Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured covers/ Couverture de couleur
- ☐ Covers damaged/ Couverture endommagée
- ☐ Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/ Le titre de couverture manque
- ☐ Coloured maps/ Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- ☑ Bound with other material/ Relié avec d'autres documents
- ☑ Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

- ☐ Coloured pages/ Pages de couleur
- ☐ Pages damaged/ Pages endommagées
- ☐ Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☐ Pages detached/ Pages détachées
- ☑ Showthrough/ Transparence
- ☐ Quality of print varies/ Qualité inégale de l'impression
- ☑ Continuous pagination/ Pagination continue
- ☐ Includes index(es)/ Comprend un (des) index

Title on header taken from:/ Le titre de l'en-tête provient:

- ☐ Title page of issue/ Page de titre de la livraison
- ☐ Caption of issue/ Titre de départ de la livraison
- ☐ Masthead/ Générique (périodiques) de la livraison

☐ Additional comments:/ Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
						✓					

THE

CANADIAN RECORD

OF SCIENCE.

VOL. V. APRIL, 1893. NO. 6.

NOTES ON THE GASTEROPODA OF THE TRENTON LIMESTONE OF MANITOBA, WITH A DESCRIPTION OF ONE NEW SPECIES.[1]

BY J. F. WHITEAVES.

According to the latest researches of the officers of the Canadian Geological Survey, the Trenton limestone of Lake Winnipeg and the Red River valley in Manitoba consists "at the bottom of a mottled buff and grey dolomitic limestone, found at Big and Swampy Islands, etc., and probably also at East Selkirk, above which are other horizontal evenly bedded limestones and dolomites, amounting in all to a few hundred feet and all more or less rich in fossils."[2] In the present communication the words Trenton limestone will be used to designate all those rocks which intervene between the white quartzose sandstone which is supposed to be the local representative of the St. Peter's sandstone of Wisconsin, etc., and the Hudson River formation, thereby including all those rocks in Manitoba which have previously been referred to the Galena limestone.

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

[2] Tyrrell, Trans. Roy. Soc., Canada, for 1891, vol. IX, sect. 4, p. 91.

The specimens to which these notes refer are, with very few exceptions, in the Museum of the Geological Survey at Ottawa, and in the enumeration of the different species it has not been thought either necessary or desirable to quote all their synonyms and references, but only such as are most likely to be useful to Canadian students.

RAPHISTOMA LENTICULARE.

Pleurotomaria lenticularis (Sowerby) Hall. 1847. Pal. St. N. York vol. I, p. 172, pl. xxxviii, fig. 6.

" " " Owen. 1844. Geol. Rep. Iowa, Wisc. and Minn., p. 86, pl. xviii, fig. 6.

Pleurotomaria Americana, Billings. 1860. Can. Nat. and Geol., vol. VI, p. 164, fig. 7.

Pleurotomaria lenticularis (Sowerby) Nicholson. 1875. Rep. Palæont, Prov. Ont., p. 19, fig. 7d.

Raphistoma lenticularis, Whitfield. 1882. Geol. Wiscons., vol. IV, p. 214, pl. vi, figs. 4 and 5.

Lower Fort Garry, D. Dale Owen, 1848. Cat Head, Lake Winnipeg, T. C. Weston, 1884: one specimen. Birch Island, Kinwow Bay, Lake Winnipeg, T. C. Weston, 1884, one specimen, and Messrs. Dowling & Lambe, 1890, two specimens. One or two specimens of this species, also, were collected by Messrs. Dowling & Lambe in 1890 and 1891, at the Dog's Head and at Commissioners (or Cranberry), Snake, and Little Tamarack islands, Lake Winnipeg.

All the specimens collected at these localities are badly preserved casts of the interior of the shell. They are obviously conspecific with the fossils from the Trenton limestone of the States of New York and Wisconsin, which Professors Hall and Whitfield have identified with the *Pleurotomaria lenticularis* of Sowerby. Similar, but sometimes better preserved specimens, are common in the Trenton limestone of Ontario and Quebec, and in the Hudson-River formation of the Island of Anticosti.

Salter, however, in 1859, expressed the opinion that the

American fossils which had then been referred to *P. lenticularis*, Sowerby, are distinct from that species, and in the following year E. Billings maintained that three species, which he then described and figured under the names *Pleurotomaria Progne*, *P. Americana* and *P. Helena*, had been mistaken for the true *P. lenticularis*. The specimens so far collected in Manitoba are too imperfect to be identified with much certainty, but they all appear to belong to the form which Billings proposed to distinguish as *P. Americana*.

Lindström, on page 108 of his valuable monograph "on the Silurian Gasteropoda and Pteropoda of Gothland," states that the shell which Conrad figured as *P. lenticularis*, Sowerby, in 1848, in Emmons' Geological Report of the Third District of the State of New York, is *P. qualteriata*, Schlotheim, and that it is "quite different" from the *P. lenticularis* of Hall.

Pleurotomaria subconica.

Pleurotomaria subconica, Hall. 1847. Pal. St. N. York, vol. I, pp. 174 and 304, pls. xxxvii, fig. 8, & xxxviii, fig. 3.
" " Billings. 1863. Geol. Canada, p. 180, fig, 174.
" " Whitfield. 1882. Geol. Wiscons., vol. IV. p. 216, pl. vi, fig. 1.

The Dog's Head (two specimens), and Stony Point (one specimen), Lake Winnipeg, T. C. Weston, 1884.

Pleurotomaria muralis.

Pleurotomaria muralis, D. D. Owen. 1852. Rep. Geol. Surv. Wisc., Iowa and Minn., p. 581, pl. ii, fig. 6.

"Lower Fort Garry, Red River of the North," Owen (op. cit., p. 626). A natural mould of the exterior of the est of the upper portion of a specimen, collected by Dr. R. Bell, in 1879, at the Limestone Rapid 100 miles up the Nelson River, Keewatin, and a very badly preserved specimen collected by Mr. Dowling, in 1891, at the Dog's Head, Lake Winnipeg, are both possibly referable to this species.

MURCHISONIA MILLERI.

Murchisonia bicincta, Hall. 1847. Pal. St. N. York, vol. I, p. 177, p. xxxviii, figs. 5a–h. But not *M. bicincta*, McCoy, 1846.

" " Salter. 1859. Geol. Surv. Can., Org. Rem., Dec. 1, p. 19, pl. iv, figs. 5 & 6.

Murchisonia Milleri, Hall, 1877. In Miller's Am. Pal. Foss., ed. I, p. 244.

Pleurotomaria bicincta, Lindstrom. 1884. Sil. Gastr. and Pterop. Gothland, p. 106, pl. viii, figs. 15–25.

Elk Island, Lake Winnipeg, Dr. A. R. C. Selwyn, 1872: one imperfect and badly preserved specimen. Snake Island (near the Dog's Head) in the same lake, Messrs. Dowling and Lambe, 1890: a well preserved mould of the exterior of the shell.

MURCHISONIA GRACILIS.

Murchisonia gracilis, Hall. 1847. Pal. St. N. York, vol. I, p. 181, pl. xxxix, figs. 4, a, b, c.

" " Salter. 1859. Geol. Surv. Can., Can. Org. Rem., Dec. 1, p. 22, pl. v, fig. 1.

" " Billings. 1863. Geol. Canada, p. 183, fig. 178.

" " Nicholson. 1875. Rep. Pal. Prov. Ont., p. 18, fig. 7c.

Snake Island, Messrs. Dowling & Lambe, 1890: four casts of the interior of the shell.

MURCHISONIA BELLICINCTA, var. TERETIFORMIS.

Murchisonia teretiformis, Billings. 1857. Geol. Surv. Can. Rep. Progr. 1853–56, p. 298.

" " " 1886. Cat. Sil. Foss. Isld. Anticosti, pp. 18 & 55.

Murchisonia bellicincta, Whiteaves. 1880. Geol. Surv. Can., Rep. Expl. and Surv., 1878–79, pp. 47c, and 48c.

Cfr. also *Murchisonia major*, Hall. 1851. In Foster and Whitney's Rep. Geol. Lake Super. Land Distr., p. 209, pl. xxvi, figs. 1 a–c.

" " Whitfield. Geol. Wiscons., vol. IV, p. 244, pl. ix, fig. 4.

One of the most abundant species of gasteropoda in the Trenton limestone of Manitoba is a large *Murchisonia* which the present writer has identified with the *M. major* of Hall, but which does not seem to differ materially from *M. bellicincta* except in size. Specimens of this *Murchisonia* (which had previously been collected at two localities on the Nelson River in Keewatin by Dr. R. Bell in 1879), were obtained by Mr. Weston, in 1884, at East Selkirk and Lower Fort Garry, at Elk, Big and Deer Islands, Big Grindstone Point, the Dog's Head, and Jack Fish Bay, Lake Winnipeg; by Mr. Tyrrell in 1889 at Berens (or Swampy) Island; and by Messrs. Dowling & Lambe in 1890 at Black Bear, Snake, Little Tamarack and Jack Head islands, in Lake Winnipeg. All the specimens from these localities, like those of *M. major* from Wisconsin, are mere casts of the interior of the shell, which are imperfect at both ends but espécially so at the larger end. They rarely exceed four inches and a half in length and not more than six volutions are preserved. Not a vestige of the surface ornamentation can be detected on any of them, and indeed Professor Whitfield has expressed the opinion that the fossils from the States of New York and Wisconsin, which have been described as *M. bellicincta* and *M. major*, are not true Murchisonias, as, so far as he has observed, "none of them show any evidence of having been marked with a revolving band." In regard to the typical form of *M. bellicincta* it may be remarked that Ferdinand Roemer has figured a European specimen of it, in which the spiral slit-band, and backwardly divergent growth lines are clearly shown on each of the volutions, on Plate v, fig. 7, of the Atlas to the first volume of the Lethæa Geognostica, published in 1876.

In 1890 Messrs. Dowling & Lambe collected, at Berens Island, Lake Winnipeg, two specimens which throw quite a new light on this point and upon the characters and affinities of this large variety of *M. bellicincta*. One of these is upwards of seven inches and the other fully eight inches in length, and nine volutions can be counted in each. The shorter of the two has the test preserved on the last two

volutions, though the whole of the specimen has obviously been subjected to abnormal and lateral compression. Its surface markings consist of a broad, flat and nearly central, spiral slit-band, to which the growth lines on each side converge obliquely backward. Apart from its abnormal compression, this specimen is essentially similar in size, shape and surface markings, to the specimens from Gamache Bay, Anticosti, which Mr. Billings refers to his *M. teretiformis* (op. cit., p. 55) and upon which he bases the statement that "this species has a wide flat band about the middle of the whorl and appears to be a large variety of *M. bellicincta*, Hall."

It would thus appear that *M. major*, Hall, and *M. teretiformis*, Billings, are most probably synonymous, the former having been based upon very imperfect casts of the interior or the shell, and the latter upon more perfect and at least partially testiferous specimens. The name *teretiformis* is here used in a varietal sense, on the ground that it was the first prefixed to a sufficiently accurate diagnosis of the characters of the shell.

Bucania (Tremanotus?) Buellii.

Bucania Buelli, Whitfield. 1878. Ann. Rep. Geol. Surv. Wiscons. for 1877, p. 76.

Bucania (*Tremanotus*?) *Buelli*, Whitfield. 1882. Geol. Wiscons., vol. iv, p. 224, pl. vi, figs. 12–14.

Lower Fort Garry, Dr. R. Bell, 1880, one specimen, and Commissioners, formerly called Cranberry Island, D. B. Dowling, one specimen, both of which are badly preserved casts of the interior of the shell.

Bucania sulcatina.

Bellerophon sulcatinus, Emmons. 1842. Geol. Rep., 2nd Distr. N. York, p. 312, fig. 4.

Bucania sulcatina, Hall. 1847. Pal. St. N. York, vol. I, p. 32, pl. vi, figs. 10, 10 a.

Bellerophon sulcatinus, Billings. 1863. Geol. Canada, p. 146, fig. 96.

A single specimen of this species was found loose, on

Reindeer Island, by Mr. Dowling, in 1890, but no specimens have yet been collected, in place, in the Trenton limestone of Manitoba.

BUCANIA BIDORSATA.

Bucania bidorsata, Hall. 1847. Pal. St. N. York, vol. I, p. 186, pl. xl, figs. 2 a-g.

Birch Island, Kinwow Bay, Lake Winnipeg, Messrs. Dowling & Lambe, 1890: one specimen.

CYRTOLITES COMPRESSUS.

Phragmolites compressus, Conrad. 1838. Ann. Rep. N. York St., p. 119.
Cyrtolites compressus, Hall. 1847. Pal. St. N. York, vol. I, p. 188, pl. xl, figs. 2 a-f.

Lower Fort Garry, Dr. R. Bell, 1880: one small but well preserved and very characteristic specimen. East Selkirk, A. MacCharles, 1884: a large cast of the interior of the shell.

EUNEMA STRIGILLATUM.

Eunema strigillata, Salter. 1859. Geol. Surv. Can., Can. Org. Rem., Dec. 1, p. 29, pl. vi, fig. 4.
" " Billings. 1863. Geol. Canada, p. 145, fig. 88.

Lower Fort Garry, T. C. Weston, 1884: one nearly perfect and well preserved specimen.

HELICOTOMA PLANULATA.

Helicotoma planulata, Salter. 1859. Geol. Surv. Can., Can. Org. Rem., Dec. 1, p. 14, pl. ii, figs. 5-7.

East Selkirk, A. MacCharles, 1884: one good specimen, with the test preserved.

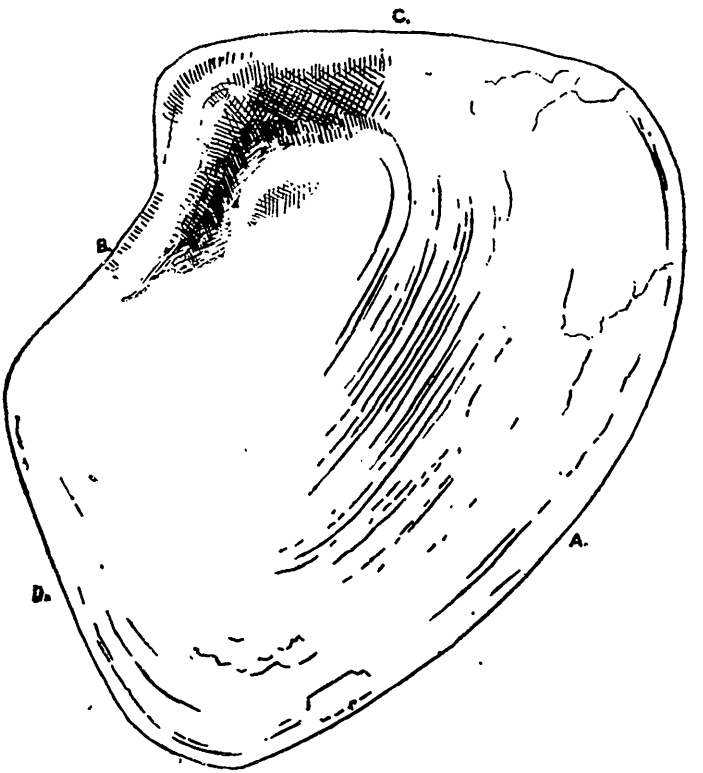
TROCHONEMA UMBILICATUM.

Pleurotomaria umbilicata, Hall. 1847. Pal. St. N. York, vol. I, pp. 43 and 175, pls. x, figs. 9 a-b, & xxxviii, figs. 1 a-g.
Trochonema umbilicatum, Salter. 1859. Geol. Surv. Can., Can. Org. Rem., Dec. 1, p. 27, pl. vi, fig. 3.
" " Billings. 1863. Geol. Canada, p. 145, fig. 92.

The Dog's Head, Lake Winnipeg, T. C. Weston, 1884: one specimen. Snake Island (one specimen) and Berens Island (one specimen), Lake Winnipeg, Messrs. Dowling and Lambe, 1890. Commissioners Island (one specimen) and Reindeer Island (one specimen, loose), Lake Winnipeg, D. B. Dowling, 1890.

Maclurea Manitobensis

Maclurea Manitobensis, Whiteaves. 1890. Trans. Roy. Soc. Canada, vol. VII, Sect. 4, p. 75, pls. xii, & xiii, figs. 1 and 2.



Maclurea Manitobensis.—Inner side of an operculum, supposed to be that of a large specimen of this species, from Jack Fish Island, Lake Winnipeg. Natural size.

All the localities at which this species had been found, up to the close of 1889, are enumerated in the paper in which it was described. Since then it has been collected by Messrs. Dowling and Lambe in 1890 at Berens Island, at Sturgeon, Snake and Black Bear islands, Lake Winnipeg; by Mr. Lambe in 1890 at the Dog's Head; and by Mr. Dowling in 1891 at Commissioners, Little Tamarack and Punk Islands, also at Grindstone Point, Lake Winnipeg. It is one of the most abundant and characteristic fossils of the Trenton limestone of Manitoba, and according to Messrs. Weston, Tyrrell, Dowling and Lambe, it always occurs with the flat side uppermost in the rock.

In 1890 Mr. Lambe collected an operculum, which is probably that of a large specimen of this species at Jack Fish Island, Lake Winnipeg. This operculum, which is represented in outline in the wood cut on page 324, is a little more than four inches in height or depth, and not quite three inches in its maximum breadth. Its outer surface is completely buried in the matrix, the inner surface only being exposed. In the woodcut, the side indicated by the letter A clearly corresponds to the outer side of the shell, and the concave side opposite,—B,—to the inner or columellar side. The side marked C corresponds to the flattened spiral side of the shell, and that marked D to the inner wall of the umbilicus. The margins of the sides C and B, whose junction forms the "nuclear angle," are thickened, but the edges of the other two sides are very thin. This thickening of the sides C and B is immediately followed by a shallow depression in the nuclear region, but the inner side of the operculum is otherwise nearly flat. The surface markings of this side consist of numerous concentric raised lines of growth, but there are no clear indications of any "internal projections for the attachment of muscles." Although the opercula of *M. Logani*, Salter, and *M. crenulata*, Billings, are known to be provided with well developed muscular processes on the inner side, this is by no means always the case in other

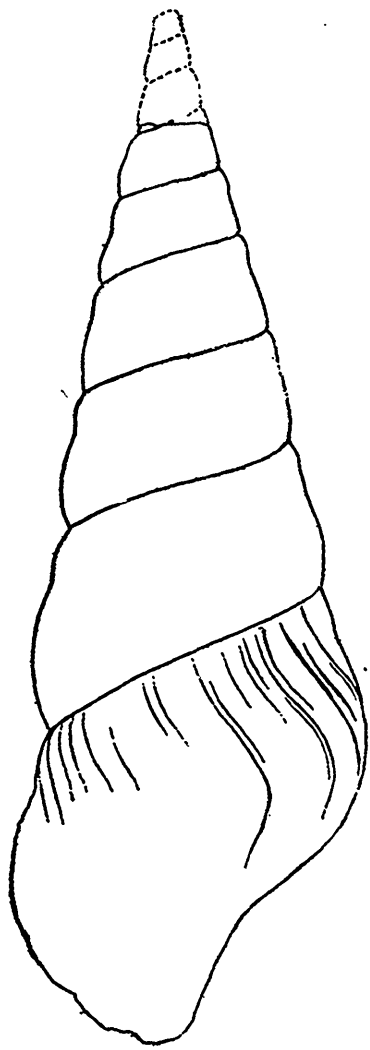
species of the genus. On page 238 of the first volume of the "Palæozoic Fossils" of Canada, E. Billings distinctly states that there are no muscular processes on the inner side of the operculum of his *M. oceana*, and on page 243 of the same volume he figures opercula of two other species of *Maclurea*, from Cape Norman, Newfoundland, in which there are no muscular processes on that side. In the Museum of the Geological Survey at Ottawa, there are two opercula from the Calciferous of the Mingan Islands, which were referred by E. Billings, with some doubt, to the *M. matutina* of Hall. There are no processes on the inner side of these opercula.

LOXONEMA WINNIPEGENSE. (Sp. nov.)

Shell large, attaining to a length of upwards of five inches, terebriform, elongated and nearly three times as long as broad: spire, as measured on the dorsal side, occupying not quite two-thirds the entire length: apical angle 27°. Volutions ten, allowing for the apical one, which is broken off in all the specimens collected, increasing slowly in size and obliquely compressed, the later ones slightly constricted above and moderately inflated below, those of the spire much broader than high: suture distinctly compressed: outer or last volution a little higher than broad, moderately convex but scarcely ventricose in the middle and narrowing abruptly into the somewhat pointed base.

Surface of the spire nearly smooth, that of the last volution marked only with a few flexuous lines of growth, which curve gently and concavely backward above, and still more gently forward below.

Four fine large specimens of this species, each with nearly the whole of the test preserved, have been collected at as many different localities on or in Lake Winnipeg. Two of these specimens were collected by Mr. Weston in 1884, one at Stony Point and one at Jack Fish Bay; one by Mr. Tyrrell in 1889 at Berens Island; and one by Mr. Dowling in 1891 at the "Dog's Head."



Loxonema Winnipegense.—Dorsal view of a specimen from Stony Point, Lake Winnipeg, in outline only, and of the natural size.

Nine volutions are preserved in the most perfect of these specimens, the slender apex of each being broken off. In the perfect shell there must have been at least ten and probably as many as eleven volutions. The species is of considerable interest on account of its strikingly close similarity to some of the most typical Jurassic species of *Pseudomelania.*

FUSISPIRA VENTRICOSA.

Fusispira ventricosa, Hall. 1871. Twenty-fourth Rep. N. Y. St. Mus. Nat. Hist., p. 229, pl. viii, fig. 6.
" " Whitfield. 1882. Geol. Wiscons., vol. IV, p. 245, pl. ix, fig, 2.
" " Miller. 1889, N. Am. Geol. and Palæont., p. 405 fig. 676.

Abundant at many of the limestone exposures on the western shore of Lake Winnipeg and on the islands in that lake. It has been collected by Mr. Weston in 1884 at Lower Fort Garry; at Bull's Head, the Dog's Head, Big Grindstone Point, Big and Elk Islands: by Mr. Tyrrell in 1889, at Berens Island; by Messrs. Dowling and Lambe in 1890, at Berens, Snake and Black Bear Islands; by Mr. Dowling in 1890 at Commissioners and Punk Islands; and by Mr. Lambe in the same year at the Dog's Head.

OTTAWA, March 22nd, 1893.

SOME MISCONCEPTIONS CONCERNING ASBESTOS.

BY J. T. DONALD, M.A.

(*Abstract of a paper read before the Natural History Society, Montreal, Feb. 27th*, 1893.)

During the past decade the uses of asbestos have become widely extended, and been consequently brought to the knowledge of the great majority of those who live within range of our industrial centres. As a result of the wide applications of this substance and of the interest excited in the minds of many by a "stone" which may be teased out into

a fluffy mass resembling silk or cotton, there has arisen a somewhat extensive literature of asbestos. This is scattered through geological, chemical, technical and even religious publications, and there have appeared one or two not unpretentious volumes devoted entirely to this mineral. In this literature there are frequent statements which clearly indicate that some of the writers entertained serious misconceptions concerning asbestos, and to call attention to a few of these is the object of this paper.

I. There is a misconception as to the mineralogical character of asbestos, and this has arisen from the use of the name in a somewhat generic sense. Dana in his "Mineralogy," says that asbestos is a finely fibrous form of hornblende, but much that is so-called is fibrous serpentine. This statement seems to divide many of our writers into two camps, the one calling the mineral a variety of hornblende, the other proclaiming its serpentinous character.

The Canadian Province of Quebec produces, it is estimated, about 85 % of the world's supply, the balance coming principally from Italy. The products of these two countries are known the world over as asbestos, and it is not unreasonable, therefore, to ask that they be allowed to appropriate the name, even though they be of other composition than the mineral to which mineralogists originally applied the term, and that other minerals, if such there be, used for similar purposes be otherwise designated.

The asbestos of commerce is a hydrated magnesian silicate of the same composition as ordinary serpentine rock; in other words, it is fibrous serpentine. It is curious to note, however, that the Canadian miners working continually among serpentine and nothing else, have fallen upon the word hornblende and apply it to very coarsely fibrous and polished serpentine, such as is often met with along lines of faulting.

II. The second misconception is in reality but a special case of the first; it is to the effect that Canadian and Italian asbestos are different minerals. In the early days of the asbestos industry, Italy was the only source of supply, and

immediately prior to the discovery of the Canadian deposits a powerful company had been formed and had succeeded in bringing under one control the numerous small mines of the Italian district.

Under the circumstances it is not to be wondered at that the Canadian fiber found no favor in the eyes of the owners of the Italian mines. The Canadian mineral was declared to be far inferior to the Italian; the latter, it was maintained, is true asbestos, while the former is only fibrous serpentine. As a matter of fact the two minerals are practically of the same composition, as is shown by the following results of analysis of fair samples recently made by myself:—

Italian.		Canadian.	
Silica	40.30	Silica	40.57
Magnesia	43.37	Magnesia	41.50
Ferrous Oxide	.87	Ferrous Oxide	2.81
Alumina	2.27	Alumina	.90
Water	13.72	Water	13.55
Total	100.53	Total	99.33

Canadian asbestos has largely displaced the Italian, not because of difference in composition, but by reason of the greater ease with which the former can be wrought into the various forms required in the arts.

III. The third misconception is that asbestos is in nowise affected by heat. This is set forth in such statements as "temperatures of 2,000° to 3,000° are easily withstood," and "a mineral which has been successfully exposed to a heat of 4,500° to 5,000° Fahr."

Now, what are the facts of the case? It is true that asbestos is infusible except at very high temperatures, but it is equally true that only a very moderate degree of heat, heating to low redness in a platinum crucible for instance, is required to entirely destroy the flexibility of the fibre and render it so brittle that it may be crumbled between thumb and finger as readily as a piece of biscuit. In this connection one is reminded that the ancients are said to

have possessed asbestos napkins which they cleansed by means of fire, and that Charlemagne in like manner cleansed his tablecloth to the delight of his warrior guests. It is not improbable that these statements are to a large extent mythical; certainly, if true, the articles in question were not made of asbestos, the HYDRATED magnesian silicate.

IV. The fourth misconception is that asbestos is possessed of non-conducting qualities. This is perhaps the gravest and most widely spread of the several misconceptions and is held by many who should know better. As an example of the manner in which this last misconception is set forth, I may cite the following from an address of a well known geologist: "Among the most important properties of asbestos is that of non-conductivity or its power of resisting the action of heat." Here we have the misconception clearly stated; it is that because asbestos is infusible it must of necessity be a good non-conductor. The truth is that asbestos itself is a very poor non-conductor, as any one may prove by placing a vessel of water on a sheet of asbestos cardboard and applying heat from below, or more simply still by placing a piece of wood or a sheet of asbestos millboard on a hot stove. If, however, asbestos is teased out and worked into a fluffy mass we then obtain a non-conducting material, but it is the air inclosed by the fibres that is the real non-conductor, the asbestos serving simply to entangle the air. The use of asbestos in the manufacture of non-conducting coverings for boilers, etc., is due to its fibrous texture and its infusibility. The latter property gives it a decided advantage over hair and other fibrous materials which char under continued exposure to heat, while the exceeding flexibility of its fibres gives it a like decided advantage over mineral wool and other fibrous but brittle mineral substances.

The removal of the misconceptions to which attention has been called, will in no respect tend to decrease the uses of asbestos, for the mineral has a sufficiency of good quality of its own to maintain and increase the demand; while, on the other hand, a true conception of its nature and proper-

ties will prevent its use under conditions where only disappointments can follow; a circumstance which in the end would tend to bring discredit upon a most valuable mineral.

The Folk-Lore of Plants.

By Carrie M. Derick, B.A.

The subject of plant-lore has been so admirably treated by Thistleton Dyer and others, that it would be difficult to present anything fresh in a paper such as this, without more time for investigation than the writer has at her disposal. Some pains, however, have been taken to arrange in brief form bits of folk-lore distinctively American as of especial interest to Canadians.

The early settlers seem to have been too much occupied with the practical side of life to weave new fancies about the primeval forest. Therefore, while some of our fables are indigenous, the majority of our common plant names and superstitions are heirlooms from our European ancestors. But there is a rich field for discovery awaiting the patient investigator, in the beliefs of the American Indians and the poetic fancies of the French Canadian people.

"To the Indian the material world is sentient and intelligent. A mysterious and inexplicable power resides in inanimate things. In the silence of a forest, is a living majesty, indefinite but redoubtable. Through all the works of nature nothing exists that may not be endowed with a secret power for blessing or for bane."[1] The Indian, in common with other uncultured men, observing that plants as well as man possessed the phenomena of life and death, endowed each with a soul like his own, and regarded it with simple reverence. So, we learn, that the Ojibwés hesitated to cut down trees lest they should hear them wailing in their suffering.

Closely allied to this idea of spiritual vitality was the wide-spread belief that plants were the homes of deities. Schoolcraft mentions an Indian tribe who fancied they

[1] Parkman's *The Jesuits in North America.*

heard, on calm days, a sound like the voice of a spirit speaking to men, issuing from the recesses of a certain tree. They, therefore, thought it the abode of a powerful divinity and held the tree sacred.

The influence of the doctrine of the transmigration of souls long continued in the notion that the spirits of the departed took up their abode in plants. Classical and mediæval literature furnish many beautiful illustrations, and a similar idea prevailed among savage nations. Thus, "some of the North-Western Indians believed that those who died a natural death would be compelled to dwell among the branches of tall trees." "Among the Virginian tribes, red clover was supposed to have sprung from and to be coloured by the blood of red men slain in battle.' [1] In certain parts of Canada, it is still thought that wherever Sanguinaria canadensis grows in the woods an Indian has been buried, and that the red juice of the plant is the dead man's blood. [2] The Ojibwé legend of Mondamin, which has been beautified and extended by Longfellow, furnishes another illustration. Mondamin comes from the sky as a handsome youth in garments green and yellow, and struggles with Hiawatha at his "fast of virility." At last Mondamin is overcome and laid in his grave.

"Day by day did Hiawatha
Go to wait and watch beside it,
Kept the dark mould soft above it,
Kept it clean from weeds and insects,
Drove away with shouts and shoutings,
Kahahgee, the king of ravens.
Till at length a small green feather
From the earth shot slowly upward,
Then another and another,
And before the summer ended
Stood the Maize in all its beauty,
With its shining robes about it,
And its long, soft, yellow tresses."

[1] Dyer's Folk-Lore of Plants.

[2] Ghost Worship and Tree Worship, by Grant Allan. Pop. Sci. Monthly, Feb., 1893.

A wide spread superstition among the Algonquins, due to such superstitious ideas as the above, is that the tales must not be told in summer, since "at that season, when all nature is full of life, the spirits are awake, and hearing what is said of them, may take offence, whereas in winter they are fast sealed up in snow and ice, and no longer capable of listening."[1]

As a natural consequence of this animistic theory, which endowed trees with souls, or of the once wide-spread custom of ancestor worship, in the agricultural stage of all primitive peoples, plant worship was an important feature of religion. Grant Allan says, at the dawn of history, men poured libations and scattered fruits upon the graves of their dead. As a result the barrows displayed a most luxuriant vegetation. Knowing nothing of the cause of fertility primitive man attributed it to the spirits of the dead, and transferred the worship of the ancestor to tree or flower. Formerly, according to Charlevoix, "the Indians in the neighborhood of Acadia had in their country, near the sea shore, a tree extremely ancient, of which they relate many wonders, and which was always laden with offerings. After the sea had laid open its whole root, it supported itself a long time, almost in the air, against the violence of the wind and the waves, which confirmed those Indians in the notion that the tree must be the abode of some powerful spirit. Nor was its fall, even, capable of undeceiving them, so that as long as the smallest part of its branches appeared above the water, they paid it the same honour as whilst it stood."

There has ever been in men's minds the idea of the antagonism of good and evil. So plants were supposed to be the abodes, not of beneficent beings only, but of demons. Sometimes, poisonous or repulsive plants were thus devoted, but no rule seems to have decided the matter. Many of our common names at the present day associate certain plants with his Satanic Majesty. In the Eastern Townships,

[1] *The Jesuits in North America.*

Nigella Damascena is called devil-in-a-bush, and certain species of Lycoperdon are his snuff-box. Along our coasts *Laminaria longicruris* supplies the devil with aprons, and in various parts, *Clematis virginiana* is known as devil's darning-needles. Mrs. Bergen says that in Ohio and New England children call *Aplectrum hyemale* "Adam and Eve." When this somewhat rare plant has been found, they immediately begin to look around for the "devil," as they call the third leaf which is frequently seen near by, it probably being a new plantlet sent up from a root stock.[1]

Much prettier are the superstitions which associate flowers and fairies. Their dainty brightness seems foreign to the Indian character, but in our country districts children still adhere to many of the fanciful ideas of their forefathers. Bright green rings of grass are to them "fairy rings," within which "the little folk" hold midnight revels, feasting on fairy cheeses, (*Malva rotundifolia*) off mushroom tables, the company having been summoned by the gay jingle of "fairy bells," (*Oxalis acetosella.*)

The belief in the supernatural character of plants is fast dying out, but, even in this rational age, some are considered effective charms and are consulted in playful divination. Children, especially, have quick eyes for the marvellous, and accept, readily, any notion once formulated. In Clarenceville, P.Q., children pull a dandelion, which has gone to seed, and blow the feathery head to see if their mothers wish them to go home. They also tell the hour by counting the number of times it is necessary to blow the dandelion before removing all the achenes.

This is referred to in:

> "Dandelion with globe of down,
> The school boy's clock in every town,
> Which the truant puffs amain
> To conjure lost hours back again."

A favorite amusement in every place, is to hold a buttercup under the chin to see if one "loves butter" or no.

[1] The Animal and Plant Lore of Children, by Mrs. Bergen. Pop. Sci. M., vol. 29.

Love-charms have a never-failing interest for many. The formula repeated, while the charm is used, being more essential than the flower chosen. In New Brunswick, on St. Agnes Eve, rosemary is placed under the pillow with these words:—

> "St Agnes, that's to lovers kind,
> Come ease the troubles of my mind."

The lovers of the girl, trying the charm, will then appear to her in a dream. The well-known European practice of ascertaining a lover's sincerity by plucking, one by one, the rays of a daisy, at the same time repeating a rhyme, has a slight variation in New Brunswick. The usual formula being often replaced by:—

> "He loves me, he don't,
> He'll have me, he won't,
> He would if he could,
> But he can't."

Bad English does not interfere with the efficacy of a charm. "Peascod wooing" is practised in various parts of Canada. If when shelling peas, the cook chances to find a pod containing nine, she places it over the door. The first man who enters will bear the same name as her future husband. In Campbellton, N.B., it is customary for a girl to gather three or four heads of thistle, cut off the purple tips, assign to each head the name of an admirer, and place them under her pillow. The next morning, the thistle which has put forth a fresh sprout will show which is the truest of her lovers.

Among North American Indians, dreams and trees have a close connection. The Ojibwés believe in a mysterious tree or vine which forms a link between earth and heaven. Upon it, spirits habitually pass up and down; but in dreams only, were men enabled to climb it and gain an insight into the future.[1]

The weather, apart from its physical effects, was supposed to have a great influence over plants. Each was

[1] Dorman's Primitive Superstitions.

under a certain "sign." Even yet, in rural districts, respect is paid to the phases of the moon, when planting and sowing crops. Root crops, which have their edible portions beneath the soil, should be "put in during the wane of the moon or 'in the sinking sign,' in contradistinction to 'the rising signs' which were those of the rising orb." "Plant corn when the little moon, i.e. the new moon, points down, the ears will then grow low on the stocks and be heavy." "All Fridays are good days for planting things that hang down, like beans or grapes, i.e. stringy things, for Friday is hangman's day." [1]

The study of the popular names of plants is most fruitful and interesting. "The fascination of plant names has its origin in two instincts, love of nature and curiosity about language. Plant names are often of the highest antiquity, and more or less common to the whole stream of related nations. Could we penetrate to the original suggestive idea that called forth the name, it would bring valuable information about the first openings of the human mind towards nature." [2] Though several have been noticed in other connections, a few of our popular American plant names may be mentioned, as illustrations of how much there may be in a name. Many flowers have, at some time, been dedicated to heathen divinity or Christian saint, and still bear their names. The Virgin Mary has been especially honoured, and various plants, from more or less fanciful resemblances, furnish her with an extensive wardrobe. For example, two flowers, the cypripedium and *Impatiens fulva* supply the slippers, the fuchsia blossoms are her ear-drops, while the campanula is her looking-glass. The Puritan element is evident in several names of flowers, *Aquilegia canadensis* being sometimes called "meeting-houses," and *Houstonia cærulea*, "quaker-ladies." A distinctively American name is that of "White man's foot"

[1] N. C. Noke in the Jour. Am. Folk-Lore, June, 1892.

[2] Earle's English Plant Names.

(*Plantago major*). The Indians, believing it followed in the steps of white men, so named it.

> "Whereso'er they tread, beneath them,
> Springs a flower unknown amongst us,
> Springs the white man's foot in blossom."

In Clarenceville, P.Q., Rudbeckia hirta is called "nigger-heads," a name which originated in the South-Western States.

Children's games and fancies have given rise to peculiar local names. In New Brunswick, *Viola tricolor* is called "old man" from its resemblance to an old man with his feet in a bath-tub. In Clarenceville, P.Q., *Viola cucullata* is known as "roosters," a favourite game with children being a bloodless battle between two violets. The one, which preserves its blossoms during the struggle, is pronounced the victor. The appearance of the plant itself or the use to which it is put explains such names as "butter-and-eggs" (*Linaria vulgaris*), crane's-bill (*Geranium Robertianum*), Jack-in-the-pulpit (*Arisæma triphyllum*), ghost-flower (*Monotropa uniflora*), face-and-eye-berries (*Juniperus sabina*), and dyer's weed (*Reseda luteola.*)

American folk-lore is eminently practical and largely made up of superstitions relating to folk-medicine. "The doctrine of signatures," which is the old theory that "plants, by their external character, indicated the disease they were intended to cure," has its adherents, at the present day. Doubtless, some of the plants used in old medicine had useful remedial properties but the majority owed their popularity to mystic virtues. One of Miss Wilkins' pretty stories takes its name "Life Everlasting," from the fancy that a pillow of the flowers of *Gnaphalium polycephalum* will cure asthma. The practice of carrying a potato in the pocket, as a charm against rheumatism is common. In New Brunswick, a double cedar knot serves the same purpose. Pliny says that snakes will sooner go through fire than creep over ash leaves or into the shadow of an ash-tree.[1] Even yet, in the United

[1] See Culpeper's *Herbal;* and Fiske's *Myths and Myth-Makers.*

States, many consider ash leaves a cure for the bite of a rattlesnake. Dr. Holmes uses this superstition effectively, in one of the closing scenes of "Elsie Venner." Elsie, who was supposed to have had engrafted upon her womanly nature that of a rattlesnake, received a basket of autumn flowers, the lining of the basket being the leaflets of the white ash. "She took out the flowers, one by one, her breathing growing hurried, her eyes staring, her hands trembling,—till, as she came near the bottom of the basket, she flung out all the rest with a hasty movement, looked upon the olive-purple leaflets as if paralyzed for a moment, shrunk up as it were, into herself, in a curdling terror, dashed the basket from her, and fell back senseless, with a faint cry which chilled the blood of the startled listeners." Mrs. Bergen states that in Portland and Boston it is thought that children, when teething, should wear a string of the seeds of Job's tears (*Coix lachryma.*) They are sold in Peabody, Massachusetts for sore-throat and diphtheria, as well. One mother "triumphantly brought to a druggist of whom she had bought them a string of these seeds covered with a dark incrustation which she identified as the substance of the disease driven out into the necklace, but which to the apothecary bore a strong resemblance to dirt."[1] Everyone who passed his childhood in the country, will recall many such remedies; the virtues of "sassprilla," "skunk cabbage," "goold-thread," and other "yarbs," being almost universally recognized, in places somewhat removed from the centres of civilization. Early superstitions are rapidly vanishing before the light of modern science, and all should record at once any legend or peculiarity met with, before it is too late, for in them lies much of the history of our people; its national legends are often the only immortal possession of a race.

[1] Some Bits of Plant-Lore, Jour. Am. Folk-Lore, March 1892.

The Late Dr. John Strong Newberry.

The United States has lost one of its ablest geological workers, in the death of Dr. Newberry. Born in 1822, and having first appeared as a scientific investigator and writer in 1851, he may be regarded as one of the senior scientific men of the Union, and few have worked more diligently and assiduously, or on a greater variety of subjects.

Personally, Newberry was frank, kindly, generous and upright; and beloved by those who had the honour of his acquaintance. His early papers on the fossil plants and fossil fishes of the Carboniferous established his reputation as a palæontologist, and were followed by a long series of reports and papers on these subjects, all done with conscientious care, and of the highest scientific value. Later, he worked with much success at the mesosoic and tertiary floras; and laid foundations in these departments which others have built on. As a physical geologist his Colorado reports and his later work in Ohio, have given him a wide reputation; and in these explorations he evinced a power of inductive reasoning and a grasp of the various phenomena observed, of a very uncommon character. While thus eminent in scientific geology, he was willing to give the benefit of his knowledge to the development of the mineral resources of his country, and he rejoiced in any opportunity to popularize the subjects of his studies in lectures and magazine articles, and he was a leading mind in the teaching work of the School of Mines of Columbia College, New York. The following notice in "Nature," is probably from the pen of the distinguished head of the Geological Survey of Great Britain; and may serve to show the estimation in which he was held beyond the limits of his native country.

J. W. D.

"It is not only in the United States that the death of this veteran of scientific research will bring widespread regret. To many geologists and palæontologists in this country and on the Continent he was personally known, and those whom he honoured with his friendship will feel keenly the

loss they now sustain. He was born at New Windsor, Connecticut, on December 22, 1822, and took the degree of M.D. from the Cleveland Medical College, Ohio, in 1848. Before beginning the practice of medicine, which he intended to be his occupation in life, he spent two years in Europe. During his stay at that time in Paris he acquired a good knowledge of the French language, and had many opportunities of cultivating a love of science, which soon manifested itself as one of his distinguishing characteristics. Returning to his native country, he began practice as a medical man at Cleveland in 1851. Even at the outset of his professional work he contrived to find time also for scientific enquiry. His first published paper appeared in the same year in which he started in his medical profession. It is devoted to the geographical distribution of land and fresh-water shells.

"But he soon entered upon the two branches of geological investigation in which he was to make his name familiar all over the civilized world—the study of fossil botany and of fossil fishes. As early as the year 1853 he made his first contribution to the history of Carboniferous plants, and three years later his earliest memoir on fossil fishes was published. By this time his scientific acquirements and enthusiasm were widely known. Hence when an expedition under Lieutenant Ives was organized for the exploration of the Colorado River of the West, Newberry was selected to accompany it, and to take charge of the observations to be made in natural history. His geological contribution to the famous Report at once placed him in the very front rank of American geology. His account of the geological structure of the region traversed by the expedition, and of the marvellous denudation of the cañons, will always remain as one of the landmarks of geological progress.

"He had now been touched by the fascination of exploration in the far west. The drudgery of medical practice became irksome to him, so that when in the year following his return from Colorado the offer was made to him to take part in another expedition, he gladly availed himself of

the opportunity. He accordingly accompanied Captain Macomb in an exploring expedition in the summer of 1859, from Santa Fé, New Mexico, to the junction of the Grand and Green Rivers of the Grand Colorado. This journey forms the subject of another masterly report by him, which, however, was not published for some sixteen years.

"The shadows of the coming great Civil War were already falling on the United States, when Newberry was at work on the preparation of the record of the results of his western journeys. The storm at last burst in 1861, the same year in which his Colorado report was issued. Among the many scientific men who placed their services at the disposal of the North, Newberry took a foremost place. His medical skill and wide general scientific knowledge enabled him to be of great use to the army. He specially distinguished himself in the organization and administration of the hospital department. Among the reminiscences of his not uneventful life he had many graphic tales to tell of his experience during that momentous epoch in the history of the United States. After the close of the war in 1865 he returned with renewed ardour to his scientific labours, and specially devoted his energies to the study of the ancient floras and fish-faunas of North America. Among his numerous memoirs on these subjects the two large monographs forming vols. xiv. and xvi. of the series published by the United States Geological Survey are specially worthy of notice. But they represent only a part of the enormous mass of material which he had worked over.

"Prof. Newberry early in his career saw how great was the aid which geology could afford in the development of the mineral industries of his native country, and he gave himself with great energy to the practical applications of the science. He became one of the highest authorities on mining matters in the country, and he was mainly instrumental in the equipment of the great mining school of Columbia College, New York. He occupied the Chair of Geology in that establishment, and threw himself heart and soul into its duties. At last, in the midst of his work and

honours, a stroke of paralysis disabled him from active duties, and he grew gradually feebler until his death. With him American science loses one of its most honoured and distinguished cultivators. His piercing eyes and well-cut features made him a marked figure in any assembly, while his courtesy and gentleness, and his unfailing helpfulness and serenity, gave him a charm which will endear his memory to a wide circle of friends. A. G."

The Rocks of Clear Lake near Sudbury.

By Prof. Coleman, Ph.D.

An exceedingly interesting set of rocks from the Sudbury district has been described by Prof. Bonney[1] and Prof. Williams,[2] and it seems worth while to compare with them a series of specimens collected last summer by the present writer in a part of the region not hitherto worked over. The point visited lies about 17 miles north of Sudbury in the area marked Laurentian on Dr. Bell's map,[3] and was reached from Chelmsford, a village ten miles west of Sudbury, on the main line of the Canadian Pacific Railway.

The rocks observed up to the crossing of Vermilion River, belong to the series colored on Dr. Bell's very useful map as "dark argillaceous and gritty sandstones with shaly bands, possibly lower Cambrian." Among the specimens obtained were dark sandstones of the kind described by Dr. Bell, having as constituents weathered felspars, mica and quartz of the granitic type, showing their origin from granite or gneiss. Other ridges were of dark grey clay-slates with a marked cleavage crossing the very distinct planes of stratification obliquely, and presenting under the microscope no distinct minerals except sericite and minute prisms of a uniaxial mineral, perhaps rutile.

[1] Quart. Journ. Geol. Soc., Vol. 44.

[2] Notes on the Microscopical Character of Rocks from the Sudbury Mining District, an appendix to Dr. Bell's report.

[3] Report on the Sudbury Mining District, by Dr. R. Bell, 1891.

North of Vermilion River, near Booth and Hales' lumber camp, examples were obtained of the remarkable black volcanic breccias described by Dr. Bell and the two distinguished petrographers before mentioned. Prof. Williams describes under the name of a vitrophyre tuff[1] specimens enclosing angular fragments of glass or pumice, turned into chalcedony, or a mosaic of small quartz individuals, or sometimes a greenish mineral or even a calcite individual.

In some of my sections enclosed fragments have been turned into a brownish green substance with faint double refraction, probably serpentine, but possibly chlorite. Other fragments are now made up of radiating crystals of epidote. One large white fragment turns out to be a microgranite consisting of quartz, orthoclase, microperthite and plagioclase with a little serpentine. Still other enclosures are of clear quartz individuals, at times with hexagonal outlines. The fluidal and vesicular structure of many of the fragments corresponds exactly with Prof. Williams' description and figure.

East of the lumber camp and south of Clear Lake gabbro makes its appearance, fine grained and dark green on fresh surfaces, but weathering to pale greenish grey when free from sulphides, and to various tones of brown when charged with them. This rock differs greatly from the green diabase, etc., found nearer Sudbury. In most thin sections the felspars are not lath-shaped, but have short idiomorphic forms, sometimes apparently of a single individual or in halves like Carlsbad twins, but generally showing several twin lamellae. The angle of extinction from the twin plane is generally large, 25° or 30°, but at times only 5° or 10°. No analysis was made to determine the presence or absence of orthoclase. The other minerals are chiefly varieties of pyroxene, especially diallage and enstatite, greatly weathered to greenish chloritic products, which have frequently been deposited between the felspars. Large stout crystals of apatite occur in one thin section, and pyrrhotite forms a large part of some specimens. An

[1] Sudbury Mining District, p. 74, etc.

analysis of the pure pyrrhotite gave 4·22 per cent. nickel and 0·21 per cent. copper.

Near the gabbro a rock occurs which, to the naked eye, appears to be a syenite, a flesh colored or dark yellowish grey rock sometimes appearing quite massive, at others splitting into thin plates. Under the microscope it proves to be a micropegmatite much like that described by Prof. Williams from the township of Levak,[1] although the nucleus from which the granophyre structure radiates is in my sections generally a crystal or group of crystals of plagioclase instead of a Carlsbad twin of orthoclase.

A very similar structure is described and figured in photo-reproductions by Julius Romberg from South American granites.[2] He holds that the structure has been caused by weathering of the felspar, at times aided by the plasticity of quartz under intense pressure; as though canals could be formed in this way and plastic quartz forced into them. My specimens afford no support to such a theory but rather seem to show that small crystals of plagioclase or orthoclase or groups of crystals formed nuclei about which the very acid magma solidified as quartz and orthoclase on all sides at once, each hampering the other and thus giving rise to the granophyre structure. In the freshest slide examined the nuclear crystals are quite sharp edged and unweathered in appearance. In most cases all the quartz and all the felspar about a given centre are similarly oriented, though opposite sides sometimes differ in this respect; and the felspar, which is unstriated as a rule, is not generally continuous with the central crystal. If the structure results from weathering or pressure, why should the nuclei have distinct crystalline outlines and the orientation be uniform in the quartz, which, if forced in while plastic should show irregular orientation or a chalcedonic structure? In some instances the quartz increases in amount as it runs outwards and forms solid masses outside

[1] Sudbury Mining District, p. 78.

[2] Neues Jahrbuch fur Min. Geol., etc., VIII Beilage Band, Zweites Heft, 1892, p. 314.

the pegmatitic portion, filling in angles between other minerals and proving that quartz was on the whole latest in crystallizing.

As a result of the visit to the Clear Lake region it is found that the band of eruptive rock represented on Dr. Bell's map as extending from the middle of Morgan Township to the northeast corner of Lumsden, and extended in the map published by the Ontario Bureau of Mines in 1892 nearly to the western boundary of the District of Nipissing, should be still extended four miles eastward so as to pass between Clear Lake and Marion Lake which lies to the south.

Notes from the Chemical Laboratory, Queen's University.

Communicated by Prof. W. L. Goodwin.

I.

A Highly Nickeliferous Pyrite.

There is at the Murray Mine, Sudbury, Ontario, a deposit of nickel ore consisting of rounded nodules in a hornblendic matrix. It is found near the surface, and is quarried out along with pyrrhotite, chalcopyrite and galena. In the same deposit is found a pyrite containing no nickel or cobalt; and in an underground working magnetite is found. This also contains neither nickel nor cobalt. The hornblendic gangue is much decomposed at the surface, so that large lumps of the rock fall to pieces with a light blow of the hammer, revealing the nickel ore as grey nodules, resembling in colour and lustre arsenopyrite. It is, however, free from arsenic. Its hardness was found to be 6·5. It was found difficult to separate the pyrite completely from gangue; but an analysis was made of as pure a sample as could be obtained, with the following results:

	I.		II.
Iron.....	37·45	p. c.	.....
Nickel (and Cobalt?)	4·82	"	.....
Sulphur.....	44·26	"	44·13
Insoluble.....	9·92	"	9·90
	96·45		

The powdered mineral dissolved to a small extent only in hydrochloric acid; but it was evident that there was some appreciable quantity of iron compounds soluble in that substance. This iron doubtless belongs to the black matrix. The 37·45 parts of iron would require 42·80 parts of sulphur for Fe S_2. This would seem to indicate a lower state of combination for the nickel. But if the nickel is calculated as Ni S_2, the remaining sulphur requires 34·12 of iron for Fe S_2. It is not unreasonable to suppose that the iron in excess of this (3·33 p. c.) was derived from the hornblendic matrix, and from particles of magnetite and pyrrhotite.

The analysis was made by Prof. W. Nicol, Mr. T. L. Walker, and the writer. Mr. Walker, formerly chemist at the Murray Mine, Sudbury, has made repeated assays of this nickel ore, and the analysis here given is concordant with his assays. The nickel and cobalt were not separated, but the indications were that the latter is present in small proportion if not altogether absent.

Carruthers Hall, Queen's University, March 29th, 1893.

Is the Fauna Called "Primordeal" the Most Ancient Fauna?

By G. F. Matthew, M.A., F.R.S.C.

Under the above title Dr. J. Bergeron discusses the claim of the Primordeal Fauna of Barrande to be considered the oldest assemblage of animals that has existed on the earth. This is the fauna which characterises the Cambrian rocks (as now understood), and which for a long time was claimed to be the oldest that has existed on the earth.

Dr. Bergeron thinks differently and cites abundant internal evidence from the fauna itself in favour of his view that there has been an older fauna.

After speaking of the influence which the opinions of Darwin and other evolutionists have had on the interpretation of late discoveries in the Cambrian rocks (especially

in the application of the discoveries in the embryology of recent animals to the interpretation of the primitive forms of the Cambrian seas), he takes the trilobites as the most interesting forms, viewed from the stand point of evolution, as being organisms of the highest type (for that age), because in them the results of evolution are most manifest.

After speaking of the trilobites as Arthropods with a chitinous test, living in the water, breathing by gills, furnished with numerous pairs of thoracic limbs of which some are connected with the jaws and some with the abdomen, he proceeds to give in outline a description of the parts of their bodies and their use in the economy of the creature.

The metamorphosis of the Cambrian trilobites has been shown by Barrande for the genus Sao and by Matthew for the genera Liostracus Ptychoparia and Solenopleura. The three latter exhibit similar series of metamorphosis and so are naturally grouped in the same family. On the other hand the changes in the young of Paradoxides follow an independent line of development, showing that this genus belongs to a different family. "We see then that in the trilobites of the fauna called Primordeal there were already differences in the mode of development; and these differences in the forms of the same group living at the same epoch, correspond certainly to a grade of evolution which is not the same; this compels us to admit that before the time when this trilobite fauna lived, there must have been another from which it proceeded."

Another argument used by Dr. Bergeron is that the size of the front lobe of the glabella in embryonic forms of the early trilobites foreshadowed the genera Paradoxides and Olenellus, which are similarly characterized in the adult stage. However, he thinks that more weight is to be given to the small size of the pygidium in these and other primordeal genera as indicating the primitive aspect of the Cambrian trilobites, for in the embryonic trilobite the pygidium is small compared with the cephalic shield.

The development of the genus Agnostus also is taken as showing the line of change through which the genera of

trilobites were inclined to pass. Tullberg had shown this for the Agnosti of Scandinavia.

The author shows that the earlier forms of Paradoxides were small and the gigantic form *P. Regina* was one of the later. These large species perished suddenly without leaving any successors. The same rule holds for Asaphus and Illanus and large species of other genera.

"The preceding study of the characters peculiar to the trilobites of the Cambrian has led us to the conclusion that these present sure indications of an evolution anterior to the epoch in which they lived. This leads us to think that there must have lived prior to the fauna called primordeal, one which may have contained the ancestral types of the most ancient one that we actually know."

Dr. Bergeron supports this view of the source of the most ancient forms of animals known by an outline of the opinions now held in regard to the metamorphism of the older sediments, by which the proofs that may have existed in the pre-Cambrian rocks of the life of that earlier epoch have been destroyed.

This article by Dr. Bergeron, published in the "Revue Générale des Sciences, Paris, 1892," is an excellent review of the evidence on this subject as based on the latest discoveries in geology.

RADIOLARIAN REMAINS IN THE AZOIC ROCKS OF BRITTANY.

Dr. Chas. Barrois helps to solve the above question of his countryman (Is the fauna called Primordeal the most ancient fauna?) by proclaiming the discovery of Radiolarian remains in the Azoic rocks of Brittany. These he discovered in a graphitic quartzite which constitutes an integral part of the granulitic gneiss of that part of France. The beds have been traced through Vannes and several neighboring towns, where they are less affected by granulitic intrusions, and become a carbonaceous quartzite and shale, and underlie the system called the schists of St. Léo. These schists are considered to be pre-Cambrian, and would correspond to the Huronian system of Canada.

Sections of the carbonaceous shales placed under the microscope show circular or rounded objects of a peculiar aspect; they recall at first view sections of *Radiolarians.* Dr. Barrois submitted sections of this shale (phtanite) for examination by M. Cayeux, who stated that the presence of Radiolarians in these phtanites was undeniable, and one could even refer them to *Monosphæridæ*, the most primitive of the Radiolarians.

"These Radiolarians are the most ancient organic remains found in France, and probably in the world; and the phtanites are at present classed in the Primitive Azoic formation about the limit of the Laurentian and pre Cambrian systems."

By degrees cotemporaries are turning up in the Pre-Cambrian rocks for the once solitary Eozoon. To Walcott's minute molluscs of the Grand Cañon of the Colorado are to be added the Stromatapora-like fossil and the Hexactinellid sponge of the Pre-Cambrian rocks of St. John (Eastern Canada), and now the Radiolarians of Western France.

On Some New Discoveries in the Cambrian Beds of Sweden.

Dr. J. C. Moberg, of Lund, has within the year that is past enlarged the number of species known from the Olenellus Zone of Sweden. In two pamphlets he has described a number of species collected by Dr. N. O. Holst and others, which are of peculiar interest. These are from sandstone boulders and beds in the south of Sweden.

Among the fossils are two new species of Olenellus, one allied to *O.* (*Holmia*) *Kjerulfi*, but differing in the more strongly arched headshield, by having a much heavier cheek-spine, by a deficient (or perhaps rudimentary) interocular spine, by a more lengthened hypostome devoid of spines at the back, etc. This species he calls *O. Lundgreni.*

The second species is allied to *O.* (*Mesonacis*) *Michwitzi*, from which it is distinguished by the arrangement of the glabellar furrows by the form of the outer part of the

pleuræ, by the presence of a small point on each side at the back of the pygidium, etc. This species he calls *O. Torrelli.*

With these two species of Olenellus, Dr. Moberg found a small Lingula?, two Hyolithes and a small Obolella?, and he supposes their geological age to be intermediate between that of *O.* (*H.*) *Kjerulfi* and *O.* (*M.*) *Michwitzi.*

He has found in loose blocks of Cambrian sandstone a brachiopod of which the arched valve is said to resemble the shell of Ancylus. It is marked within by a set of radiating ridges like the supposed operculum of *Hyolithellus micans* and Dr. Moberg revives Dr. Hall's genus *Discinella*, referring his species to it. As it has 14 radiating furrows in place of the 9 or 10 that are found on the form from Troy, N.Y., described by Hall, he considers it specifically distinct, calling it *D. Holsti.*

He very significantly remarks that in the material in which his Discenella was found, one "very seldom finds any fossil which is plainly the living chamber of a pteropod of the type which Billings described under the name of Hyolithellus; and on the other hand one does not find the Discina-like fossil in the material where the reed-shaped or Hyolithus-like fossil is plentiful."

Dr. Moberg describes two species of Kutorgina; one doubtfully as such, having a very peculiar interior. This probably is of some other genus. Other genera described are Acrothele, Obolella?, Scenella??, Dentalium?, Hyolithes, Volborthella?.

G. F. M.

Memphremagog a Cold Water Lake.

By A. T. Drummond.

Lake Memphremagog is the Loch Lomond of Canada, but, being less easy of access from the great cities, does not attract the tourist as does the Scottish lake. It is, however, not less beautiful. From the summit of Owl's Head there is a view that for beauty and breadth is probably

unsurpassed elsewhere in Canada, while at the lake margin there are lovely scenic effects particularly in the evenings when the purple hills are brought into bolder relief by the brilliant tints of the setting sun and are mirrored in the waters of the lake.

Whilst the surrounding mountains and glens have an interest to the botanist, and the whole environs of the lake present to the geologist a peculiar record of the past, the waters of the lake have in their temperatures a feature of interest to which, in a word, I would like to draw attention. Lake Memphremagog has a length of about thirty miles, an area of thirty-seven square miles, and, according to Sir William Logan, a surface level of 756 feet above the level of the sea. Lake Superior, with its cold waters, is in higher latitude but is only 600 feet above the sea level, whilst its deeper depths sink far beneath it. The smaller and shallower lakes are, like the rivers, susceptible to the equalizing influences of summer temperatures, but, in the case of Lake Memphremagog, circumstances peculiar to itself, affect the conditions of heat and cold in its waters. Whilst it is exceptionally high above the sea, it is in many places of considerable depth. Nearly opposite Owl's Head, the sounding line, it is claimed, has reached the depth of 600 feet, whilst near Georgeville, six miles further down the lake, there are places where I have not found the bottom at 325 feet. The opposite shores at this point are about two miles apart, and it was here, about midway across, that last August the temperatures were taken. Negretti & Zambra's deep-sea thermometer was used for ascertaining bottom records. The following register made on 10th of August at 11 a.m. under the conditions of strong sun and cloudless sky, indicates generally the results:

Air in shade				77.5° F.
Water	1″	below	surface	74°
do	6	fms.	do	57.5°
do	12	do	do	51°
do	48	do	do	48°
do	54	do	do	44.75°

The results establish the two facts,

1. That Lake Memphremagog is a cold water lake whose bottom temperature at 54 fathoms is, in early August, as low as 44.75° F.

2. That the high temperature of the surface at the same period is only maintained for, relatively, a few feet beneath, beyond which the mercury falls rapidly to near the lowest temperature.

At the head of the lake at Newport, the flow of water from the small rivers rising in the Vermont hills, creates a decided surface current past Newport, and although I have not specially endeavored to trace this current onward to the outlet at Magog, it is suggestive from the temperatures that the warm waters from the neighboring rivers and streams flow, river-like, over the colder waters of the lake, just as the Gulf Stream, under a different influence, but lightly skims the surface of a large portion of the broad Atlantic Ocean.

To illustrate the relative temperatures, whilst the thermometer at 12 fathoms here registered 51°, the waters of Lake Ontario, at their outlet into the St. Lawrence, indicated at the same depth, and at about the same period, 67°.

On the Political and Economic Significance of the Small Industries; and their Encouragement by Central-station Power Supply.

By J. T. Nicolson, B.Sc. (Edin.)

I.

One of the greatest questions of the present day, in view of the rapid centralization throughout the civilized world which is now taking place in great industrial cities; is that of the welfare and advancement of the skilled labouring classes. The attention of all who, like the writer, have lived for any length of time among artizans, is irresistibly directed to this matter; and the conclusion that things are far from being satisfactory is forced upon them.

It is the author's belief that the ill conditions of life of the manufacturing classes are responsible for most of the vexatious labour controversies, the political disaffection, and even the widespread Socialism of the present day. The system, which has gradually developed during the last few decades, of large manufacturing centres, consisting mostly of great factories where the capitalist reigns supreme over armies of labourers, usually reduced to the meanest conditions of life, is the ultimate source of all these political evils.

The question is of moment to us here in Canada, for this unsatisfactory state of affairs is beginning to show its evil results even in the New World, where nature's gifts still overflow in prodigal abundance.

It has been truly said that it is very easy to criticize, as it requires neither heart nor head. The author therefore feels the necessity of going a little further; and, assuming that he has correctly diagnosed the disease, he will essay to prescribe a remedy.

It may be presumed that the happiness of the members of the human race, in so far as this depends on merely sublunary affairs, is inseparably bound up with the amount of wealth they possess. By wealth it must not for a moment be supposed that money is here meant. This was the error into which the old protectionist statesmen of England fell, when they acted on the supposition that the amassing of bullion was synonymous with the aggregation of wealth. Adam Smith and Ricardo first showed the falsity of this notion and gave the true economic definition of the word, viz: wealth is anything whatever which has an exchange value. So that, when a man possesses anything, whether it be wit or courage or learning or skill, which possesses a value for exchange purposes, he may become a useful member of the community; and in so far as agreeable conditions of life and the commendation of his species can make him so, he may be contented and happy. People whom we are accustomed to call "the poor" have very often large stores of wealth in this sense of the word; and hence mere im-

pecuniosity does not of necessity also imply misery or unhappiness in the case of the fortunate or unfortunate individual involved.

If wealth be one of the most potent factors concerned with happiness, we shall find it necessary, in a search for the causes of discontent amongst the labouring classes and for measures for the removal of the same, first to consider briefly the elements necessary for the production of wealth.

The three great factors which political economists find to be requisite for this purpose are: Land, Capital and Labour.

It will be found, on closer examination, that land and capital are agents of very much the same nature. The latter is defined as that part of wealth which is accumulated to assist future production. Agricultural labourers, for instance, must be supported by wealth previously accumulated; as it is obvious they cannot live on that which they are engaged in producing. It is important to note that capital plays a very subordinate part in the matter, since it is only essential during one single cycle of operations. For if the labourer can exist at all on the fruits of his labour, it is obvious that he only requires assistance during the first production period.

Land, or, to use a broader term, Matter, is evidently an indispensable agent in the production of wealth. In the mere statement that wealth is anything which has an exchange value, it is obvious that the objects included are mostly material and have been derived from land; the exceptions being mostly qualities of mind, which, though not material, yet have a value. The importance of land as an agent of production is so great that at one time political economists in France asserted it to be the sole source of wealth. It has since, however, been shown that labour also is indispensable to the production of wealth.

The exact service which labour renders in the production of wealth is defined by Mill to be "putting things into fit places" or "moving one thing from or to another." This simple definition is so comprehensive as to include all the

varied operations of industry. "Labour in the physical world is always and solely employed in putting objects in motion." Man has no other means of acting upon matter than by moving it.

Money, which is the appointed medium of exchange of valuables, has nowadays also become a commodity, and as such has a changeable value. It ought in reality to be only the means of mobilizing or circulating wealth ; but is now essentially the most highly privileged factor of all, demanding security and interest, and which can itself earn wealth unproductively and without risk. Every operation of credit, if only for the mobilization of actual wealth, begets an excessive demand for the only valid measure of value, viz, Gold. Payments which in their origin had nothing whatever to do with gold must nevertheless be paid in gold. In short, the present monetary system produces an artificial and previously undreamt of demand for this single privileged value-measurer; while it is perfectly conceivable that a medium for the circulation and estimation of valuables could be procured which would dispense with all these questionably essential privileges.

The attempt to ameliorate the condition of the working classes by making a certain amount of wealth a common birthright by an equal division of the land, or rather of the matter of the universe, can never become a *modus vivendi*. It is against laws of nature, such as the struggle for existence and the survival of the fittest, which are not to be got rid of. Endeavours after a common ownership of the land, whether in the gross communistic form or in the blander form of Bellamyism, can never have any result in actual fact.

We must consequently confine our attention to some form of distribution which is consonant with the law of the struggle for existence, and which, as to its possibilities for the individual, depends on his fitness to acquire the wealth which improved conditions of life will enable him to obtain.

Every consideration points to the fact that machinery is

to-day the most powerful wealth-producing agent with which we have to deal.

Machine power is, economically considered, neither more nor less than an enormous massing of labouring power, or vast capability of moving matter, for the production of wealth; in comparison with which the agency of the whole human race is of unimportant magnitude. Labouring humanity is rapidly becoming the intelligent supervisor of the moving force, instead of the moving agent itself. Machine power even now vastly transcends all the human power of the whole earth; it drives the master machine-tools and the highly developed technical machinery which repeats a thousandfold the isolated performances of man. It is also most highly influential on those who live in the most civilized countries.

In regard to this we learn from statistics that, for the work produced by every single labouring man, there is at present more than one hundred times the amount produced by machine power; so that all economic activity is governed by this agency.

This matter has been put in a most striking form by Prof. Riedler of Berlin, by giving to machine power anthropomorphism; say in the form of Chinamen, who are supposed set to work in gangs of one hundred against each one of us to produce commodities. We have only to say, towards the estimation of the result, that our imaginary Chinamen are far more modest and unpretending than real ones; that they require no homes, only workshops to live in; that they feed on coal; never strike; have no personal necessities; and that, when no longer capable of service, they are either repaired or simply broken in pieces.

This mode of viewing the matter makes the enormous influence of this agency more apparent; and no one will venture to doubt, that the sooner we begin to regulate this vast and remorseless power the better it will be,—the more so as statistics show that 80 per cent. of all the mechanical power in the world has arisen within the last quarter of a century.

Neither can this agency be dispensed with and got out of the world; our material culture would then contemporaneously come to an end, for machine power alone has rendered available to the many commodities which were formerly only the privilege of a favoured few. Repression or even limitation of its influence involves, *pari passu*, a reversion to our pre-civilized state.

In these circumstances there remains but one way out of the difficulty.

Instead of confiding to the capitalist the sole mastery and control of this enormous power, upon the right wielding of which the destinies of the race depend, we ought to render it equally serviceable to all, as a beneficent working agent.

The common supply to the whole working community of this all-producing mechanical energy at its proper cheap rate is the solution which the author now proposes for some of the social problems which lie before us in the form of dissatisfaction with present conditions of life in manufacturing centres, and the consequent result of political disaffection and socialism.

That the writer does not overestimate the advantages to be obtained by a general adoption of such a scheme for the encouragement, or indeed creation, of the small or home industries, he will endeavour to show by describing the conditions of life of the factory hand, and then contrasting with them those of an independent workman or small employer.

Consider the case of a workman in a mill or factory. When a young workman he sees no prospect of being able to compete as an independent employer with the large establishments producing the commodities he helps to make; he accordingly never dreams as a rule of saving his earnings for the purpose of establishing himself in business; but, on the contrary, uses the same to minister merely to his pleasures, and frequents the society of men who, like himself, naturally ill content with their conditions of life, indulge in noxious political talking, if nothing worse. When trouble, whether in the form of illness, want of work,

accident or of any other kind, befalls such a man, he at once becomes discontented, begins to complain bitterly, and, instead of viewing his own improvident conduct as the cause of his present state, he throws the blame upon conditions which have very little to do with the matter. If government should interfere on behalf of workmen, to organize a sick benefit or accident fund, in order that the unfortunate artizan may not be forthwith penniless when anything of this kind befalls him; then he murmurs against the deductions made from his wages, at least so long as nothing happens to him which renders an application to the fund for payments possible to him; and when he does have recourse to the accident fund for support, he murmurs equally at the inadequacy of the amount allowed him for maintenance. In this way discontent arises in, grows with and spreads from such a man; the state of things being certainly not improved when, as he advances in life, from which the freshness and gloss have now been removed, he sees nothing before him but his day of toil unrewarded save by his weekly wage. Again, since in great factories large numbers of men work together in relatively small rooms, there is every facility for, as the men are only too prone to be, taking part in the discontent and reiterating the complaints of others. Such places consequently become the very breeding-places for all manner of dissatisfaction with things as they are, and of envy and hatred for more favourably placed fellow-men. That the ideas of revolutionaries have always obtained so wonderfully rapid a hold upon the employés of the large industries can only be explained in this way, and is a proof of the truth of the above contention.

It is far otherwise with a man who can be his own employer He takes pleasure in and works with diligence and foresight at an occupation from which he anticipates a personal reward for his own industrious skill. He consequently becomes essentially a higher class of man than his compeer in the factory. The habits of thrift which the successful initiation and pursuit of his little concern have inculcated have a good general effect on his whole moral character.

His intelligence is quickened by the invention of better methods for the carrying on of his work and in the buying of his own materials and the sale of his own finished products.

"Only those can have a real pleasure in their calling" (says Leopold von Kunowski in his *brochure* "Wird die Socialdemokratic siegen"), "who first freely choose it, and afterwards have the hope of seeing before them the fruits of their labour and skill, of attaining for themselves and their families a greater opulence, of reaching a more independent and important position in their profession, and lastly of hereby fulfilling such other good and noble aims as every man carries in his breast to a greater or less extent. These traits of character lie so deeply in man's nature, and are so founded on the natural freedom inculcated equally by his religion and his philosophy, as to be absolutely ineradicable and incapable of being silenced."

To no one can these noble words be applied with greater force and truth than to the small employer, whose industry is not confined within certain specified working hours as with the dependent factory hand, and who by his special skill or business aptitude can attain more and more to a comfortable position. Such an independent workman will be replaced as the generations go on by his apprentices; of whom he ought to have one or two. These should, if they are not already members of his family, live in his house, and they will then from personal esteem take as keen an interest in the business as he does himself. They know that they themselves will some day be small employers, so that no detail of the whole organization will escape their vigilance.

There is no reason why such people as these should not have high moral and political aims, if only a strong government attends to the just protection of their rights and property.

And in such a case the logical conclusion to be drawn is, that in a state where the small industries flourish there will reign peace, contentment, order and prosperity; for dis-

cord imported from without can find no root, and discontentment from within can never arise.

The condition of things in this and other countries is, however, far from being favourable to the small industries. Large manufacturers can secure not merely the most perfect machinery, but need pay hardly the seventh part of what independent workmen or small employers have to expend for power supply.

The employment of machinery is made as difficult as possible, and sometimes is entirely out of the question, in large towns, by the troublesome regulations, mostly required by the public safety, which are imposed upon prime movers.

The one essential condition for the flourishing of the small industries, however, is their situation in the midst of crowded centres of population; so that the municipal restrictions are especially injurious to the independent workman and small employer; for the large mills and factories may be situated any where in the vicinity beyond the city limit, where a prosperous small industry could not exist.

The result of all this is that all the great technical advances pass over the heads of these workers, since the first requisite for their application is the possession of mechanical energy. They consequently fall hopelessly behind in the industrial race, in which they are so heavily handicapped; and finally cease to exist as a class of any national importance.

The great principle of the division of labour, so closely identified with mills and manufactories, which carries with its adoption the advantages, as enunciated by Adam Smith and Babbage, of (1) increased dexterity of the labourer and his employment on that work at which he is most skilful; (2) time saved by the workman not passing from one employment to another, and (3) suitable machinery more likely to be invented by the concentration of the workman's mind on one process; will be advanced by many as a sufficient reason why large factories must inevitably form the chief part of an economical industrial system.

If this be really the case, then the solution of the problem of the temporal prosperity of the labourer lies in some system of coöperation and the securing of identity of interest by profit-sharing, so that the worker may participate in the results of his industry, skill and intelligence. At the present time the whole benefit accrues to the capitalist who employs him.

Several instances of the successful operation of such schemes are given in Mr. Sedley Taylor's most interesting work on profit-sharing.

With reference to this the writer is not inclined to coincide in the view that labour employ in large factories need form the main or indeed the staple form of industrial production.

Adam Smith's, or rather Babbage's, third advantage of the division of labour, viz: "Suitable machinery more likely to be invented by the workman for the carrying out of the process upon which he is employed," suggests the future result of the production of manufactured articles in this manner.

The effect will always be, and we have seen above that this has already partly taken place during the last twenty or thirty years, that more and more of the labour of the world will be done by machinery, and that the part of man in this work will tend more and more to become that of intelligent supervision. This is indeed the only ground on which higher education for the masses can be justified; for the education of men whose employments demand nothing but mere brute force can result in nothing but dissatisfaction with their condition, or, in other words, political disaffection.

Now the chief reason why this intelligent supervision is at the present time carried on almost wholly in large factories, and therefore with no reward to the labourer in the shape of profit-sharing, is because the capitalist has the entire monopoly of that power or mechanical energy without which the machinery cannot be used.

It happens that the cost of the production of power from coal by means of steam engines and boilers (in comparison

with which all other forms of energy utilization are mere vanishing quantities) gets less and less as the size of the engines gets greater. So much so, that the cost of a horse power to the possessor of a 10-horse engine will be from five to ten times that of the cost of one horse power to the owner of a mill engine of 1000-horse power; while the power of still smaller engines will be proportionately more expensive, costing anywhere from ten to one hundred times as much as it ought and would if supplied by a large engine at a central generating station.

It is thus obvious that such small employers cannot compete on anything like equal terms with mill-owners or large factories; and that, in spite of their usually superior intelligence and their greater zeal and activity, fostered by self-interest, they cannot sell their commodities in the open market as cheaply as can the capitalist with his cheaper power supply.

It is therefore essential for the encouragement and development of the small employer, who earns his own profits, and of the workman doing skilled labour in a workroom in his own house under every human incentive to industry, that efforts should be made to render this mechanical energy, which is so absolutely essential, equally at the service of all. And this must be done so that the power can be supplied to each isolated workman on equal terms and at the same rate as their at present much too favourably treated competitors, the capitalists, obtain it.

If this can be done by any extension of technical possibilities, the writer sees no reason why a great part of the industry at present carried on in factories, with the profits all accruing to the capitalist, should not be transferred to small workshops managed each by its own independent workmen, on competitive equality with other modes of manufacture, and with all the beneficent results on the individual and to the nation at large which such a system has been shown to entail.

That the work would be as quickly, and consequently cheaply, done there is no reason to doubt; and, that it would

be very much better done, is perfectly obvious, when it is simply stated that the interests of the employer and the workman would then be identical.

In the sequel it is proposed to consider the technical possibility of effecting this desirable result, by means of the generation of the power at central stations; under the best conditions of careful management and most economical type and size of prime mover; and its subsequent distribution by means of one or other of the four working agents—steam, air, electricity or water—which have been practically tested and found most capable of good results.

Reclaiming Bog in Westmoreland County, New Brunswick.

By Prof. W. L. Goodwin, D.Sc.

As is well known, the long wedge shape of the Bay of Fundy and its subdivisions causes the tides at the head of the bay to rise to a great height, and to rush up the terminal inlets with much force and velocity. When this rush of water reaches Chignecto Bay it causes a rapid wearing away of the little-resisting clay, sandstone and shale which here form the shores. Thus the waters of the Bay of Fundy are proverbially muddy. The mud is constantly filling up the head waters of the bay, and great stretches of red flats are seen everywhere. Sir Wm. Dawson, in his *Acadian Geology*, has given a careful description of the natural production in this way of fertile "dyke" lands, and has also pointed out that unless such lands are kept drained they deteriorate into "blue dyke," and, finally, I may add, become quaking morasses and even lakes. Thousand of acres of bog, interspersed with fresh water ponds, have thus been formed in Westmoreland County, New Brunswick, and the adjoining Cumberland County, Nova Scotia. These bogs and lakes stretch far into the land, dividing into three series, the middle series reaching from the Bay of Fundy side to within three or four miles of Baie Verte, on the op-

posite side of the Isthmus of Chignecto. The change from solid meadow to bog and lake has no doubt been due to the formation of natural dykes by the deposit of heavier material in greater quantity on to the banks of the creeks, thus enclosing the marsh and preventing the further deposition of mud, excepting by unusually high tides. It is likely that these dykes were increased in height by the action of ice. This was followed by the gradual depression of the enclosed area, in which fresh water collected, forming bogs and lakes. One of the most enterprising and intelligent of the farmers now engaged in reclaiming these bogs has told me that beneath the bog is to be found a great depth of soil exactly like that now being formed by the Bay of Fundy tides. The formation of natural dykes can be observed along the banks of the canals and rivulets which lead the muddy water up into the marshes. The reclamation of bog and conversion of it into meadows of almost inexhaustible fertility has been going on in the parishes of Sackville, Westmoreland and Cumberland for nearly half a century. Canals are cut from the natural tidal channels, so as to lead the salt water into the bogs. The rush of the tides, combined with the flow of fresh water at low tide, gradually wear the canals into wide streams, from which smaller streams can be led in all directions into the bog. The bog settles as the fresh water drains off, and then every tide brings in its quota of mud, which is deposited in layers varying in thickness according to the height of the tide and the distance from the main channel. I have seen some layers of coarser material on the banks of the canals nearly an inch in thickness. Some distance from the canals the thickness varied from one-sixteenth to one-fourth of an inch. The conversion of bog into tillage land occupies several years, varying according to the situation, the depth of water to be replaced by mud, and other circumstances. In the summer of 1892 I saw, bearing an abundant crop of hay, a large tract which in 1867 was a fresh-water lake from ten to fifteen feet in depth. As the filling up process goes on, the level of the soil rises until at length it is covered only

by the highest spring tides. A low dyke, say a foot high, will then keep out the tide altogether, and the work of reclamation is complete. Various plants, the seeds of some coming in with the mud, others being brought by winds and birds, soon cover the red glistening expanse with patches of brown, gray and green. The following is in general the order in which these plants appear. The specimens, gathered by myself, were identified by my colleague, Prof. Fowler.

1. *Spartina stricta*, var. *alterniflora.*
2. *Salicornia herbacea.*
3. *Plantago maritima.*
4. *Suæda linearis.*
5. *Hordeum jubatum* and *Puccinellia distans.*

The salt grass, *Spartina*, grows luxuriantly on the banks of the canals, where it is partially covered by every high tide, and must grow fast to keep its head above the mud.

After a year or two the land becomes suitable for tillage, and then produces large crops of hay and cereals. It is worth from $1.60 to $2.00 an acre, and requires no manure. I have been informed that about 3,000 acres have been reclaimed in the parish of Sackville, and that there is an equal amount awaiting reclamation.

Discovery of Platinum in Place in the Ural Mountains.

By R. Helmhacker.[1]

The metal platinum has up to the present time been obtained only from alluvial washings, and its mode of occurrence when "in place" was for many years a matter of conjecture.

The solution of the problem did not seem difficult. Since the most important platinum deposits occur in connection with serpentine, which is merely an alteration product of

[1] "Zeitschrift für praktische Geologie," February, 1893. Translated from the German by Dr. Frank D. Adams.

olivine or olivine-bearing rocks (as in the case of the largest platinum deposits of the Urals), it might be considered as entirely probable that serpentine or some olivine rock formed the matrix in which the platinum occurred, and from which it found its way into the alluvial deposits.

The very extensive platinum washings in the valleys of the Salda and the Tagil (both tributaries of the Tura, which in its turn is a tributary of the Tobul, which flows into the Irtys) occasionally afforded specimens in which the platinum could be seen intergrown with olivine or chromite. From an examination of the alluvial washings of the eastern slope of the Urals, therefore, it was pretty certain that the platinum had been derived from the disintegration of serpentine rocks, although the metal was never found in place. Very recently, however, these probabilities have become certainties.

About ten years ago, in the Krestovozdvizensky property belonging to Count Suvalov, in the district watered by the rivers Vyzaj and Kaiva tributaries of the Kama, and on the western slope of the Urals, platinum was found in grains disseminated through the rock on which alluvial deposits containing platinum rested. This rock is an olivine gabbro. Another discovery has just been made in the Goroblagodatsk district, on the eastern slope of the Urals, where platinum, associated with chromic iron-ore, has not only been found disseminated in an olivine rock, but has been found in such abundance that the rock can actually be worked with profit. Twenty-two grains of platinum were obtained from one ton of the rock, and although this result was highly encouraging, laboratory assays of other portions of the rock impregnated with platinum have given much higher results, in some cases as much as 93 to 110 grains of platinum to the ton of rock being found.

Proposed Change
In Reckoning the Astronomical Day.

Toronto, Canada, 21st April, 1893.

The Canadian Institute in co-operation with the Astronomical and Physical Society of Toronto, have had under consideration the subject of Astronomical Time Reckoning, and have, after much deliberation and consultation, appointed a Joint Committee to suggest the best means of ascertaining the views of astronomers throughout the world.

The Joint Committee have presented the accompanying Report, in which both Societies concur.

On behalf of the two Societies we have the honour to direct attention to the observations and recommendations of the Joint Committee, as well as to the appended extracts, expressing the views of the following gentlemen:—

1. Sir John Herschel.
2. M. Otto Struvè, Imperial Astronomer, Pulkowa.
3. Mr. W. H. M. Christie, Astronomer Royal, Greenwich.
4. Prof. S. Newcomb, Nautical Almanac Office, Washington.
5. Commodore Franklin, United States Naval Obs., Washington.
6. Mr. C. Carpmael, President Astronomical Society, Toronto.
7. Mr. Arthur Harvey, President Canadian Institute, Toronto.

In order to obtain the views of as many astronomers as possible the Joint Committee recommend that answers be invited to the following question:—

Is it desirable, all interests considered, that on and after the first day of January, 1901, *the Astronomical Day should everywhere begin at Mean Midnight ?*

It is requested that early answers to this question be sent to the following address:—

Joint Committee Astronomical Time,
Canadian Institute,
Toronto, Canada.

As it is intended to send copies of further papers on this subject to those replying, it is desirable that the full name, official designation, if any (professional or non-professional) and proper address be furnished with each reply.

ALAN MACDOUGALL,
G. E. LUMSDEN,
Joint Secretaries.

REPORT OF THE JOINT COMMITTEE

OF THE CANADIAN INSTITUTE AND THE ASTRONOMICAL AND PHYSICAL SOCIETY OF TORONTO.

SANDFORD FLEMING, C.E., C.M.G., LL.D., Etc., Chairman.

Canadian Institute.	*Astronomical Society.*
ARTHUR HARVEY, President.	CHARLES CARPMAEL, M.A., F.R.A.S., Etc., Pres.
GEO. KENNEDY, M.A., LL.D.	JOHN A. PATERSON, M.A.
ALAN MACDOUGALL, C.E., Sec.	G. E. LUMSDEN, Corresponding Secretary.

TORONTO, April 20th, 1893.

Your Committee on the subject of Astronomical Time Reckoning, beg leave to report as follows:—

(*a*) That the Sixth Resolution of The Washington International Conference of 1884, which was carried unanimously by the representatives of the twenty-five nations there assembled, counting among them several astronomers of world-wide fame, reads as follows:— "The Conference expresses the hope that, as soon as may be practicable, the Astronomical and Nautical Days will be arranged everywhere to begin at Mean Midnight;"

(*b*) If any action is to be taken on this Resolution, the most appropriate date for the new reckoning to take effect would be the first day of the new century;

(*c*) As the Ephemerides are usually prepared four or five years in advance, it is obvious that if it be decided to make Astronomical Time accord with Civil Time at the date named, a common understanding should not be delayed beyond the year 1895 or 1896;

(*d*) To arrive at an agreement, it is considered essential to ascertain the views of those concerned;

(*e*) The Canadian Institute and the Astronomical Society

should, in the general interest, assume the duty of inviting opinions upon the subject, to be collated, tabulated and published in a special report;

(*f*) If the weight of opinion expressed by those who respond to such invitation, be in favour of a change, further steps may be taken with the view of reaching an international understanding;

(*g*) Your Committee suggest that the opinions which have already been expressed by some leading astronomers be published. To this end, extracts from the writings of Herschel, Struvè, Christie, Newcomb and Franklin, are hereto appended; also, remarks recently made by the President of the Astronomical and Physical Society of Toronto, and the President of the Canadian Institute;

(*h*) Your Committee recommend that replies be asked to the following question, and that it be widely circulated:—

QUESTION.

Is it desirable, all interests considered, that on and after the first day of January, 1901, the Astronomical Day should everywhere begin at Mean Midnight?

(*i*) Your Committee further suggest that astronomers generally throughout the world be invited to send definite replies to the question as soon as convenient. Replies to be addressed, "*Joint Committee, Astronomical Time, Canadian Institute, Toronto, Canada.*"

Respectfully submitted,

SANDFORD FLEMING,
Chairman.

APPENDIX.

EXTRACTS FROM THE OPINIONS OF ASTRONOMERS AND OTHERS REFERRED TO BY THE JOINT COMMITTEE.

I. (935) Astronomical time reckons from noon of the current day; Civil, from the preceding midnight, so that the two dates coincide only during the earlier half of the Astronomical and the later half of the Civil Day. This is an inconvenience which might be remedied by shifting the astronomical epoch to co-incidence with the civil. (147) . . . This usage has its advantages and disadvantages, but the latter seem to preponderate; and it would

be well if, in consequence, it could be broken through and the Civil reckoning substituted. Uniformity in nomenclature and modes of reckoning in all matters relating to time, space, weight, measures, etc., is of such vast and paramount importance in every relation of life as to outweigh every consideration of technical convenience or custom. The only disadvantage to astronomers of using the Civil reckoning is this—that their observations being chiefly carried on during the night, the day of their date will, in this reckoning, always have to be changed at midnight, and the former and latter portions of every night's observations will belong to two differently numbered civil days of the month. There is no denying this to be an inconvenience. Habit, however, would alleviate it; and some inconveniences must be cheerfully submitted to by all who resolve to act on general principles. All other classes of men, whose occupations extend to the night as well as day, submit to it, and find their advantage in so doing. — *Sir John Herschel's Treatise on Astronomy—Third Edition.*

II. Much earnest reflection, on the other hand, must be given to the desire expressed at the meeting, that Astronomical Time Reckoning should be brought in accord with the commencement of the day in civil life. In this matter, astronomers have not simply to abandon a custom of long standing, and consequently to make conditional changes of practice established for many years, but, at the same time, astronomical chronology is disturbed, which is easily understood, must exercise a marked effect on the comprehension of all problems bearing upon matter. Without doubt, the astronomer must make a great sacrifice for the fulfilment of this desire; but, in reality, this sacrifice is not greater than that entailed on our forefathers when they passed from the Julian to the Gregorian Notation of Time, or when they altered the commencement of the year: a sacrifice of convenience by which we yet suffer when it becomes necessary to refer to phenomena of remote dates. At this period, we must the less stand in fear of a like sacrifice, when by such means an acknowledged existing non-accord between science and ordinary life can be set aside: a non-accord which, it is true in individual cases, does not press heavily on the astronomer, but which is a constant source of inconvenience for non-professional astronomers who are desirous of making use of astronomical information. And in such respect, this sacrifice ceases so to be considered and is transformed into an act of public utility with regard to all astronomical details which stand in clear relationship with the outer world in which almost daily conflicts come to the surface between the different designations of dates. Conflicts among others which are even injurious to astronomical

labours in such observatories where observations are continually adjusted to the day. . . . While the Directors of the Pulkowa Observatory make their full acknowledgment to the Astronomer Royal for this precedent, which has been established, so are they ready to follow the example, and this fact leads us the more to expect that also this course will be adopted by the Washington Naval Observatory, as in the American Marine the Date Notation from midnight has been already accepted. It is only in the matter of the period when the Date Notation, according to Universal Time, should be introduced into the publications of the observatories, that we feel inclined to recommend that there should be delay until, in this respect, the most perfect possible understanding be attained by all astronomers, in order to avoid the much more critical disturbance in astronomical chronology which would arise if the transition to the new Date Notation was not equally followed on all sides. We are desirous, accordingly, of suggesting a suitable time-point for the commencement of the year for which the Nautical Almanac would inaugurate the changes corresponding to the requirements named. The latter, as has before been said, could come to pass in the year 1890. We would, however, ourselves prefer the change to take place, in the first instance, with the change of the century. Until that date it would probably be the simultaneous proceeding of all astronomers, with general consent, to look forward to this period of transition, and it would more easily stamp itself on the memory of all who hereafter would be busied in investigation in which exact chronology plays a part.—*Paper on the Washington Conference by Otto Struvè, Director of the Imperial Astronomical Observatory, Pulkowa, Russia.*

III. The reasons for making the change, as affecting astronomers, are:—(1) The introduction of the Universal Day commencing at Greenwich Midnight, and reckoning from 0 to 24 hours makes it inexpedient to have another time reckoning of 0 to 24 hours starting from Greenwich Noon. There are already frequent mistakes of date arising from confusion between civil and astronomical reckoning, several practical observers using the former, which is also commonly employed in almanacs and occasionally in some astronomical periodicals. The use of *three* different systems of reckoning solar time would greatly increase the confusion. (2) The circumstances under which astronomical observations are made have completely changed in modern times since the application of powerful telescopes to meridian instruments and the development of Solar Physics. The change of date at noon in the middle of the day's work has thus, in many cases, become very inconvenient. (3) As regards

meridian observations, the experience of the past year at Greenwich Observatory (where observations are carried on as continuously through the 24 hours as at any other observatory) shows that the whole of the astronomical day can be introduced very easily and with decided advantage on the whole. (4) In the case of extra-meridian observations, the observer usually finds it convenient to work in the earlier hours of the night, so that little or no inconvenience would result from a change of date at midnight. Discoverers of comets and observers of meteors, who observe in the early morning, often use civil reckoning, and mistakes of date have, on several occasions within my own knowledge, resulted from the existence of two different modes of counting time. (5) For spectroscopic and photographic observations of the sun, it is now recognized that the day should be reckoned from midnight, and the same reckoning would naturally be used by the observer when he takes spectroscopic and photographic observations at night, and also in determinations of the places of comets, stars, etc., which he may make in connection with his spectroscopic observations. It seems absurd to expect the same observer to change his system of reckoning mean solar time according to the class of observations he is making at the moment. (6) The proposal to include in the routine work of an observatory, photography of the stars, as well as of the sun, will further increase the difficulty of maintaining a distinction as regards time-reckoning between the various classes of astronomical observations. (7) At many observatories, magnetical and meteorological observations are carried on concurrently with astronomical observations, and it is admitted that for the two former classes the day commencing at midnight should be used. (8) For the distribution of the time to the public, a work which is undertaken by many observatories, the civil day would be used. (9) Thus civil reckoning commencing at midnight must be used for solar, magnetical, and meteorological observations, and also for the distribution of time to the different systems of mean solar clocks, differing by 12 hours, in the same observatory—a circumstance likely to lead to intolerable confusion. (10) As regards the supposed discontinuity which would arise from the change in the Nautical Almanac, the difference of time-reckoning is precisely similar to that which would have to be taken into account in the comparison of Greenwich observations with those made at any other observatory. The astronomical calculator is in the habit under the present system of allowing for the difference in time-reckoning between different observatories, and his task would be greatly simplified if he had only to deal with the universal time.—*Report to the Trustees of Greenwich Observatory, by W. H. M. Christie, M.A., LL.D., Astronomer Royal of England.*

Proceedings of the Natural History Society.

Montreal, January 30th, 1893.

The third monthly meeting was held this evening, T. Wesley Mills, M.D., Vice-President, in the chair.

The minutes of the last meeting were read and approved.

Minutes of meeting of Council of January 23rd were read.

The following donations to the museum were reported, and the thanks of the Society voted to the donors, on motion of Dr Girdwood, seconded by Mr. Jos. Fortier: A sea dove, from Mrs. Mackenzie; a rattlesnake and a flying fish, in spirits, from Mr. C. T. Hart; a large flag from Mr. James Morgan, jr., and a large rug composed of feathers, from Maorialand, New Zealand.

A lecture on magnetism was then given by Prof. Cox. The lecturer dealt with the recent investigations by Dr. John Hopkinson and others upon the magnetic properties of iron, nickel and cobalt, especially in relation to other properties connected with temperature, electric resistance, thermo-electric action and escalescence, and the bearing of these facts on the magnetic theories of Poisson, Weber, Impere and Ewing.

A vote of thanks was proposed by Dr. Stewart and seconded by the Rev. Dr. Campbell.

Montreal, February 27th, 1893.

The fourth monthly meeting was held this evening, the Rev. Dr. Campbell, Vice-President, in the chair.

The minutes of the last meeting were read and approved.

Minutes of meeting of Council of February 20th were read.

The Librarian reported the usual exchanges received.

On motion of Mr. J. S. Shearer, seconded by Mr. E. T. Chambers, Mr. W. G. Macfarlane was elected by acclamation, the rules being suspended.

Prof. J. T. Donald read a paper on "Some Misconceptions Concerning Asbestos." 1st. It has long been believed that asbestos could resist fire, but it removed the elasticity. 2nd. That the Italian is a different and much superior

mineral to the Canadian, but their composition was identical. 3rd. That asbestos is a good non-conductor; on the other hand, it is a splendid conductor; when made into a fluff containing air, the air will act as a non-conductor. 4th. That it contained chromic iron; the iron always associated with it is magnetic.

On motion of Dr. Wanless, seconded by Mr. W. W. Lynch, the thanks of the Society were given to the lecturer, with the request that an abstract be prepared for publication in the "Record."

MONTREAL, March 27th, 1893.

The fifth monthly meeting was held this evening, Dr. T. Wesley Mills, Vice-President, in the chair.

The minutes of meeting of February 27th were read and approved.

The minutes of Council meeting of March 20th were read.

The Librarian reported two volumes of "Histoire des Découvertes et Voyage dans le Nord," from Mr. E. D. Wintle; a pamphlet on the life of Dr. T. Sterry Hunt, from the author, Prof. Frazer; "Collections of the State Historical Society of Wisconsin," vol. xii, from the Society; and the Annual Report of the Smithsonian Institute for the year ending 1890.

On motion of Mr. E. T. Chambers, seconded by Mr. J. A. U. Beaudry, the thanks of the Society were given to these donors.

After some conversation regarding the proposed saloon adjoining the Society's building, it was moved by Mr. J. S. Shearer, seconded by Mr. Geo. Sumner, that a petition be prepared and signed by the officers and members of this Society, and sent to the License Commissioners, opposing the granting of a license to any saloon adjoining the property of the Society.

The Rev. Dr. Smyth read a paper on "The Attitude of the Church towards Science."

On motion of Prof. F. D. Adams, seconded by Mr. Walter Drake, the thanks of the Society were given to Dr. Smyth for his valuable paper.

MONTREAL, April 24th, 1893.

The sixth monthly meeting was held this evening, Mr. J. H. Joseph, Vice-President, in the chair.

The minutes of meeting of March 27th were read and approved.

Minutes of Council meeting of April 17th were read.

Mr. Shearer reported that the Mayor and Council of St. Agathe would do all in their power to make the stay of the Society in the place comfortable. He recommended that the excursion be to St. Agathe, the matter as to place being left in the hands of the Committee. The date proposed is the 3rd of June.

No additions were reported to the library or museum.

Mr. Chas. Branchaud, proposed by J. A. U. Beaudry, seconded by J. S. Shearer; Mr. Jules Prume, proposed by J. A. U. Beaudry, seconded by Dr. Beaudry; Mr. G. Cyrus Adams, proposed by R. W. McLachlan, seconded by James Gardner, and A. C. MacDonald, proposed by J. S. Shearer, seconded by James Gardner, were proposed as ordinary members. Elected unanimously.

Messrs. C. S. J. Phillips, S. Finley and Dr. Stirling were appointed auditors.

On proposition of Mr J. S. Shearer, seconded by Mr. Sumner, the thanks of the Society were voted to Prof. W. H. Carlyle, Ma.E.; Prof. John Cox, M.A.; Prof. J. T. Nicolson, B.Sc.; Prof. H. T. Bovey, M.A., C.E.; Prof. J. C. Carus-Wilson, and Prof. C. H. McLeod, Ma.E., lecturers in the Somerville course.

A letter was read from Mr. Milton L. Hersey, B.Sc., resigning his membership. Resignation accepted.

Letters from Prof. C. H. Carus-Wilson and the Auer Light Company were referred to the Council.

Dr. R. T. Ruttan then delivered his paper on the "Land Phosphates of Florida."

On motion of Geo. Sumner, seconded by J. S. Shearer, the thanks of the Society were given to Dr. Ruttan for his interesting paper.

Proceedings of the Microscopical Society.

Montreal, 16th January, 1893.

The regular monthly meeting of the Montreal Microscopical Society was held this evening in the library of the Natural History Society, at 8 o'clock. There were present Dr. Girdwood, president, in the chair, and Messrs. J. A. U. Beaudry, J. Stevenson Brown, Learmont, Chambers, McIntosh, Barton, Richards, Hausen, Williams, Drs. Wanless, Stirling, Bruere, McConnell, J. G. Shaw, and also friends of the Society.

The minutes of the last meeting were read and passed.

The President, Dr. Girdwood, then requested Prof. J. G. Adami, M.D., to read his paper on "Methods of Imbedding" The professor described different methods of imbedding subjects. Among them parafine, which could be hardened or made softer as required, and, by the use of a microtome, demonstrated how objects could be sliced off at any angle for the purpose of displaying their structure. The lecture, which was replete with useful information, was listened to with marked attention, and, at its close, the audience evinced their gratification by very hearty applause.

Dr. Girdwood thanked the lecturer, and said he and all present were very much gratified with the clear manner in which the different methods were described and hoped we should have another such treat afforded us.

The meeting then adjourned.

Montreal, 13th February, 1893.

The regular monthly meeting of the Microscopical Society was held this evening, in the Library of the Natural History Society, 32 University Street, at 8 o'clock. There were present, Dr. Girdwood, president, in the chair, and members, Messrs. E. R. Barton, J. S. Brown, Prof. Adams, Chambers, Gardner, Dr. Bruere, Dr. McConnell, Rev. Dr. Campbell, Jas. G. Shaw, and a number of visitors.

The minutes of the last meeting were read and confirmed.

Dr. Girdwood proposed as member Mr. Wm. Angus, 240 Drummond Street, seconded by Mr. J. G. Shaw, which was carried unanimously.

The President then requested Prof. Frank D. Adams, Ph.D., to read his paper on the "Microscope as Applied to the Study of Rocks." The professor began by stating that attempts to investigate the character of rocks and minerals were made in the 17th century but did not amount to much until 1826. Wm. Nicol, the discoverer of the Nicol "Prism," first put in practice the grinding and preparing very thin sections of rock, but not much advance was made till 1850, when Henry Clifton Sorby, an Englishman of very great ability, laid the foundation for the whole science of petrography, and after him Prof. Zirket, of Leipzig, wrote the first general treatise on the composition of rocks. Prof. Adams then described the manner of cleaning a piece of stone, attaching it to a copper or glass plate, rubbing down with coarse, then fine, emery, then with prepared very fine ground rotten stone, then transferring to a slide. Considerable discussion took place on this most graphically described subject which had been listened to with very close attention, and a very hearty vote of thanks was tendered to the lecturer for his most interesting paper. The President drew the attention of the meeting to the great value of this and other papers which were prepared with extreme care by the lecturers, and regretted that many of them not being in manuscript could not be kept among the records of the Society.

MONTREAL, 13th March, 1893.

The regular monthly meeting of the Montreal Microscopical Society was held this evening, in the Library of the Natural History Society, 32 University Street, at 8 o'clock.

The President being unavoidably absent from the city, Mr. J. Stevenson Brown was requested to take the chair.

There were present, Mr. J. S. Brown, chairman, and Messrs. Chambers, Richards, Barton, McIntosh, Learmont, Shearer, Hausen, Sumner, Rev. Dr. Campbell, Williams, J. G. Shaw and Mr. E. A. Small and a number of other visitors.

The minutes of the last meeting were read and approved.

A letter of resignation from Mr. Winn was read, which

elicited many remarks of sincere regret from the members, with the hope that Mr. Winn would reconsider his decision. A letter from Mr. Jas. Fletcher, secretary of the Royal Society of Canada, stating that the annual meeting of that society would be held, in the city of Ottawa, on Tuesday, May 23rd, and requesting the appointment of a delegate from this Society. The President, Dr. Girdwood, was unanimously requested to represent the Society as delegate.

The chairman then requested Dr. A. Arthman Bruere to read his paper on the Microscope in Medico-Legal Investigation. The lecture was most instructive and was illustrated by diagrams, and preparations were placed under microscopes arranged around the table. A lengthy discussion followed, in which many members took part; Dr. Bruere answered many questions put to him in a manner which showed how much interest he took in the subject and how conversant he was with all its details. A hearty vote of thanks was tendered the Doctor.

Notices of Books and Papers.

The Canadian Antiquarian and Numismatic Journal, edited by a committee of the Numismatic and Antiquarian Society of Montreal. Published by Monongahela de Beaujeu. Volume III, Nos. 1 and 2, 1893. Montreal, Desaulniers Printing Co., 22 St. Gabriel street.

The Numismatic and Antiquarian Society of Montreal are providing important materials for illustrating the history of the past, and are doing good work, especially for future students of the science of anthropology. Their journal is a most creditable literary production. The last two numbers contain much that is of general interest, besides several articles in which experts in coins and ancient relics are likely to be especially delighted.

Benjamin Sulte's historical articles are exceedingly valuable. Following up his interesting sketch of the Indian settlement in the Bay of "Kenté," embraced in Vol. II, No. 3, he contributes to Vol. III, No. 1, a paper on "Cataracoui," which M. Courcelles chose as

the spot for most effectually checking the inroads of the formidable Iroquois, as well as that most suitable for drawing to itself the Indian trade in peltries, which up till then found its way from the Lake Ontario regions to the Dutch merchants at Albany. No. 2 has a continuation of the subject under the heading of the "First Fort Frontenac," detailing the history of the undertaking and the bearing and address of the great Frenchman whose name it bears, as well as the enterprising La Salle's connection with it. Like all M. Sulte's French writings, these papers are composed in a most charming style. Other articles of general interest are Lemoine's "Hawkins' Picture of Quebec, 1834," "The Building of the Church of Longue Pointe," "The Laying of the Foundation Stone of the Montreal General Hospital, 1821," "Black-Hawk's Speech in 1832 at Prairie du Chien," and a "Sketch of the North-West Company."

EXCHANGES.—Among the most valuable of the recent exchanges of THE RECORD OF SCIENCE is "The Journal of Geology," a semi-quarterly magazine of geology and related sciences, published at Chicago by the University Press of Chicago, of which the second number is before us. All the articles are written with great care, and the get-up of the magazine is all that could be desired, the paper and type being excellent. The first paper in this number is from the pen of C. R. Van Hise, and is one of special interest to Canadian geologists, being "an historical sketch of the Lake Superior region to Cambrian time." This is accompanied by a fine colored plate. "The Geological Time Scale," by H. S. Williams, is a valuable *resumé* of the attempts of geologists to fix the age of the several series of rocks composing the earth's surface. "Traces of Glacial Man in Ohio," by W. H. Holmes, contains an account of the finding of a paleolith in a gravel pit at Newcomerstown in 1890.

"Transactions of the Texas Academy of Science," the first number of which was issued in November last, is one of the latest established organs of the opinions and observations of the active scientists of the United States. It must be said, however, that much of the matter embraced in this initial issue savours more of the spread eagleism of the fourth of July oration than of the modesty and sobriety which characterize true science, which is cosmopolitan. This remark is especially applicable to the last and most interesting article in the journal, "The Development of the American Trotter, a Study in Animal Physics," by Geo. W. Curtis, U. S. A., Director Texas Experimental Station.

R. C.

ABSTRACT FOR THE MONTH OF JANUARY, 1893.

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

DAY.	THERMOMETER.				* BAROMETER.				† Mean pressure of vapour.	‡ 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.					
SUNDAY..... 1	.....	33.2	22.3	10 9	.....	.....	.....	.....	.	....	....	S E.	7.7	....	..	..	00	....	6.7	0.67	1 .....SUNDAY
2	30.57	38.0	22.0	16.0	29.1217	29.355	28.943	0 412	.1403	80.1	25 7	W.	23.2	10.0	10	10	00	....	3.5	0.35	2
3	— 3.10	22.0	— 9.3	31.3	29.6973	29.820	29.472	0 348	.0295	78.3	— 8.5	W.	22.7	3.7	10	0	59	....	....	....	3
4	— 7.20	— 1.8	—12.0	10.2	29.7882	29.816	29.755	0.061	.0267	85 7	—10 5	N.W.	9.8	0.0	0	0	68	....	....	....	4
5	— 5.55	2.6	—16.0	18.6	29.7480	29.795	29.665	0.130	.0253	73.5	—12.2	N.	17.5	3.7	10	0	65	....	....	....	5
6	5.83	9.8	0.0	9.8	29.7992	29.818	29.782	0.036	.0387	70.0	— 2.5	N.W.	24.6	2.8	10	0	76	....	....	....	6
7	1.45	6.6	— 0.8	7.4	29.9082	29.952	29.872	0.080	.0328	71.7	— 5.8	W.	21.7	3.5	10	0	00	....	....	....	7
SUNDAY..... 8	.....	2.2	— 7.3	9.5	.....	.....	.....	.....	. ...	....	....	N.	10.4	....	..	..	66	....	Inap.	Inap.	8 ..... SUNDAY
9	— 0.90	7.1	— 7.7	14.8	29.4515	29.746	29.243	0.503	.0377	89.5	— 3.2	N.	10.0	10.0	10	10	00	....	2.2	0.25	9
10	— 0.32	9.3	—10.8	20.1	29.2482	29.375	29.181	0.194	.0103	89.0	— 2.5	W.	30.1	8.8	10	3	00	....	1.4	0.15	10
11	—12.63	—10.0	—16.4	6.4	29.7425	29.909	29 537	0.372	.0210	87.5	—15 0	W.	30 0	3.5	10	0	76	....	....	....	11
12	— 8.53	— 1.8	—16.3	14.5	29.7828	29.920	29 638	0.282	.0228	78.0	—13.5	W.	7.5	3.2	7	0	36	....	....	....	12
13	— 0.10	4.3	— 2.6	6.9	29.6880	29.771	29.636	0.135	.0267	63.5	—10.2	W.	12.2	0 3	2	0	74	....	....	....	13
14	0.60	4.2	— 3.4	7.6	29.9183	29.959	29 838	0.121	.0357	81.3	— 4.3	W.	9.3	2.8	10	0	68	....	Inap.	Inap.	14
SUNDAY.... ...15	.....	5.0	— 4.2	9.2	.....	.....	.....	.....	. .	....	....	W.	8.6	....	..	..	42	....	....	....	15 ..... SUNDAY
16	2.87	5.7	— 0.5	6.2	30.1385	30.263	29.992	0.276	.0155	72 3	— 4.2	W.	14.7	4.5	10	0	30	....	....	....	16
17	2.27	6.7	— 0.4	7.1	30.3922	30.430	30.345	0.085	.0367	77 7	— 3.3	N	4.3	6.2	10	0	00	....	Inap.	Inap.	17
18	— 2.43	2.6	—10.2	12.8	30.3125	30.448	30.126	0.322	.0323	83 5	— 6.5	N.	8.5	7.0	10	0	00	....	....	.	18
19	7.92	11.6	2.0	9.6	29.9813	30.087	29.933	0.154	.0550	89.5	5.2	N.	7.1	9.7	10	8	22	....	0.8	0.08	19
20	7.75	11.5	4.5	7.0	29.9932	30.057	29.953	0.104	.0483	79 2	— 2.8	N.W.	22.0	6.7	10	0	22	....	0.3	0.04	20
21	3.20	7.8	0.0	7.8	30.1683	30 210	30.133	0.077	.0367	75.0	— 3 5	W.	18.2	0.3	1	0	90	....	....	..	21
SUNDAY.....22	.....	10.8	1.8	9.0	. .....	.....	.....	.....	.....	....	....	W.	10.2	....	..	..	28	....	....	....	22 .....SUNDAY
23	6.98	11.;	— 1.7	13.1	30.0687	30.156	30.018	0.138	.0528	86 8	3.8	N.E.	8.2	8.7	10	2	00	....	0.4	0.03	23
24	13.00	17.3	9.3	8.0	30.0415	30.057	30.026	0.031	.0723	91.8	10.8	N.E.	3.8	10.0	10	10	03	...	0.6	0.02	24
25	21 73	27.8	15.4	12.4	29.9003	30.068	29.751	0.317	.1090	92.0	19.8	S.E.	14.6	6.7	10	0	00	....	3.2	0.40	25
26	14.42	23.5	8.3	15.2	30.0235	30.152	29.903	0.244	.0727	86.0	11.2	S.W.	19.2	10 0	10	10	00	....	Inap.	Inap.	26
27	5.15	19.0	— 1.0	20.0	30.4612	30.623	30.188	0.435	.0437	76 2	— 0.8	N.W.	11.2	6.7	10	0	58	....	....	....	27
28	1.40	8.6	— 4.0	12.6	30.4567	30.637	30.221	0.416	.0405	86.3	— 1.8	N.E.	18.5	10.0	10	10	00	....	2.5	0.30	28
SUNDAY.....29	.....	41.7	8.3	33.4	.....	.....	.....	.....	.....	....	...	S.W.	23.4	....	..	..	00	0 16	0.2	0.18	29 .. ..SUNDAY
30	12.88	31.7	10.0	21.7	30.2872	30.378	30 154	0.224	.0683	88.0	10 2	S.W.	21.7	3.3	10	0	93	....	...	....	30
31	8.70	12.7	4.7	8.0	30.4478	30.519	30.285	0.234	.0522	80.5	4.2	W.	7.6	5.0	10	0	73	....	0.6	0.02	31
....Means	4.08	12.29	—0.52	12.81	29.9449	.....	.....	0.220	.0475	81.3	0.06	W. 13° S.	14·8	5.7	....	....	34	0.16	22.4	2.49	Sums .....
18 Years means for and including this month.....	11.72	20.16	3.80	16.4	30.0532	.....	.....	0 332	.0720	80.9	....	.....	....	6 4	....	....	¶32.0	0.82	29.9	3.65	18 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.....	1852	863	315	412	188	1496	4143	1735	2
Duration in hrs..	183	79	27	39	20	68	220	106	
Mean velocity....	10.12	10.92	11.67	10 56	9.40	22.00	18.83	16.37	

Greatest mileage in one hour was 62 on the 29th.
Greatest velocity in gusts, 72 miles per hour on the 29th.
Resultant mileage, 5,350.

Resultant direction, W. 13° S.
Total mileage, 11,004
Average velocity 14.8 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.
¶ 12 years only.

The greatest heat was 71.7 on the 29th; the greatest cold was —16.4 on the 11th, giving a range of temperature of 58.1 degrees. Warmest day was the 2nd. Coldest day was the 11th. Highest barometer reading was 30.637 on the 28th; lowest barometer was 28.943 on the 2nd, giving a range of 1.694 inches.

Maximum relative humidity was 97 on the 25th.
Minimum relative humidity was 53 on the 5th.
Rain fell on 1 day.
Snow fell on 15 days.
Rain or snow fell on 16 days.
Auroras were observed on 1 night.
Lunar halos on 3 nights.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1893.

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

DAY.	THERMOMETER. Mean.	Max.	Min.	Range.	* BAROMETER. Mean.	§ Max.	§ Min.	Range.	† Mean pressure of vapour.	‡ Mean relative humidity.	Dew point.	WIND. General direction.	Mean velocity in miles perhour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. of Possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	5.15	12.0	— 0.4	12.4	30.2943	30.435	30.224	0.211	0.0478	85.3	1.3	N.E.	12.1	10.0	10	10	00	....	0.4	0.05	1	
2	8.67	14.1	— 2.0	12.1	30.5268	30.602	30.381	0.221	.0510	78.2	3.2	W.	14.6	5.2	10	0	68	....	....	....	2	
3	3.07	2.0	— 6.6	8.6	30.1010	30.423	29.945	0.478	.0315	84.7	— 7.0	N.	26.1	7.5	10	1	00	....	5.9	0.75	3	
4	7.22	3.5	— 9.8	13.3	30.6338	30.866	30.272	0.594	.0235	77.3	—12.8	W.	31.2	1.8	10	0	92	....	....	.. .	4	
SUNDAY.. 5	.....	— 2.9	—12.7	9.8	.....	.....	.....	.....	.....	....	....	S.W.	5.1	. ..	..	..	00	....	....	....	5	.....SUNDAY
6	17.28	32.3	— 8.0	40.3	29.9407	30.386	29.592	0.794	.1012	90.5	15.0	S.	14.4	8.3	10	0	29	0.27	2.8	0.59	6	
7	11.78	28.2	— 2.7	30.9	30.0728	30 481	29.763	0.718	.0715	82.8	7.2	S.W.	22.0	5 3	10	0	30	....	1.6	0.12	7	
8	2.02	7.8	— 6.1	13.9	30.5455	30 [illegible]9	29.522	0.067	.0397	83.0	— 2.0	S.	17.4	2.5	7	0	84	....	....	....	8	
9	16.02	24.3	6.4	17.9	30.3947	80.3,1	30 045	0.546	.0847	90.0	14.0	S.	20.6	9.8	10	9	25	....	Inap.	....	9	
10	33.80	40.8	22.7	18.1	29.5713	29.852	29.358	0.494	.1787	90.5	31 3	S.E.	29.0	10.0	10	10	17	0.08	2 8	0.56	10	
11	16.85	30.0	13.0	17.0	30.1760	30.345	29.931	0.414	.0737	78.7	11.7	N.W.	11.8	2.5	8	0	84	....	....	....	11	
SUNDAY.. 12	.....	23.7	14.0	9.7	.....	.....	.....	.....	.....	....	....	S.W.	11.2	....	..	..	47	....	Inap.	....	12	.. ..SUNDAY
13	18.18	23.7	13.9	9.8	30.4247	30.548	30.303	0.245	.0815	82.0	13.8	S.W.	11.7	10.0	10	10	00	....	....	....	13	
14	27.33	35.1	19.8	15 3	30.1560	30.342	29.772	0.570	.1243	82.5	22.8	N.	13.7	5.3	10	0	46	Inap.	....	....	14	
15	31.75	39.2	21.9	17.3	29.7927	29.927	29.669	0.258	.1472	76.2	24 7	W.	22 7	7.8	10	0	31	0.07	....	0.07	15	
16	14.45	24.7	1.7	23.0	30.0680	30.319	29.942	0.377	.0558	62.8	3.8	N.W.	15.9	5.0	10	0	61	....	Inap.	....	16	
17	0.38	5.8	— 5.0	10.8	30.3053	30.476	30.063	0.413	.0295	68.3	— 8.3	W.	6.9	7.0	10	0	39	....	....	....	17	
18	4.50	10.2	— 2.3	12.5	29.6558	29.865	29.559	0.306	.0455	85.2	0.7	N.E.	16.7	9.5	10	3	00	....	0.8	0.08	18	
SUNDAY.....19	.....	18.2	7.7	10.5	.....	.....	.....	.....	.....	....	....	S.W.	20 0	....	..	..	00	....	2.7	0.16	19	.....SUNDAY
20	3.85	13.2	— 0.3	13.5	29.5883	29.851	29.296	0.555	.0355	69.5	— 4.2	W.	36.1	6.2	10	0	41	....	....	..	20	
21	3.43	12.0	— 7.4	19.4	29.9815	30.070	29.877	0.193	.0428	80.7	— 1.2	S.W.	24.3	5.0	10	0	25	....	....	....	21	
22	14.62	22.4	7.5	14.9	29.5978	29.799	29.483	0.316	.0668	79 5	9.5	N.E.	26.2	8.3	10	0	00	....	2.9	0.25	22	
23	13.92	22.7	10.1	12.6	29.7000	29.746	29.643	0.103	.0680	82.5	9.7	N.W.	15.9	3.7	10	0	82	....	....	....	23	
24	9.00	16.5	3.3	13.2	29.6712	29.793	29.596	0.197	.0558	84.5	5.2	S.W.	22.1	5.7	10	0	46	....	....	....	24	
25	13.32	19.5	5.0	14.5	29.8023	29.823	29.772	0.051	.0653	80.5	8.5	S.W.	18.7	0.5	2	0	83	....	....	....	25	
SUNDAY.....26	.....	23.1	13.6	9.5	.....	.....	.....	.....	.....	....	....	S.W.	23.3	....	..	..	75	....	....	....	26	....SUNDAY
27	16.30	22.1	10.2	11.9	30.3712	30 478	30.282	0.196	.0763	83.5	12.2	W.	21.4	1.7	10	0	95	....	....	....	27	
28	19.78	29.3	8.5	20.8	30.0342	30.310	29.859	0.451	.0585	80.2	5.5	N.E.	17 2	8.3	10	0	18	....	1.2	0.18	28	
29	.....	....	....	....	.....	.....	.....	.....	.....	....	....	.....	....	....	..	..	....	....	....	....	29	
30	.....	....	....	....	.....	.....	.....	.....	.....	....	....	.....	....	....	..	..	....	....	....	....	30	
31	.....	....	....	....	.....	.....	.....	.....	.....	....	....	.....	....	....	..	..	....	....	....	....	31	
....Means	12.99	19.77	4.29	15.5	30.0611	.....	.....	0.365	.0690	80.8	6.9	S. 71° W.	18.9	6.1	....	....	40	0.42	21.1	2.81	Sums	
18 Years means for and including this month	15.57	23.94	6.90	17.0	30.0454	.....	.....	0.322	.0822	78.8	....	.....	....	5 9	....	....	40 8	0.86	23.1	3.07	18 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.....	956	1437	105	829	978	4135	3284	996	
Duration in hrs..	43	83	10	47	55	213	165	51	5
Mean velocity...	22.2	17.3	10.5	17.6	17.8	19.4	19.9	19.5	

Greatest mileage in one hour was 49 on the 20th.
Greatest velocity in gusts 56 miles per hour, on the 20th.

Resultant mileage 5513.
Resultant direction, S. 71° W.
Total mileage, 12,720.

* Barometer readings reduced to sea-level and temperature of 32° Fahrenheit.
§ Observed.
† Pressure of vapour in inches of mercury.
‡ Humidity relative, saturation being 100.
¶ 12 years only.

The greatest heat was 40.8 on the 10th; the greatest cold was —12.7 on the 5th, giving a range of temperature of 53.5 degrees. Warmest day was the 15th. Coldest day was the 17th. Highest barometer reading was 30.866 on the 4th: lowest barometer was 29.296 on the 20th, giving a range of 1.570 inches.

Maximum relative humidity was 96 on the 6th, 9th and 10.
Minimum relative humidity was 45 on the 15th.
Rain fell on 4 days.
Snow fell on 12 days.
Rain or snow fell on 14 days.
Auroras were observed on 3 nights.
Hoar frost on 1 day.
Lunar halos on 2 nights.
Fog on 1 day.

ABSTRACT FOR THE MONTH OF MARCH, 1893.

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

DAY.	THERMOMETER. Mean.	Max.	Min.	Range.	* BAROMETER. Mean.	§ Max.	§ Min.	Range.	† Mean pressure of vapour.	‡ Mean relative humidity.	Dew point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. of Possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	26.90	33.2	23.7	9.5	29.8012	29.884	29.732	0.152	0.1167	79 5	21.7	S.W.	27.0.	5 3	10	0	54	....	Inap.	....	1
2	18.28	24.2	14.0	10.2	29.8587	29.910	29.785	0.125	.0742	74.0	11.7	W.	25 0	6 3	10	0	31	....	....	....	2
3	21.00	28.0	12.1	15.9	29.7615	29.898	29.663	0 235	.0852	72.7	13 7	S W.	14.8	8 3	10	6	30	....	....	....	3
4	16.72	24 0	12.2	11.8	29.6460	29.752	29.573	0.179	.0582	61.8	5.3	N.	18.2	0.0	00	0	91	....	....	....	4
SUNDAY.. 5	.....	19.4	7.4	12.0	.....	.....	.....	.....	.....	....	....	W.	20.2	. ..	..	..	21	....	Inap.	....	5 .... SUNDAY
6	14.72	21.3	4.7	16.6	29.9433	30.001	29 831	0.170	.0657	74.3	8 3	S.W.	16.8	7 7	10	0	53	....	....	....	0
7	27.73	33.7	18.3	15.4	29.8295	29.961	29.741	0.220	.1062	69.8	19.7	S.W.	21.4	4 2	10	0	74	....	....	....	7
8	31.52	40.5	20 9	19.6	29.8825	29 998	29.786	0.212	.1462	81.0	26.3	S.W.	21.4	4.0	10	0	48	....	....	....	8
9	32.50	41.3	26.8	14.5	29.9003	30.094	29 807	0.287	.1545	83 8	28.2	N.E.	26 0	4.7	10	0	14	....	....	....	9
10	29.02	36.8	20.8	16.0	30.3270	30.382	30 224	0.158	.1237	80.8	23.8	N.E.	23 2	0.3	2	0	15	....	....	..	10
11	36.52	38.7	28.4	10.3	30.0887	30.331	29.819	0.512	.1658	76.5	29.7	S.E.	24.7	8.3	10	0	00	0 18	....	0.18	11
SUNDAY 12	.....	40.5	35.8	4.7	.....	....	.....	.	.....	...	....	S.W.	20.1	....	..	..	00	0.65	....	0.65	12 .. ..SUNDAY
13	28.65	37.4	25.1	12.3	30.0883	30 136	30 001	0.135	1.1387	87 2	25.5	S.W.	7.4	6 7	10	0	00	....	....	....	13
14	30.30	35.8	23.1	12 7	29.8253	30.052	29 710	0.344	.1520	89.2	27 7	N.E.	8.6	8.3	10	0	00	0.23	....	0.23	14
15	19.55	36.5	7.6	28.9	29.7163	29.862	29.617	0 244	.1025	87.7	16 7	S.W.	35 5	8.3	10	0	00	....	2.3	0.24	15
16	11.52	16.8	6.4	10.4	30.0900	30.179	29.924	0.255	.0467	64.2	1.5	S.W.	32.3	1.8	10	0	88	....	0.2	0 02	16
17	20.77	27 9	12.7	15.2	30.0857	30.143	29.959	0.184	.0892	79.5	15.5	S.W.	22.7	4.7	10	0	87	....	0.2	0.02	17
18	6.78	17.0	— 0.3	17.3	30.2307	30.262	30.202	0.060	.0388	66.5	—2.7	N.	16 0	0.2	1	0	91	....	....	....	18
SUNDAY 19	.....	22.3	6.9	15.4	.....	.....	.....	. ..	....	....	....	S.W.	9 3	....	..	..	53	....	...	..	19 .....SUNDAY
20	25 18	33.4	11.7	21.7	30 2700	30.395	30 042	0 353	.1185	83.2	20.7	S.E.	12.1	2.2	10	0	00	....	....	....	20
21	34.50	40.2	29.4	10.8	29.8801	30.039	29.710	0 329	.1702	85.3	30.5	S.W.	25.8	10.0	10	10	91	. ..	1.5	0.20	21
22	16.75	34.5	10.6	23 9	30.4680	30.587	30 182	0.406	.0702	70.8	9.8	N.E.	13.8	5.0	10	0	49	....	0.2	0 02	22
23	18.08	29 6	5.6	24 0	30.3470	30.633	29.917	0.716	.1025	79 8	16.5	N.E.	16.3	8 3	10	0	00	....	0 9	0.08	23
24	37.50	42.9	26.4	16.5	29.5352	29.869	29.441	0.428	.2022	88.8	34.5	S.E.	21 2	10.0	10	10	04	0.21	....	0.21	24
25	34.37	42.0	26.9	15.1	29.8790	30 109	29.620	0.489	.1450	71 5	26.2	S.W.	20 0	8.3	10	7	34	0.01	...	0.01	25
SUNDAY.....26	. . .	32.5	18.6	13.9	.....	.....	.....	.....	.....	..	....	N.	15.3	...	..	..	71	...	....	...	26 ... .SUNDAY
27	26.37	33.2	19.1	14.1	30.2957	30 367	30.264	0.103	.1123	77.8	21 2	N.	16.6	0.3	1	0	96	....	....	....	27
28	21.63	25.7	14.5	11 2	30.4737	30.512	30 444	0.068	.0765	66.5	12.2	N.	16 8	2 3	10	0	66	....	....	...	28
29	27.03	33.6	20.5	13.1	30.4280	30.543	30 245	0 298	.1168	77.7	21.3	S.W.	16.8	2.2	7	0	80	....	....	....	29
30	22.75	33.7	26.5	7.2	29.8103	30.148	29.670	0.478	.1618	86.3	29.3	S.	24.3	9 8	10	9	00	....	....	....	30
31	35.10	38 6	28.7	9.9	29.8553	29 911	29.737	0.124	.1587	76.8	29.0	W.	18 7	7.8	10	1	30	....	0 08	0.11	31
....Means	25.25	32.10	17.58	14.52	30.0136	.....	.....	0.269	.1150	77.5	19.4	S. 46° W.	19.6	5.4	....	...	41	1.28	6 1	1.97	Sums .....
19 Years means for and including this month	24 02	31.36	16.51	14.8	29.9694	.....	.....	0.261	.1071	75.6	....	.....	....	6 1	....	...	40 3	0.94	24 5	3 38	19 Years means for and including this month.

ANALYSIS OF WIND RECORD.

Direction.....	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
Miles	1621	1870	61	1306	1211	6381	1507	647
Duration in hrs..	85	105	5	66	77	294	76	36
Mean velocity...	19 1	17 8	12.2	19.8	15.7	21.7	19.8	18.0

Greatest mileage in one hour was 58 on the 15th.
Greatest velocity in gusts 64 miles per hour, on the 15th.
Resultant mileage 5820.

Resultant direction, S. 46° W.
Total mileage, 14,604.
Average mileage per hour 19 6.

* Barometer readings reduced to sea-level and temperature of 32° Fahrenheit.
§ Observed.
† Pressure of vapour in inches of mercury.
‡ Humidity relative, saturation being 100.
¶ 12 years only

The greatest heat was 42.9 on the 24th; the greatest cold was —0.3 on the 18th, giving a rang of temperature of 43.2 degrees. Warmest day was the 24th. Coldest day was the 18th. Highest barometer reading was 30.633 on the 23rd; lowest barometer was 29.441 on the 24th, giving a range of 1.192 inches.

Maximum relative humidity was 98 on the 14th, and 24th.
Minimum relative humidity was 38 on the 4th.
Rain fell on 5 days.
Snow fell on 9 days.
Rain or snow fell on 14 days.
An Aurora was observed on 1 night.
Hoar frost on 6 days.
Lunar halo on 1 day.
Lunar coronas on the 20th and 22nd.
Fog on 1 day.
Solar halo on 19th.
Lightning on 23rd.

ABSTRACT FOR THE MONTH OF APRIL, 1893.

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

DAY.	THERMOMETER. Mean.	Max.	Min.	Range.	* BAROMETER. Mean.	§ Max.	§ Min.	Range.	† Mean pressure of vapour.	‡ Mean relative humidity.	Dew point.	WIND. General direction.	Mean velocity in miles per hour	SKY CLOUDED IN TENTHS. Mean.	Max.	Min.	Per cent. of Possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	38.58	44.8	30.0	14.8	29.4060	29.685	29.204	.481	.1918	80.0	33.0	S.W.	29.2	8.0	10	3	00	0.40	....	0.40	1	
SUNDAY.. 2	.....	34.5	12.2	22.3	.....	.....	.....	....	.....	...	....	S.W.	18 2	..	..	..	86	....	....	0.12	2	SUNDAY
3	23.12	28.5	20.4	8.1	30.1512	30.455	29.989	.466	.1043	83.7	18.8	S.E.	12.5	8.3	10	0	60	....	1.4	0.14	3	
4	33.25	45.5	19.7	25.8	29.4985	29.904	29.272	.632	.1593	83.2	28.2	S.W.	21 4	10.0	10	10	00	0 14	....	....	4	
5	28.77	42.4	24.0	18.4	30.0313	30.226	29.780	.446	.0897	56.5	15.7	S.W.	26.5	4.7	8	0	70	....	....	....	5	
6	19.53	27.8	11.9	15.9	30.5173	30.580	30 377	.203	.0857	80.0	14.8	N.	12.8	0.2	1	0	66	....	....	0.20	6	
7	27.32	34.0	19.7	14.3	30.2522	30.517	29.870	.647	.1318	86.3	23.8	S.E.	20 4	8.3	10	0	00	0.13	0.8	0.14	7	
8	43.40	60.8.	34.0	26.8	29.6483	29.769	29.438	.331	.2118	75.8	35.3	S.E.	30 5	7.0	10	0	09	0.14	....	..	8	
SUNDAY.. 9	.....	42.3	30.7	11.6	.....	.....	.....	....	.....	....	....	N.W.	12.8	....	..	..	97	....	....	....	9	SUNDAY
10	37.88	45.8	30.1	15.7	30.2073	30.243	30.165	.078	.1483	65.0	27.2	S.W.	6 2	5.0	10	0	14	....	....	....	10	
11	41.60	51.1	31.7	19.4	30.3418	30.380	30.246	.134	.1472	57.5	26.8	E.	6.3	1.3	5	0	93	....	....	..	11	
12	46.65	55.8	35.6	20.2	30.2223	30.379	30.070	.309	.1342	42.5	24.5	S.E.	21.5	7.0	10	0	50	Inap.	....	Inap.	12	
13	46.98	60.8	41.5	19.3	29.7978	30.007	29.628	379	.2505	76 2	39.8	S.E.	26.3	7.2	10	0	32	0.04	....	0.04	13	
14	37.80	44.3	31.8	12.5	29.9418	30.015	29.902	.113	.1435	62.7	26.0	S.W.	18.5	6.7	10	0	08	....	....	....	14	
15	28.30	31.8	27.7	4.1	29.8725	29 967	29.774	.193	.1352	87.0	25.0	N.E.	30.5	8.3	10	0	00	....	5.4	0.54	15	
SUNDAY.....16	.....	39.0	31.9	7.1	.....	.....	.....	....	.....	...	....	N.W.	9.5	....	..	..	00	....	....	....	16	SUNDAY
17	36.53	42.9	27.3	15.6	30.1202	30.224	29.982	.242	.1480	67.8	27.0	S.E.	11.6	6.2	10	0	86	....	....	.. .	17	
18	37.42	45.6	32.2	13.4	29.8748	29.941	29.794	.147	.1655	73.2	29.3	N.W.	18.0	6.8	10	0	28	0.01	0.8	0.14	18	
19	33.70	40.8	27.0	13.8	30.0267	30.163	29.962	.201	.1182	61.5	21.7	W.	21.6	0.2	1	0	95	....	....	....	19	
20	39.33	48.6	27.3	21.3	30.1417	30.287	29.940	.347	.1175	51.2	21.8	N.	24.6	6.7	10	0	51	Inap.	....	Inap.	20	
21	39.48	47.7	33.4	14.3	29.7915	29 866	29.707	.159	.1805	74.8	31.5	S.E.	15.1	10.0	10	10	00	0.18	....	0.18	21	
22	41.50	48.7	34.0	14.7	29.6537	29.690	29.622	.068	.1942	75 0	33.8	S.W.	17.1	9 7	10	8	10	....	....	....	22	
SUNDAY.....23	.....	50.4	36.2	14.2	.....	.....	.....	....	.....	....	....	W.	25.0	. ..	..	..	18	0.08	....	0.08	23	SUNDAY
24	37.98	46.4	29.4	17.0	30.1278	30.199	30.051	.148	.1260	55.3	23.0	S.W.	10.4	5.7	10	0	76	....	....	....	24	
25	36.38	44.6	22.5	22.1	30.1175	30.405	29.992	.413	.1388	63.7	24.2	N.W.	16.2	4.8	10	0	67	....	....	....	25	
26	34.75	44.3	21.0	23.3	30.4635	30.552	30.340	.212	.1163	56.7	21.5	W.	9.4	1.7	10	0	91	....	....	....	26	
27	39.98	42.2	36.4	5.8	30.0035	30.216	29.870	.346	.1887	76.2	32.8	S.E.	26.3	10.0	10	10	44	0.20	....	0.20	27	
28	45.32	50.8	39.9	10.9	29.8907	29.926	29.852	.074	.1593	52.7	28.8	S.W.	25 5	6.3	10	0	00	Inap.	....	Inap.	28	
29	44.52	53.5	34.8	18.7	29.9123	29 952	29.864	.088	.1475	50.5	27.2	S.W.	13.9	5.5	10	0	78	....	....	....	29	
SUNDAY.....30	.....	54.9	37.4	17.5	.....	.....	.....	....	.....	....	....	N.	9.2	....	..	..	74	....	....	....	30	SUNDAY
....Means	36.80	45.0	29.0	16.0	30.0005	.....	.....	.274	.1494	67.8	26.5	S. 43° W.	18.1	6.2	..	..	¶42	1.32	8.4	2 18	Sums	
19 Years means for and including this month.....	39.68	48.15	32.07	16.07	29.9464	.....	.....	.206	.1680	66.52	....	.....	....	5.9	..	..	51.3	1.59	6.7	2.26	19 Years means for and including this month.	

ANALYSIS OF WIND RECORD.

Direction.....	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
Miles.....	1032	1086	513	3055	419	3522	1718	1679
Duration in hrs..	64	58	34	166	31	171	103	93
Mean velocity...	16.1	18.7	15.1	18.4	13.5	20.6	16.7	18.5

Greatest mileage in one hour was 53 on the 8th.

Greatest velocity in gusts 64 miles per hour, on the 8th.

Resultant mileage 2855.

Resultant direction, S. 48° W.

Total mileage, 13,024.

Average velocity, 18.1 m. per hour.

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

§ Observed.

† Pressure of vapour in inches of mercury.

‡ Humidity relative, saturation being 100.

¶ 12 years only.

The greatest heat was 60.8 on the 8th and 13th; the greatest cold was 11.9 on the 6th, giving a range of temperature of 48.9 degrees. Warmest day was the 13th. Coldest day was the 6th. Highest barometer reading was 30.580 on the 6th; lowest barometer was 29.204 on the 1st, giving a range of 1.376 inches. Maximum relative humidity was 97 on the 1st and 3rd. Minimum relative humidity was 24 on the 20th.

Rain fell on 12 days.

Snow fell on 4 days.

Rain or snow fell on 14 days.

Auroras were observed on 3 nights.

Lunar halo on 4 nights.

Lunar corona on the 26th.

Very heavy thunderstorm on the 7th.