linear pinnæ, villous-pilose at apex and sparingly so on both surfaces. Flowering stems scarcely leafy, 4 to 6 inches high, the flowers on slender pedicels an inch or two long; achenes few, obliquely obovoid, smooth and glabrous.

High slopes of Castle Mountain, Rocky Mountains, Herb. No. 7,242; crevices of rocks at The Mound, Banff, Rocky Mountains, Herb. No. 7,235; Sheep Mountain, Waterton Lake, Lat. 49° 05′, Rocky Mountains, Herb. Nos. 10,488, 10,489. (*John Macoun.*)

Though considered a variety of *P. Plattensis* by Dr. Watson, Prof. Macoun always believed the Rocky Mountain plant to be quite distinct from that species, and more nearly related to *P. dissecta*. Later he came to the conclusion that it was a good species, and in this opinion he is sustained by Dr. Edw. L. Greene, who has examined the specimens collected on Sheep Mountain in 1895. The above preliminary description is based on his diagnosis. Prof. Macoun has seen the specimens labelled *P. Plattensis*, var. *pinnatisecta* in the Grey Herbarium, and believes them to be all referable here.

CALLITRICHE HAMULATA, Kürtz.

Dr. Morong having examined the specimens referred to this species (Macoun Cat. Can. Plants, Vol. II., p. 322,) pronounced them to be *C. verna*, L. We have no authentic Canadian specimens of *C. hamulata.*

LUDWIGIA PALUSTRIS, Ell.

Wet places, Sproat Lake, Vancouver Island, 1887. (*John Macoun.*) Not before recorded west of the Saskatchewan.

GAYOPHYTUM RAMOSISSIMUM, T. & G.

Near Dog Lake, Okanagan Valley, B.C., 1895. (*Jas. Fletcher.*) New to Canada.

SANICULA.

Following Mr. Bicknell's revision of the eastern species of this genus, our herbarium specimens have been arranged as below:—

S. MARYLANDICA, L.

From New Brunswick and Nova Scotia west to Vancouver Island.

S. GREGARIA, Bicknell, Bull. Torr. Bot. Club, Vol. XXII., p. 354.

Near Belleville, Ont. (*John Macoun*) Wingham, Ont. (*J. A. Morton.*)

S. CANADENSIS, L.

We have, in our herbarium, no specimens of this species as diagnosed by Mr. Bicknell, though it may be common enough throughout Eastern Canada.

S. TRIFOLIATA, Bicknell, Bull. Torr. Bot. Club, Vol. XXII., p. 360.

Casselman, Ont.; Hastings Co., Ont.; Amherstburg, Ont. (*John Macoun.*) This *Sanicula,* with conspicuously trifoliate, petioled cauline leaves, has been generally taken in Canada to be typical *S. Canadensis,* L.

OSMORRHIZA BREVISTYLIS, DC.

From Prince Edward Island west to Lake Winnipeg.

OSMORRHIZA LONGISTYLIS, DC.

From Nova Scotia west to the Saskatchewan.

OSMORRHIZA NUDA, Torr.

From the Eastern slope of the Rocky Mountains west to Vancouver Island.

OSMORRHIZA OCCIDENTALIS, Torr.

Mountain woods at Ainsworth, Kootanie Lake, B.C., alt. 5,000 ft., 1890. (*John Macoun.*) A new station for this plant.

CICUTA CALIFORNICA, Gray.

New Westminster, B.C.; Ainsworth, Kootanie Lake, B.C. (*John Macoun.*) Not before recorded from British Columbia mainland.

CARUM CARUI, L.

Waste places near the brick-yard at Banff, Rocky Mountains. (*John Macoun.*)

LIGUSTICUM GRAYI, C. & R.: Macoun, Cat. Can. Plants, Vol. II., p. 327.

Woods on the mountains at Ainsworth, Kootanie Lake, B.C., alt. 5,000 feet. (*John Macoun.*)

LIGUSTICUM SCOPULORUM, Gray.

Specimens collected by Prof. John Macoun, at Roger's Pass, Selkirk Mountains, B.C., in 1890, have been doubtfully referred here by Prof. Coulter. Not before recorded from Canada.

HELIANTHUS GROSSE-SERRATUS, Martens.

Along the Grand Trunk Railway, near Stamford, Ont., 1895. (*R. Cameron.*) Introduced from United States.

CLADOTHAMNUS CAMPANULATUS, Greene, Erythæa, Vol. III., p. 65.

Shrub 3 to 5 feet high, with few and stoutish ascending branches; leaves lanceolate, 1 to 3 inches long, tapering to a short petiole, which, together with the veins beneath, is more or less strigose-hirsute with red hairs; flowers solitary or in pairs or threes, from lateral buds, on pedicels ½ inch long, those setose-hispid with red hairs; sepals ovate-oblong, densely ciliate with short gland-tipped hairs; corolla light salmon colour, campanulate, the petals joined at base into a short tube; anthers opening only by a pair of large round terminal pores.

Credited to British Columbia by Dr. Greene, but all our specimens, both from Vancouver Island and the mainland, are *C. pyrolæflorus*, Bong. The new species should be looked for by collectors in British Columbia on the higher mountains of the Coast Range. We have specimens of *C. pyrolæflorus* collected at Sitka by Bongard himself.

VINCA MAJOR, Linn.

In fields near Victoria, Vancouver Island, 1893. (*John Macoun.*) Escaped from gardens.

GENTIANA PLATYPETALA, Griseb.

Mount Rapho, Bradford Inlet, Lat. 56° 13′, Long. 131°36′, alt. 4,050 ft., July 7th, 1894. (*H. W. E. Canavan.*) Yakoun Lake, Queen Charlotte Islands, 1895. (*Dr. C. F. Newcombe.*) New to Canada.

MENYANTHES CRISTA-GALLI, Menzies.

Port Simpson, B.C., 1893. (*Jas. McEvoy.*) Shore of Yakoun Lake, Queen Charlotte Islands, 1895. (*Dr. C. F. Newcombe.*)

MYOSOTIS CÆSPITOSA, Schultz.

Cartwright, Ont., 1891. (*W. Scott.*) New to Canada.

SOLANUM NIGRUM, L., var. VILLOSUM, Mill.

A new station for this plant is New Westminster, B.C. 1895. (*A. J. Hill.*)

VERBASCUM THASPUS, L.

Waste plates, Revelstoke, B.C.: Vernon, Lake Okanagan, B.C., and Sannach Road, near Victoria, Vancouver Island. (*John Macoun.*) Not before recorded west of Ontario.

VERBASCUM BLATTARIA, L.

Waste places, Revelstoke, B.C. (*John Macoun.*) On the sea shore at Union Mines, Comox, Vancouver Island. (*Anderson.*) Not before recorded west of Ontario.

CHELONE GLABRA, Linn.

Banks of west branch of Nottaway River, N.E. Ter., 1895. (*Dr. R. Bell.*)

EUNANUS BREWERI, Greene.

Amongst grass on hillsides at Sproat, Columbia River, 1890. (*John Macoun*, Herb. No. 10,307.) New to Canada. Determined by Dr. Greene.

THYMUS CHAMÆDRYS, Fries.

Stanley Park, Vancouver, B.C., September, 1895. (*Rev. H. H. Gowen.*) *T. Serpyllum*, L., is not uncommon in Eastern America, but this species has not been before recorded from this country.

CALAMINTHA CLINOPODIUM, Benth.

New Westminster, B.C., 1895. (*A. J. Hill.*) Not recorded west of Manitoba. Probably introduced.

POGONIA OPHIOGLOSSOIDES, Ker.

In bogs, near small lakes at head of Gatineau River, Que. (*Dr. R. Bell.*)

ALLIUM GEYERI, Wats.

Gravelly banks, Botanie, west of Spence's Bridge, B.C., 1890. (*Jas. McEvoy.*) Found on Vancouver Island, but not before on mainland of British Columbia. Referred by mistake to *Allium Nevii*, Wats., in No. II. of these papers.

ALLIUM ACUMINATUM, Hook.

On gravelly banks, Botanie, west of Spence's Bridge, B.C., 1890. (*Jas. McEvoy.*) Not before recorded from mainland of British Columbia.

CAREX FESTIVA, Dew., var. GRACILIS, Olney.

Borders of coulees, Cypress Hills, Assa., 1894. (*John Macoun*, Herb. No. 7,396.) Not before recorded east of British Columbia.

REVIEW OF THE EVIDENCE FOR THE ANIMAL NATURE OF EOZOÖN CANADENSE.

By SIR WILLIAM DAWSON, C.M.G., LL.D., F.R.S., Etc.[1]

I. HISTORICAL AND STRATIGRAPHICAL.

The writer of these notes had hoped to have been able long ago to let the vexed questions respecting Eozoön repose in peace in so far as he was concerned, and he is now induced to offer a short summary of the evidence in the case only with the view of correcting some misapprehensions that seem to have arisen in regard to points well established, and which, independently of any question as to the nature of Eozoön, belong to the certain data of geology. These misapprehensions lead to the confounding of the structures originally discovered by Logan with things in no way related to them, and from which they had been clearly distinguished by my own original studies, and by those of Hunt, Carpenter, and Rupert Jones. New facts relating to pre-Cambrian life have also been coming to light from time to time, and many of these are connected, either directly or indirectly, with the evidence respecting Eozoön.

As early as 1858, Sir William Logan had begun to suspect that the Stromatoporoid forms collected from the great Laurentian limestones in different parts of Canada must be of organic origin, and he ventured to mention them as possibly of this nature at the meeting of the American Association in 1859, and in his General Report on the Geology of Canada in 1863. The evidence on which he relied was their occurrence only in the limestones, their similarity in form and general structure to the Stromatoporæ, or "Layer-Corals" of the Palæozoic, and the circumstance that, while the forms and structures seemed to be identical, they were mineralized by Serpent-

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[1] [Reprinted from the Geological Magazine, Decade IV., Vol. II., October, November, December, 1895.]

ine, Loganite, Pyroxene, and Dolomite, an indication that a similar mould had been filled by diverse minerals.

At that time the little leisure that I could spare for original work was occupied with Carboniferous and Pleistocene geology, and I had no ambition to invade the great and difficult pre-Cambrian districts of Northern Canada any further than might be necessary to my work as a teacher of geology. In the interest of that work, however, I had gone over considerable portions of the Laurentian and Huronian districts surveyed by Logan and Murray, with the aid of their maps and reports, and had satisfied myself of the great accuracy of their work, which led in my judgment to the following results:—

(1) That the upper part of the Lower Laurentian of Logan, since called the Grenville Series,[1] consisted of truly stratified metamorphic deposits, including great and extensive beds of limestone, quartzite, iron-ore, and other rocks, evidently of aqueous origin, and that the condition and crystalline and chemical characters of these rocks were not essentially different from those of the altered Palæozoic beds with which I was familiar in Nova Scotia and New England.

(2) That the Huronian, a less disturbed, less altered, and in the main evidently a clastic series, rested unconformably on the Laurentian, and was in part composed of its materials.

(3) That the "Upper Copper-bearing series" of Lake Superior, since known as Kewenian, was newer than the Huronian, but older than the oldest fossiliferous Cambrian rocks then known in Canada.

(4) That, while the Kewenian and Huronian rocks, and those designated by Logan as Upper Laurentian, indicated by the presence of igneous masses, and, in the case of the two former, by the prevalence of coarse, clastic material, littoral conditions and much volcanic disturbance, the

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[1] By Dr. Sterry Hunt.

still older Grenville Series was of a character more indicative of long-continued quiescence, accompanied by the accumulation of great calcareous deposits, possibly of organic origin.

These conclusions were noticed in papers contributed to local societies, in published lecture-notes, and in class-teaching, and were frequently discussed with Logan and Hunt. Accordingly, when, in 1863, at the urgent request of Logan, I undertook the microscopic examination of large series of his supposed Laurentian fossils and the containing limestones, as well as of other crystalline limestones of various ages, slices of which he had caused to be made, I was not unprepared to find the curious and beautiful structures which developed themselves in his Stromatoporoid forms, and in portions of the limestone in which they were contained, but which appeared to resemble those of Foraminifera rather than those of Corals.

The results thus attained, in 1864, were not fully published until after Logan was prepared to sustain them by detailed maps and sections of the district on the Ottawa containing Eozoön, a work extending over many years of arduous and skilful labour; and until Dr. W. B. Carpenter and Prof. Rupert Jones had studied the original specimens and others prepared for themselves, along with my notes, and camera drawings executed by the artist of the Geological Survey. Dr. Sterry Hunt had also examined chemically the serpentine and other minerals associated with the supposed fossils, and various hydrous silicates mineralizing organic remains in Silurian and other limestones, as terms of comparison. The whole was then communicated to the Geological Society of London, and appeared in the somewhat elaborate joint paper published in 1865.[1]

[1] A preliminary accoount entitled "On the occurrence of Organic Remains in the Laurentian Rocks of Canada." had, however, been communicated to the British Association at Bath, Sept. 15-21, 1864, and was subsequently published in the Geological Magazine, Vol. I, for November, 1864, pp. 225-227.

I confess that in the intervening time I have seen no good reason to induce me to doubt the essential validity of the work embodied in this paper of 1865, or to modify to any considerable extent the conclusions therein stated. On the other hand, many new and confirmatory facts have been disclosed, and after careful and, I trust, candid study of the objections raised, down to those which have recently appeared in the Dublin Transactions, I believe that they largely depend on the want of knowledge of the character of the Grenville formation, and on misapprehension as to the form and structure of Eozoön and its mode of occurrence.

It is true that in those members of the Laurentian system of Logan which are below and above the Grenville Series, later observations have not only failed to detect fossils, but have shown valid reasons adverse to the probability of their occurrence, at least in the portions of those formations hitherto open to our study.[1]

The lowest Laurentian gneiss of Logan (Trembling Mountain gneiss, Ottawa gneiss, fundamental gneiss), which occupies a vast area in Northern Canada,[2] and is the only part of the system known to many geologists, consists, so far as known, wholly of foliated or massive orthoclase gneiss, with bands of hornblendic schist (amphibolite), and of hornblendo-micaceous schist. While in some places it appears to have a truly bedded structure, especially where different varieties of gneiss, amphibolite, and biotitic schist alternate, in others its foliation is obscure, or seems to have been induced by heat and pressure. Dr. F. D. Adams, who has given much study both to its character on the large scale, and to the microscopic structure of the rocks, in his latest publication on the subject[3] characterizes it as

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[1] See *Geological Magazine*, June, 1895.

[2] According to the geological map of Northern Canada prepared by Dr. G. M. Dawson for the Geological Survey, the area of Laurantian rocks exceeds two millions of square miles. Of this, so far as is known the older or fundamental gneiss occupies by far the larger portion.

[3] Journal of Geology, Vol. i, No. 4, 1893.

a complicated series of rocks of unknown origin, but comprising a considerable amount of intrusive material. He regards it as either the remains of a primitive crust penetrated by much igneous matter, or as a series of altered rocks older than the Grenville Series, and formed under different conditions. In any case it seems to want the evidences of ordinary aqueous deposition presented by the limestones, ironstones, quartzite, and schists of the Grenville Series. Similar views were advocated in my address on the "Geological History of the Atlantic," before the British Association, in 1886.[1]

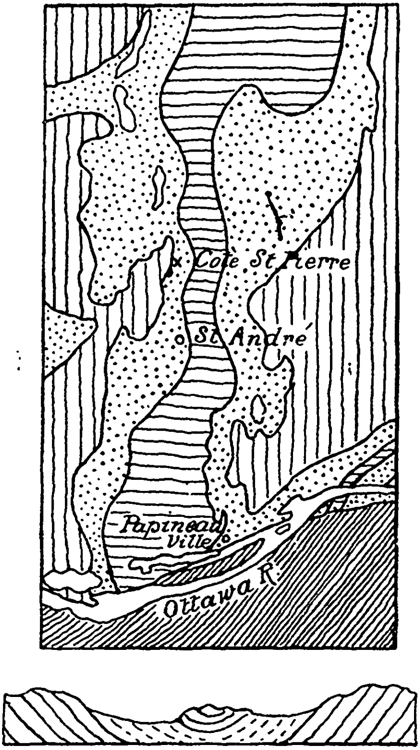

FIG. 1.—Distribution of Grenville Limestone in the district north of Papineauville, with section showing arrangement of the beds. Scale of map 7 miles to an inch. (See also Dr. Bonney's paper, *Geological Magazine*, July, 1895, p. 295.)

Dotted area : Limestone.

Horizontal lines : Upper gneiss (fourth gneiss of Logan.)

Vertical lines : Lower gneiss (third gneiss of Logan.)

Diagonal lines : Overlying Cambrian and Cambro-Silurian (Ordovician.)

The Upper Laurentian of Logan (Labradorite, Anorthosite, or Norian Series), supposed by him to overlie the

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[1] See also Museum Memoir on Eozoon, pp. 2, 3. Montreal, 1888.

Grenville Series uncomformably, is now stated by Adams to consist of eruptive matter, mainly composed of triclinic or lime felspars, and to which the name Anorthosite[1] may properly be applied. These rocks, cutting the Grenville Series, and apparently in some places, interbedded with it, are not now regarded as a distinct series of beds, but as indicating local outbursts of igneous action dating about the close of the Grenville period. What aqueous rocks may have been contemporaneous with these, or may have filled the interval between the Grenville Series and the Huronian, we do not at present certainly know, though possibly some of the rocks associated with the upper part of the Laurentian, or the lower part of the Huronian in the interior, and in the eastern part of Canada, may come into this place.[2]

It is to be observed that in 1865 these facts respecting the fundamental gneiss and the Upper Laurentian of Logan, were not distinctly before our minds, though in subsequent papers I thought it best to consider the Grenville group as a distinct series under the name "Middle Laurentian." It is quite possible, however, that our referring in the first instance to the Laurentian as a whole may have led to erroneous impressions.

For the purpose of these notes, therefore, it will be best and most accurate to confine ourselves to the Grenville Series, which has been carefully explored and mapped by the officers of the Geological Survey in the country lying north of the Ottawa River, and also in some parts of the areas between that river and the St. Lawrence. In these regions Logan recognized a thickness of 17,250 feet of deposits, of which no less than 4,750 feet consisted of limestone, principally in three great bands, though with intercalated gneissose layers. The Grenville Series may

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[1] Proposed by Hunt.

[2] Some of these beds are regarded by Von Hise (Jour. of Geology, Vol. i.) as a lower member of the Huronian. They may be identical in part with the "Kewatin" group of Lawson.

thus be regarded as one of the great calcareous systems, comparable with those of the Palæozoic period, which it also rivals in its association with carbonaceous and ferruginous, deposits. Though minute globular forms, probably organic, have been found in the Middle Limestone, that of Long Lake, Eozoön proper is confined, so far as known, to the Upper Limestone, known specially as the Grenville Band. This band and its accompaniments I have myself studied in the region north of the Ottawa, at the Augmentation of Grenville, near the Calumet, in the quarries opposite Lachute, at Côte St. Pierre, at Montebello, at Buckingham, and Templeton, as well as in some of the districts west of the Ottawa, where the same limestone is supposed to recur. Everywhere it is a large and regular bed, sometimes with even strike and dip, but at intervals thrown into violent contortions along with the enclosing beds, in the manner usually seen in disturbed strata of later age, where it is common to find portions little affected by plication alternating with strongly folded beds having the harder ones dislocated; others are merely bent or folded (Figs. 4 and 5). It presents subordinate beds of different qualities, dolomitic, serpentinous, or graphitic, and is immediately associated with thin-bedded, fine-grained gneisses, quartzite, and biotitic and hornblendic schists. In some beds it has disseminated crystals of minerals usually found in metamorphic limestones, while in others there are concretionary masses, nodules and grains of serpentine and pyroxene. Eozoön in masses occurs only in certain layers, most frequently in those which are serpentinous, but a careful examination detects in many layers, not showing perfect examples of Eozoön, small

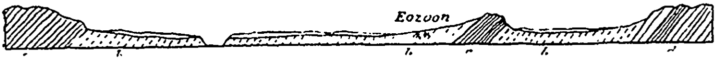

FIG. 2.—Arrangement of beds in valley of Calumet River—(*a*) Upper gneiss; (*b*) Limestone partly covered with soil; (*c*) Included bed of gneiss; (*d*) Lower gneiss.

fragments or patches having its characteristic structures, or detached chamberlets or groups of these. The occurrence of these fragments I regard as an important fact, and as showing that what may be termed "Eozoön sand" enters largely into the composition of the limestone.

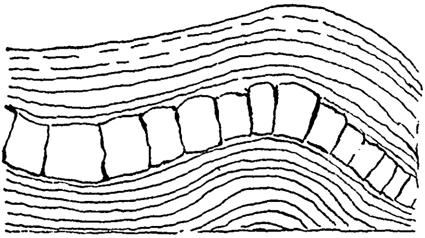

FIG. 3.

In illustration of this part of my subject, I present a rough map of the district near the Petite Nation River, in rear of Papineauville, referred to by Dr. Bonney in his valuable paper in the July No. of the Geol. Magazine, and in addition to the section given in his paper, one showing the order of succession in the valley of the Calumet, a little stream some distance to the eastward. I also give examples of the manner in which the associated gneiss, though often very regular, is along certain lines contorted, and the manner in which, in these contorted spots, the quartzite bands are cracked and broken, exactly as may be observed in the shales and sandstones of the Quebec group on the Lower St. Lawrence.

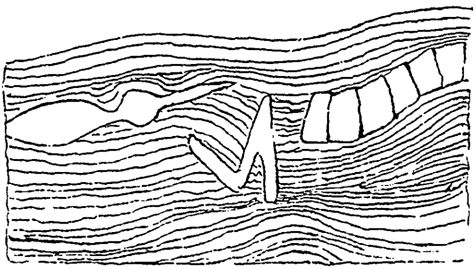

FIG. 4.

FIGS. 3 and 4.—Bent and dislocated Quartzite, in contorted schists interstratified with Grenville Limestone, near Montebello. The quartzites have been broken and displaced, while the schists have been bent and twisted. In the immediate vicinity the same beds may be seen slightly inclined and undisturbed.

I may add here that Dr. F. D. Adams has found that in certain localities the rocks of the Grenville Series become almost horizontal, though even in this case they show evidence of having been subjected to much alteration and great pressure. He has also shown, by comparison of a number of detailed analyses, that several of the gneisses of the Grenville Series have the chemical composition of Palæozoic slates, snd thus that there can be no chemical objection to regarding them as altered sediments. This I consider a very important observation; and I may refer for details to his paper in the *American Journal of Science*, 1895, p. 58.

The summary of facts above given should, I think, be sufficient to show that in the case of the Grenville limestone we have phenomena which cannot be explained by mere pressure acting on massive rocks, or by segregation of calcite from igneous rocks, or by vein structnres, or by any contact structures arising at the junction of igneous and aqueous deposits. We have, on the contrary, to deal with a formation which indicates that in the early period to which it belongs regular sedimentation was already in full operation. The more precise vital and chemical agencies which prevailed in the ocean of the Laurentian period we must notice later.

I have merely to add here that the characters assigned above to the Grenville Series have not only been fully corroborated by the recent work of Adams and Ells in Canada,[1] but also by the surveys of Kemp and Smyth in the more disturbed and elevated district of the Adirondack Mountains in New York.[2]

We have thus paved the way for the consideration of evidence of a structural and chemical character.

To be Continued.

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[1] *American Journal of Geology*, 1893, No. 4. Also Reports Geol. Snrv. of Canada.

[2] Bulletin Geol. Soc. of America, March, 1895.

THE CHEMICAL COMPOSITION OF ANDRADITE FROM TWO LOCALITIES IN ONTARIO.

BY B. J. HARRINGTON, B.A., PH.D., MCGILL COLLEGE.

(Presented to the Meeting of the Royal Society of Canada, May 17th, 1895).

1. LUTTERWORTH.

The specimens examined were collected by Dr. F. D. Adams at the "Paxton Iron Mine," in the township of Lutterworth, Ontario.[1] The magnetite at this locality is associated with a number of other minerals, including garnet, pyroxene, and hornblende. The ore body is also cut by reticulating veins holding quartz, calcite, orthoclase, pyroxene, scapolite, allanite, etc. The garnet is black in colour, and looks exceedingly like ordinary black tourmaline. It is mostly massive, but also found in crystals, which are rhombic dodecahedrons with their edges generally truncated by the tetragonal tris-octahedron (∞ O, 2 O 2). Carefully selected material was found to have a specific gravity of 3.813 at 17°C., and gave on analysis the following percentage compositions:—

Silica	35.68
Alumina	5.88
Ferric oxide	23.70
Ferrous oxide	3.65
Manganous oxide	0.81
Lime	29.64
Magnesia	0.35
Loss on ignition	.28
	99.99

The mineral was specially examined for titanium, but no trace found.

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[1] See Report of the Geological Survey of Canada, Vol. VI., 1891-92-93, Part J, by Dr. Adams,

The atomic and quantivalent ratios deducible from the above figures are as follows:—

	Atomic.	Quantivalent.		
Si	595 × 4 = 2380	2380	2380	 1
Al	112 × 3 = 336	1224	2424	 1
Fe^{III}	296 × 3 = 888			
Fe^{II}	51 × 2 = 102	1200		
Mn	11 × 2 = 22			
Ca	529 × 2 = 1058			
Mg	9 × 2 = 18			

This shows that the mineral is a unisilicate, and it agrees well with the garnet formula $R_3\overset{II}{R}_2\overset{III}{Si}_3O_{12}$, R being chiefly calcium and R chiefly ferric iron. Being, therefore, a lime-iron garnet, it should be referred to the sub-species *Andradite*.

2. DUNGANNON.

Among the minerals in the Nepheline Syenite of Dungannon, Ontario,[1] is a brown garnet, sometimes showing crystalline form, but occurring for the most part in small irregular grains. After careful separation by means of dense liquids, the grains were found to have a specific gravity of 3.739 and the following percentage composition:—

Silica	36.604
Titanium dioxide	1.078
Alumina	9.771
Ferric oxide	15.996
Ferrous oxide	3.852
Manganous oxide	1.301
Lime	29.306
Magnesia	1.384
Water	.285
	99.577

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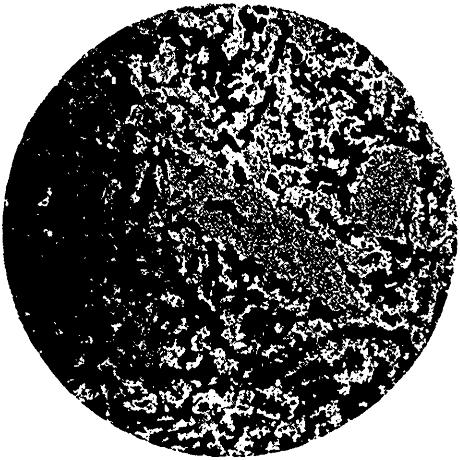
[1] See papers on this rock and some of the minerals which it contains, by Dr. Adams and the writer, in the American Journal of Science, Vol. XLVIII., July, 1894.



No. 1.

No. 2 (*a*).

No. 2 (*b*).

MICRO-PHOTOGRAPHS OF DYKES.

The atomic and quantivalent ratios deducible from the above analysis are as follows:—

Si	610 × 4 =	2440	2492	2492 1
Ti	13 × 4 =	52		
Al	192 × 3 =	576	1176	2434 1
Fe^{III}	200 × 3 =	600		
Fe^{II}	53 × 2 =	106	1258	
Mn	18 × 2 =	36		
Ca	523 × 2 =	1046		
Mg	35 × 2 =	70		

Evidently the mineral belongs to the sub-species *Andradite*

SOME DYKES CUTTING THE LAURENTIAN SYSTEM IN THE COUNTIES OF FRONTENAC, LEEDS, AND LANARK, ONT.

BY W. G. MILLER AND R. W. BROCK, KINGSTON, ONT.

[With Plate III.]

During a canoe trip which the writers took last September in connection with a party in field geology from the Kingston School of Mining, a large number of dykes cutting the Laurentian series were examined. In the district traversed, the county of Frontenac and adjoining eastern counties, the dykes show a considerable variety in mineralogical composition. It is proposed, in the present paper, to give a short description of a few of the more basic representatives of these.

The larger masses of more coarsely crystalline igneous rocks throughout the district belong to the granite and gabbro families. The characters of the more typical granites in the south-western part of the district seem worthy of notice. The quartz in these generally forms about one-fourth of the mass of the rock, and possesses a blue colour; the feldspar consists of microperthite, orthoclase, microcline, albite, and probably anorthoclase; while the ferro-magnesian constituents, which are usually so much decomposed that their true characters are not determinable even in specimens obtained from a considerable distance beneath the surface of the ground, are to a large extent grouped in such a way that a face of the rock shows numerous dark patches, often two inches or more in diameter. In some of the most acid of these granites, there are basic segregations which consist of lime-soda feldspar, together with small amounts of pyroxene. The granite dyke rocks, in many cases, are very coarse-grained, and consist of microcline and other alkali feldspars, quartz, and a light-coloured mica which occurs in varying amounts.

Many of the schistose rocks of the district, with the exception of the crystalline limestones, are in all probability of eruptive origin; but very little work has so far been done on them.

The scapolite rocks are among the most interesting representatives of the schistose group. While it is likely that some of these have been produced by the alteration of gabbros, there are others in which such evidence of their origin has not been obtained. The writers have examined specimens, taken in some cases from a considerable distance beneath the surface of the ground, which consisted of the two essential minerals, scapolite and pyroxene. Some grains of the latter constituent were seen to be quite fresh, while others, especially in those specimens from near the surface, were more or less changed to hornblende. In the rock referred to, no plagioclase was noticed.

Another rock of a very striking character, when examined microscopically, consists of the minerals microperthite and pyroxene, together with small amounts of orthoclase, lime-soda feldspar, and a finely-striated plagioclase which is probably anorthoclase. The microperthite is present in much greater quantity than the other constituents. The rock is undoubtedly of eruptive origin, and occurs in the district adjacent to the locality in which the mineral perthite was first discovered.[1]

Thin sections of the scapolite-pyroxene and microperthite-pyroxene rocks referred to have a general resemblance to each other when examined under the microscope in ordinary transmitted light. The pyroxene has about the same form and green colour, occurs in about the same proportion, and is set in a colourless matrix in each. In polarized light, however, the resemblance ends, the scapolite possessing very much brighter colours than the feldspar.

Masses of gabbro and norite are found at a number of localities throughout the district traversed. These coarse-grained rocks possess the same general characters as those of their class which have been described from other parts of Canada. In most of the masses a considerable differentiation is shown: in one part they may show the characters of a normal gabbro while in others they are true norites: and again, in certain portions of the mass free silica may be present. The gabbro-norite mass which crosses the railroad a short distance north of the village of Parham is interesting on account of the comparatively large size of the inclusions which occur in both the diallage and hypersthene. This rock appears to offer a good opportunity for the determination of the characters of these materials which, except in size, are similar in appearance to those commonly found in these minerals. Prof. Judd, the late Prof. G. H. Williams, and others, have examined such inclusions in rocks from different parts of the world. In some rocks they have been held to be of secondary origin, while in others it is claimed they are original constituents. Their chemical composition is said to be different in different cases.

Dykes of the basic rocks occur in great numbers

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[1] This rock seems to resemble one referred to by Prof. K. de Kroustchoff, of St Petersburg, Bulletin Soc. Franc. de Min., IX., 1886. Tschermak's Min., u Pet. Mitth. 1887.

throughout these counties. They do not cut the strata of Cambrian and Silurian age, which are found at a number of places overlying the Laurentian, nor are any surface flows known to occur, although, from the characters of one set of very fine-grained porphyrite dykes which will be described, it seems not unlikely that such flows have taken place over the Laurentian series, but the material of which they were composed has been removed by the excessive denudation to which these rocks have been subjected since pre-Cambrian times.

The late Mr. H. G. Vennor mentions a dyke, composed of "a fine-grained, black, glittering dolorite, weathering greyish-white," discovered by him near the banks of the Rideau canal, in the township of North Burgess, and states that "in width it varies from four to one hundred feet."[1] Series of specimens were taken from this dyke, and when examined in thin sections under the microscope the rock is seen to consist of lime-soda feldspar and a secondary ferro-magnesian mineral, together with small amounts of brown mica, hornblende, and quartz. The plagioclase occurs in more than one generation, so that the rock is a porphyrite. The larger phenocrysts of this mineral, whose length rarely exceeds 2·5 mm., occur sparingly, and are of earlier formation than any of the other essential constituents of the rock. The most important ferro-magnesian constituent is a uralitized pyroxene which occurs in irregular grains, enclosed, to some extent, in crystals of the second generation of plagioclase. Individuals of this latter mineral, whose average length is under 0·35 mm., have, like the older phenocrysts, the "dusted" appearance commonly seen in the feldspar of gabbros. Some of the inclusions are air cavities. Filling up the interstices between the two generations of crystals mentioned are grains of quartz and feldspar, some of which is probably orthoclase. A considerable

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[1] Report of Progress, Geological Survey of Canada, 1872-3.

proportion of these minerals forms an intergrowth of micropegmatite. The most important accessory minerals are magnetite and apatite. The latter occurs in needle-like forms, and, curiously enough, is most abundant in the minerals filling the interstitial spaces. The rock at the contact, and in the centre of the wider parts of the dyke, is seen to vary considerably, specimens from the centre being somewhat coarser grained and more acid. The latter point is illustrated by the more abundant occurrence of quartz and hornblende, and by the shorter and broader form of the feldspar, which commonly shows twinning according to both the albite and pericline laws. Phenocrysts of plagioclase of the first generation are also less abundant near the centre of the dyke. A specimen of the rock, taken some distance from the contact, was found to contain 52·96 per cent. of silica. Thin sections of the rock taken from a number of dykes in the township of Bedford were found to be similar in character to those taken from the North Burgess dykes. These rocks, from both townships, appear to belong to the gabbro family, the more acid representatives of which frequently contain 53 per cent. of silica. We believe that they should be described as quartziferous gabbro porphyrites. The following table will show the relation they hold to other gabbro and diorite dyke rocks which have been described from other countries:—

	GABBRO.	DIORITE.
DYKE ROCKS	Gabbro aplite. (Beerbachite).[1]	Diorite aplite. (Malchite).[2]
	Gabbro porphyrite. (————)	Diorite porphyrite. (Orbite).[1]
	Gabbro lamprophyre. (Odinite)[1]	Diorite lamprophyre. (1. Kersantite). (2. Camptonite).

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[1] Dr. C. Chelius. Notizbl. Ver. Erdk. Darmstadt, IV., Folge, 1891 u. 1892.

[2] Prof. A. Ossan: Mitth. grossh. bad. Geol., Landesanst, II., 380.

A number of dykes which occur near the west bank of the Rideau canal, in the vicinity of Seeley's Bay, were examined. One of the smaller of these, which cuts the graphite-holding crystalline limestone near a narrows in the canal, has a width of four feet, and sends off branches into the surrounding rock. It is dark in colour, very fine-grained, and possesses a highly perfect columnar structure, developed in a direction at right angles to its walls. The rock has a specific gravity of 2·92, and on analysis was found to have the following chemical composition:—

SiO_2 46.51, TiO_2 2.90, Al_2O_3 12.33, Fe_2O 11.14, Fe_2O_3 3.87, CaO 9.37, MgO 6.48, Na_2O 3.67, K_2O 1.18, H_2O+CO_2 2.47, S ·16. Traces of copper and bàrium were observed. Manganese and nickel are both present.

The rock fuses readily. About twelve ounces of it were finely pulverized, placed in a covered graphite crucible, and fused for some hours in a coal furnace. It was then allowed to cool. On breaking the crucible the fused mass was found to have separated into two parts—a highly perfect, clear, slightly amythistine glass, and a "button" containing most of the metallic matter. The latter rested on the bottom of the crucible, and was easily detached from the glass. It had a diameter of about 2·5 cm. and a thickness of about 1 cm., and weighed about one and one-quarter ounces.

In hand specimens many minute crystals are seen scattered through the rock. Examined microscopically, in thin sections, the groundmass is found to be very fine-grained, and, in the denser portions, microlitic. Abundant phenocrysts of plagioclase and pyroxene are present. These minerals are also constituents of the groundmass, which contains, in addition, much magnetite. The larger individuals of plagioclase of the groundmass, Fig. 2 (*b*), are in needle or lath-like forms, having an average length of about 0·05 mm., but there are innumerable smaller and less regular ones. The magnetite occurs in octahedrons, irregular grains, and in skeleton crystals or dendritic forms. A number of octahedrons are often seen joined together into strings, having branches at right angles. The porphyritic plagioclase, Fig. 2 (*a*), usually has the lath-shape and an average length of less than 1 mm. Phenocrysts of this mineral are more abundant than those of pyroxene, with which they are often intergrown—the pyroxene being the older, and having served as a point of attachment for the feldspar when it began to crystallize. The porphyritic crystals of monoclinic pyroxene are light-brown to colourless, and frequently have a somewhat elongated form, with rough edges. Some of the largest are 1·8 mm. in length. An irregular parting perpendicular to the longest axis of the crystal is present. Rhombic pyroxene occurs sparingly in some of the sections. Its phenocrysts are smaller than those of the monoclinic, and generally have a somewhat regular octagonal outline. Patches or irregular grains of chloritic material are present in all of the thin sections examined.

Thin sections were examined from some larger dykes in the same vicinity. These were found to possess the general characters of the rocks just described. Pyroxene, however, was not observed among the phenocrysts, and olivine appeared to be absent. A flow structure is often seen in the sections from the narrow dyke. This structure is illustrated by the arrangement of the feldspar phenocrysts and the constituents of the groundmass around the earlier-formed individuals. This dyke rock, which may be classed as a porphyrite, appears to resemble the members of the effusive group more closely than it does those of the plutonic. Effusive masses, however, are not known to overlie the Laurentian in any part of the district.

DESCRIPTION OF FIGURES.—PLATE III.

No. 1.—Gabbro porphyrite from North Burgess. The thin section was photographed in ordinary transmitted light, a number two objective being used in the microscope. Two large phenocrysts of plagioclase are shown. The feldspar of the second generation is also shown in white. The minerals filling the interstitial spaces do not come out distinctly.

No 2 (*a*).—Dyke rock (porphyrite) near Seeley's bay, Rideau canal. Photographed under the same conditions as No. 1. A number of phenocrysts of plagioclase and one or two of pyroxene are shown. The feldspar in the groundmass is also brought out.

No. 2 (*b*).—This is a portion of No. 2 (*a*) more highly magnified, a number seven objective being used. The white central portion represents an end of a plagioclase phenocryst. The feldspar of the groundmass is also shown.

The writers are indebted to their friend Mr. William Lawson, B.A.Sc., for the photo-micrographs from which these figures are taken.

GEOLOGICAL DEPARTMENT.
SCHOOL OF MINING.

ON THE FERNS IN THE VICINITY OF MONTREAL.

By HAROLD B. CUSHING, B.A.

Montreal has been spoken of by more than one writer as a very favorable locality for collecting plants. However this may be with regard to plants in general, the remark is certainly true of the ferns, principally on account of the situation of the city at the foot of Mount Royal. In the comparatively small area comprised by the mountain, we have rich damp woods, rocky hillsides, swamps and shaded cliffs, in fact, all the most favorable conditions for the growth of the various species of ferns. Thus, out of at most forty-five varieties which include Montreal within the limits of their distribution, no less than thirty-two have been found within an area of about one square mile. My purpose in writing this paper is to collect the past records of Montreal ferns, describe as far as possible the present distribution of the various species in this vicinity, and contrast it with what can be learned from the records of their distribution in the past.

Ferns have always received their due share of attention by botanists. While the rest of the Cryptogams and many of the orders of Phanerogams are persistently neglected, except by specialists, the ferns form part of every herbarium and are included in all manuals of flowering plants. As a result of this, we find, on referring to past records of Montreal plants, that we have a fairly complete record of ferns from 1821, when the Holmes Herbarium was made, to the present time. The more important of these records are as follows ;—

Catalogue of the Holmes' Herbarium ; Canadian Naturalist, April, 1859.

List of Canadian Plants, by Dr. Maclagan ; Annals of the Kingston Botanical Society.

Synopsis of Canadian Ferns, by Dr. Geo. Lawson ; Canadian Naturalist, August, 1864.

Notes on Canadian Ferns, by John B. Goode ; Canadian Naturalist, Vol. IX., p. 49.

Canadian Filicineæ, by Macoun and Burgess ; Transactions of the Royal Society of Canada, Vol. II.

Catalogue of Canadian Plants, Part V., by John Macoun.

Flora of Montreal Island, by Dr. Robt. Campbell ; Canadian Record of Science, Vol. V., No. 4.

A few species have also been recorded from Montreal by McCord, St. Cyr, Provancher, Parsons, and others.

I have made a careful comparison between these various records, and have for three years past carefully examined the present distribution of Montreal ferns, to observe how far their distribution corresponded to the past records. I hoped by these means to be able to trace the influence of civilization in exterminating species through the clearing of land and draining of wet places. The change in the flora should be especially evident in the case of the ferns on account of their peculiar habitat, and, moreover, of no other group of plants have we such a complete local record. The chief result of my investigation, however, is a realization of the difficulty of exterminating species even in a limited locality. Thus, out of the thirty-two varieties recorded, I have been able to discover twenty-nine still occurring, though several of these were spoken of thirty years ago as on the point of disappearing. Doubtless this persistent survival of species, which have become rare, is partly due to the mountain having been preserved as a park, though great changes have been made in it. The following instances will serve to illustrate what I have stated :—

Pellæa gracilis is only recorded from Montreal by Dr. Holmes in 1822. In view of the very complete character of several of the above records, the absence of any mention of it since that time is sufficient proof of its rarity. However, it still occurs sparingly on the mountain side.

Asplenium angustifolium is recorded by McCord and Goode as occurring on the smaller mountain with *Aspidium Goldianum*, and a colony of this fern is still found there, though *A. Goldianum* has probably become extinct.

Aspidium acrostichoides is recorded by Goode in 1879 as occurring back of Sir Hugh Allan's and behind the cemeteries, but becoming scarce. It is still found, however, in sufficient abundance in both localities.

Dicksonia pilosiuscula is only recorded by Maclagan, and is found behind the cemeteries.

There are only three species which I have been so far unable to discover, but which may possibly still occur. These are *Aspidium Goldianum, Camptosorus rhizophyllus* and *Botrychium ternatum.*

Aspidium Goldianum, Hooker, is of especial interest, as Montreal is the locality where it was first discovered, in 1818, by Mr. Goldie, after whom it was named by Sir William Hooker. Since then it has been recorded by Maclagan, McCord and Goode, though Mr. Goode writes, in 1879, that he has not found it for some years. I have been unable to discover it in the locality described by these writers.

Camptosorus rhizophyllus, Link, is represented in the Holmes Herbarium by a specimen from St. Helen's Island. It is recorded from l'Abord-à-Plouffe and St. Helen's Island by McCord, and from Montreal Mountain by Provancher. It probably does not now occur on the mountain or on St. Helen's Island.

Botrychium ternatum, Swz., var. *lunarioides,* has also been recorded by McCord and Goode, and a specimen, marked "Montreal, 1861," is in the McGill Herbarium, but I have not succeeded in finding the fern in this vicinity.

In the following list I have chiefly given the distribution of the various species on the mountain, as that is the locality to which I have devoted most attention. The mountain consists of three separate hills, divided by Côte des Neiges road and the cemeteries. For convenience of description I have referred to these as Mount Royal and the North and West Mountains.

Polypodium vulgare, Linn.—Polypody—Rather common, especially abundant on the north-east slope of Mount Royal, growing on loose rocks.

Adiantum pedatum, Linn.—Maidenhair.—Common in many places, in rich woods and on wooded hillsides.

Pteris aquilina, Linn.—Common Brake.—Common everywhere in thickets and open places, especially in sandy soil.

Pellæa gracilis, Hook.—Cliff Brake.—Crevices in the cliffs of volcanic rock on the north-east face of Mount Royal, rare.

Asplenium Trichomanes, Linn.—"A few plants were found on the north slope of mountain, growing in the crevices of a huge detached rock in a very secluded and precipitous spot," Goode, 1879. About a dozen rather weak and stunted plants still grow in this situation.

Asplenium angustifolium, Michx.—A small colony of these ferns grows in the rich damp woods near the gate of Mount Royal Cemetery. "Nun's Island," Parsons.

Asplenium thelypteroides, Michx.—Rich woods and hillsides, round the base of Mount Royal, and on the north mountain.

Asplenium Filix-fœmina, Bernh.—Spleenwort.—Very common and variable, growing in low grounds and in woods.

Camptosorus rhizophyllus, Link. — Walking-Leaf.— "Montreal Mountain," Provancher. "Dry rocks at l'Abord-à-Plouffe, Isle Jesus, not common," McCord. "St. Helen's Island," Sheppard. I have been unable to find it either on St. Helen's Island or on Mount Royal.

Phegopteris polypodioides, Fée.—Beech Fern.—Damp woods, at the north-east base of Mount Royal, and between the cemeteries.

Phegopteris Dryopteris, Fée.—Oak Fern.—Rocky woods and hillsides, north-east base of Mount Royal, and on the north and west mountains.

Aspidium Thelypteris, Swartz.—Wet places, base of Mount Royal, between the cemeteries, and on the west mountain.

Aspidium Noveboracense, Swartz.—Wet places, rather common, especially in the mountain swamps.

Aspidium spinulosum, Swartz.—Wood Fern.—In mountain swamps, between the cemeteries, and on the west mountain, not common.

Aspidium spinulosum, Swz., var. *intermedium,* D.C.E.—Woods and shaded hillsides, in drier places than the last, found in several localities on all three mountains, but nowhere common.

Aspidium cristatum, Swartz.—Shield Fern.—Swamp between the cemeteries and in mountain swamps, not common.

Aspidium cristatum, Swz., var. *Clintonianum,* D.C.E.—In the same localities as the last, distinguished chiefly by its size and the position of the sori.

Aspidium Goldianum, Hook.—Recorded from Montreal Mountain, by Goldie, Maclagan, McCord and Goode, and from Nun's Island, by Parsons. I have been unable to find it on the mountain.

Aspidium marginale, Swartz.—Shield Fern.—Rocky hillsides, common in many places.

Aspidium acrostichoides, Swartz.—Christmas Fern.—Not common, on the rocky hillside above Ravenscrag, and on the north mountain. The form known as var. *incisum* is recorded by McCord in 1861.

Cystopteris bulbifera, Bernh.—Bladder Fern.—Common on the east slope of Mount Royal, and on the north and west mountains.

Cystopteris fragilis, Bernh.—In crevices of shaded cliffs, rather common in various places on all three mountains.

Onoclea sensibilis, Linn.—Sensitive Fern.—Common in swampy places. The occasional form known as var. *obtusilobata* occurs in the mountain swamps.

Onoclea Struthiopteris, Hoffm.—Ostrich Fern.—Common in the swamp near the Riding Ring, Mount Royal; occurs also in the mountain swamps.

Woodsia Ilvensis, R. Br.—Woodsia.—Common all along the exposed cliffs on the face of Mount Royal.

Dicksonia pilosiuscula, Willd.—Dicksonia.—A few plants were found growing in open places on the north mountain.

Osmunda regalis, Linn.—Flowering Fern.—Abundant in mountain swamps and west of the Riding Ring.

Osmunda Claytoniana, Linn.—Osmunda.—Rather common in swampy places.

Osmunda cinnamomea, Linn.—Cinnamon Fern.—Common in swampy places. The occasional state, called var. *frondosa*, occurs in the mountain swamps.

Botrychium simplex, Hitchcock.—On a grassy hillside at the north-east base of Mount Royal, rare.

Botrychium ternatum, Swartz, var. *lunarioides.*—"Dry open spot, on top of mountain, back of the Redpath property," Goode, 1879, also recorded by McCord. I have been unable to find this station.

Botrychium Virginianum, Swartz.—Moonwort.—Rich woods, rather common in various places.

GOLD AND SILVER ORES OF THE SLOCAN, B.C.

By J. C. GWILLIM, B.A.Sc.

One of the most striking physical features of the interior of British Columbia is caused by the great system of lakes and rivers which almost surrounds the Selkirks within their Canadian limits.

These waterways form long north and south depressions and are connected by low transverse passes, which drain to the east and west.

This region is, therefore, fairly accessible to the explorer or prospector. The geology has not as yet been fully worked out, but enough has been learned to show it to be a region of intrusive and of uplifted rocks of undetermined age.

The western portion of this watershed is largely of a granitic nature, but there are several large areas of metamorphic rocks, such as quartzites, schists and calcareous slates. The eastern portion is mainly composed of slates and schists.

Up to the present time the most richly mineralized belt appears to lie along the summits of this watershed. Yet the whole region is well stocked with economic minerals and offers to the mineralogist a rich and varied field for study.

The existence of the chief galena silver districts appear to be determined to a great extent by the large areas of impure limestones and calcareous slates. Such districts are the Slocan and Lardeau. Of this mineral, so abundant and valuable, there are three principal varieties, and these have come to be recognized as bearing certain relations to one another in their silver bearing capacity. *Cubical*, well crystallized galena, is by far the most common; it forms the backbone of the silver mining industry and assays, in the Slocan district, from 50 oz. to 200 oz. in silver. Here it occurs in fairly massive impure limestones and slates. Galena differing in no way in appearance, coming from Lower Kootenay Lake or the Lardeau country, carries far less silver. The same is true of the great galena bodies of East Kootenay.

This variety forms the largest ore bodies; it seems to be the mother mineral of the chief fissure veins. Calcite crystals and chalcopyrite are sometimes intimately mixed with it, as in the great "Slocan Star" mine

Steel galena is of a granular texture, with some resemblance to broken iron. It occurs in patches through the cubical variety, but is seldom found in large bodies. Assays made upon this usually show it to carry a higher percentage of silver than the preceding.

Wavy galena is of much the same texture as steel galena, but is more lustrous and is foliated, giving it a somewhat laminated appearance. The value of this variety often exceeds that of the others mentioned. The relative values of these varieties, together with the fact that locality bears such a strong relation to their silver value, may go to show that the silver itself exists outside of a chemical combination with this mineral. Silver is found throughout the whole range, pervading all formations and associated with so many different minerals that the question of the form in which it is present becomes interesting.

Tetrahedrite, or "gray copper," is widely represented, and much sought after. It is usually of a dark grey color with a faint iridescence and a texture like steel galena. Specimens of this carry from 200 oz. to 800 oz. of silver. It occurs associated with galena, zinc blende and calcite, giving, upon decomposition, very beautiful ores of azurite and malachite. Silver has entered into many curious relations where the absence of galena has caused its association with some other mineral. One case occurs near Slocan Lake, where little bunches of native arsenic have been found containing 1,000 oz. to the ton.

In one of the principal producing mines, the "Alamo," upon Silver Mountain, it is found with antimony, giving a very rich ore. This is known as "antimonial silver." The mineral is very dark grey, sometimes faintly streaked, and occurs as small patches included in a matrix of cubical galena.

Silver is found in combination, as Sylvanite in one mine near Slocan Lake, as "Ruby silver" in several places and as native silver filaments and silver sulphides all about the limits of the Slocan area of limestones, in granite.

These latter constitute the dry ores of the district, and are rarely found in the main galena limestone belt.

Argentite is usually associated with iron pyrites in a coarsely crystallized gangue of quartz. Often this mineral is well crystallized, but in most cases it occurs chiefly as a fine black dust or stain. The veins, having a comb-like structure, easily open to decomposing agencies,

Usually a paying quantity of gold is associated with the argentite ores. Some of the veins are banded. A notable example occurs at the "Exchange" mine, near Slocan City. Here there is first a band of opaque milky quartz some inches in thickness. Next to this comes an inch band of iron pyrites (always well crystallized) mixed with silver sulphide dust. An inch from this, in a clearer quartz, there occurs a distinct broken lamina of native silver. This arrangement is repeated four times. The pyritous band assays 270 oz. in silver. There are no pyrites with the native silver band. It would be interesting to find what relations exist between the pyrites and silver sulphide and if the silver exists as a sulphide below the line of decomposition.

As regards gold, there is little evidence of its occurrence in a free state. It does occur so in a few places along the east side of Slocan Lake, in a quartz gangue, but even here the ore body carries so much pyrites that it would cause it to become unfit for free-milling. Usually the gold is intimately associated with pyritous matter, such as arsenical iron, chalcopyrite and pyrrhotite, as in the Trail Creek country. One of the deposits carrying gold in a free state also carries it in combination as sylvanite, but this is rare.

Very little gold is found in the galena mines. What is produced seems to be derived from the pyritous matter contained therein.

The Trail Creek gold ores are a mixture of chalcopyrite and pyrrhotite, greatly resembling the Sudbury nickel ores. They carry from half an ounce to five ounces of gold. Assayers of this ore have come to the conclusion that there is a direct proportion between the amount of chalcopyrite present and the gold contained. Some such relation as exists between the copper and nickel in certain nickel ores.

As this region becomes more developed, there will, doubtless, be found many rare and interesting mineral combinations. It is but four years since it was a wilderness, in which some stray prospectors found the first galena lode.

BOOK NOTICES.

EIN PRÄ-KAMBRISCHES FOSSIL, PALÆNTOLOGISCHE NOTIZEN, VON CARL WIMAN.—Bull. Geol. Inst., Upsala, No. 3, Vol. II., 1894.

The above author, in this paper, offers a contribution toward the explanation of an enigmatical fossil found in the pre-Cambrian rocks of the Island of Visingsö, in Lake Wetter, in Sweden.

The terrain which these rocks form is said to underlie unconformably the Cambrian-Silurian[1] terrain, and is therefore clearly older than the Olenellus Zone. It consists of a conglomerate, with yellow sandstone at the base; then 40-50 metres in thickness of red and green slate and sandstone; then 250 metres of slates—greyish-green below and white above, where there are layers and seams of argillaceous limestone.

In the white slates appear small, round, black disks of 1 to 2 millimetres diameter. These fossils have caused considerable speculation among Swedish geologists. (In 1879) A. G. Nathorst mentioned them, and thought they were of organic origin. (In 1880) G. Linnarsson also spoke of them as objects of organic origin, but of very uncertain nature. (In 1885) G. Holm described them as being similar to a small flattened Brachiopod, such as a Discina. (In 1886) Nathorst referred to the fossil again, and says it reminded him of a small Estheria, although the agreement was far from being decided.

Herr C. Wiman submitted these objects to various tests with Shultze's masceration fluid and other preparations, and from their resistance to reagents concluded that the shell was chiefly Chitine, as in the graptolites. He found that the object was originally globular, but had been flattened in the shale, and that it was perforated with minute holes, for the passage of pseudopoda, and had some larger openings. However, he thinks that the affinities of these fossils (which are obscured by clay clinging to the surface) are still so uncertain as to make it inadvisable to give them a name.

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[1] This is not the Cambro-Silurian of English authors.

Though their affiliations are obscure, the concensus of such high Swedish authorities as those above cited, that the objects are organic, is valuable, as making known a type of pre-Cambrian animal not hitherto recognized.

The formation, or terrain, in which these fossils are found is described as pre-Cambrian, but nevertheless Palæozoic; hence it would appear to hold the same relation to the Cambrian of Sweden that the Etchuninian series does to that of Canada.

A plate, with figures and section of the fossil accompanies the article. G. F. M.

MINERALS, AND HOW TO STUDY THEM: A BOOK FOR BEGINNERS IN MINERALOGY. — By Edward Salisbury Dana, Yale University, New Haven. John Wiley and Sons, New York, 1895, pp. 380.

This little book is a most welcome addition to the rather scanty literature of elementary mineralogy, and will, we hope, be widely read not only by "the young people of both sexes," but by many of larger growth. Books on "popular science" multiply apace, but while many of them are popular, few are scientific. In Dr. Dana's new volume, however, we have an example of a work which is thoroughly scientific, and which, we think, is sure to prove popular. The author himself tells us in the preface that "the attempt has been made to present the whole subject in a clear, simple, and so far as possible a readable form, without too much detail, and at the same time without cheapening the science." The attempt has been successful.

As an example of the style in which the book is written, we give the following extract from the introductory chapter :—

"And here it is important to realize how little we can know by actual contact and direct observation about this earth, though we live upon it. It is possible, indeed, to measure its size and shape, to find out its density as a whole, to study its surface features and the changes which they have undergone; but of the materials of which it is made we can know little beyond those which form the surface upon which we walk. The miner digs down a little distance, and the artesian-well borer goes down still deeper, and we may have a chance to examine the specimens that their work brings up; or perhaps we can go down with the miner and see them in place. But the deepest mines descend to less than three-quarters of a mile; and though this seems deep to one who is let down a shaft in a bucket, it is but a little way compared with the whole distance to the earth's centre, which would require a journey of nearly four thousand miles. Even the deepest artesian-well borings hardly go down to the depth of one mile.

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"Thus the mineralogist is limited to the study of the little part of the crust of the earth which he can reach with his hammer; and he cannot extend his collection much beyond this, unless indeed he takes in some of those rare visitors from outer space—called *meteorites*—which once in a while tumble down to the earth, usually with a bright light and loud explosion."

Chapter VIII., on the Determination of Minerals, gives some useful advice, a little of which may be reproduced here :—

"Confidence and hasty judgment," Dr. Dana tells us, "belong to those who have little experience and a scanty knowledge of the difficulties of the subject.

"But, on the other hand, to recognize most of the minerals which are likely to be collected on a mineralogical excursion, or to be obtained by exchange with other collectors, is generally easy even for the beginner, if he goes at the subject in the right way.

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"The best way, then, for one with a specimen of an unknown mineral in hand, is to think of the common species first, and afterwards of others which may suggest themselves, running over in mind, or by reference to the book, the characters observed and those of the species to which it is provisionally referred, but with care not to decide too hastily, but to give each character full weight. Do not give the name *albite* to a specimen of *barite*, either the tabular glassy crystals or the white massive granular kind, because both species are often white and also resemble each other in form, and overlook the fact that it is much too heavy as well as too soft. Do not give the name *beryl* to a crystal of *apatite* because it is a green hexagonal prism, and overlook the fact that it is quite too hard. Finally, do not hesitate to confess ignorance—that the experienced mineralogist is ever ready to do ; and it is this fact that enables him from time to time to identify some rare and interesting species, and perhaps occasionally one new to science."

The chapters on the physical and chemical characters of minerals are clear and to the point, and the descriptions of species, while necessarily restricted, bring out well the essential characters of the minerals.

The book has an attractive cover, is well printed, and admirably illustrated.

B. J. HARRINGTON.

LIFE AND ROCK : A COLLECTION OF ZOOLOGICAL AND GEOLOGICAL ESSAYS.—By R. Lydekker, B.A. Cantab., F.Z.S. (Knowledge Series). London, 1894.

"Life and Rock," comprises a series of essays relating to zoological and geological subjects, more especially to the former. Some of the chapters deal with the natural history of certain animals ; others treat of the interesting problems of evolution and development in a popular style, aimed to reach those lovers of nature who are repelled by the technical phraseology of scientific treatises.

The first few pages are devoted to the elephant, cousin of the extinct mastodon, and differing from it chiefly in the structure of the teeth. "The first and most obvious peculiarity in regard to its dentition is to be found in the tusks, which correspond to one of the pairs of upper teeth in man, and also to the single pair of such teeth in the Rodents (rats, hares, etc.) Moreover, these teeth, like the incisors of the Rodents, grow continuously through the life of the animal, owing to the circumstance that the pulp cavity at their base always remains open and has a permanent connection with the soft structures of the gum. In our own teeth, on the contrary, the pulp cavity closes at a certain period, after which there is a total cessation of growth."

A rude shock to our common ideas of elephantine nature is afforded by the extinct elephants of Malta, which show us that gigantic size is not a necessary concomitant of the group, and that when the area in which a species dwelt was small the size of the species itself was proportionately reduced. These little Maltese elephants were very closely allied to the living African species, but whereas "Jumbo" attained eleven feet in height, and wild specimens of the African elephant may be still larger, the smallest of the Maltese species was scarcely taller than a donkey. So small, indeed, are the bones and teeth of this species, exhibited in the National History Museum, that it is sometimes difficult to convince people that they really belong to elephants at all.

As regards their distribution, elephants and mastodons formerly roamed over the whole world, with the exception of Australia; true elephants ranging over the whole Northern Hemisphere, while mastodons extended as far south in the New World as the confines of Patagonia. It is in the north-east of India, Burma, and the Islands of the Malayan region that the fossil elephants connecting the living species with the mastodons are alone found; and it is thus probable that from these regions the true elephants migrated westward into Europe and Africa, while the mammoth, in later times, crossed from Asia into Alaska by way of Behring Strait. That the mammoth, which ranged from the Arctic regions to the Alps and Pyrenees, was a contemporary of the primeval hunters of Europe, is now a well-established fact; but it appears that throughout the Old World mastodons had utterly died out before the advent of man. In the New World, however, the continuity between the old and the new fauna was more fully sustained, the Missouri mastodon having survived well into the human period, so that we have in this survival a good instance of the vast changes that have taken place in the fauna of the globe within what we may metaphorically call the memory of man.

In organized nature, two factors are in constant opposition; one being adherence to a particular type of structure—the other, adaptation to a particular mode of life. The resultant of these two forces is usually found to be, that animals living similar modes of existence become similar in external appearance, and may be distinguished only by their internal anatomy. A striking example of this is the mole, which has taken to a burrowing existence. Moles, be they insectivorous, rodent, or marsupial, have assumed a character adapted to their subterraneous existence. A coat of spines lends resemblance to other members of the same class of animals. Thus the author shows that though certain animals may resemble one another very closely in external appearance, as the burrowing animals, or may possess certain peculiar structural features, as tusks, they may not be internally related, and the similarities of form and structure must therefore have been independently acquired, and not inherited from a common ancestor. These so-called accidental resemblances indicate what may be termed parallel development, or, to be brief, "parallelism." This parallelism is exemplified in respect to teeth and dentition, and to the elongation of the limbs. The resemblances between Unintatheres and Protoceras are clearly due to parallel development.

Cestaceans next claim attention. Existing Cestaceans are divisible into the two groups—Whalebone Whales and Toothed Whales; differing, as the name implies, in the presence or absence of true teeth. Whether these two groups have been derived from a common ancestral stock, or have had a totally independent origin, is as yet undecided. The discovery in Patagonia of certain toothed whales that have nasal bones nearly as well developed as is the case in whalebone whales, removes one of the difficulties in regarding the latter as descended from the former. Be that as it may, they are extremely ancient, and have undergone parallel development. That the whalebone whale has been developed from an ancestor provided with a full series of functional teeth is proved by the fact that their young, in an early stage of development, are provided with teeth germs, which are absorbed by the gum prior to birth. As might be expected, closely associated with the function of rumination is the complexity of the molar teeth, known as selenodont structure. True ruminants, or chewers of the cud, possess hoofs, a cannon bone in both limbs, and no upper front teeth.

The tallest of all quadrupeds owes its towering stature to the lengthening of two of the bones of the leg and of the vertebræ of the neck. In delegating to the giraffe the position it should take among mammals, especial notice must be taken of its three bony horns, covered with skin, and which are quite unlike those of any other ruminant. Were it not for certain bodily peculiarities, the "ship of the desert" might find in the giraffe a formidable rival as a beast of burden, since the latter is better adapted to life in desert places, and can live much longer without water. Though in the Pliocene period the giraffe roamed over Southern Europe and Asia, at the present day it is confined to Eastern and Central Africa; and unless care be taken this unique animal will soon suffer extermination—shot by the relentless hunter solely for the paltry sums brought by the skins.

"There is one point to be mentioned in connection with the adaptation of the giraffe to its surroundings, before passing on, and this relates to its coloration. When seen within the enclosures of a menagerie—where, by the way, its pallid hue gives but a faint idea of the deep chestnut tinge of the dark blotches on the coat of the wild male—the dappled hide of a giraffe appears conspicuous in the extreme. We are told, however, that among the tall kameel-dhorn trees, or giraffe mimosas, on which they almost exclusively feed, giraffes are the most inconspicuous of all animals; their mottled coats harmonizing so exactly with the weather-beaten stems and with the splashes of light and shade thrown on the ground by the sun shining through the leaves, that at a comparatively short distance even the Bushman or Kaffr is frequently at a total loss to distinguish trees from giraffes or giraffes from trees."

Previous to the discovery by Cuvier, in 1818, that the minute jaws found in the Stonesfield slate of the lower Jurassic were those of a mammal, mammals were supposed to have been unknown before the Tertiary period. It has been concluded that these jaws are those of a marsupial—the lowest of all living mammals. Some of the Jurassic mammals of Dorsetshire and North America may be more nearly allied to insectivores. There seems to be a likelihood that some of the Jurassic mammals were actually the link connecting marsupials with insectivores.

The distinction between crocodiles and alligators is not a well known one. In the lower jaw of crocodiles there are invariably fifteen teeth; the teeth of the two jaws interlock when the mouth is closed; when the jaws are in opposition, the first tooth on each side of the lower jaw is received into a pit in the palate of the skull, while the fourth lower tooth bites into a notch in the side of the skull, and is distinctly visible externally in the living animal. The alligator, on the other hand, has never less than seventeen lower teeth; the upper teeth bite on the outside of the lower without interlocking. The first and fourth lower teeth are received into pits in the skull, and are invisible when the mouth is closed. Modern crocodiles show advance in organization over those of the Jurassic period, in the backward placing of the internal nostrils, and in the ball-and-socket vertebræ. Change in mode of life has wrought a transference of body armour from the under surface to the back of the creature.

The fins and tails of fishes are of two types—the fringe-like and the fan-like. The former is the older type, and has gradually become modified into the latter as best adapted for speed in locomotion. A representative of the fringe-like type is the Australian lung-fish, allied to Ceratodus, the name applied to certain teeth found in the Trias of Europe. The lung-fish is the oldest type of vertebrate now living.

The term "living fossil" is applied to types which, though more or less abundant at the present day, are of extreme antiquity, or to such as were abundant in past epochs, but are now represented by few forms. The most remarkable instance of this persistence of type is the brachiopod—Lingula, which ranges from the Cambrian—the base of the Palaeozoic, to the present day. Other examples are the crinoids or stone lilies, the lung-fish above cited, and the water chervotain of Africa. Our world is fast being impoverished of many forms of animal life. Though this is due largely to the demon of destructiveness, inherent in human nature, other causes are at work. The introduction of other animals by human agency has led in some cases to final extinction. Occasionally it is a catastrophe of nature. As an instance, may be cited the submergence of the breeding place of the Great Auk. The African elephant, the walrus of the polar regions and the New Zealand tuatera are in urgent need of protection if they are to be preserved. Animals often endeavor to protect themselves from their foes by simulating some object—animate or inanimate—that the foe may be deceived thereby. This is especially true of the order of Insecta.

"As old as the plains" would, in many instances, be a more truthful simile than the current saying, "as old as the hills," The higher a mountain range, the shorter we know is the time it has been subjected to the denuding agencies of nature, and, therefore, the younger it is. Nummulites are exceedingly interesting to those who study the genesis and growth of mountain ranges, for the reason that they occur in large numbers only in the Eocene period. Therefore when we find limestones, rich in nummulites, as is the case in the Alps, Pyrennees, Carpathians, Caucasus and Himalayas, we must conclude that elevation in these cases must have taken place at a time subsequent to the Eocene period.

Three great lessons, Mr. Lydekker informs us, may also be learned from the chalk. First, that there is a certain Chalk or Cretaceous style or Facico. Though the rock of this age be chalk, limestone, sandstone or slate, the Facico, or style of its fossils, will be the same, with certain limitations the whole world over. Secondly, from the researches carried on during the voyage of the "Challenger," the old view that chalk was an abyssal deposit was entirely dissipated. All the stratified rocks, therefore, with which we are acquainted have been laid down in comparatively shallow water. This leads to the general acceptance of the grand doctrine of the permanence of continents and water basins. The study of the European chalk, in the third place, has proved the former existence of two great seas, in which Cretaceous rocks were laid down, the northern one being a "mare clausum," cut off from the Atlantic, and in which was deposited the white chalk, while the southern one, in which the great limestones of Southern Europe were laid down, connected the Atlantic and Indian oceans. It is almost certain that at this period there was land connection between India and Southern Africa by way of Madagascar. This will account for the remarkable similarity in many of the animals inhabiting these countries.

The purity and thickness of the chalk deposit are hard to explain. It has been suggested by an eminent geologist that in addition to its partially organic origin it may have been formed as a chemical precipitate of carbonate of lime. The origin of flints in the chalk has been a subject of great interest. It is believed that they were originally an integral portion of the rock itself, which was then a slightly silicated limestone, and that the silica has separated out by segregation, a sponge spicule or an echinoid shell being the nucleus around which the segregating process has taken place.

The conciseness and clearness with which this book is written is worthy of notice· A large amount of information is presented in a small bulk (220 pp,). The illustrations are excellent, while here and there the humor of the writer enlivens the discussion of dry facts.

Rosalind Watson.

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ABSTRACT FOR THE MONTH OF AUGUST, 1895.

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

DAY.	THERMOMETER.				BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew point.	WIND.		SKY CLOUDED IN TENTHS			Per cent. of possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted	DAY.
	Mean.	Max.	Min.	Range.	Mean.	Max.	Min.	Range.				General direction.	Mean velocity in miles perhour	Mean.	Max.	Min.					
1	59.38	64.9	53.0	11.9	29.7065	29.778	29.659	.119	.4048	80.3	53.0	W.	18.5	6.8	10	2	47	....	....	....	1
2	61.52	68.0	55.2	12 8	29.8470	29.869	29.796	.073	.4592	84.5	56.3	S.W.	14.9	5.3	10	0	60	Inap.	....	Inap.	2
3	63.17	68 2	57.0	11.2	29.8567	29.910	29.803	.107	.4628	80.2	56.7	S.	14.5	9 8	10	9	04	Inap.	....	Inap.	3
SUNDAY. 4	.....	76.4	61.0	15 4	... .	.....	......	...	....		....	S.	11 5	....	..	..	42	0.30	....	0.30	4.... ....SUNDAY
5	68.97	77.2	59.5	17.7	29.8298	29.916	29.715	.201	.5503	78.5	61.7	S.W.	8.9	5.0	10	0	72	....	....	....	5
6	70.85	81.2	61.8	19.4	29.8642	29.946	29.760	.186	.5787	78.3	63.0	S.W.	13.1	5.0	10	0	56	0.32	....	0.68	6
7	67.80	75.2	65.3	9 9	29.6872	29.722	29.589	.133	.6007	88.5	64.2	S.	17.1	7.0	10	3	24	0 68	....	0 02	7
8	67.02	75.3	63.0	12.3	29.8018	29.885	29.722	.163	.5088	77.7	59.5	S.W.	22.1	6.0	10	1	40	0.02	....	0.02	8
9	69.43	80 0	60.2	19.8	29.9332	29 976	29.906	.070	.4648	66.8	57.0	N.W.	18.3	1.2	4	0	95	....	....	....	9
10	71.35	80.5	62 9	17.6	29.8770	29.944	29 825	.119	.4667	61.2	56.8	W.	9.1	2.8	5	0	98	....	....	....	10
SUNDAY.... ...11	.....	78.8	61.5	17.3	....		..		.....	...	....	N.	8 4		......		22	0.34	....	0.34	11...........SUNDAY
12	67.97	78.0	63 7	14.3	29.7123	29.754	29.667	.087	.6345	93 0	65.8	S.	6.5	8 8	10	6	35	0.71	....	0.71	12
13	68.42	76.8	62 2	14.6	29.8515	29.956	29.764	.192	.5318	77.7	60.8	W.	10 6	5.5	10	2	69	Inap.	....	Inap.	13
14	69 15	76.0	62 2	13.8	29.9620	30.010	29.933	.077	.4658	66.0	57 0	N.	8.5	6.3	9	1	79	....	....	....	14
15	69.07	78.0	62.0	16.0	29.9768	30.027	29.927	099	.5210	73.5	59.8	S.W.	14 7	5 2	10	0	52	0 08	....	0.08	15
16	69.22	79.3	60.0	19.3	30.0607	30.118	30.024	.094	.4323	61.3	55 0	N.	7.6	0.5	3	0	99	..	....	.	16
17	70.05	81 8	58 0	23.8	29.7768	29.965	29 624	.341	.5913	79 8	63.5	S.	15 7	3 3	10	0	93	1.08	...	1.08	17
SUNDAY.. 18	.....	77.0	59 6	17 4	......	.....	......	...	....	...	...	S.W.	18.1	....		..	69	1.24	....	1 24	18..........SUNDAY
19	61.38	70.5	56.1	14.4	29.7598	29.867	29.686	.181	.4097	76.3	53.2	W	18.1	1.8	5	0	96	Inap.	....	Inap.	19
20	57.75	65.8	52.0	13.8	29.8717	29.914	29.838	.076	.3550	74.3	49.2	W.	11 5	3 3	10	0	64	0.02	....	0.02	20
21	54.92	60.8	50.5	10.3	29.9318	30.126	29.734	.342	.3220	75 5	46.7	N.W.	22 5	5 5	10	0	73	0.32	....	0.32	21
22	57.50	65.2	47.7	17.5	30.1415	30.242	30.040	.202	.3620	76.5	50.0	S.W.	11 8	4 7	10	0	69	Inap.	....	Inap.	22
23	64.67	71.5	56.8	14 7	29.8692	29.888	29.836	.052	.5330	87.0	60 3	S.W.	21.4	10 0	10	10	00	0 22	...	0.02	23
24	64.33	66.2	62.8	3.4	29.7258	29.818	29 614	.204	.5852	97.2	63.3	S.	10.8	10 0	10	10	00	1.43	....	1 43	24
SUNDAY 25	.....	72.2	61.2	11.0	....	.. .	......	....	...	....	....	N.W.	14.5	....		..	92	....	....	....	25..........SUNDAY
26	67.97	76.2	60.0	16.2	29.9532	29.995	29.892	.104	5405	79 0	60.8	W.	15.2	7.0	9	0	56	Inap.	....	Inap.	26
27	71.55	82 2	61.9	20.3	29 8878	29.979	29.794	.185	.5800	76.3	63 2	S.W.	13 0	1.8	5	0	67	Inap.	....	Inap.	27
28	67.60	73.5	62.8	10.7	29.8443	29.902	29.780	.122	.4785	71.5	57.5	W.	10 6	7.7	10	2	69	0.02	....	0.02	28
29	65.10	72 2	59.9	12.3	29.8437	29 9 2	29.808	.113	.4558	71.3	56.2	N.	6 7	6.8	10	4	43	0.06	..	0 06	29
30	67.97	76.5	60.8	15.7	30.0017	30.049	29 965	.084	.5020	74.0	59 0	S.W.	10.9	1.7	5	0	94	. ..	....	....	30
31	63.57	77.5	54.2	23.3	29.8014	29.927	29 636	.291	4742	79 5	57.0	S.	18.5	5.5	10	0	08	0.08	....	0.08	31
....Means	65.84	74.29	59 19	15.10	29.8658	29.9104	29.7921	.1482	.4916	77.25	58.02	S. 54° W.	15.69	5 3	8.7	2 0	57 7	6.92		6.92	Sums ....
21 Years means for and including this month	66.71	75 03	58.70	16.39	29.9384	..	...	.134	.4810	73.0	....	......	s12.82	..	..	..	¶54.7	3.59	....	....	21 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.... ...	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	522	36	72	197	2505	531	2305	1012	
Duration in hrs..	61	5	12	15	192	224	177	57	1
Mean velocity....	8.56	7.20	6.00	13.13	13 05	15 76	13.02	17.75	

Greatest mileage in one hour was 33 on the 21st.

Greatest velocity in gusts, 36 miles per hour on the 21st.

Resultant mileage, 6,900.
Resultant direction, S. 54° W.
Total mileage, 10,180.

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

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 14 years only s Ten years only.

The greatest heat was 82.2° on the 27th; the greatest cold was 47.7° on the 22nd, giving a range of temperature of 34.5 degrees.

Warmest day was the 10th. Coldest day was the 21st. Highest barometer reading was 30.242 on the 22nd. Lowest barometer was 29.589 on the 7th, giving a range of .653 inches. Maximum relative humidity was 100 on the 12th and 24th. Minimum relative humidity was 45 on the 16th.

Rain fell on 23 days.

Auroras were observed on 2 nights, the 9th and 10th.

Solar halo on 22nd.

Thunder and lightning on 7 days, the 6th, 7th, 11th, 12th, 13th, 17th and 18th.

ABSTRACT FOR THE MONTH OF SEPTEMBER, 1895.

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

DAY.	THERMOMETER.				BAROMETER.				†Mean pressure of vapor.	‡Mean relative humidity.	Dew point.	WIND.		SKY CLOUDED IN TENTHS			Per cent. of possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	Max.	Min.	Range.				General direction.	Mean velocity in miles perhour	Mean.	Max.	Min.					
SUNDAY.........1	.....	61.5	48.0	13.5	....	.....	......	....	.....	....	....	W.	15.5	....	.....	..	77	....	....	....	1.........SUNDAY
2	57.47	65.0	50.0	15.0	29.9302	30.017	29.860	.157	.3292	71.3	47.3	S.W.	13.0	2.2	6	0	86	....	....	....	2
3	65.33	76.5	52.2	24.3	29.8457	29.900	29.803	.097	.4530	73.3	55.8	S.W.	17.9	1.8	10	0	90	....	....	....	3
4	71.65	82.8	59.2	23.6	29.8642	29.908	29.840	.068	.5833	74.8	63.0	S.	14 0	4.3	10	0	90	....	....	....	4
5	72.07	79.9	64.8	15.1	30.0263	30.101	29.944	.157	.6188	78.8	64.8	S.W.	15.1	9 0	10	6	47	....	....	....	5
6	70.43	80.0	61.5	18.5	30.1125	30.171	30.042	.129	.5562	76.0	62.0	N.E.	6.5	3.7	7	0	82	....	....	....	6
7	69.98	78.8	62.2	16.6	29.9797	30.054	29.909	.145	.5582	76.3	62 0	S.	11 3	7.5	10	6	42	0.04	....	0.04	7
SUNDAY........8	.....	71.2	55.5	15.7	....	......	......	....	.....	....	....	S.W.	13.0	....	.....	..	90	....	....	....	8.........SUNDAY
9	60.02	69.8	52.6	17.2	30.1193	30.185	30 056	.129	.4400	83.2	54.7	S.W.	16.7	4.3	10	0	29	Inap.	....	Inap.	9
10	64.17	72.2	56.0	16.2	30.1350	30.229	30.015	.214	.4883	81.7	58.3	S.	10.4	2.3	10	0	88	....	....	....	10
11	69.12	77.0	61.5	15.5	29.8388	29.953	29.716	.237	6597	92.5	66.8	S.W.	13.7	8.0	10	2	49	1.69	....	1 69	11
12	64.20	71.8	54.5	17.3	29.7353	29.827	29.663	.164	.5322	86.5	59.5	N.	12.9	8.8	10	3	00	0.02	....	0.02	12
13	51.57	59.8	43.8	16.0	29.9722	30.156	29.844	.312	.2390	63.8	38.8	N.W.	17.4	2.3	8	0	96	....	....	....	13
14	46.78	53.4	29.5	13.9	30.1960	30.301	30.077	.224	.2282	71.5	37.8	N.	13 0	3.7	9	0	64	...	....	....	14
SUNDAY.......15	.....	56.6	39.0	17.6	....	......	......	....	.....	....	....	N.	9.2	....	......	..	96	....	....	....	15.........SUNDAY
16	53.20	57.2	47.3	9.9	29.9553	30.113	29.827	.286	.3597	88.3	49.7	S.	15.0	7.2	10	0	00	0.03	....	0.03	16
17	56.60	65.8	46.5	19.3	29.8460	29 890	29.815	.075	.2963	63.3	43.7	N.W.	19.6	1.7	9	0	83	....	....	....	17
18	49.05	55.3	42 0	13.3	29.7793	29.889	29.703	.186	.2285	65.5	37.7	E	5.0	7.3	10	0	12	....	....	....	18
19	56.20	63.0	46.0	17 0	29.9395	29.968	29.880	088	.3372	74.3	47.8	S.W.	10.0	6.2	10	0	52	....	....	....	19
20	63.60	73.0	55.8	17.2	29.9925	30.033	29.935	.098	.5212	88.5	60.0	S.E.	9.1	5.7	10	0	53	0.02	....	0.02	20
21	76.48	84 0	62.0	22.0	29.9512	29.963	29.932	.031	.6875	75.7	68.0	S.W.	23.5	1.5	5	0	92	....	....	....	21
SUNDAY.......22	.....	84.8	69.0	15.8	....	......	......	...	.....		....	S.W.	21.0	...	.....	..	92	....	....	....	22.........SUNDAY
23	71.88	86.3	56.3	30.0	29.8732	30.040	29.753	.287	5753	73.2	62.5	S.W.	26 0	2.0	7	0	70	....	....	....	23
24	55.05	61.0	49.0	12.0	30.1242	30.172	30.092	.080	.2972	69.7	44.7	S.	15 2	1.0	3	0	96	....	....	....	24
25	56.62	65.3	45.5	19.8	30.0538	30 149	29.886	.263	.3293	71.8	47.2	S.	12.0	4.0	8	0	78	....	....	....	25
26	62.78	71.2	55.8	15.4	29.6568	29 757	29.587	.170	.4688	81.3	56.7	S.W.	20.3	6.5	10	0	24	0.25	....	0.25	26
27	53.28	61.3	44.0	17.3	29.9238	30.143	29.730	.413	.2905	70 8	43.8	W.	16.8	5.0	10	0	78	Inap.	....	Inap.	27
28	44.40	49.3	36.5	12.8	30.2278	30.313	30.126	.187	.1893	64.8	33.2	N.E.	10.7	2.7	10	0	96	....	....	....	28
SUNDAY.......29	.....	58.1	42.8	15.3	....	......	......	....	.....	....	....	S.E.	15.6	....	..	.	00	0.79	....	0.79	29.........SUNDAY
30	45.77	54.3	40.9	13.4	29.6903	29.755	29.645	.110	.2613	85.2	41.2	S.W.	16.2	9 2	10	5	50	0.56	....	0.56	30
....Means	60.30	68.21	51 32	16.88	29.9508	30.0395	29.8672	.1723	.42113	76.08	52.28	......	14.52	4.7	8.9	.88	63 4	3.40	...	3.40	Sums ....
21 Years means for and including this month......	58.60	66.72	50.83	15 88	30.0149	.....	......	17 9	.3834	75.47	....	......	ƨ12.72	5.5	..	..	¶54.1	3.14	....	....	21 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	921	263	215	500	2125	4686	1066	685	
Duration in hrs..	84	31	32	44	144	258	86	40	1
Mean velocity....	11.0	8.5	6.7	11.4	14.8	18.2	12.4	17.1	

Greatest mileage in one hour was 40 on the 23rd.
Greatest velocity in gusts, 60 miles per hour on the 23rd.

Resultant mileage, 5,876.
Resultant direction, S. 44½° W.
Total mileage, 10,461.

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

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 14 years only. ƨ Ten years only.

The greatest heat was 86.3° on the 23rd; the greatest cold was 36.5° on the 28th, giving a range of temperature of 49.8 degrees.

Warmest day was the 22nd. Coldest day was the 28th. Highest barometer reading was 30.313 on the 28th. Lowest barometer was 29.587 on the 26th, giving a range of 0.726 inches. Maximum relative humidity was 100 on the 11th, 26th and 29th. Minimum relative humidity was 41 on the 17th.

Rain fell on 10 days.

Auroras were observed on 2 nights, the 14th and 16th.

Lunar halo on 6th.

Lunar corona on the 7th.

ABSTRACT FOR THE MONTH OF OCTOBER, 1895.

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

DAY.	THERMOMETER.				BAROMETER.				†Mean pressure of vapor.	‡ Mean relative humidity.	Dew point.	WIND.		SKY CLOUDED IN TENTHS.			Per cent. of possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	Mean.	Max.	Min.	Range.	Mean.	Max.	Min.	Range.				General direction.	Mean velocity in miles per hour	Mean.	Max.	Min.					
1	42.57	47.4	36.2	11.2	29.9315	30.050	29.670	.380	.2188	80.7	36.5	S.W.	25.1	7.2	10	0	44	0.07	....	0.07	1
2	53.17	60.2	40.2	20.0	30.0152	30.040	29.992	.048	.3207	78.8	46.5	S.	19.5	5.3	10	0	53	0.00	....	0.00	2
3	50.53	57.8	44.3	13.5	30.2153	30.315	30.081	.234	.2772	75.5	41.2	N.	13.7	4.5	10	0	65	....	....	....	3
4	47.67	55.5	39.4	16.1	30.2545	30.348	30.148	.200	.2617	79.2	41.2	N.	8.0	0.0	0	0	97	....	....	....	4
5	48.10	54.8	39.8	15.0	30.0143	30.121	29.893	.228	.2723	81.2	43.3	N.	7.7	2.7	10	0	62	....	....	....	5
SUNDAY.......6	.....	61.1	40.4	20.7	....	.....	......	....	.....	...	....	S.W.	12.0	....	....	..	91	....	....	....	6.........SUNDAY
7	52.47	57.8	43.3	14.5	29.5857	29.683	29.475	.208	.3188	80.3	46.5	S.	10.1	7.3	10	0	21	0.00	....	0.00	7
8	45.08	53.5	38.0	15.5	29.6602	29.830	29.539	.291	.2027	66.5	34.3	S.W.	24.1	9.5	10	8	29	....	....	....	8
9	37.93	43.8	32.2	11.6	30.0662	30.197	29.906	.291	.1570	69.0	28.5	W.	16.7	7.0	10	0	14	....	....	....	9
10	37.52	44.6	33.5	11.1	30.2963	30.351	30.246	.105	.1527	69.0	27.8	W.	9.7	4.5	10	0	89	....	....	....	10
11	47.30	56.6	34.0	22.6	30.0695	30.191	29.973	.218	.2180	67.7	36.5	S.	18.3	5.3	10	0	85	0.00	....	0.00	11
12	48.67	54.2	46.0	8.2	29.9570	30.003	29.905	.098	.3285	95.7	47.2	E	10.7	10.0	10	10	00	0.24	....	0.24	12
SUNDAY......13	.....	58.0	45.0	13.0	....	......	......	....	.....	....	....	N.	13.2	....	......	..	30	....	....	....	13.........SUNDAY
14	45.25	56.7	38.0	18.7	29.9738	30.170	29.742	.428	.1933	63.5	33.0	N.W.	18.4	4.8	10	0	79	....	....	....	14
15	37.52	42.3	34.2	8.1	30.1183	30.179	30.046	.133	.1598	71.2	28.7	N.	5.2	7.0	10	4	00	....	....	on 16th	15
16	41.98	48.0	34.1	13.9	29.7495	30.009	29.465	.544	.2225	83.8	37.2	S.E.	15.2	9.8	10	9	00	0.07	....		16
17	39.22	45.6	29.7	15.9	29.6943	29.933	29.544	.389	.1797	73.0	31.2	N.W.	24.7	8.0	10	4	58	0.00	....	0.00	17
18	32.50	40.4	24.0	16.4	30.0390	30.179	29.809	.370	.1517	80.2	27.2	W.	19.6	1.8	10	0	85	....	....	....	18
19	47.40	58.2	34.6	23.6	29.5885	29.695	29.462	.233	.2302	69.7	37.7	S.	25.4	4.8	8	0	39	0.00	....	0.00	19
SUNDAY.......20	.....	37.7	28.5	9.2	....	......	......	...	.....	..	....	S.W.	14.9	....	..	..	99	....	0.00	0.00	20.........SUNDAY
21	32.60	36.6	25.8	10.8	30.0070	30.093	29.857	.236	1457	83.2	26.8	S.	9.8	6.2	10	0	74	....	0.80	0.07	21
22	42.62	51.2	28.4	22.8	29.8680	30.072	29.717	.355	.1810	66.0	31.5	S.	18.8	9.3	10	6	27	0.06	....	0.06	22
23	36.17	40.5	31.6	8.9	30.0603	30.136	29.951	.185	.1390	65.3	25.5	W.	14.5	5.3	10	1	37	0.01	....	0.01	23
24	37.30	43.4	29.5	13.9	30.0003	30.094	29.860	.234	.1712	77.5	30.5	S.	14.8	8.0	10	3	70	....	....	....	24
25	37.37	40.6	27.6	19.0	29.7218	29.951	29.553	.398	.1698	75.5	30.2	S.	22.2	7.8	10	1	08	0.00	....	0.00	25
26	32.18	41.7	23.8	17.9	29.8978	30.008	29.702	.306	.1373	73.5	24.8	S.E.	7.1	7.0	10	0	07	...	....	....	26
SUNDAY.......27	.....	58.6	33.8	24.8	.....	......	......	....	.....	....	....	S.	12.6	....	...	.	07	0.00	....	0.00	27.........SUNDAY
28	44.10	49.2	35.5	13.7	29.7435	29.902	29.569	.333	.1838	63.0	31.8	S.	27.5	8.3	10	5	20	0.06	....	0.06	28
29	32.47	39.3	29.8	9.5	30.1405	30.263	30.029	.234	.1285	70.0	23.8	S.W.	12.3	6.3	10	0	19	....	....	....	29
30	30.05	34.9	25.4	9.5	30.4797	30.571	30.347	.224	.1238	74.8	22.8	W.	10.7	5.0	10	0	35	....	....	....	30
31	34.27	42.2	24.1	18.1	30.3443	30.517	30.066	.451	.1343	70.8	24.5	S.	16.0	8.3	10	0	02	0.13	....	0.13	31
....Means	41.22	48.98	33.89	15.09	29.9812	30.1074	29.8350	.2724	.19926	74.24	33.21	S. 25½ W.	15.43	6.33	9.56	1.89	43.4	0.64	0.80	0.71	Sums ....
21 Years means for and including this month......	45.35	52.40	38.63	13.78	29.9951	.....	.....	.2140	.2433	76.49	....	......	ꜱ13.82	6.44	..	..	¶40.4	3.09	1.31	3.22	21 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	793		266	647	4108	2967	1732	976	
Duration in hrs..	90		24	52	260	136	119	57	6
Mean velocity....	8.81		11.08	12.44	15.80	21.82	14.55	17.12	

Greatest mileage in one hour was 48 on the 28th.

Greatest velocity in gusts, 60 miles per hour on the 28th.

Resultant mileage, 5,719.
Resultant direction, S. 25½° W.
Total mileage, 11[illegible]9.
Average velocity 15.54 m. p.h.

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

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 14 years only. ꜱ Ten years only.

The greatest heat was 61.1° on the 6th; the greatest cold was 23.8° on the 26th, giving a range of temperature of 37.3 degrees.

Warmest day was the 2nd. Coldest day was the 30th. Highest barometer reading was 30.571 on the 30th. Lowest barometer was 29.462 on the 19th, giving a range of 1.109 inches. Maximum relative humidity was 100 on the 5th, 12th and 31st. Minimum relative humidity was 43 on the 31st.

Rain fell on 14 days.

Snow fell on 2 days, 20th and 21st.

Rain or snow fell on 16 days.

Auroras were observed on 1 night, the 14th.

Lunar halo on 1 night, 10th.

Hail storm on the 17th.