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The Cabinet Anticlinal.

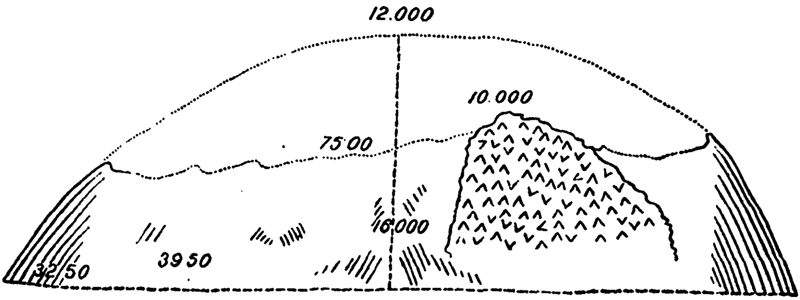
By Herbert R. Wood.

A short study of a range of mountains on the border lines of Idaho and Montana, known as the Cabinet Range, developed a few interesting facts which I have noted down. The range has a trend, or the axis of the anticlinal has a trend 20° to 25° E. of south for a distance of 30 miles, the Kootenai River cutting through it near its upper end. It forms no doubt a spur, a broken continuation of the Kootenai Range in Southern British Columbia, or a southern extension of Dawson's[1] Gold Range which is known farther south as the Cœur d'Alene and Bitter Root Ranges. The rocks consist of graphitic slates or shales which have a black streak, dark argillites near the central portions of the Anticlinal which has a probable width of 8 or 10 miles, heavily bedded quartzites of greenish grey color, compact or more coarse, and of a dull red color, owing to oxidation.

No evidences of fossils were obtained in the rocks, though graptolites were looked for. A number of veins parallel with the strike of the anticlinal and near the axial line, carrying argentiferous galenas, are in the black graphitic

[1] See Dawson on Mineral Wealth of British Columbia.

FIG. I.



8 TO 10 MILES

shales, thin-bedded quartzites, which I observed only along the axial portions. The above figure shows a transverse section of the anticlinal taken at Snow Shoe Gulch, twenty miles south-east of the Kootenai. The heights given are barometrical measurements, save that given as 10,000 feet, (which is the height of Mount Ibec as recorded by an English traveller who made the ascent). The western flank of the range which I did not examine, however, closely—is the least denuded, and has resisted the abrasion of the ice, because of a granitic upthrow which extends north and south for eight or ten miles or more. A number of parallel streams flowing east have their sources in the snows of the higher western flank, deep gulches having been formed four and five miles in length with an east and west trend.

Glacial striations are observable along the flanks of the gulches. The grooved and polished surfaces of rocks along the sides of the gulches, show glacial striæ 43° W. of south. This gulch rises about 300 feet per mile and is perhaps three miles in length. The dip 35° E.N.E. as secured at Cherry Creek, which flows along the eastern flank of the range, represents the outer eastern margin of the anticlinal fold, which is about four miles from the axis of the fold, or to the point marked on the figure as 5,200 feet above the sea. Roughly speaking the thickness of the upheaved strata is from 12,000 to 15,000 feet. Taking four miles as the length of the base line from the outer edge of the anticlinal to the centre or axis, and the angle as 35° at which the strata at this extreme eastern margin of the fold dip east, the length of the vertical is 12,000 feet, showing a great area of denudation of at least 4,500 feet. Much of this detrital material is piled along the eastern flanks at the mouth of the gulch on the already denuded strata, which denudation preceded the glacial period. As to the exact age of the rocks, I am as yet in doubt. The evidence I have obtained is as follows: One hundred miles east of this point the lower Cambrian quartzitic series is found, consisting of heavily bedded greyish quartzites, pinkish-red quartzites, and red argillites and sandstones. In the interval a great anticlinal of more than one fold is observed. The rocks are greyish-black slates, quartzites, shales, etc. The margin of the Cambrian ocean extended apparently then along the eastern flank of the Bitter Root Range, a series of Huronian slate-schists being largely denuded, which is a bedded quartz porphyry and gneiss with distinct granitic areas, the whole coeval with Pilot Knob of South Eastern Missouri, north westerly along 114° to Tobacco Plains at the 49th parallel and thence into British Columbia. In the Correlation of the Cambrian series by Walcott, it will be seen on page 323, that he says "the Cambrian rocks of Montana are restricted to the southern portion of the strata." This is undoubtedly an error since I have examined them south of the boundary and still farther south of this in the vicinity of Missoula, ripple marks, cross-bedding, and all the evidences abound of marginal shallows and shore lines. This peculiar series of rocks I have not observed west of this. Selwyn notes[2] a series of graphitic slates and shales in which no fossils were found in British Columbia. He is inclined to call them Cambro-Silurian (ordovician). Dawson[3] says, "Granites and crystalline schists of great age are abundant in the Gold

[2] See Mineral Wealth of British Columbia, p. 63.

[3] Dawson Mineral Wealth of British Columbia, p. 8,

Range, together with great masses of palæozoic rocks, respecting the structural relations of which very little is as yet known." Considering their position, the character of the rocks, the absence of fossils, their relationship both to the ranges of British Columbia and the southern country (the Cœur d'Alene and Thompson Falls country), I am inclined to call them pre Cambrian or Huronian.

This upheaval occurred in all probability during the Palæozoic period when the rocks to the east constituting the Cambrian (Upper Cambrian ?) were upheaved. The denudation so enormous has extended over many geological epochs. The range appears to be intersected with dikes of fine grained diabase, but they were not observed in situ save in one instance. Dynamically considered this fold is of great interest. A series of dips and strikes show a variation from the eastern limit of the fold as follows (taken at Snow Shoe Gulch) :

Strike 20° E. of S.;	Dip 38° S. E.;	Elevat. 3,250 feet, 4 miles from axis.
Strike 15° E. of S.;	Dip 45° E.;	Elevat. 5,000 feet, 300 yds. from axis.
Strike 20° E. of S.;	Dip 67° E.;	Elevat. 5,600 feet, 30 yds. from axis.

There is a number of mellow flexures along the base of the gulch about the central portions of the anticlinal one of 60 ft. in width at its apex, another 100 ft. broad. The rocks take a nearly vertical dip, then dip west as follows :—

Strike 30° E. of S.:	Dip 68° or 70° W.;	100 feet west of vertical.
Strike 36° to 40° E. o5 S.:	Dip 62° W.;	120 feet west of former.
Strike 36° to 38° E. of S.;	Dip 50° to 48° W.,	200 feet west of former.

The strike is inconstant, the rocks having a tortuous course, due to unequal pressure and crowding together of rocks confined. Faults and short breaks occur, slips in the formation due to fracture produced by the strain of upheaval. It will be seen by the following observations made eight miles north of this point, that the dip increases suddenly to the vertical. The height where I observed them was 3,700 feet, 500 feet above the gulch bottom or Granite Creek. The distance here from the eastern margin of the anticlinal was four miles, a recorded dip at this point being :

Strike 25° E. of S.:	Dip 88° E.,	Centre of anticlinal.
Strike 25° E. of S.;	Dip 50° W.;	100 feet west of above.

A number of other strikes and dips were taken which have no particular significance. Through the anticlinal, nearly parallel with the strike and its axis, runs a great vein or a series of veins, on which many locations have been made. It cuts the summit of the mountains at the central portion of the anticlinal, and has been traced for ten or twelve miles. This crack, contrary to what might be expected, widens at the base of the mountains and narrows at the summit, and seems to have been produced not so much by the force of upheaval and lateral pressure as by the later subsidence of the fold, due to the instability of the crust. Had it been an anticlinal crack it would have been wide at the summit and narrowed with depth, but it is the reverse, and probably has been produced as above stated by a pulling apart, produced by subsidence.

The smaller anticlinals and the vertical dip occur about 6,000 feet below the original summit of the anticlinal, the greatest pressure having been exerted here. The veins widen at the base, their width as taken in Snow Shoe Gulch at the summit about 7,000 feet being 2½ to 4 feet, while 1,500 feet below this they measure eight or nine feet in width. The strike of the vein is about 25° east of south, slightly to the east of the centre of the anticlinal. It is filled with quartz, some carbonate of iron with alternating bands of galena, zinc blende and iron pyrites, and may be called a rib banded vein. There are many stringers frequently mineralized, extending out on both sides of the vein in the joint cracks which run nearly at right angles to the bedding planes of the formation, eight miles north of the Snow Shoe Gulch. I examined the vein 3,700 feet above the sea and it exhibited a width of a foot or more. The stringers in the joint cracks on both sides were highly mineralized and in one instance a foot or more in width. This crack or fissure does not extend to as great a height in some portions of the anticlinal as in others. There are other large veins parallel with this both east and west of it but differently mineralized. All the veins carry a small percentage of gold, which accounts for the placer beds formed at the mouth of the gulch. The veins were probably filled at the time of the fissuring produced at the upheaval, or as I have stated, at the time of a relaxation of the pressure and subsidence of the fold. The slips and faults would seem to indicate this subsidence. The quartz is no doubt the product of the mechanical energy exerted when the rocks were squeezed and upturned. Some of the more interesting facts regarding this anticlinal fold are :—

The great denudation, at least 6,000 feet having been removed from the upper portion of the anticlinal. The removal of this detritus before the glacial period which left its detrital material at the mouths of the gulches, in piles 700 feet in thickness resting on the eroded upturned strata.

The lateral pressure developed producing small anticlinals in the base of the great fold, with fractures and faults.

The relaxation of the strain and final subsidence producing fissures, filled with galenas, etc.

The variation in dip, which seems to assume a rate proportionate to the strain or pressure. The lateral pressure seems to have been applied by a crowding and pushing of the lower portions of the lateral flanks of the strata included in the upheaval.

New Species of Canadian Fungi.

By J. B. Ellis and J. Dearness.

Leptosphæria Lilii.

Spots pallid, thin, oval, with a narrow, slightly raised reddish border, 4 — 10 mm. in the longer diameter. Perithecia conspicuous, epiphyllous but visible from both sides, 150 — 200 μ. Asci oblong-cylindrical, with a short, nodular base, paraphysate, 50 — 60 $\times$ 7 μ. Sporidia biseriate, fusoid, nearly straight, pale yellow (subhyaline at first), 3-septate, constricted at the middle septum, the cell next above swollen, 15 — 18 $\times$ 3 μ.

Accompanied by a phyllosticta:

Phyllosticta Lilii. Ell. & Dear., in similar perithecia, with sporules, pale umber, 4 — 5 × 3 μ. Doubtless the pycnidial stage of the Leptosphæria.

On leaves of *Lilium Superbum*, London, Can., Aug. 1890. (Herb. D. 259).

Phyllosticta Dircæ.

Spots suborbicular, sometimes confluent, subzonate, margin narrow and nearly black, the centre turning cinereous and early falling out, ½ — 1 cm. Perithecia numerous, reddish, scattered over the entire spot, epiphyllous, but visible below, only the apex erumpent, 60 — 100 μ. Sporules oblong-elliptical, hyaline, bi-nucleate, 5 — 8 × 2½ — 3 μ.

On leaves of *Dirca palustris* London, Can., July, 1892, (Herb. D. 1934). This is probably the spermogonial stage of *Sphærella Dircæ* E. & E. *n.s.* found at the same place.

On the same leaves is another (?) Phyllosticta on spots of the same character but smaller and less regular in shape with sporules 8 — 10 × 2 μ.

Phyllosticta Viburni.

Spots amphigenous, rusty-brown, orbicular, about 2 mm., with a narrow dark border. Perithecia epiphyllous, semi-erumpent, black, convex, 100 — 125 μ. Sporules elliptical, brownish, 4 — 5 × 2½ — 3 μ.

On leaves of *Viburnum lentago*, London, Can., July 1892. This differs from all other known phyllostictas on Viburnum in the color of its sporules.

Phyllosticta Chrysanthemi.

Spots orbicular, 1 — 3 mm. purplish-brown, with an obtuse raised border, sometimes confluent and finally deciduous. Perithecia, epiphyllous, black, innate, minute, 80 — 100 μ. Sporules elliptical, obtuse, smoky-hyaline, 4 — 5 × 2½ — 3 μ.

On leaves of *Chrysanthemum Sinense*, London, Can., Aug., 1890. (Herb. D. 260).

Phyllosticta Clematidis.

Spots mostly marginal, then yellowish or withered but when not on the margin whitish, orbicular, 1 — 3 mm. with narrow reddish border. Perithecia brown, epiphyllous, 50 — 75 μ. Sporules ovate-elliptical, hyaline, 4 — 6 × $2\frac{1}{2}$ — 3 μ.

On leaves of *Clematis Viorna* var. *coccinea*, London, Can., Aug., 1892. (Herb. D. 1991).

Phyllosticta punctata.

Spots small, $\frac{1}{2}$ — 1 mm., angular, often confluent, diaphanous, bordered by an obscure reddish line, finally deciduous. Perithecia brownish, epiphyllous but visible from under side, 50 — 100 μ. Sporules amber-colored, elliptic-oblong, 6 — 8 × 3 μ.

Very destructive to the leaves of the guelder-rose or snow-ball (*Viburnum opulus*) on which it is found. London, Can., Aug., 1892. (Herb. D. 1982).

Vermicularia Podophylli.

Perithecia on black, slightly sunken, roundish areas $\frac{1}{2}$ — 3 c.m., conic-hemispherical, 100 — 200 μ, thin, membranaceous, clothed above with spreading black, septate, bristles 100 — 225 × 4 μ. Sporules nucleate, hyaline, lunate, 16 — 23 × 3 — $3\frac{1}{2}$ μ.

On fruit of *Podophyllum peltatum*, Aug., 1892. (Herb. D. 1964).

Cytispora Pruni.

Tubercles seated on the inner bark, raising the outer bark into pustules, apex barely emergent, ellipsoid or conic, opening through white granular substance by a single mouth from a unilocular or incompletely 2 or more celled whitish interior, $\frac{3}{4}$ — $1\frac{1}{2}$ mm. Sporules fusoid-oblong, 2 — 4 nucleate, non-septate, acute at both ends, arising without perceptible basidia from the hyphal nodular lining of the stroma, 12 — 16 × $2\frac{1}{2}$ — 3 μ.

The tubercles are thickly and more or less regularly scattered on dead branches of *Prunus Virginiana*. London, Can., May, 1892, (Herb. D. 1817). Probably this is the conidial stage of *Cryptospora Pennsylvanica* (B. & C.).

Sphæropsis Viburni.

Spots as in *Phyllosticta Viburni* and on the same leaves, brown, orbicular, distinctly margined with a dark border, 2 — 5 mm. Perithecia amphiphyllous, mostly above, prominent, with a distinct mouth, black, 125 — 200 μ. Sporules oblong-elliptical, dark-brown, 16 — 27 × 10 — 12 μ.

On leaves of *Viburnum lentago*, London, Can., July, 1892, (Herb. D. 1902).

Septoria Lunariæ.

Perithecia gregarious, dark-colored, innate, slightly erumpent, 55 — 85 μ. Sporules straight or flexuous, linear, hyaline, continuous, 10 — 16 × 1 μ.

On silicles of *Lunaria biennis*, London, Aug., 1890, (Herb. D. 244).

Glœosporium Saururi.

Spots dark-brown, sub-orbicular, early deciduous, 5 — 15 mm. Acervuli conspicuous, generally along the veins, hypophyllous, pale-brown, 50 — 180 μ. Conidia binucleate, 10 × 3 μ.

On living leaves of *Saururus cernuus*, London, Can., Aug., 1891, (Herb. D. 843; N. A. F., 2781).

Glœosporium oblongisporum.

Spots suborbicular, pale-brown with a red border, resembling those of *Phyllosticta acericola* C. & E., mottled with minute angular, brown areas bounded by the veinlets, the latter (areas) bear the acervuli which are amphiphyllous but mostly hypophyllous and minute. The discharged conidia spread over the little brown spot and give it when fresh the appearance of bearing a ramularia. Conidia oblong, continuous, 16 — 18 × 2 μ.

On living leaves of *Acer saccharinum* associated with *Septoria belonidium*, E. &. E., London, Can., Sept., 1891, (Herb. D. 912).

Glœosporium Bowmani.

Spots pale-brown, bordered by a narrow bright red line obscurely zonate, along the edge of the leaf and extending from margin to midrib or indefinitely along the margin. Acervuli epiphyllous, pustulate, concolorous with spot or paler, 90 — 180 μ. Conidia numerous, oblong, hyaline, binucleate 5 — 6 × 1½ — 2 μ.

On leaves of *Epilobium coloratum*, Port Stanley, Ont., (Prof. J. H. Bowman) Aug., 1892, (Herb. D. 2076).

Cylindrosporium longisporum.

Spots pale-brown, orbicular, border brown, 2 — 5 mm. Acervuli small, dark, epiphyllous, 35 — 90 μ. Conidia straight or mostly curved, 8 — 14 septate, 60 — 105 × 3 — 4½ μ.

On leaves of *Lupinus perennis*, July, 1891, London, Can. (Herb. D. 791 , N. A. F., 2784).

Cylindrosporum Chrysanthemi.

Spots large (1 cm. or more), sub-indefinite, nearly black. Acervuli immersed, 100—170 μ diam. Conidia fusoid, nearly straight, 50 — 100 × 3—4½ μ, issuing copiously on both surfaces of the leaf.

On leaves of *Chrysanthemum Sinense*, quickly killing or deforming plants in Greenway's Chrysanthemum houses, London, Can., Nov., 1892, (Herb. D. 2081).

Septoria Chrysanthemi, Cavarra, (Fungi Langobardiæ, 40), has outwardly the same appearance, but it has true perithecia; the sporules are only 35—65 × 1½ — 2 μ and not septate.

Cercospora Pontederiæ.

Spots reddish-brown, indefinite, extending from 1 — 5 cm. or elliptical and more definitely limited 3 — 5 × 2 — 3 mm. and sometimes concave above. Hyphæ epiphyllous, tufted, on a small tubercular base, sub-hyaline, simple, continuous, nearly straight 10 — 15 × 2½ μ. Conidia slender, linear-cylindrical, hyaline, faintly nucleate, 15 — 40 × 2

μ, straight or curved towards the narrow end. Allied to *C. Nymphæacea*, C. & E.

On leaves of *Pontederia cordata*. Niagara-on-the-Lake, Aug., 1891, (Herb. D. 1800).

Cercospora Gerardiæ.

The areas bearing the fungus scarcely perceptible on the upper side of the green leaf, but plainly visible on the under side by the smoky, effused tufts of hyphæ; these areas are irregular, sub-angular, and bounded by the veinlets. Hyphæ tufted, hypophyllous, olivaceous, simple, septate, tapering upward, obtuse and toothed, swollen at base, 25 — 45 × 3 — 7 μ. Conidia slender, sub-olivaceous, faintly 3 — 5 or more-septate, 50 — 112 × 3 — 3½ μ.

On leaves of *Gerardia quercifolia*, Walpole Island, St. Clair River, July, 1892, (Herb. D. 1957).

Macrosporium florigenum.

Effused forming a thin olive-black layer consisting of dark-brown nucleate, septate, prostrate hyphæ sending up sub-fasciculate fertile branches 30 — 100 × 5 μ, subhyaline at the tips, conidia lateral and terminal, clavate, 3 — 5-septate, usually one, occasionally two longitudinal septa, 15— 40 × 12 — 18 μ.

This fungus ran rapidly over the open flowers of China asters in gardens in London, Can., Sept., 1891. A bed of asters in fine flower would within a day or two of the appearance of the fungus have every flower, young and old, darkened and spoiled. One florist, Mr. Gammage, speaking of it, said: "It seemed as though a wind had blown over the asters and blackened them, so quickly was it done." (Herb. D. 1459).

Ramularia Melampyri.

Hyphæ simple, hyaline, 25 — 70 × 3 μ, in tufts arising from an effused nodular mycelium forming a mealy whitish coating on the lower surface of the leaf which becomes curled and deformed. Conidia fusoid-oblong, hyaline, granular, continuous (*Ovularia, Sacc.*) $10 - 20 \times 4 - 5\ \mu$, very abundant.

On leaves of *Melampyrum Americanum*, Port Stanley, Ont., Aug., 1892. (Herb. D. 1967).

Botrytis Epichloes.

Hyphæ effused, forming an olivaceous coating on its host, sparingly branched, subgeniculate above, torulose, $25 - 40 \times 2\frac{1}{2} - 3\ \mu$. Conidia lateral and terminal, fusoid-oblong, nucleate, hyaline, $8 - 12 \times 3\ \mu$.

Parasitic on the stroma of *Epichloe typhina*, (Pers.) London, Can., July, 1892, (Herb. D. 1943).

The Horn Fly.

(*Haematobia serrata, Robineau Desvoidy*).

By A. F. Winn.

This very troublesome pest has made its first appearance in several parts of Canada, including the Province of Quebec, during the past summer, and I have been asked to give a few notes regarding it in the Record of Science.

I have only seen the insect in nature in one place, near Boucherville, and have had no opportunity as yet for personal observation. There is little, if anything, still to be learned, however, regarding its life history and habits, as they have been fully worked out by the United States Division of Entomology, and published in their valuable periodical "Insect Life." Our own Department of Agriculture has also recently issued a special Bulletin (No. 14) by the Dominion Entomologist, Mr. Fletcher, on the subject.

The fly, like so many of our other injurious insects, is a European species, having been known there since 1830, and has no doubt been introduced into this country with some imported cattle. The first record of its appearance in large numbers is from Camden, New Jersey, in August, 1887. The next season they spread very considerably, and now extend as far south as Florida, Alabama, Mississippi and

Texas; west to Iowa, Ohio, Kentucky and Kansas; and north through Massachusets and New York into Canada. How much further it will go next summer it is impossible to say, but one thing is certain, and that is, that the farmers of this Province will have plenty of them.

In shape the mature insect is similar to the common house fly, but is only about one third of the size, and of a dark grey color, the body covered with black spines. When settled on the cattle the flies assume two different positions. While at rest on the horns, the wings are almost flat on the back of the abdomen, overlapping one another at the base, and the beak is horizontal; when feeding, the wings are slightly elevated, and held out from the body at an angle of about 60 degrees, and the beak is nearly vertical.

The habit of the flies settling in such masses on the base of the horns, has given rise to many popular errors, the principal one being that the eggs are laid there, and that maggots cause the horn to rot and penetrate through it into the brain. As a matter of fact, the horn is not injured in any way by the flies, and this situation is chosen because they are out of reach of both the head and the tail of the animal. Between the head and foreshoulders they also congregate, but in smaller numbers.

Some breeds of cattle are much more affected than others, by the bites; horses and other animals are not attacked at all. To bite their victims the flies have to work their way down through the hair to the skin, and one would think that the bristles of their bodies would get entangled, but they do not; as soon as the animal gives a stroke of the tail, every fly is on the wing, forming a small cloud about a foot in the air, ready to alight in a moment as soon as the danger is over.

The bites produce great irritation, and sores are often formed by the animals rubbing themselves against trees and fences. If the flies lasted only a few days each season they could do but little harm, but unfortunately the preparatory stages only last about 17 days, and therefore there is a new brood continually appearing to take the place of the former one, from May till September. The animals, so constantly tormented, fall off very much in weight, and the yield of milk is reduced in some cases to the extent of one-quarter to one-half.

The eggs are deposited singly, between 9 a.m. and 4 p.m. on the surface of the moist dung the moment it is dropped. They are of a brown color .05 of an inch long, from which the minute pure white maggots, or larvae, hatch in less than 24 hours. They immediately descend into the dung a short distance, feeding on the liquid portions, which is their only food. In about a week they are full grown, about .4 of an inch long and of a dirty white color. Entering the ground to become a brown pupae, they remain only about five days in midsummer before the perfect fly makes its appearance, but in the last brood the whole winter is passed as pupae, the flies emerging the following spring.

Of remedies for this pest, there are two distinct classes, one to prevent the flies from biting the cattle, and the other to kill off the insects either in the mature or larval stages. As preventives, almost any greasy substance will keep away the flies for a day or two. Train oil, axle grease, and tallow have all been used with success—the train oil seeming to be the most lasting in its effects.

The flies may be killed by applying kerosene emulsion to the cows with a sponge, or in a large herd by spraying them with a pump. A substance known as "X. O. Dust," made by a Baltimore firm is highly spoken of as an insecticide, and costs about 25 cents a pound, but its effects last only about two days.

The most practical way to combat this insect is to attack the larval stage, immediately after the flies appear in the spring, as every one killed then prevents the existance of a large number later. The maggots can only live in the droppings when moist, and consequently any substance that will absorb the moisture will destroy them. For this purpose lime, plaster, and wood ashes have been recommended, and a shovelful on each dropping would destroy all the larvae. If none of these are at hand dry earth would absorb sufficient of the moisture to kill most of them, and a still more practical suggestion is that of Prof. J. B. Smith, "By sending a boy over the pasture every other day with a shovel to thoroughly spread out the cow droppings, all eggs and larvae would be destroyed." This would be as effective in wet weather, when the substance would be wasted away, as in dry weather, when it would dry up.

I conclude with a copy of a letter received from Mr. W. A. Oswald, of Belleriviere, Que., in answer to an inquiry of mine regarding the first appearance and habits in his district, which is only some twenty miles from Montreal :—

BELLERIVIERE, Oct. 10th, 1892.

"The Horn fly first made its appearance in this locality about the middle of July, 1892, and from their sudden appearance, and annoying the cattle in such vast numbers, they caused alarm to dairymen, for it was evident that cattle attacked by them failed in flesh, and their yield of milk was much reduced. A noticeable feature was the manner in which it attacked cattle, always settling on the back of the animal immediately behind the shoulder blade, where the heads or tails of the animals could not reach to brush them off. Young cattle, whether from the tenderness of the skin, or the inadequate length of the tail to keep them off seemed to suffer more from their attacks than the older animals. One animal in our herd, a yearling bull was confined to a dark stable for a time, but even there they clung to his sides, until he got a sponging with a weak solution of carbolic acid, or coal oil, which kept them off only a few days unless another sponging was applied. The manner in which they settle around the base of the horns may be compared to the seeds in a sunflower head, so thickly do they congregate, covering the base of the horns completely for two or three inches. Coal tar applied freely to the horns, but not so much as to endanger the animal's eyes keeps them off entirely for a few days. Train oil was applied by some, and pronounced effective in freeing the animals from the flies for a period of five or six days, when it had to be repeated to keep them free from the pest."

TREMATOBOLUS.

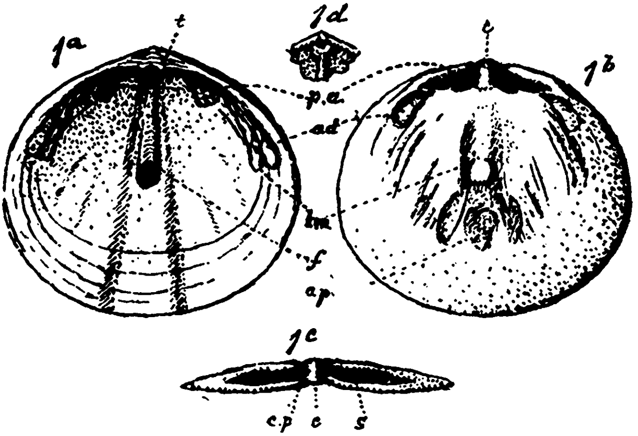
AN ARTICULATE BRACHIOPOD OF THE INARTICULATE ORDER.

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

A remarkable shell has come to light in working over the material from Band *b* of Division 1 of the St. John Group, which seems worthy of special notice.

TREMATOBOLUS, n. gen.[1]

TREMATOBOLUS INSIGNIS. Fig. 1 *a* to *d*.



1. *Trematobolus insignis.* Mag. $\frac{4}{1}$—1*a*. Ventral valve—1*b*. Dorsal valve—1*c*. Back view of hinge line of dorsal valve—1*d*. inside of beak of ventral valve (beneath the hinge area.)

Notation of the muscles, &c.—*p.a.* Posterior adductors—*a.d.* Adjustor muscles—*l.m.* Lateral muscles—*a.p.* Anterior depression—*c.p.* Cardinal pits—c. Cardinal process—*s.* Hinge socket—*t.* Dentiform process of the ventral valve—*f.* Foramen.

Shell a meniscus, inequi-valve, articulate. Valves thin, closely applied. Shell substance calcareo-corneous ?

Dorsal valve, oblate, concave. At the hinge is a long narrow socket, at right angles to the plane of the valve, fitted to receive the anterior edge of the area of the ventral valve. The socket is interrupted in the middle by a cardinal process; this process extends into the interior of the

[1] Name from *trema* and *obolos*.

valve, and is flanked on each side by a small, deep pit. At the back of the shell on each side of the cardinal process is a dental plate and in front of it two transverse, lobed, triangular depressions, supposed to be due to the posterior adductor (cardinal ?) muscles. On each side of the shell adjoining these depressions are the scars of the adjustor muscles. There is a broad shallow groove along the median line of the valve which would mark the place of the anterior adductor muscles ; this depression is divided lengthwise by a low ridge, and forks at the middle of the valve into two arched branches, which include between them a shorter depression ; the arched branches, would perhaps be the scars of the lateral adjustors. There are several faint raised vascular lines (about four on each side of the median line of the valve) ; of these lines the outer are more arched than the inner, and all radiate toward the margin of the valve.[1]

The ventral valve is moderately convex and oblately orbicular, with a short blunt umbo; and has two, low gradually diverging ridges marking off a narrow, triangular, median area. There is a low, striated hinge area, the front edge of which is slightly toothed, to fit the small pits on each side of the cardinal process of the dorsal valve. The interior of the ventral valve has a prominent ridge extending from beneath the area, half way to the front of the valve; this ridge arises from the indentation of the back of the valve by the pedicle groove ; the surface of the ridge is seamed transversely by arched ridgelets, which marked the changing position of the foramen of the pedicle, as the shell grew ; the ridge does not quite reach the umbo but is separated from it by a small, low boss, having a central depression, or umbilicus. In the ventral valve the position of the posterior adductors is marked by a pair of triangular scars, beginning under the outer part of the hinge. Each scar shows the points of attachment of three muscular bands. The scars of the ad-

[1] The boss at the centre of this valve appears to be the clay plug of the foramen of the ventral valve, cemented to the dorsal valve.

justor muscles, and of the lateral (anterior adductor?) muscles, run parallel to each other along the sides of the valve, from near the hinge line; and they extend further forward than do the scars of the adjustors of the dorsal valve.

Sculpture—As we have only the interior of this shell the surface markings of the outside are scarcely discernible; towards the front of the valve, however, they become visible under the lens, and are seen to consist of fine concentric ridges; and very fine, broken, radiating striæ, visible only in a few places.

Size—Length of the dorsal valve 8 mm., width 10 mm. The ventral valve is 1 mm., longer than the dorsal.

Horizon and *Locality*—Found by W. D. Matthew in the upper part of the second assise of Band *b* in Division 1, (1 *b.* 2") of the St. John Group at Hanford Brook, St. Martin's, N.B., Canada.

This remarkable brachiopod is a synthetic form, showing affinities in several directions; it is thus connected chiefly with the Obolidæ, but differs from all in the articulate connection of the valves. The arrangement of the muscles is similar to that in Obolus and Obelella, but as regards the ventral valve is modified in the direction of Siphonotreta. The position of the pedicle corresponds almost exactly with that of *Schizambon* (?) *fissus* var. *Canadensis* Hall, of the Utica Slate,[1] but in our species the interior of the beak exhibits a peculiarity, which may indicate a habit in the young shell (or in an ancestral form of the species) different from that of the adult; this peculiarity is the existence of a small boss or callus in the umbo, which, having a central umbilicus, appears to be homologous with the boss and foramen in the umbo of such shells as Acrotreta and Linnarssonia.[2] Evidently the pedicle did not go out at this point in the adult shell, but the umbilicus may indicate that it did at an early stage of growth. According to Kutoraga[3]

[1] See Genera of Palæozoic Brachiopods, Hall & Clarke, Pl. IV, fig. 33.
[2] Op. Cit. Pl. III, figs. 35, 38 and 39.
[3] Op. Cit. Pl. IV, figs. 22 and 23.

Siphonotreta had a mammiform swelling around the tube in the umbo.

The nature of the hinge connection too, is very remarkable, and implies a mechanism similar to that of the articulate brachiopods. Compare for instance the dorsal valve of *Orthis strophomenoides*, Hall,[1] (or *O. testudinaria*, Dal.[2]) with its central ridge and cardinal process, with that of Trematobolus; in the Orthis, the sockets of the dorsal valve afford a rest similar to that furnished by the elongated hinge pit of the corresponding valve of the former genus; in the Orthis, however, the socket is in the inner face of the valve and met the tooth only of the opposite valve, whereas in our genus the whole base of the dorsal is applied to the ventral.

The genus Barroisiella of the Genessee shale shows a mechanism at the hinge somewhat similar to that of Trematobolus, in the bosses on each side of the pedicle groove of the ventral valve,[3] but no such cardinal process is figured on the dorsal valve as that which exists in the latter genus.

In the form of the median muscular imprint of the dorsal valve Trematobolus will be seen to resemble the corresponding sculpture of the dorsal valve in Obolus, as figured by Kutoraga.[4] In both genera this depression breaks up at the centre of the valve, into three scars of which the two outer ones arch around the middle one.

This genus differs from Obolus and Obolella in its perforated ventral valve; from Siphonotreta in the perforation being in front of the beak, and in the absence of the sipho; from Schizambon in its articulate valves, and in the arrangement of the muscles of the ventral valve; and from all these in its concave dorsal valve. From Michwitzia, which also has a concave dorsal valve, in its perforated ventral valve.

In general Trematobolus may be looked upon as combining the features of Siphonotreta, Schizambon and Obolus in its ventral valve with those of Obolus, Obolella and Orthis in its dorsal valve.

[1] Op. Cit. Pl. V, fig. 26. [2] Op. Cit. Pl. VB, fig. 39.

[3] Op. Cit. page 80, fig. 34.

[4] Op. Cit. Pl. II, fig. 14 and 15. The hinge of the dorsal valve, fig. 16, (copied from Meek & Worthen) evidently does not fit the cardinal line of the ventral valve.

The Colours of Flowers in Relation to Time of Flowering.

By A. T. Drummond.

A new interest has, during recent years, been given to the study of plant life by the researches of Wallace, Darwin, Lubbock, Grant Allen and others. We had been led to think, and it seemed a natural conclusion, that the fragrant odours, the brilliant colours, the varied forms and the distinctive habits of flowers were all intended for the pleasure and education of man. There had been the suggestion that these characteristics had their part in the economy of the plant itself, but this suggestion had not attracted much attention. Now we find that in at least a very large number of plants, the beautiful tints and curious shapes of the petals and sepals, the honey which flowers secrete, and the odours, fragrant or offensive, which they give out, all play their part in the processes of reproduction, by attracting to them insects which unconsciously, in their turn, carry the pollen from one flower to another, and thus perfect fertilization. Whilst the colour, the scent, the honey or pollen form the objects of the insect's visits, the plant has in turn, in process of long time, adapted itself in habit and in the brilliancy of hue and in the shape of its flowers to attract the insect, and cause it to carry the pollen from flower to flower and plant to plant.

The question of colour in connection with plant life has, however, a further interest, to which I desire in this paper to refer. Among flowers, different colours preponderate during different months of the year, and this will be found to be true, not merely of the great masses of flowers taken as they appear, month by month, without reference to species, but also in relation to the species themselves. Everyone who has collected flowers must have observed that whilst in the spring white is the predominating hue, and in August yellow prevails, the month of September is characterized in our latitude by the preponderance of tints of blue and purple. Sometimes a few species will, through the great abundance of the individuals of each, or the size of their flowers, give to a locality the preponderating colour. Thus, in early spring, the Blood root and the Trillium, in patches here and there, mottle the ground with white, whilst in August and September the Golden Rods and the Asters give the yellows and blues of the foreground of our landscapes. The subject is one of some interest, and I have recently attempted, in a general way, to ascertain what proportion, in our northern temperate latitude, one colour bears to another, month by month, taking, not the general mass of the individuals of each species, for that would be difficult over any wide area, but the number of species having one colour in contrast with the number having another.

In making this attempt I have taken into account, as far as variations and differences of locality would allow of comparisons being made, the colours and times of flowering of 539 of the plants of Ontario and Quebec. The most striking feature at once observable is the preponderance of white flowers, which form rather more than one-third of the whole. Following somewhat closely upon them, the Composites contributing largely, are the yellow flowers, which include about one-fourth, whilst the purples and blues are much less numerous, and comprise about one-ninth and one-tenth respectively of the whole. We have long known that a considerable proportion of the Arctic plants have white blooms, and a preponderance of this colour appears to be continued into northern temperate latitudes as well.

It has been suggested that the flowers which have undergone least modification are usually yellow or white, or in other words, that these are more or less original colours among flowers, a higher development leading to pink, red, purple and blue. Grant Allen has gone further in considering that "all flowers, it would seem, were, in their earliest form, yellow; then some of them became white, after that a few of them grew to be red or purple, and, finally, a comparatively small number acquired various shades of lilac, mauve, violet or blue." This is a very broad assertion, needing, probably, more careful enquiry, and that over the widest possible area. Judging from the flora of North Eastern America alone, I should have been inclined to regard white as the earliest, as it is, in our latitude, a preponderating colour among flowers. There is an intimate association between light and the development of colour among plants. Where light plays a less important part, as among night flowers, the tints of the petals are white, as if that were the starting colour. The colours of the spectrum, separately, and blended into one as white, are, besides, the colours we meet with among flowers. Again, variation in colour in the same species is a well-known feature among some of our American forms, but this variation is, as a rule, from purple, blue or rosé to white, or the reverse. Thus *Viola cucullata* shades from purple and blue to white, and some of the Asters and species of Mimulus, Veronica, Hepatica and others have as wide a range. Should this variation be regarded as, in any sense, progression or degeneration, the tendency would be from or to the original color, and it is but rarely with us that the tendency is to or from yellow. The little Bluets are said to sometimes produce even white flowers with a yellow eye, *Oxytropis Campestris* to have yellowish or white flowers, and *Anemone Multifida* to vary in colour from red to greenish yellow and white. We have also a few cream-coloured flowers, but it is, perhaps, more easy to predicate of these that they have sprung from a white than a yellow ancestor.

If we consider the relative ages of the species comprising the flora of North Eastern America so far as there are data on which to found an opinion, we find that *Viburnum pubescens*, which occurs in the Eocene, has white blossoms, that *Magnolia glauca* found in the Pliocene, has also white flowers, that a very large proportion of the plants common to Europe and America—the remains of one of our older floras—has also white flowers, whilst the newer creations, like the Composites—an order of no great antiquity—have a large proportion bearing yellow flowers. The whole question of priority of colour is one for speculation rather than one susceptible of proof.

In considering the colours prevailing during the different months, it must be remembered that in time of flowering and in, probably, the length of continuance in bloom, a species in the Ontario peninsula bordering Lake Erie will differ from the same species in the neighbourhood of Montreal or Quebec. Thus, the spring flowers which may be collected during the first and second weeks of April in the vicinity of London, Ontario, are not found in bloom around Montreal until about two or three weeks later. Again, species occur in the Ontario peninsula which are not found to the eastward of it. The conclusions drawn must therefore be, in a sense, general.

The following is, then, approximately, the distribution of the 539 species before referred to, throughout the summer months, according to colour, a species continuing in flower into another month, appearing in that month's column as well, in order to show the prevalence of colour for that month.

	April.	May.	June.	July.	Aug.	Sept.	Oct.
White	16	73	82	79	50	23	12
Yellow	8	23	34	49	73	52	2
Blue	..	14	14	17	16	21	17
Violet and Purple	6	14	25	33	22	27	14
Green, and shades of it	6	13	17	14	7	3	1
Rose, Pink and Red	..	11	8	8	6	3	..

April, May and even June and July are thus remarkable for the prevalence of white, July and especially August of yellow, and September and October of purple and blue.

It is suggestive that the appearance of white as the predominating colour in early spring has its explanation, in part, in the absence of bees and other insects which commence their search for honey later on, and prefer the more highly colored flowers. Where the process of fertilization depends on the aid of certain insects, there would be no reason why these plants should *burst into bloom before* these insects appeared. Opportuneness is characteristic of the operations of nature. When bees, wasps, butterflies, moths and flies abound, the plants which they more especially frequent will be found presenting their flowers in all their attractiveness, and ready to engage the attention of these insects. And there is design in all this, for, as Sir John Lubbock says, "just as our gardeners, by selecting seed from the most beautiful varieties, have done so much to adorn our gardens, so have insects, by fertilizing the largest and most brilliant flowers, contributed unconsciously, but not less effectually, to the beauty of our woods and fields."

NOTES ON AN OLD INDIAN ENCAMPMENT.

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

Cape Tormentine is the general name for a group of headlands forming the part of New Brunswick nearest to Prince Edward Island. On Jourmain Island, now joined to the mainland by salt marsh, is Money Point, the one of these headlands selected as the point of departure for the proposed tunnel to connect New Brunswick with Prince Edward Island. The coast in this neighborhood seems to have been a favorite camping ground for the Micmacs. Stone implements of all sorts are found in considerable numbers. Five or six very good axes were found last summer. Arrow-heads are, I believe, not often found. The axes and other cutting and scraping implements are made of diorite, boulders of which are quite common along the shores of Cape Tormentine, although rather rare inland. The red Permian sandstone is here rather soft, and yields rapidly to the action of salt water. The shores are thus undermined, and the overlying boulder clay is brought down. The diorite boulders are thus strewn along the shore, intermingled with slabs and rounded fragments of sandstone, granite boulders, etc. From the number of halffinished implements found, it would seem that the aborigines visited this place for the purpose of manufacturing. There is to be seen on the shore of Jourmain Island a large diorite boulder, weighing several tons, which has evidently served as a source of material. It is easy to see that pieces have been split off. The upper surface is quite rough and new as compared with less accessible parts. The operation of splitting must have been very difficult with the means at the disposal of the Indians. This diorite takes a beautiful polish, which brings out the colours of the feldspar and the hornblende which compose it. It is quite evident, however, that the fashioners of these stone implements were a very inferior race. Their workmanship is of the rudest. Perhaps the comparative scarcity of arrow-heads has some significance in this respect. A beautifully wrought arrow-head of milky quartz was found last September quite near the surface in Baie Verte (about 20 miles westerly from Cape Tormentine). This, however, I imagine to belong to a later age. In a cove between Money Point and the bluff headland upon which Cape Tormentine light stands is to be found the camp-ground of these rude savages. The washing away of the shore has exposed a vertical section of a shell-midden, and, not far away, of a fire-place. These are about 18 inches below the present surface. The shells are mostly those of the edible mussel (Mytilus edulis), with a few large whelks (Lucata heros?) These shell-fish are still very plentiful along the shores. The site of the fire-place is marked by ashes, small pieces of charcoal, and "burned" stones.

Here in this quiet cove, sheltered from the north winds by the highland of Money Point, at a place where the land sloped gently down towards the sea, and the sandy beach free from rocks offered a safe landing place for their canoes, the savages built their wigwams, replenished their stock of implements, and meanwhile lived upon mussel and whelks, with perhaps an occasional striped bass; although these vigorous fish would in all likelihood be too strong for their imperfect lines and hooks.

A Visit to Lake Superior Mines.

By W. A. Carlyle, Ma. E. McGill University.

The following pages cannot be consistently classed as pertaining to purely scientific matters, describing, as they do, a few weeks spent with much profit and interest among those celebrated mines of Lake Superior, in visiting the most noted mines, observing the many details of work and collecting data as to the geology of the deposits, the ores, the mining work and machinery, data of more especial interest to an engineer. However, as the ultimate destiny of scientific work is its practical application to the affairs of man, these pages of practical observations may prove of some interest.

During the early part of the summer last past, impelled by an eager desire to see and enjoy the long-heard of and bepraised beauties and natural charms of the great Upper Lakes, but primarily incited thither by accounts of the iron and copper mines on the American side of Lake Superior, we left Detroit on an American steamer for the northern waters. The night was dark with a drizzling rain, still the scene was fine as we steamed up the river into the darkness. The lofty electric light towers gemmed the black clouds while the lower city lights and those of the many craft on the river, of the rapid, brilliantly illuminated ferry boats and the more sombre freight steamers, plying unceasingly through the dark waters, made such a pretty sight that, despite the rain, we watched from the deck the glittering picture of myriad flashing, scintillating lights, rapidly drawing astern.

Few in Canada, attracted by commercial interests, are aware to what gigantic proportions has grown the American shipping trade on these lakes. To state that during the seven months of open water a greater tonnage passes by the port of Detroit than the combined annual tonnage of London and Liverpool, is to provoke an incredulous smile, often not politely concealed; yet we have from official reports that in 1889, 36,203,000 tons passed this port, while the total tonnage of the port of London was 19,245,000 and that of Liverpool 14,175,000 tons, or an excess in favor of Detroit of 3,000,000 tons above the combined shipping of the two great English shipping ports, and a corresponding excess has been maintained during the ensuing years.

Of this great traffic we became conscious as our steamer followed the direct route northward through Lake Huron. Day and night we had ever in sight an unending succession of large vessels heavily laden with ore, grain, flour, lumber, bound down the lake from the ports on Lakes Michigan and Superior, the collecting centres of much of the produce of the great West; or of vessels returning with cargoes of coal, coke, iron and merchandise. In fact a vessel is passed every seven minutes on the average, bound the opposite way. To one not prepared this journey is a revelation. The vessels mostly used in this vast carrying trade are distinctly peculiar to these waters, and, known as "steam barges," are screw steamships of large capacity, built of iron and steel, and equipped with the finest naval machinery, capable of maintaining a speed of 14 to 15 miles per hour with a burden of 2,000-3,000 tons of freight. Many of these steamships, apart from their own cargoes, have in tow two or three convoys or large iron vessels without machinery. Thus day after day during the shipping season does this vast fleet of ever increasing numbers, ply over these great waterways, carrying to and fro, of the commodities from the granaries, mills and mines of the nation to our south.

Off to the east could be seen surrounded by strong triple booms, enormous rafts of logs towed by large steam-vessels, bound from our Canadian forests to the mills on its American shores, a reciprocal reduction of duty on timber between these two countries having speedily engendered a great advance in that industry during the past year. Passing Presquile Point this great highway of the lakes divides and many vessels comprising the shipping to and from Lake Michigan and carrying the great tonnage from Escanaba, Milwaukee and Chicago take the route to the west into this lake.

We pursued our northward course until we entered the narrow and tortuous channels leading to St. Mary's river, the connecting link with Lake Superior. With slackened speed our steamer carefully threaded the difficult passages and the whistle kept booming out the signals of "port" or "starboard," signalling to the vessels coming down on what side to pass.

Through this part the scenery is beautiful and interesting, but our attention was suddenly all-absorbed when our steamer, sweeping around a point, headed for the Port of Sault Ste. Marie, towards a veritable forest of masts rising near the fleecy foam-tossed Falls, or the Sault, that marks the place where men, undaunted and determined, to sail their vessels up into the Great Father of Waters, have built the great canal locks, the largest in the world.

The Canadian town at the Sault is very quiet and unassuming, with some large hotels, but little used, and pretty residences. But little shipping enters this port, not even the large steamships of the C. P. R., nor will they until the completion of the Canadian locks and the deepening of the harbor. At the American Sault a large number of vessels is always awaiting above and below the lock for their turn of passage, and daily from 60 to 84 are locked through. Hard by a second lock is being built by the United States Government which will be 800 feet in length, 100 in width and 21 feet on the mitre sills, and costing $4,800,000, while the present lock is 515 feet long, 80 wide and 17 feet deep on the mitre sills, permitting four vessels of the largest size to be locked through at once in the short time of twenty minutes if all goes well. The Canadian lock of nearly the same dimensions as the American new one, and to cost $5,000,000, is being hurried to completion with all speed, when Canada will have from Port Arthur to the Atlantic perfectly independent waterways, while the United States will, perforce, be compelled to use our channels at

Niagara and the St. Lawrence but most notably the Lime Kiln Crossing near Detroit.

At present Canada's share in this vast lake commerce is comparatively insignificant, but we hope that she will yet be in a position to compete for and win a more goodly share and to utilize her many fine harbors, fitted up at great expense but now almost deserted and unused. Much of the commerce rightly hers has been lured away and is being carried in American ships of better and speedier construction, while our own lake fleet languishes and grows yearly smaller. In 1880 there passed through the Sault Ste. Marie canal 1,734,800 tons valued at $29,000,000, while in 1890, 10,557 vessels gave 9,041,000 tons of cargo valued at $102,214,000, or a tonnage nearly doubling that of all nations passing through the Suez canal. It may be of interest to note the chief constituents of this great traffic:—Coal, 2,177,000 tons; flour, 3,239,000 bbls.; wheat, 16,217,000 bushels (in 1891, 38,816,000 bushels; copper, 43,729 tons; iron ore, 4,774,000 tons; lumber, 361,929,000 feet B. M.

At Marquette, the prettiest town on Lake Superior, we disembarked. This port, with its excellent harbor is, with Escanaba, the great outlet to the lakes for the iron ore from the mineral ranges inland. There are three gigantic ore docks, with a capacity of several hundred thousands of tons, double-tracked on top on which run the trains from the mines with 600-1000 tons of ore each, discharging into large pockets that in turn can be very rapidly discharged into the vessels, so rapidly in fact, that under very favorable conditions, a vessel has been loaded with 3,000 tons of ore in one hour and forty minutes.

Going inland about twenty miles we visited Ishpeming and Negaunee, two towns three miles apart of 16,000 population each, the centre of one of these great iron regions. The country round about is very rough and rocky and in the valleys are situated the mines. The rocks belong to the oldest of geological formation, and the country, rugged and irregular, with ridges of gneiss and the stratified formation of the Huronian, with great eruptive masses of greenstone or diorite, exposing on their flanks outcrops of steeply inclined beds of "lean ore" or very ferruginous jasper-rock, or even of the best iron ore, tells of great dynamic influences that rent and twisted and up-turned the earth's floor after the deposition of the great beds of iron oxide.

The ore of this district is all hæmatite of 55-66 per cent. iron and it is found and known as "hard," "soft" and "specular" iron ore. The "soft" ore seems to be the result of the decomposition of strata containing a high per centage of iron, and is so soft that in many mines it can be mined with pick and shovel alone, using but little dynamite, but necessitating a very strong system of timbering. In some properties with very thick deposits the ore has been worked out by beginning at the top, and mining away a thickness of about eight feet, allowing the roof to fall in after the floor had been covered with slabs. When the roof had come down, another thickness of ore was removed, the shabs on the timber keeping the rocks of the broken roof from inter-mingling with the ore, in this manner enabling the company to mine a deposit from 60 to 80 feet thick without entailing much expense for timbering. In some cases the specular iron is extremely hard to drill, being very much harder in such cases than quartz or granite. The ore is always classed as Bessimer or Non-Bessimer, according as it analyses low or high in phosphorus, and the Bessimer commands about 50 cents more per ton, so that in mines having both classes of iron some superintendents have materially increased annual returns by mixing ore high in phosphorous with ore very low up to the limit allowable in Bessimer ore.

These Michigan iron ores so far are found only in rocks of the Huronian Series, consisting of quartzites, schists, banded jaspers, limestones and diorites. There are two distinct, and nearly parallel, groups about 40 miles apart, the Marquette and Menominee, though of recent years two other ranges, the Vermillion and Gogebec, have come into great prominence. In mining the ore is found in very irregular forms, seldom disturbed by faults of any considerable throw, and often in masses or lenses of great thickness and area, producing immense quantities of the best ore but little intermixed with waste rock. This is of great importance as prices have fallen so low that ores not assaying at least 56% iron are barely remunerative enough to mine. On examining the many large stockpiles of ore broken during the winter, one sees that the ore is nearly perfectly pure, and at some mines it is difficult to find any waste material whatever in these piles, so large are the beds of clear hæmatite, and so skilfully and carefully do the miners extract and sort the ore.

Some of the largest properties are now owned and operated by large companies that have most extensive smelting works in Ohio and Pennsylvania, near the market for iron and within a short distance of the sources of coal or coke. The companies have erected superb mining plants, have reduced the cost of mining to a minimum, and by using their own fleets of steamers, have so cheapened the ore, that now at Cleveland or Ashtabula on Lake Erie, ore when delivered at these ports is worth only from $3.50 to $5.50 per ton. At latest quotations Bessimer pig iron is worth $15.25 per ton and grey forge iron $13.50. During the season now closed it has been computed that from this iron region of Lake Superior, 9,000,000 tons have been shipped, and that during the season of 1892, 13,000,000 tons will be sent to the smelters. Keeping in mind this enormous production from Michigan alone and the very low prices, one can readily see that it will be a long time yet before our extensive Canadian iron deposits can be mined with profit, and our own production of pig iron will be limited to that amount of charcoal iron as will supply our home market.

The copper mining of Lake Superior has been mostly confined to that peninsula of Northern Michigan terminated on the North by Keweenaw Point, and known as the Portage Lake District. The geological history of this area has proved a very puzzling study, but the copper ores are found in the rocks of the Huronian age. The older mines, such as the Quincy, Franklin, Atlantic, are working in an Amygdaloid rock, in which great masses of pure copper, so difficult to mine, have been found. Our time, however, was spent mostly at the Calumet and Hecla, the greatest copper mine in the world.

This great mine along with the Osceola, Alluez and Tamarack, is working in a conglomerate containing much felsite and quartz, that has a dip of 38° from the horizontal, and maintains a nearly uniform thickness of eight feet of ore averaging 5% of copper. In the early history of the Calumet and Hecla we read of the long and hard struggle of the men who first realized the great possibilities of this copper-bearing conglomerate, men who, with very limited means, not only spent all the money they could gather, but also labored themselves in the mine amidst many hardships and discouragements. Two of the leaders, or in fact, the two leaders, were Agassiz, a son of the eminent scientist, and a relative, and these two now are enjoying the great wealth this mine is pouring into their coffers.

This mining property embraces the out-crop of the deposit, and along this out-crop the company has thirteen inclined shafts down through the ore body, some over 6,000 feet in length. In the power-houses one sees the finest mining machinery in the world. From each, three or four shafts are operated, the cable drums being driven by one engine. In the chief station is a magnifient engine of 4,700 horse power and costing nearly one half million of dollars, which hoists 5 tons of ore at a time in four shafts besides supplying compressed air for many machine drills. One is simply amazed at the vast assemblage of powerful engines of the finest design, and all in duplicate so that if one breaks down another in a few minutes is doing its work. This summer from 2,500 to 3,000 tons of ore were being mined daily, the ore on reaching the head of the shafts, being run through rock breakers thence into railroad cars which were taken four miles, descending 700 feet, to the concentrating mills at Lake Linden, a lake supplying, besides all water, a direct connection with Lake Superior.

These mills are very large, one being the largest frame building under one roof in the world. The locomotive runs the loaded cars in at the top of the building where the ore is shot down into large ore-bins whence it is fed into the large improved steam stamps, each of which is crushing in 24 hours, the large amount of 235 to 250 tons of ore fine enough to pass screens of $\frac{3}{16}$ inch aperture. From these stamps the ore passes first into hydraulic classifiers, where all the coarse copper is collected, thence on to the Collum's jigs with 56 screens per stamp, while the fine slimes pass onto the slime-tables to receive the final washing.

In all these mills a great volume of water is required, and in the pump houses there was one set of pumps with a daily capacity of 50,000,000 gallons, but at the time of our visit a magnificent triple expansion pump, designed by Mr. Leavitt of Boston, with a daily capacity of 60,000,000, was pumping to an elevation of 50 feet, 44,000,000 gallons a day, or about three times the amount of water used daily in Montreal. To get rid again of this immense amount of water and waste rock from the mills, two sand wheels, 50 feet in diameter, and capable of daily lifting 30,000,000 gallons of water and 3,000 tons of sand, lift these tailings 50 feet into flumes that discharge far out into the lake.

Situated about two miles away on the lake shore, are the smelting works where the concentrated copper from the mills is smelted and run into ingots, although a large part is smelted at the company's works near Buffalo.

Visiting some of the other mines, though none in equipment or output can compare with this great mine, we found them working at the Tamarack mine at a depth of over 3,300 feet, while another shaft was down over 4,000 feet, propably the deepest shaft in the world. Looking over the mining returns of this famous peninsula, we learn that up to 1890, 65 mines had produced 1,327,799,420 lbs. of copper, valued at $243,706,809. In 1891 the yield of copper in the

United States was 43% of the world's production, or as follows :—

United States.............	292,620,000 lbs
Montana.....................	113,200,000 "
Lake Superior Region...	109,370,000 "
Calumet and Hecla.......	65,000,000 "

In 1893, it is expected that this great mine that has now paid over $35,000,000 in dividends, will produce 90,000,000 lbs. of copper, and it is now so prepared that should copper fall from its present price of 11·7 cts. per lb. to 6 cts., a good profit will still be made.

In a rapid journey along the Canadian side of the Lakes, we learned that little or no mining was being done, the mines near Port Arthur that had been busy having been closed down for various reasons. Passing down between Manitoulin Island and the mainland we saw the mills and smelter of the once well-known Bruce mines falling into decay. But some day, we believe, in this part of Ontario, there will be opened up and vigorously developed valuable ore bodies now lying untouched or unknown.

Changes in the Flora of Montreal Island.

By Robert Campbell, D.D., M.A.

Dr. Holmes' catalogue of the grasses and carices prevailing in the vicinity of Montreal seventy years ago was never published, and so the only means we have of comparing those two classes of plants, as they were represented then and now in this district, are in keeping of the authorities of McGill College, in whose museum the Holmes Collection is preserved. His Herbarium did not embrace the Musci and Hepaticæ of the neighborhood; and so for the present our remarks extend not beyond the more popular flora—well-known phænogamous plants.

As might be expected, the chief changes that have taken place have been owing to the introduction of foreign summer plants. A few spring flowers are now found which

Dr. Holmes did not mention; but some of these must have been accidentally omitted from his list, as they always probably grew in our forests. *Caulophyllum thalictroides* for instance, one can scarcely doubt, is a native of the district, as it is found widely diffused throughout both Ontario and Quebec. The same thing is true of *Elodes Virginica, Prunus Americana, Fragaria Vesca, Rubus hispidus, Ribes hirtellum* and *Aster Acuminatus* among others. The cutting down of woods, the clearing of swamps, and the drainage of marshes have no doubt greatly circumscribed the growth of our wild flowers, especially those that gladdened the eyes of the early settlers in this country, coming in with the first heat of spring. But I think it likely that no plant that ever flourished in the district has become entirely extinct with the progress of agriculture. There are still typical swamps and marshes and clumps of wood on the island affording the peculiar soil and protection which each native plant requires; and, although collectors, non-scientific more than scientific ones, have not spared some of the rarer and more showy plants, yet I believe that a patient search will be rewarded with finding specimens still in unfrequented spots of every species that ever characterized the island. Some mentioned by Dr. Holmes are now rare. I have not found them, but I do not despair of coming across them in due time. The following, for instance, Dr. Holmes credits the district with producing: *Ranunculus Purshii, Brasenia peltata, Nymphæa odorata, Sarracenia purpurea. Mollugo verticillata, Rhamnus alnifolius, Lathyrus palustris, Apios tuberosa, Dalibarda repens, Lythrum verticillatum, Lobelia Kalmii, Oxycoccus palustris, Chiogenes hispidula, Andromeda polifolia, Kalmia glauca, Ledum palustre, Rhodora Canadensis, Lysimachia ciliata, Utricularia vulgaris, Epiphegus Americana, Gentiana Saponaria, Menyanthes trifoliata, Asclepias incarnata, Dirca palustris, Cypripedium Spectabile, Symplocarpus fœtidus, Lemna polyrrhiza, Potamogeton lucens,* do. *natans,* do. *perfoliatus, Pontederia cordata,* and many orchids. If we have lost any species at all, it is probable that it is among the plants that demand seclusion and moisture, chiefly those that come early in the season. But several plants that used to be easily found on or near Mt. Royal are now rare, amomg them *Podophyllum peltatum*, *Dicentra Canadensis*, *Geranium Carolinianum*, *Staphylea trifolia*, *Chrysoplenium Americanum*, *Triosteum perfoliatum*, *Antennaria Margaritacea*, *Chimaphila umbellata*, *Lilium Philadelphicum*, and a good many ferns. The clearing away of the underwood by our Park and Cemetery Commissioners, and the Gothic habits of the people visiting our noble park and beautiful cemetery in carrying away armfuls of the wild flowers, must be held responsible for the gradual disappearance of many species that used to adorn those popular resorts. *Solanum nigrum*, *Gerardia purpurea*, *Datura Stramonium*, *Sambucus ebulus*, *Celtis occidentalis*, and *Daphne Mezereum*, all grow on the island, but are not every day met with.

On the whole, however, it is clear that we have gained more than we have lost by the progress of civilization, and the advance of soil cultivation. The gain is due mainly to the introduction of foreign grains and flowers and grasses. New varieties of wheat, barley, oats, turnips, beets, clover, timothy, &c., have been imported, and in spite of all care the seed of other plants has come in with them. In this way we have received an immense addition, especially to our summer flora—those plants which in their native country were contemporaneous with the grain and other seed which we have brought from abroad. The mustard family have won an unfortunate eminence in this respect, proving an increasing nuisance to our farmers. *Lepidium intermedium*, *Senecio Jacobœa*, *Erigeron bellidifolium*, *Rudbeckia hirta*, *Cichorium intybus*, *Sonchus Asper*, *Tragopogon pratensis*, *Leucanthemum vulgare*, *Nepeta glechoma*, *Lithospermum hirtum*, many *Asters* and *Solidagos*, *Silene cucubalus*, *Silene Pennsylvanica*, several varieties of *Ranunculus*, *Trifolium agrarium*, *Medicago lupulina*. *Melilotus officinalis* and *Melilotus alba* and several *Euphorbias* are among the most prominent of the plants thus introduced since the Holmes collection was made.

Report of Mr. R. W. McLachlan, Delegate to the Royal Society.

Notwithstanding that delegates representing affiliated societies, at the meetings of the Royal Society, are only expected to read reports from their respective societies and then participate in all further proceedings as mute listeners, by coming in contact with our most renowned scientists and men of letters, they cannot but become imbued with a deeper love of these higher pursuits. It was a happy thought to give the different literary and scientific societies of Canada a voice in this annual congress of scientific men. This voice should be untrammelled by any disabilities. Thus those less advanced lay brethren in the paths of science may each year go home with more heart for scientific research, and with a greater measure of ambition to delve after hidden truths and bring such truths to light. And they communicating this spirit, if not the ambition, to their fellow workers in local scientific circles, begin to grow apace. With this band of union, the local bands, more closely drawn together, may go cheerily on to greater results in the future pursuit of science through the whole Dominion.

As unfortunately our President, who was first chosen, found it impossible to represent us, the duty devolved at the last moment on your Secretary. His report referred to the continued success of the Record of Science, and to the work done by the Society in the shape of a list of papers read, and the Somerville lectures delivered, as well as a mention of the additions and improvements to the museum and library.

In his presidential address, the Rev. Abbè Laflamme confined himself mainly to a biographical sketch and a review of the scientific work of the late Dr. T. Sterry Hunt. It was a most interesting address, and we look forward with pleasure to its appearance in the proceedings of the Royal Society.

Reference was made to the royal entertainment the Society had received at our hands in Montreal last year, and our Society received high praise for the admirable manner in which it had carried out all the arrangements.

About forty papers in all were presented in the different sections. Eleven of these in the French section treated mainly on questions relating to the history of their race in America. Some of them were of the highest interest in a historical point of view.

As our delegate attended every session of the English section, he can speak of its proceedings with more confidence. Of the eight papers on the programme, four were submitted by non-members. Two of these (by missionaries among the Indians of British Columbia) were read only by title, as they gave details of observations regarding the language and mythology of these Western tribes. Another, by a delegate from Manitoba, gave an interesting description of the Archæological remains of that province. The fourth by our own delegate, was a history of the currency of Nova Scotia, with copies of many unpublished letters and documents. This paper provoked considerable discussion, eliciting some new facts on the question. Of the papers by members, two were by Rev. Dr. Patterson. That on the vocabulary of the extinct Indian race of Newfoundland was read by title. The other gave an account of the early Scottish attempt at the colonization of Nova Scotia, wherein a regular American titled aristocracy was to be founded. In another paper, by Charles Mair, one of the old mythological legends of the Ottawas was translated or paraphrased; and the fourth, by the late Sir Daniel Wilson, described the defects of our Canadian Copyright Act. On account of its interest to all the members, it was read in the General Session. As it was probably his last public utterance, those who had the good fortune to listen to him, and to his lucid replies in the discussion that followed, enjoyed a rare treat.

In the mathematical section there were five papers, all dealing with obscure questions, not calculated to interest those who have no particular inclination towards the subject.

The natural science section is by far the best organized; both from the number and interest of the papers, and from the manner in which they are discussed. This section has also more interest to us, not only because it covers our particular work, but because four papers were by our members, and other four by former members. Of the fifteen papers presented, seven treated of geological subjects.

Without entering into any details as to the manner of treatment, the titles may be enumerated as follows:—

1. On the Diffusion and Sequence of the Cambrian Faunas.
2. On Palæozoic Corals.
3. The Fossils of the Hudson River Formation in Manitoba.
4. Illustrations of the Fauna of the St. John Group.
5. On the Correlation of Early Cretaceous Floras in Canada and the United States, and on some new plants of the period.
6. Observations on the Geology of South Western Nova Scotia.
7. On the Occurrence of Graptolites and other Fossils of Quebec Age, in the black slates of Little Metis.

There were six papers in Zoology as follows:—

8. Hybernation and Allied States in Animals,
9. Notes on Land and Fresh Water Mollusca of the Dominion.
10. On some Sponges from the Pacific Coast of Canada and the Behring Sea.
11. On the Artificial Propagation of Marine Food Fishes and Edible Crustaceans.
12. Report on a Collection of Coleoptera made on Queen Charlotte Islands.
13. The Use of Arsenites as Insecticides.

In Botany there were only two papers:—

14. Notes Supplementary on the Revision of Canadian Ranunculaceæ.
15. On the Literary History and Nomenclature of Canadian ferns.

A popular lecture on science in schools was delivered by one of our members, Dr. T. Wesley Mills, before a large and appreciative audience, composed mainly of those interested in education. Although at first sight, the subject did not seem attractive, the novel and attractive manner in which it was handled, held the audience to the end and carried conviction to the minds of all present.

The entertainment of the visitors, while not so elaborate as in Montreal, was not forgotten. It was altogether of a private character. At the close of one of the sessions, Mr. Sanford Fleming had an electric car in readiness which conveyed the members and delegates to his palatial residence, where during the afternoon at a reception, pleasant conversation was the order rather than dry science. At another reception at Rideau Hall, His Excellency Lord Stanley brought together a large company of citizens to meet this select gathering of Canadian scientists.

The meeting of the Royal Society of Canada of 1892, while not equal to the Montreal meeting of 1891, either in attendance or in the general interest elicited, accomplished more good in scientific research, and the privileges of these meetings, so far as they are accorded to delegates, should be used to their fullest extent by all scientific societies.

WHITE VARIETY OF THE FIREWEED.—While out camping among the Laurentian hills near Cap-a-l'Aigle, Que., last August, I came across two specimens of the common fireweed (*Epilobium angustifolium, Linn.*) having pure white flowers, instead of the well-known purple color. Although the plants were very abundant in the neighborhood, a careful search failed to reveal any more albinos.

I presume this is the variety known as *canescens*, Wood, mentioned in Macoun's Catalogue as occurring in the Mountains of British Columbia, about the Lake of the Woods, Owen Sound, and in Hastings County, Ontario. As there is no reference to its occurrence in this Province, I thought this might be of interest.

A. F. WINN.

PROCEEDINGS OF THE NATURAL HISTORY SOCIETY.

MONTREAL, October 31st, 1892.

The first monthly meeting was held this evening, the Very Rev. Dean Carmichael, President, in the chair.

The minutes of the meeting of May 30th, were read and approved.

The minutes of the Council of May 30th and October 24th were read.

The Librarian reported a large number of exchanges added to the library.

The Hon. Curator reported a Morning Warbler and Ruby Throated Humming Bird from Mr. McKee, the Horn Fly from Mr. Oswald, a large moth from A. B. McIntyre, and a number of insects from A. F. Winn.

Moved by J. S. Shearer, seconded by Dr. T. Wesley Mills that the thanks of the Society be sent to the donors.

Moved by the Rev. Robert Campbell, D.D., seconded by J. A. U. Beaudry, that as Mr. J. Stevenson Brown had through press of his private business ceased to hold office in this Society, a vote of thanks be tendered him for his long and valuable services, especially as Honorary Curator. Carried.

Moved by James Gardner, seconded by George Sumner, that the rules be suspended and that Alex. Lang be elected an ordinary member by acclamation. Carried.

Mr. J. S. Shearer appointed to interview the Provincial Treasurer with regard to a continuation of the grant had received a favorable answer. The following members participated: Hon. Senator Murphy, J. Gardner, G. Sumner, A. Holden, R. White.

Dr. T. Wesley Mills read a paper on "The preparation of the human mind for humane ideas." There was considerable discussion on the question of rabies in dogs brought out by the paper.

On motion the thanks of the Society were tendered to Dr. Mills.

The Secretary read a report as Delegate to the meetings to the Royal Society of Canada at Ottawa. A vote of thanks was passed.

The Chairman asked what should be done with his suggestion about reviving the literary feature of the Society. Referred to the Council.

MONTREAL, November 28th, 1882.

The second monthly meeting was held this evening. The Hon. Senator Murphy, Vice-President, in the chair.

The minutes of last meeting were read and approved. The minutes of Council meeting of November 21st, were read.

The Honorary Librarian acknowledged the receipt of two pamphlets from Mr. de Beaujeu, one entitled "Le Heros de la Monongahela," the other "Documents inedits sur le Colonel de Longueuil." Also two papers read by Dr. G. M. Dawson at the meeting of the Royal Society of Canada. The thanks of the meeting were given to the donors.

On proposition of Mr. Shearer, Mr. Alfred Pennell was submitted for membership. It was agreed that the rule be suspended and Mr. Pennell was elected by acclamation.

The Rev. Dr. Campbell was then called upon to read his paper on the Flora of Montreal, in the course of which the reverend gentleman stated that he had collected and mounted 416 species of plants growing in the neighborhood of Montreal, which he will present to the Society as soon as a cabinet is provided for them. He then compared these plants with those collected by Dr. Holmes, distinguishing those which have disappeared or which have been introduced since his time. He also directed attention to the localities in which the specimens were collected. A most interesting discussion took place on the subjects brought forward in the paper.

On motion of Mr. Shearer, seconded by Mr. Shaw, a vote of thanks was unanimously tendered to Dr. Campbell.

Proceedings of the Microscopical Society.

Montreal, March 14th, 1892.

The monthly meeting of the Society was held this evening in the Library of the Natural History Society, at eight o'clock. Present, J. Stevenson Brown, President, in the chair; Dr. Smyth, Dr. Beaudry, J. Gardner, J. A. U. Beaudry, Hon. Sen. Murphy, J. G. Shaw, A. Henderson, J. F. Hausen, E. T. Chambers, J. B. Picken, Dr. Girdwood, J. T. Donald, Leslie J. Skelton and several visitors.

The minutes of the last meeting were read and confirmed.

A letter was read from the Royal Society of Canada, advising that the eleventh general meeting of the Society would be held in Toronto on Wednesday, May 25th, and requesting a large attendance of delegates. It was moved by Alex. Henderson and seconded by J. A. U. Beaudry that Prof. Cox be requested to represent this Society, and that the Secretary be instructed to ascertain if he could do so. Carried.

Hon. Sen. Murphy stated that if an evening could be arranged, Dr. Baker Edwards would be glad to give an account of the early history of the Society. It was decided that as all the regular meetings of the Society had been already arranged for, that it would not be possible to hear Dr. Edwards' paper this session.

The question of appointing a committee to arrange the papers for next season came up, but as it was getting late, it was decided to leave the matter for next meeting.

Dr. Smyth now read the paper on "The House Spider," in which the life history of the spider, its structure and adaptability to its surroundings were all clearly and most interestingly described. The palobe eyes, organs of respiration, fangs, poison ducts and spinnerets, were each in turn carefully illustrated and explained. Remarks were made by several members and questions asked which were answered by Dr. Smyth.

A vote of thanks was proposed by Hon. Sen. Murphy, seconded by J. A. U. Beaudry, and carried unanimously to Dr. Smyth for his instructive paper.

MONTREAL, April 11th, 1892.

The monthly meeting of the Society was held this evening in the Library of the Natural History Society. Present: J. Stevenson Brown, President, in the chair; A. T. Winn, Dr. Stirling, Geo. Sumner, J. B. Learmont, J. G. Shaw, E. T. Chambers, J. Gardner, J. S. Shearer, Dr. Beaudry, A. Holden, Dean Carmichael, J. J. McIntosh, Leslie J. Skelton, J. A. U. Beaudry and several visitors.

The minutes of the last meeting were read and confirmed.

The Secretary reported that Prof. Cox regretted he would not be able to represent the Society at the meeting of the Royal Society. It was decided to leave the matter of a delegate in the hands of Dean Carmichael, J. S. Shearer and J. A. U. Beaudry, with the understanding that this Society would not be put to any outlay in the matter.

A committee to be composed of J. Stevenson Brown, Dean Carmichael, Dr. Sterling and J. Ferrier was proposed by J. B. Learmont and seconded by Mr. Geo. Sumner, to prepare next season's programme, and it was suggested that if possible the list of papers should be completed now, so that the programme could be issued before the next meeting. Carried.

The following gentlemen were proposed and elected as ordinary members:—M. Monongahela de Beaujeu, proposed by J.A. U. Beaudry, seconded by Dr. J. A. Beaudry; F. W. Richards proposed by J. B. Picken, seconded by J. Stevenson Brown; Mr. Geo. Gebhardt proposed by J. B. Picken, and seconded by J. Stevenson Brown, was elected an associate member.

Mr. A. T. Winn now read a paper on "The American Tent Caterpillar," which was filled with practical hints to the horticulturist, as to how the eggs were deposited, how soon they germinated and the best methods of dealing with them. Mr. Winn illustrated his remarks with diagrams, *live caterpillars and a large and beautiful collection of* moths of this and other species. On the conclusion of the paper a vote of thanks was moved by J. B. Learmont, seconded by Dr. Stirling, and carried unanimously, thanking Mr. Winn for his very interesting description of this caterpillar, and also for his further useful notes on how to collect moths and other insects. An interesting discussion on the paper ensued in which several members took part.

MONTREAL, May 9th, 1892.

The monthly meeting of the Society was held this evening in the Library of the Natural History Society at eight o'clock. Present: J. Stevenson Brown, President, in the chair; Dr. Girdwood, J. B. Learmont, A. T. Winn, Dr. Bruere, J. G. Shaw, Dr. Lovejoy, Jos. Bemrose, Hon. Sen. Murphy, J. S. Shearer, J. A. U. Beaudry, E. T. Chambers, J. F. Hausen, F. W. Richards, Leslie J. Skelton and several visitors.

The minutes *of the last meeting were read and confirmed.*

A letter was read from Dean Carmichael stating that he was going out of town, and requesting that the committee appointed to arrange a programme for next season would act during his absence.

A letter from the Secretary, Leslie J. Skelton, was read stating that as he would likely be absent from Montreal next October, the date of the next meeting, he thought it better in the interests of the Society to tender his resignation now, so that a new secretary might be appointed who would begin with the next season's work.

The question of naming a new secretary now came up and the names of Mr. A. T. Winn and Mr. J. B. Learmont, were suggested, but neither of these gentlemen was able to accept the office.

It was moved by J. A. U. Beaudry, seconded by J. B. Learmont, that the matter of a secretary be left in the hands of the executive, and that J. Stevenson Brown, Hon. Sen. Murphy and J. S. Shearer be requested to arrange for the secretary's work until a new secretary was elected. Carried.

It was moved by J. Stevenson Brown and seconded by Hon. Sen. Murphy, that this Society desires to tender its thanks to the retiring secretary Leslie J. Skelton, for the prompt and efficient manner in which he had performed his duties, as well as for the valuable services rendered to the Society during his tenure of office. In presenting the motion, the President expressed his regret that Mr. Skelton could not continue to act as secretary and took this occasion to thank him for the kind and courteous manner in which he had aided him in the administration of the affairs of the Society. The motion was carried unanimously.

Dr. Girdwood now gave his paper on the "Use of the Microscope in the Identification of Burnt Documents." He exhibited specimens of burnt bank bills and showed how they could be identified by counting the edges, examining the different parts and by the process of photo-micography. The lecture was illustrated by photographs taken from a series of bills of the Bank of Montreal taken from a burnt postal car. In this case the use of the microscope had prevented a law suit between the bank and the insurer.

The question of the detection of forgery by the use of the microscope and camera was also carefully explained and a most interesting series of photographs taken from actual forgery cases were passed about for examination.

A vote of thanks was moved by Hon. Sen. Murphy, seconded by Dr. Lovejoy, to Dr. Girdwood for his very interesting paper. Carried unanimously.

MONTREAL MICROSCOPICAL SOCIETY.

MONTREAL, 10th October, 1892.

The annual meeting of this Society was held this evening in the Library of the Natural History Society at 8 o'clock. Present: J. Stevenson Brown, President, in the chair; Hon.

Sen. Murphy, Dr. Girdwood, Geo. Sumner, J. Gardner, J. S. Shearer, F. W. Richards, E. T. Chambers J. B. Learmont, J. F. Hausen, — Macintosh, J. G. Shaw.

The minutes of the last meeting were read and approved.

The President on behalf of the committee appointed to arrange for lectures and papers for the ensuing season, reported that the following members had promised to furnish papers:

November 14, Dr. G. P. Girdwood; December 12, Professor Cox; January 9, 1893, Prof. Adami; February 13, Prof. F. D. Adams; March 13, Dr. Bruere; April 10, Dr. McConnell.

Dr. Girdwood reported that as requested by the Society he had acted as their representative at the meeting of the Royal Society of Canada at Ottawa, and dilated on the work and progress in research being made by its members during the season. A cordial vote of thanks to the Doctor for the able manner in which he had fulfilled his mission was proposed by Mr. J. S. Shearer, seconded by Geo. Sumner, and carried unanimously.

The following gentlemen were proposed as members:—Mr. W. C. McDonald, 891 Sherbrooke street, associate member; Rev. Dr. Campbell, 68 St. Famille street, ordinary member; Mr. C. T. Williams, 23 Chomedy street, ordinary member, by the President, seconded by Mr. J. Gardner, and carried unanimously.

The Secretary's report was read by Mr. J. S. Shearer who had acted as Secretary *pro. tem.*, and on motion of the Hon. Sen. Murphy, seconded by Mr. Jas. G. Shaw, was adopted.

Mr. Shearer as treasurer reported that the Society has now $101 deposited in the bank, and also the very gratifying statement that no member was in arrear of dues. The report was signed by Messrs. Gardner and Sumner, auditors. Mr. Shearer was thanked by the members for his statement.

The election of officers of the Society for the ensuing year was now proceeded with, resulting as follows:—

President—Dr. G. P. Girdwood, M.D., M.R.C.S. Eng., proposed by Hon. Sen. Murphy, seconded by Mr. J. S. Shearer.

Vice-President—Dr. J. W. Stirling, proposed by Mr. J. S. Shearer, seconded by Mr. J. Gardner.

Treasurer—Mr. J. S. Shearer, proposed by Mr. Geo. Sumner, seconded by Mr. F. W. Richards.

Secretary—Mr. Jas. G. Shaw, proposed by Mr. Geo. Sumner, seconded by Mr. J. S. Shearer, whose election was carried unanimously.

Each of the newly appointed officers thanked the members for the high honor bestowed upon them by election to such very important offices.

By a unanimous vote the retiring officers received the thanks of the meeting for their close attention and zeal manifested in promoting the welfare of the Society during their term of office.

The retiring President, Mr. J. Stevenson Brown, in congratulating the Society upon its selection of officers, took occasion to thank the members for the kindly manner in which they had assisted him in the administration of the affairs of the Society during his three years of office. He expressed his gratitude for the perfect harmony which had characterized all its meetings and bespoke the same kind consideration for his successor whom he had now the pleasure of calling to the chair.

The new President, Dr. Girdwood, having assumed the chair, first thanked the Society for the honor they had conferred upon him and promised he would use his best endeavours to further its interests, and then called upon the retiring president to deliver his annual address, which he then did, taking for his subject "The Microscope as an Educator," which he treated in an exhaustive manner and was listened to with marked attention, and at the close Mr. Brown was greeted with applause, and received a cordial and hearty vote of thanks.

A committee composed of the President, Secretary, Dr. McConnell and J. Stevenson Brown, were desired to consider what means could be taken to inaugurate meetings for instruction in the use of the microscope. Approved.

MONTREAL, 14th November, 1892.

The monthly meeting of this Society was held this evening in the Library of the Natural History Society at 8 o'clock, Present: Dr. Girdwood, President, in the chair; Rev. Dean Carmichael, Messrs. Geo. Sumner, Gardner, J. Stevenson Brown, Ferrier, Richards, Dr. Wanless, J. A. U. Beaudry, E. T. Chambers.

Dr. Girdwood presented to the Society four (4) volumes of "Cole's Studies in Microscopical Science," now very scarce. Mr. J. S. Brown in proposing a vote of thanks to Dr. Girdwood, spoke of the value of the books presented as he had had an opportunity of looking over them and proposed that they should be substantially bound. The Rev. Dean Carmichael in seconding the motion, called the attention of the members to the advantage it would be to the Society were a bookcase provided in which any books, papers or slides belonging to it could be kept secure. The vote of thanks was carried unanimously.

Mr. E. R. Barton, 58 Beaver Hall Hill, was proposed as an ordinary member by Mr. F. W. Richards, seconded by Mr. J. S. Brown.

Rev. Dean Carmichael proposed, seconded by Mr. Geo. Sumner, that the providing of a bookcase be referred to the committee appointed at the last meeting for the formation of classes for instruction.

As there had been a considerable amount of business talked over and the evening was far advanced, it was proposed to call a special meeting for Monday evening the 21st inst., to hear Dr. Girdwood's address. Dr. Girdwood having acquiesced in this proposition a resolution to that effect was carried unanimously.

The meeting then adjourned.

MONTREAL, 21st November, 1892.

A Special meeting of the Society was held this evening in the Library of the Natural History Society, University street, to hear a paper read by Dr. Girdwood, President of the Society.

Present: Dr. Girdwood, President; Dr. Stirling, Vice-President. Messrs. J. S. Shearer, Treasurer; E. T. Chambers, Jas. Gardner, Dean Carmichael, Canon Empson, Hon. Sen. Murphy, J. B. Learmont, J. A. U. Beaudry, Chas. D. Williams, Prof. Cox, J. Stevenson Brown, F. W. Richards, J. F. Hausen, E. R. Barton, Dr. McConnell and a number of visitors.

The Secretary read the resolution carried at the last meeting, calling a special meeting for this evening.

The 1st Vice-President, Dr. Stirling, was then called to the chair, and after a few remarks he requested Dr. Girdwood to address the meeting, his subject being "The Microscope, its Construction and Application."

Dr. Girdwood first took up the subject of refraction and explained it in all its details, after which by numerous diagrams he showed how the rays of light were affected according to the different styles of lenses through which they passed, and explained how by a combination of different lenses the object was magnified, and the image carried to the eye. This was proved by practical illustration. The lecture was replete with valuable information and was delivered in the doctor's usual clear style and listened to with marked attention. Considerable discussion followed and the doctor gave further information on the subject by replying to the questions put to him.

After a very hearty vote of thanks was accorded the lecturer the meeting adjourned.

MONTREAL, 12th December, 1892.

The regular monthly meeting of this Society was held this evening in the Physics Building, McGill College, by invitation of Prof. John Cox, B.A., on account of its being hazardous to remove the apparatus required to illustrate the lecture on "Polarized Light, its Application in Microscopical Research."

The chair was taken by the President, Dr. Girdwood, and a considerable number of the members were present. A large and appreciative audience filled the theatre and the President introduced Prof. Cox to the audience, promising them a most entertaining and instructive lecture on the subject chosen. The professor illustrated very clearly the different subjects on which he discoursed, and at the close on motion of Dr. Girdwood received a marked appreciation of thanks from the large audience.

The following new members were proposed and elected:

Prof. J. G. Adami, M.D., proposed by Dr. Girdwood, seconded by Mr. Jas. G. Shaw; Rev. Edmund Wood, M.A., proposed by Mr. J. B. Picken, seconded by Mr. J. Stevenson Brown; Mr. F. L. Wanklyn proposed by Mr. Albert Holden, seconded by Mr. Jas. G. Shaw.

Notices of Books and Papers.

Tiefencontacte an den intrusiven Diabasen von New Jersey von A. Andreae und A. A. Osann—Verhandlungen des Naturhist-Med Vereins zu Heidelberg, V Bd. 1 Heft., 1892.

This paper by Professors Andreae and Osann of Heidelberg, treating as it does of the contact of the great intrusive Diabases forming the Palisades of the Hudson with the "Newark Shales," is of interest to all American geologists. The publication in which the paper appears has unfortunately a somewhat limited circulation especially in America, and it has therefore been thought advisable to give a somewhat extended notice of it in the *Record of Science.*

The paper is one of a number on various subjects connected with American Geology which have recently been published by European geologists who visited America to attend the International Congress of Geologists held in Washington in the summer of 1891. The geological relations of these traps have been worked out by Mr. N. H. Darton, and described by him in his pamphlet on "The Relations of the Traps of the Newark System in the New Jersey Region," (Bull. No. 67, U. S. Geol. Survey, 1890.) In this region the strata of the "Newark system," which are generally of Upper Triassic age, are associated with eruptive diabases, which being hard, resisting erosion and following pretty closely the strike of the sedimentary strata, cross the country as abrupt cliffs 300-400 feet in height and form marked features in the landscape.

Those diabases lying to the west of the Watchung Mountains, and therefore higher up in the series forming the so-calling " Watchung traps" are as Prof. Davis has shown effusive masses, but the "Palisade traps," lying further east and lower down in the Newark strata and which form the celebrated Palisades on the Hudson River, are true intrusive sheets. Where the diabase constituting these Palisade traps comes in contact with the Newark shales along its lower face, these latter are much altered, but the alteration is not the ordinary alteration into Spilosite, Desmosite or Adinole, nor does the diabase itself assume the usual variolitic structure, but the contact products resemble much more closely those ordinarily found in connection with Plutonic rocks, and may be classed as follows :—

1. Normal Hornstones, which cannot be distinguished from those found in connection with Plutonic rocks.

2. Hornstone containing a large amount of Tourmaline. This mineral is transparent and of a grey and brown colour and usually has a well marked zonal structure.

3. Contact rocks derived from the alteration of arkoses and which are characterized by the development in them of a fibrous green hornblende.

4. Lime-silicate Hornstones (" Kalksilicathornfelse ").

A fact of especial interest, on account of its bearing on the subject of regional metamorphism,[1] is that the lines of separation beween the different hornstones which represents rocks of very different chemical composition, are even when examined under the microscope, perfectly sharp and well defined.

The principal results of the investigation may be summed up as follows :—

1. The diabase of Jersey City belongs to the group of the quartz bearing hypersthene diabases and forms, according to American geologists, an intrusive sheet. The hanging wall has been for the most part removed by erosion, while the lower contact is characterized by what is for diabase a series of very peculiar contact products.

2. The diabase at its lower contact not only becomes finer in grain, but shows an alteration in both structure and chemical composition. The ophitic structure of the normal diabase passes over into a typical porphyritic structure, while the hypersthene disappears and its place is taken by olivine. Biotite also which occurs but very sparingly in the normal diabase, becomes more abundant.

[1] Rosenbusch—" Zur Auffassung der chemischen Natur des Grundgebirges," Tscher. Min. u. Pet. Mittheil, 1891, p. 52.

3. The sedimentary rocks of the "Newark system," which have been altered by the diabase were originally clay slates with interstratified limestones and arkoses. The products of their alteration are a series of hornstones which differ entirely from those usually found at diabase contacts. The conclusion reached by the American geologists from stratigraphical considerations that the Palisade diabase forms an intrusive sheet, is in this way confirmed.

4. The microscopically sharp bounderies of the hornstones, resulting from the alteration of the various rocks, against each other, as well as the perfect preservation of the original relations of the rocks in question, as for instance the change in character of materials from layer to layer or the cracked and brecciated structure shows that the alterations took place while the rocks were in a solid or at least but slightly plastic condition.

Diabase contacts of a somewhat similar character have been described by Brogger, from Norway (1), by Cohen, from South Africa (2), and by Verbeek, from Sumatra (3).

1. "Die Mineralien der Syenitpegmatitgänge der südnorwegischen Augit und Nephelinsyenite," Zeit. für Kryst, Bd. 16, p. 20.

2. "Geog.-Pet. Skizzen aus Süd Africa," Neues Jahr. für Min. V Beil. Bd., p. 251.

3. See Rosenbusch.—"Physographie der Massigen Gesteine." p. 244.

FRANK D. ADAMS.

EXPERIMENTAL FARMS: APPENDIX TO THE REPORT OF THE MINISTER OF AGRICULTURE, pp. 348, OTTAWA, S. E. DAWSON, QUEEN'S PRINTER, 1892.

EVIDENCE OF MR. JAMES FLETCHER, ENTOMOLOGIST AND BOTANIST BEFORE THE SELECT STANDING COMMITTEE OF THE HOUSE OF COMMONS, ON AGRICULTURE AND COLONIZATION, SESSION OF 1892, pp. 19, PRINTED BY ORDER OF PARLIAMENT.

These publications are of great scientific interest, as well as of vast practical utility. If all the investments of public money, by the Government of Canada, were as judiciously made as the 75,500 odd dollars expended upon the Experimental Farm, near Ottawa, and the four branches at Nappan, N.S.; Brandon, Manitoba; Indian Head, North-West Territories; and Agassiz, British Columbia respectively, there would not be much room for criticism of its expenditure. Agriculture, with its allied pursuits of horticulture and arboriculture, is the main industry of Canada, and is likely to continue so for generations to come; and it is wise statesmanship which brings all the resources of science and art to bear upon its development and advancement. Indeed, it is only the application of the best scientific knowledge and the use of the latest improvements in apparatus that make it possible for the modern tiller of the soil to maintain himself. The old-time farmer, who merely followed the example of his father in his methods, and was ignorant of the processes of nature farther than these came practically under his observation, and conducted his routine of yearly operations largely by main force, in a spirit of haphazard, without regard to economic laws, has no chance in competition with the man who has made an earnest study of the science of agriculture, and applies its principles rigidly in the practice of his calling. The establishment of agricultural colleges, and the holding of conventions in local centres, so as to gain the ear of the entire farming community, must be spreading a higher degree of intelligence among our rural population, which cannot but tell upon the future course of agriculture in this country. It will not do to place supreme reliance upon the virgin qualities of the soil, and to expect mother earth to go on yielding nourishment from her bosom for successive generations, without her being herself rejuvenated. She needs nursing in her turn, and trained nurses alone can treat her according to her requirements. Every farmer in the Dominion would do well to read the reports of the experts employed at the Central Farm, as contained in the Government Blue Book. Every page is charged with instructive matter with which he ought to make himself acquainted. From the Directors' Report he would learn what particular varieties of grain, roots and trees are best adapted to the district in which he resides, and the fact that 12,285 kindly were distributed among 5,140 applicants, shows a keen appreciation of the advantages which the Experimental Farm affords to those for whose benefit it was established. Prof. Robertson, in his report, gives details showing the relative profitableness of different breeds of cattle and swine, dealing with the live questions regarding dehorning and feeding of calves, the value of ensilage and other descriptions of fodder, the best methods of dairying,—and all the advice he offers is the result of careful experiment. Fruit growing is developing into an important industry in Canada, and as improvements in communication with the old world advance, bringing us closer to the European markets, a bright future is unquestionably in store for Canadian orchardists. Those who are staking anything on this line of business should read with care what Mr. John Craig, our national horticulturalist, has written on the subject in his report. If Canada is to achieve distinction in horticulture and our gardeners and fruit growers would add to their wealth, it must be by producing the varieties best suited to our climate and soil.

What these are they will discover by studying Mr. Craig's notes on the subject. The people of Manitoba and the North-West Territories will be particularly interested in the experiments now making in the growing of forest trees in their vast, bare prairies, of which an account is given in this Blue Book. Not the least interesting part of this volume scientifically as well as from a utilitarian point of view, is the report of Mr. F. T. Shutt, M.A., chemist to the Central Experimental Farm. It sets forth in detail the results obtained by different kinds of fertilizers applied to the soil, and gives the analysis of varieties of cattle feed, showing which are the best milk producers, and affords advice as to the chemical remedies to be employed in destroying vermin on cattle, and insect pests on trees. His report deals with the scare produced by the enemies in Great Britain of Canadian fruit, who spread through the English papers a rumuor that our apples were dangerous, through the absorption of Paris green. Mr. Shutt demonstrates the scientific absurdity of the charge against our fruit. Mr. A. G. Gilbert, poultry manager at the Central Experimental Farm, briefly reports on the most thrifty and profitable breeds of hens, and on the best feed for them, giving specially useful hints regarding the winter treatment for poultry, which is one of the difficult problems of our climate.

If the Experimental Farm Report disseminated no other information than that contained in the section of it furnished by Mr. James Fletcher, Entomologist and Botanist, it would well repay the country to have it printed and spread broadcast. It deals with all the insect pests, and weeds and fungi, which vex the farmer's righteous soul, and advises him how to fight them. And their names are legion. Here is a list of these foes of agriculture and horticulture dealt with in the report:—*Cutworms, Black Army Worm, Grain Plant Louse, Tomatoe Stalk-borer, Buffalo Tree-hopper, Blister Beetles, Hop Aphis, Cigar Casebearer of the Apple, Pearleaf Blister, Clover Root-borer, Oat-weevil, Eye-Spotted Bud-Moth, Cankerworm, Leafrollers, Pea-Weevil, Oyster Shell Bark Louse, Pear-Tree Slug, Red Turnip-Beetle, Apple Maggot, Codling Moth, Plum Curculio, Potato Rot* and *Grape Mildew.* Mr. Fletcher tells how the invasions of these enemies are to be warded off, and how they are to be treated at close quarters. Dealing with the vegetable kingdom, he instructs our agriculturists how to deal with the inroads made into different parts of the Dominion of certain obnoxious weeds, mentioning particularly pepper-grass (*Lepidium intermedium*), penny-cress (*Thlaspi arvensis*), purslane (*Portulaca oleracea*), common Ragwort (*Senecio Jacobæa*), perennial sow thistle (*Sonchus arvensis*), burdock (*Lappa officinalis*), wild chicory (*Cichorium Intybus*), orange daisy (*Rudbeckia hirta*), ox-eye daisy (*Chrysan-*

themum Leucanthemum), Canadian Fleabane (*Erigeron Canadense*), Canada thistle (*Cnicus arvensis*), couch grass (*Agropyrum repens*), wild oats (*Avena fatua*), and chess (*Bromus secalinus*.)

But Mr. Fletcher's *brochure* is not all negative. It has valuable suggestions showing what to cultivate as well as what to pull up. The experiment making in grasses on the Central Farm, is most important in its bearing on the future history of the agriculture of this country. The raising of stock is as yet only in its infancy in the Dominion, and the possibilities in this connection are immense. If we have native grasses that can be generally utilized, specially suited to our climate and of high nutritive qualities, the bringing of these prominently under notice cannot but give a new impulse to the breeding of cattle and horses for the European markets. Mr. Fletcher's Report contains woodcuts of ten of our native grasses, by which the most inexpert reader will be easily able to identify them, as they are described in the text of the Report, and as they are found in nature.

The pamphlet, embracing Mr. Fletcher's evidence before the Select Committee of the House of Commons, enlarges upon the topics touched on in his report and in that of the Director of the Experimental Farm, and dwells on many additional points of great importance, on which a want of space forbids remark at length. Our readers are referred to the *brochure* itself, if they desire detailed information regarding it. A later bulletin of Mr. Fletcher's deals with the "Horn Fly," (*Hæmatobia Serrata*), the most recent of the pests by which our farmers are afflicted, and gives a specific for its destruction, "Kerosene Emulsion," and instructions how to apply the same.

ROBERT CAMPBELL.

ABSTRACT FOR THE MONTH OF OCTOBER, 1892.

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	46.45	65.8	39.7	27 1	30.1618	30.288	29.997	0 291	.2210	71.0	36 8	N.W.	19 0	4.8	10	0	95	....	....	....	1
SUNDAY...... 2	.....	51.9	36.8	15.1	....	......	......	....	.....	....	....	S.W.	13.9	....	..		68	....	....	....	2 .... SUNDAY
3	47.32	51.8	44 0	7 8	29.7732	30.053	29.552	.501	.2593	78.8	40.7	S.	9.9	10.0	10	10	52	0.38	....	0.38	3
4	49.22	57.3	43.1	14 2	29.5570	29 591	29.536	.055	.2740	78 2	42 3	N.W.	6.2	7.2	10	3	90	Inap.	....	0 00	4
5	42.85	49.4	38.6	10 8	29 6623	29.719	29 619	.100	.1948	70.7	34.0	N.W.	16 8	8.3	10	0	20	Inap.	....	0.00	5
6	43.85	50.3	39.0	11.3	29.6748	29 717	29.640	.077	.1932	67.5	33.3	N.W.	34.2	10.0	10	10	15	....	....	....	6
7	52 88	61.8	45.7	16 1	29.6632	29.694	29.624	.070	.2947	74.8	44.3	W	18.0	8.7	10	2	56	0.02	....	0 02	7
8	50.13	54 8	47.3	7.5	29.7440	29.771	29.738	.033	.2928	80.8	44.3	N.	8.7	8.8	10	2	34	Inap.	....	0.00	8
SUNDAY....... 9	.....	52 2	42.5	9 7	....	......	......	....	.....	....	....	N.	14.8	...	..	..	76	....	....	....	9 ....SUNDAY
10	43 53	50.4	36 5	13 9	29.9605	39.002	29 923	.079	.2037	71 8	34.8	W.	12.8	8 3	10	0	00	0 02	....	0.02	10
11	41 63	49.4	36.0	13.4	30.1245	30.302	29.955	.347	.1857	72.5	32 7	N.W.	12 5	5.2	10	0	38	0.02	....	0.02	11
12	40 40	46.8	32.6	14.2	30.4260	30.467	30 313	.154	.1790	72.0	31.8	N.W.	6.2	3.3	10	0	98	....	...	....	12
13	52 90	62.4	42.6	19.8	30.2482	30.388	30.083	.305	.2850	70.0	43.3	S.W.	16.1	7.7	10	0	64	....	....	....	13
14	58.28	67 8	50 5	17.3	30.0435	30.069	30.003	.066	.3505	72.0	49.0	S.W.	21.5	2.2	6	0	89	....	....	....	14
15	55.57	64.3	45.5	18.8	29.9743	30 097	29.835	.262	.3608	81.2	49.7	S.	9 9	8.3	10	0	39	0.22	....	0.22	15
SUNDAY...... 16	.....	64.8	47.7	17.1	....	......	......	....	.....	....	...	W.	11 5	....	..	..	20	0.05	....	0.05	16 .... SUNDAY
17	42.23	48.8	36.0	12.8	30.2462	30.301	30 202	.099	.2040	76 0	35.2	N.W.	12.5	1.0	5	0	93	....	....	....	17
18	43.57	51.4	35.0	16.4	29.9945	30.189	29.771	.418	.2573	69 5	40 7	W.	5 8	6.7	10	0	00	...	....	....	18
19	53.12	59.7	44 8	14.9	29.7310	29.859	29 644	.215	.3240	79 8	46.7	S.W.	17 5	7.0	10	1	36	0.40	....	0 40	19
20	45 47	51 2	40.4	10.8	29.9[illegible]20	30 012	29 962	.050	.1743	57 5	31.0	S.W.	13.3	4.5	10	0	83	....	....	...	20
21	47.07	54.8	40 5	14 3	29.9705	30.006	29.939	.067	.1993	62 8	34.3	N.	15 4	5.0	10	0	96	....	....	....	21
22	47.78	55.5	41.0	14.5	29.9237	30.079	29.746	.333	.2557	77.7	41.0	S.W.	12.3	2 2	10	0	52	....	....	..	22
SUNDAY........ 23	.....	51.4	40 9	10.5	......	......	......	....	.....	....	....	S.W.	19.8	....	..	..	37	Inap.	....	0.00	23 ....SUNDAY
24	41.88	47 3	36 7	10.6	29 8538	29.879	29.835	.044	.1880	70.5	32.8	S.W.	20.5	7.3	10	0	49	....	....	....	24
25	42.07	45.5	38.7	6.8	29.8568	29 869	29 830	.059	.2287	85.7	38.2	S.W.	12.8	10 0	10	10	12	Inap.	....	0.00	25
26	41 23	45 3	39 5	5.8	29.7402	29.795	29 639	.096	.2360	91 0	39.0	S.W.	4.7	10.0	10	10	00	0.16	....	0.16	26
27	40.17	44.0	38.7	5.3	29.7533	29.831	29.709	.122	.2067	82.0	35 2	S.W.	12.7	10 0	10	10	09	0.02	....	0.02	27
28	41.17	47.7	34.5	13.2	29 7975	29.86[illegible]	29 685	.184	.2115	80.7	35.5	S E.	7 3	6.8	10	0	36	0.01	....	0.01	28
29	39 50	41.8	36.5	5.3	29.5475	29.639	29 460	.179	.2210	91.0	37.2	N.E.	9 5	10.0	10	10	00	0.27	....	0.27	29
SUNDAY....... 30	....	45.6	36 6	9.0	... ...	......	..	....	....	....	..	S.W.	12.6	....	..	..	56	Inap.	....	0.00	30 .. ..SUNDAY
31	40.03	45.4	34.0	11.4	30.0555	30.140	29.990	.150	.2112	85.0	35.8	S.W.	8.3	8.3	10	0	00	Inap.	....	0.00	31
....Means	46.27	52.83	40.06	12.76	29.9027	.....	......	.168	.2390	76.6	38.4	......	13.5	7.0	...	....	¶46.9	1.57	....	1.57	Sums ....
18 Years means for and including this month......	45.13	52.07	38.48	13.59	29.9980	.....	......	.208	.2410	76.37	....	......	..	6 50	....	....	41.1	3.22	1.48	3.38	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.
Miles	1090	200	112	334	546	3973	1204	2551
Duration in hrs ..	85	27	18	37	60	255	90	172
Mean velocity....	12.82	7.41	6.22	9.03	9.10	15.58	13.38	14.83

Greatest mileage in one hour was 43 on the 6th.
Greatest velocity in gusts, 46 miles per hour on the 6th.

Resultant mileage, 5580.
Resultant direction, S. 72° W.
Total mileage, 10,010.

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

The greatest heat was 67.8 on the 14th; the greatest cold was 32.6 on the 12th, giving a range of temperature of 35.2 degrees. Warmest day was the 14th. Coldest day was the 29th. Highest barometer reading was 30.467 on the 12th; lowest barometer was 29.460 on the 29th, giving a range of 1.007 inches. Maximum relative humidity was 98 on the 3rd. Minimum relative humidity was 41 on the 21st.

Rain fell on 18 days.
Snow fell on 1 day.
Rain or snow fell on 18 days.
Auroras were observed on 3 nights.
Hoar frost on 2 days.
Fog on 2 days.
NOTE.—This is the only month of October in 18 years on which the temperature has not fallen below freezing.

ABSTRACT FOR THE MONTH OF NOVEMBER, 1892.

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	36.00	44.6	30.5	14 1	30.2397	30.390	30.038	0.352	0.1477	68.0	26.2	N.W.	13.7	8.5	10	4	12	0.05	....	0.05	1
2	31.85	37.4	28.7	8.7	30.1193	30.343	29.938	0.405	0.1662	92.2	29.8	N.E.	12.9	10.0	10	10	00	0.24	4.9	0.94	2
3	33.78	35.2	32.5	2 7	29.8540	29.993	29.779	0.214	0.1797	92.7	32.2	S.W.	7.4	9.5	10	7	co	0 03	....	0.03	3
4	36.67	49.9	32.8	8.1	29 6582	29.802	29 502	0 300	0.2000	92.0	34.3	S.	9.3	10.0	10	10	00	0.03	0.6	0 09	4
5	25.80	37.5	22.2	20.3	29.8262	30.014	29.558	0.456	0.1265	89.7	23.2	S.W.	21.9	9.8	10	8	04	....	5.5	0.52	5
SUNDAY...... 6	.....	35.4	21.8	13.6	......	......	......	....	.....	....	....	S.	12.9	....	..	..	30	....	....	....	6 ....SUNDAY
7	41.98	48.3	33.5	14.8	29.8672	30.076	29.664	0.412	0.2135	77.3	35.3	S.E.	20.3	9.3	10	6	00	0.08	....	0.08	7
8	40.02	51 2	33.8	17.4	29.9035	30.122	29.669	0.453	0.1745	68.5	30.3	S.W.	38.4	9.3	10	6	00	0.05	....	0.05	8
9	31.10	41 6	28.5	13.1	30.3965	30.453	30 301	0.152	0.1050	60.0	19.5	S.W.	13.1	5 5	10	0	35	....	....	....	9
10	28.13	33.6	25 7	7.9	29.9880	30.235	29.833	0.402	.1363	88.2	25 0	N.E.	15 2	8.3	10	0	00	....	7.3	0.67	10
11	27.30	31.4	24.5	6.9	30.0762	30.134	30 005	0.129	.1117	75.5	20.8	W.	12.0	6.7	10	0	98	....	....	..	11
12	32.67	34.7	27.0	7.7	30.0212	30 157	29.952	0.205	.1708	91.8	30.7	S.E.	13.7	10.0	10	10	00	0.02	1.3	0.16	12
SUNDAY........13	.....	35.4	27.1	8.3	....	......	......	....	.....	....	....	S.W.	11.9	....	..	..	00	....	0.3	0.03	13 ....SUNDAY
14	39.37	42.2	28.2	14.0	30.0550	30.100	30.007	0 093	.1867	77.0	32.8	S.E.	24 5	8.7	10	7	00	....	....	....	14
15	43.12	50 2	39.3	10 9	30.1437	30 188	30.096	0 092	.2483	88.5	39.7	S.E.	11.8	7.5	10	0	02	....	....	....	15
16	44.40	46.5	40.9	5 6	29.7720	30.034	29 603	0.431	.2813	96 0	43.3	N.W.	13.9	10.0	10	0	00	0.45	....	0 45	16
17	46.30	51.3	42.1	9.2	29.9513	30.047	29.812	0.235	.2648	84.7	41.8	S.W.	13.9	5.3	10	0	58	....	...	. .	17
18	55.53	63.7	38.5	25.2	29.5733	29.782	29.221	0.561	.2982	66.7	44 2	S.E.	20.4	9.7	10	8	09	0.41	....	0.41	18
19	37.03	45.7	35.0	10 7	29.7203	29.773	29 675	0 098	.1683	76 3	30.2	N.W.	13.0	6.7	10	0	13	....	....	....	19
SUNDAY........20	.....	36.6	27.6	9.0	....	......	......	....	.....	....	....	S.W.	13 1	....	..	..	94	....	....	..	20 ....SUNDAY
21	28.37	36.5	23.2	13.3	30.0005	30.259	29.848	0.411	.1317	83.7	24.2	N.	8.4	8.3	10	0	03	....	0.2	0.02	21
22	24.02	33.5	16.7	16.8	29 9382	29.982	29.870	0.112	.1043	79.3	18.8	N.W.	17.2	9 5	10	7	09	....	0.5	0.06	22
23	17.63	21.1	15 5	5.6	29.8137	29.885	29.774	0.111	.0697	72.3	10.7	N.W.	16.2	10 0	10	0	00	....	0.6	0.05	23
24	22.40	25.9	16 2	9 7	29.8673	29.948	29.786	0.162	.0982	81.3	17.7	W.	17.5	8.3	10	0	25	....	0.8	0.08	24
25	27.78	31.3	24.0	7.3	30.0727	30.192	29 958	0.234	.1218	80 7	22.7	N.W.	10.6	10.0	10	10	05	....	0.1	0.01	25
26	24.97	29.4	21.3	8.1	30 3277	30.419	30.235	0.184	.1130	84 3	21 0	N.W.	4.2	8.2	10	0	10	....	....	....	26
SUNDAY........27	.....	30.2	25.6	4.6	......	......	......	....	.....	....	....	N.	5.6	....	..		00	....	....	....	27 ....SUNDAY
28	29.37	33.4	24.5	8.9	30.3058	30.369	30.261	0.108	.1382	84.0	25.3	N.	12.5	8.5	10	1	01	....	....	....	28
29	26.57	31.5	20.9	10.6	30.2630.	30.300	30.232	0.068	.1180	82.0	22.0	N.W.	16.8	8.2	10	0	37	....	....	....	29
30	27.05	29 2	25 7	3.5	30.1488	30.213	30.085	0.128	.1197	81.8	22.5	N.W.	14.5	10.0	10	10	00	....	....	..	30
....Means	33.05	38.18	27.79	10 56	29.9962	.....	......	.251	.1613	81.3	27.85	S 72° W	14.6	8.7	....	....	14.8	1.36	22.1	3.70	Sums ....
18 Years means for and including this month.	32.28	38.77	26.45	12.32	30.0103	.....	......	.262	.1554	79.5	....	......	....	7.4	....	....	¶29.0	2.37	13.3	3.72	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............	758	806	50	2130	414	2240	1244	2835	
Duration in hrs..	82	66	11	114	38	120	90	197	2
Mean velocity....	9.2	12.2	4.6	18.7	10.9	18.7	13.8	14.4	

Greatest mileage in one hour was 50 on the 8th.
Greatest velocity in gusts, 56 miles per hour on the 8th.

Resultant mileage, 2845.
Resultant direction, S. 72° W.
Total mileage, 10,477.
Average velocity 14.55 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.
¶ 11 years only.

The greatest heat was 63.7 on the 18th; the greatest cold was 15.5 on the 23rd, giving a range of temperature of 48.2 degrees. Warmest day was the 18th. Coldest day was the 23rd. Highest barometer reading was 30.495 on the 27th; lowest barometer was 29.221 on the 18th, giving a range of 1.274 inches. Maximum relative humidity was 97 on the 4th and 16th. Minimum relative humidity was 51 on the 9th.

Rain fell on 9 days.

Snow fell on 11 days.

Rain or snow fell on 17 days.

Lunar halo on 1 night.

ABSTRACT FOR THE MONTH OF DECEMBER, 1892.

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	30.62	36.5	25.6	10 9	29.9422	30.065	29.859	.206	1332	78.0	24.7	N.W.	14.8	10.0	10	10	00	....	0.1	0.01	1
2	25.05	34.6	21.2	13.4	29.8288	29.895	29.759	.136	1108	81.8	20.5	W.	25.9	5.3	10	0	53	....	....	....	2
3	25.93	28.3	20.3	8.0	29.6177	29.746	29.532	.214	1267	90.5	23.5	W.	7.6	10.0	10	10	00	....	0.8	0.06	3
SUNDAY...... 4	.....	29.2	23.1	6.1	....	......	......	....	.....	....	....	N.W.	10.0	....	..	..	00	....	0.4	0.04	4 ....SUNDAY
5	22.37	27.5	19.7	7.8	30.1248	30.197	30.026	.171	1010	84.2	18.8	W.	10.5	6.2	10	0	13	....	....	....	5
6	21.30	27.7	15.3	12.4	30.0185	30.235	29.816	.419	0980	85.3	17.5	W.	5.5	8.3	10	0	00	....	1.1	0.11	6
7	27.18	31.7	19.0	12.7	29.9852	30.022	29.927	.095	1232	83.5	22.8	W.	9.6	9.3	10	7	16	....	Inap.	Inap.	7
8	35.90	39.5	27.0	12.5	29.6342	29.832	29.598	.234	1892	89.2	33.0	S.E.	18.7	10.0	10	10	07	0.76	....	0.76	8
9	34.93	38.7	33 7	5.0	29.9208	30.075	29.752	.323	1538	75.3	27.8	W.	11.2	10.0	10	10	00	....	....	....	9
10	33.15	35.2	31.7	3.5	30.0518	30.118	30 006	.112	1530	81.0	27.8	W.	4.9	10.0	10	10	00	....	....	....	10
SUNDAY........11	.....	33.0	25.4	7.6	....	......	......	....	.....	....	....	W.	18.3	....	..	..	21	....	0.5	0.05	11 .... SUNDAY
12	27.57	30.7	23.8	6 9	30.3632	30.415	30.332	.083	1272	84.8	23.8	W.	16.2	10.0	10	10	01	....	0.2	0.01	12
13	29.48	32.7	23.8	8 9	30.3267	30.377	30.225	.152	1393	85.0	25.7	W.	9.4	8.3	10	0	07	....	....	....	13
14	27.70	32.5	25 2	7.3	29.9867	30.135	29.936	.199	1420	93.8	26.5	N.E.	11.5	10.0	10	10	00	....	4.9	0.50	14
15	32.67	36.4	27.5	8.9	29.9415	30.987	29.888	.099	1548	82.8	28.0	W.	17.8	8.2	10	0	00	0.04	Inap.	0.04	15
16	28.95	33.7	25 5	8.2	29.9801	30 018	29.941	.077	1227	76.3	22.7	W.	17.8	4.2	10	0	51	....	0.2	0.02	16
17	16.13	25.5	9.5	16.0	29.9983	30.027	29.968	059	0727	79.0	10.8	N.	6.3	4.2	10	0	60	....	Inap.	Inap.	17
SUNDAY........18	.....	18.5	4.3	14.2	....	......	......	....	.....	....	...	E.	5.7	....	..	..	07	....	0.3	0.02	18 ....SUNDAY
19	24.72	33.4	16.0	17.4	29.7157	29.789	29.643	.146	1205	87.8	21.7	W.	14.3	6.7	10	0	00	....	2.5	0.25	19
20	5.92	21.0	1.7	19 3	29.9635	30.071	29.875	.196	0418	73.0	—0.8	N.W.	17.0	2.3	10	0	80	....	....	....	20
21	12.75	21.7	1.5	20.2	30.1020	30.172	30.049	.123	0642	80.2	8.0	N.W.	16.7	6.7	10	0	09	....	0.3	0.03	21
22	— 1.62	4 3	— 5.6	9 9	30.1082	30.185	30.054	.131	0297	73.3	—8.2	N.W.	20.2	0.0	0	0	00	....	....	..	22
23	— 4.22	—0.8	— 7.2	6.4	29.8105	29.984	29.660	.324	0278	77.3	—9.5	W.	20.6	4.2	10	0	84	....	....	....	23
24	— 2.13	+1.8	— 6.8	8.6	29.7193	29.757	29.695	.062	0285	69.3	—8.8	N W	34.2	7.3	10	0	00	....	....	....	24
SUNDAY........25	.....	5.1	— 9.1	14.2	....	......	......	....	.....	....	....	W.	15.2	....	..	..	00	....	1.0	0.10	25 ....SUNDAY
26	— 6.80	4.0	—16.0	20.0	29.8150	29.914	29.670	.244	0857	79.5	—11.5	W.	13.0	4.0	10	0	44	....	....	....	26
27	7.92	11.5	4.0	7.5	30.0942	30.160	30.007	.153	0497	79.7	2.7	N.W.	7.4	10.0	10	10	09	....	....	....	27
28	7.77	12.3	3.5	8.8	30.2167	30.263	30.187	.076	0487	78.8	2.5	N.	3.2	1.7	10	0	67	....	....	....	28
29	8.92	13.5	4.0	9.5	30.3417	30.389	30.290	.099	0538	83.0	4.7	W.	11.3	3.5	10	0	67	....	....	....	29
30	12.47	18.2	4.8	13.4	30.4082	30.469	30 305	.164	0633	82.3	8.0	W.	10.7	8.0	10	0	01	....	....	....	30
31	20.28	26.3	13.9	12.4	30.1628	30.263	30.085	.178	0902	82.0	15.7	S.W.	8.9	7.8	10	7	00	....	Inap	Inap.	31
............Means	18.70	24.01	13.11	10.90	30.0088	.....	......	.166	.0960	81.36	14.01	. 81° W.	13.40	6.90	....	....	19	0.80	12.3	2.00	Sums ....
18 Years means for and including this month.......	18.94	25.92	11.71	14.21	30.0199	.....	......	.286	0986	82.0	....	......	....	7.07	....	....	¶28.4	1.36	23.1	3.63	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	594	191	160	218	250	460	5443	2551	
Duration in hrs ..	94	17	32	12	27	36	357	168	1
Mean velocity....	6.3	11.2	8.1	18.2	9.3	12.8	15.2	15.2	

Greatest mileage in one hour was 42 on the 24th.
Greatest velocity in gusts, 44 miles per hour on the 24th.
Resultant mileage, 7,115.

Resultant direction, N. 81° W.
Total mileage, 9,967
Average velocity per hour, 18.4.

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

The greatest heat was 39.5 on the 8th; the greatest cold was —16.0 on the 26th, giving a range of temperature of 55.5 degrees. Warmest day was the 8th. Coldest day was the 26th. Highest barometer reading was 30.469 on the 30th; lowest barometer was 29.456 on the 26th, giving a range of 1.013 inches. Maximum relative humidity was 98 on the 14th. Minimum relative humidity was 56 on the 22nd.
Rain fell on 2 days.
Snow fell on 16 days.
Rain or snow fell on 17 days. Hail fell on 1 day.
Auroras were observed on 2 nights.
Hoar frost on 3 nights.
Lunar halo on 2 nights.
Lunar corona on the 26th.

Meteorological Abstract for the Year 1892.

Observations made at McGill College Observatory, Montreal, Canada. — Height above sea level 187 ft. Latitude N. 45° 30′ 17″. Longitude 4h 54m 18s.55 W.

C. H. McLEOD, *Superintendent.*

Month.	Thermometer.					* Barometer.				Mean pressure of vapour.	Mean relative humidity.	Mean dew point.	Wind.		Sky clouded per cent.	Per cent. possible bright sunshine.	Inches of rain.	Number of days on which rain fell.	Inches of snow.	Number of days on which snow fell.	Inches of rain and snow melted.	No. of days on which rain and snow fell.	No. of days on which rain or snow fell.	Month.
	Mean.	Deviation from 17 years means.	Max.	Min.	Mean daily range.	Mean.	Max.	Min.	Mean daily range.				Resultant direction.	Mean velocity in miles per hour.										
January	14.52	+ 2.38	43.7	— 12.4	14.04	29.9794	30.707	29.170	.292	.0791	83.2	10.4	W. 32° S.	14.9	74.	19.0	0.73	5	39.7	22	4.59	3	23	January
February	17.91	+ 2.19	38.8	— 9.0	14.60	30.1406	30.962	29.152	.210	.0910	81.2	13.0	N. 38° W.	14 6	63.	35.1	0.00	0	36.4	16	3.27	0	16	February
March	23.26	— 0.69	40.8	— 0.5	13.90	29.9644	30.526	29.035	.216	.10 6	76.3	16.8	W. 10° S.	19.2	53.	50.0	0.29	5	34.6	10	3.84	5	10	March
April	41.23	+ 1.39	63.0	20.6	16.30	29.9817	30.512	29.453	.201	.1632	62.2	28.5	N. 84° W.	17.7	55.	54.0	1.01	9	7.2	5	1.73	1	13	April
May	52.92	— 1.44	81.2	34.0	18.00	29.9234	30.365	29.485	.187	.2046	64.6	40.0	N. 30° W.	15.3	59.	43 0	2.20	15	...	..	2.20	..	15	May
June	65.73	+ 1.16	88.6	48.2	16.96	29.8985	30.354	29.486	.169	.4725	72.8	56.1	N. 84° W.	12 9	61.	44.0	8.00	22	0.	..	8.00	..	22	June
July	09.81	+ 0.92	88.5	50.6	17.30	29.9758	30.522	29.512	.145	.5371	72.2	60.0	N. 56° W.	16.1	47.	68.0	2.95	18	0.	..	2.95	..	18	July
August	66.37	— 0.54	86.2	51.2	15.70	29.9680	30.282	29.701	.116	.5078	78.2	58.5	N. 46° W.	13.3	59.	56.0	5.24	13	..	..	5.24	.	13	August
September	57 42	— 1.24	78.8	39.3	16.20	30 0613	30.442	29.341	.182	.3629	74.9	49.3	S. 35° W.	12.1	46.	62.0	2.92	10	....	.	2.92	.	10	September
October	46.27	+ 1.14	67.8	32.6	12.76	29 9027	30.467	29.460	.168	.2390	76.6	38.4	S. 72° W.	13.5	70.	46.9	1.57	18	...	1	1.57	1	18	October
November	33.05	+ 0.77	63.7	15.5	10.56	29.9962	30.495	29.221	.251	.1613	81.3	27.8	S. 72° W.	14.6	87.	14.8	1.36	9	22.1	11	3.70	3	17	November
December	18.70	— 0.24	39.5	— 16.0	10.90	30.0088	30.469	29.456	.166	.0960	81.4	14.0	N. 81° W.	13.4	69.	19.0	0.80	2	12.3	16	2.00	1	17	December
Sums for 1892	....	....	....	....	....	.	....	....	....	....	.	....	N. 85° W.	....	....	....	27.07	126	152.3	81	42.01	14	192	Sums for 1892
Means for 1892	42.27	+ 0.48	....	....	14.77	29.9835	....	....	.192	.2564	75.4	34.4		14.89	61.9	42.7	....	....	....	....	3.50	..	16	Means for 1892
Means for 18 years ending Dec. 31, 1892.	41.78	....	...	....	...	29.9783	....	....	....	.2499	74.3	....	....	15.19	....	§ 45.8	28.07	134	123.6	83	40.09	16	....	Means for 18 years ending Dec. 31, 1892.

The greatest heat was 88.6 on June 1st and 88.5 on July; the greatest cold was 16.0 below zero on December 26th; extreme range of temperature was therefore 104.6. Greatest range of the thermometer in one day was 35.3 on February 26th; least range was 2.4 on March 9th. The warmest day was July 27th when the mean temperature was 79.0. The coldest day was January 20th when the mean temperature was 7°.7 below zero. The highest barometer reading was 30.962 on February 27th. The lowest barometer was 29.035 on March 11th, giving a range of 1.927 for the year. The lowest relative humidity was 16 on April 20th. The greatest mileage of wind recorded in one hour was 63 on March 11th, and the greatest velocity in gusts was at the rate of 70 m. p. h. on March 11th. The total mileage of wind was 127,718. The resultant direction of the wind for the year was N. 85° W., and the resultant mileage 46.540. Auroras were observed on 45 nights. Fogs on 16 days. Hoar-frost 5 days. Thunder storms on 15 days. Lunar halos on 11 nights. Lunar corona on 1 night. Solar halos on 2 days, and on May 10th Solar Halo with parhelic arc. The sleighing of the winter closed in the city on March 29th, and snow all gone on open ground on April 12th. The first snowfall of the autumn was on October 31st. The first sleighing of the winter was on November 2nd.

NOTE.—The yearly means above, are the averages of the monthly means, except for the velocity of the wind.