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Canadian Fungi.

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

Thus far the reports of the Geological Survey of Canada have not listed the fungi of the Dominion. No very considerable number of this family of plants found in Canada has been reported or published hitherto. In the "Canadian Naturalist," Vol. II. (New Series), issued in 1865, there is found, pp. 390-3, "A Provisional Catalogue of Canadian Cryptogams," by Mr. D. A. P. Watt, which includes a list of the "Alliance Fungales" of our country, as known at that date. Those collecting at that time had, however, confined themselves mainly to the microscopic forms. Since then Mr. J. Dearness, of London, Ontario, has prosecuted the study of the latter, the *Physomycetes*, but his collections have been reported mainly in American magazines, although two papers from him bearing on this subject have appeared in this journal (Volumes V. and VIII). The undersigned list, collected partly at Cap-a-L'aigle, in July and August, 1902, and partly around Montreal, in September and October, 1902, and from August to October, 1903, embraces 129 species. Of these only about 25 are mentioned in Mr. Watt's catalogue, without any information as to where and when they were found.

In late years, much attention has been given to the native mushrooms or toadstools of this continent by the botanists of the United States, resulting in several important publications on the subject. I have availed myself of the information and descriptions given in three of these publications—"Studies of American Fungi," by Prof. George Francis Atkinson, of Cornell University; "Students' Handbook of Mushrooms of America," by Dr. Thomas Taylor, Chief of the Division of Microscopy, United States Department of Agriculture; and the "Reports of the New York Museum of Natural History," by Prof. C. H. Peck, State Botanist. I have not had access to the larger and more recent volume of Mr. Charles McIlvaine, of Philadelphia.

Special interest in this subject was first awakened in Montreal by a paper communicated to the Natural History Society by Miss Mary Van Horne in the winter of 1902, in which she described some sixty odd species which she and her niece, Miss Agnes Van Horne, had collected around their summer home at St. Andrews, New Brunswick. The list then submitted and described, it is hoped, will yet be given to the readers of the RECORD OF SCIENCE. Of the species given below, it will be observed that the number reported as edible is vastly greater than that of the poisonous ones. The knowledge of this fact has created a good deal of popular curiosity, for the word toadstool has generally been regarded as ominous—something to be avoided. Now that many species are found to be delicious and nutritious, it may be expected that this branch of botanical study will obtain new recruits. So distinct are the mushrooms from other vegetable organisms that a person who knows little or nothing of botany generally may take up the subject and prosecute it successfully. The subjoined list contains the substance of two papers submitted to the Natural History Society of Montreal. The order followed is that observed in Prof. Atkinson's work.

BASIDIOMYCETES.

HYMENOMYCETES.

AGARICACEÆ—GILL-BEARING FUNGI.

(PURPLE BROWN SPORED AGARICS.)

Agaricus silvaticus Schaeff. (Edible.) Edge of woods, Cap-a-L'aigle, July.

Hypholoma sublateritium Schaeff. (Edible.) Mount Royal, August.

Hypholoma appendiculatum Bull. (Edible.) Mount Royal Cemetery, October.

Stropharia semiglobata Batsch. In fields, Cap-a-L'aigle, August.

(BLACK-SPORED AGARICS.)

Coprinus comatus Fries. (Edible.) Mount Royal Cemetery, October.

Coprinus atramentarius (Bull) Fries. (Edible.) Mount Royal Cemetery, Westmount and Fort Street, August-October.

Coprinus micaceus (Bull) Fries. (Edible.) Mount Royal Cemetery, McGill College Grounds and St. Famille Street, July-October.

Panæolus retirugis Fries. Mount Royal Cemetery, July.

Psathyrella disseminata Pers. At the foot of maple tree, Cemetery Road, May.

(WHITE-SPORED AGARICS.)

Amanita Muscaria Linn. (Poisonous.) Under spruces, Cap-a-L'aigle, August.

Amanita phalloides Fries. (Deadly poisonous.) Edge of wood, Cap-a-L'aigle, August.

Amanita verna Bull. (Deadly poisonous.) Under spruces, Cap-a-L'aigle, August.

Amanita Cæsarea Scop. (Edible.) Under spruces, Cap-a-L'aigle, August.

Amanita solitaria Bull. (Edible.) In white birch woods, Cap-a-L'aigle, July.

Amanitopsis vaginata (Bull) Roz. (Edible.) On the ground, Mount Royal, August.

Amanitopsis farinosa Schw. Under white birch trees, Cap-a-L'aigle, August.

Lepiota naucina Fries. (Edible.) On the ground, Hochelaga Bank, July.

Lepiota cristata A. and S. (Edible.) On the ground, Mount Royal Park, July.

Armillaria Mellea Vahl. (Edible.) On the ground, Mount Royal Park, August.

Tricholoma personatum Fries. (Edible.) On the ground, Cap-a-L'aigle, July.

Tricholoma sejunctum Sowerb. (Edible.) On the ground, Cemetery, October.

Clitocybe candida Bres. (Edible.) On the ground, Cemetery, October; Cap-a-L'aigle, August.

Clitocybe illudens Schw. (Not edible.) At root of stump, Pte-aux-Trembles, September.

Collybia radicata Rehl. (Edible.) On the ground, Petite Cote Woods, August.

Collybia fusipes Bull—"spindle-foot collybia." (Edible.) McGill College Grounds, Mount Royal Cemetery, October.

Mycena galericulata Scop. (Edible.) On rotten log, Cap-a-L'aigle, August.

Mycena pura Pers. On rotten log, Cap-a-L'aigle, August.

Mycena vulgaris Pers. On decayed stump, Mount Royal Park, August.

Mycena aciculata Schaeff. On decayed trunk, Cap-a-L'aigle, August.

Mycena hæmatopa Pers. On rotten stump, Hochelaga Bank, July.

Omphalia campanella Batsch. On oak stump, Westmount, August.

Omphalia epichysium Pers. On logs, Westmount, August.

Pleurotus ulmarius Bull. (Edible.) Growing out of end of elm log, Longue Pointe, September.

Pleurotus ostreatus Jacq. (Edible.) On decaying log, Mount Royal Park, September.

Pleurotus Sapidus Kaleb. (Edible.) On dead trunk of tree, Mount Royal Cemetery, August.

Pleurotus dryinus Pers. (Edible.) On an oak tree at St. Anne's, September.

Pleurotus sulphuroides Pk. On a decaying log, Petite Cote Woods, September.

Pleurotus petaloides Bull. (Edible.) At foot of maple stump, Mount Royal Park, September.

Pleurotus applicatus Batsch. On under side of rotting oak log, September.

Hygrophorus chrysodon (Batsch) Fries. (Edible.) On the ground, at edge of Cemetery Woods, September.

Hygrophorus eburneus (Bulliard) Fries. (Edible.) Under the pines, top of Mount Royal, October.

Hygrophorus fuligineus Frost. (Edible.) In Cemetery Woods, October.

Hygrophorus miniatus Fries. On the ground in the Cemetery Woods, October.

Hygrophorus coccineus (Schaeff) Fries. On the ground in Mount Royal Woods, September.

Lactarius volemus Fries. (Edible.) On the ground in Bagg's Woods, July.

Lactarius fuliginosus Fries. On the ground in woods, Cap-a-L'aigle, August.

Lactarius piperatus (Scop) Fries. On the ground in Bagg's Wood, July.

Lactarius chelidonium Pk. (Edible.) On the ground in woods at Cap-a-L'aigle, August.

Russula alutacea Fries. (Edible.) On the ground in woods at Cap-a-L'aigle, July and August.

Russula lepida Fries. (Edible.) On the ground in Mount Royal Woods and in woods at Cap-a-L'aigle, August.

Russula virescens (Schaeff) Fries. (Edible.) On the ground in Mount Royal Woods, September.

Russula fragilis (Pers.) Fries. On the ground in woods at Cap-a-L'aigle and on Mount Royal, July and August.

Russula emetica Fr. (Poisonous.) Very common in the woods on Mount Royal and at Cap-a-L'aigle, July and August.

Russula adusta (Pers.) Fries. On the ground in Bagg's Woods, September.

Cantharellus cibarius Fries. (Edible.) On the ground under spruces near the St. Lawrence, Cap-a-L'aigle, August.

Cantharellus aurantiacus Fries. On rotten log, Cap-a-L'aigle, August.

Marasmius oreades Fries. (Edible.) Common on Fletcher's Field and in cemetery lots, July-October.

Marasmius cohærens (Fries) Bres. At foot of rotten stump, Inverness, October.

Lentinus vulpinus (Fries). On a decaying bass-wood, Westmount Woods, July.

Lentinus lepideus Fries. On underside of fallen maple, Cemetery Woods, September.

Schizophyllum alneum (L.) Schroet. On fallen log, St. Anne's, September.

Trogia crispa Fries. On fallen white birch, St. Anne's, September.

(ROSY-SPORED AGARICS.)

Pluteus cervinus Schaeff. (Edible.) Common on Mount Royal, in the Cemetery and Cap-a-L'aigle Woods, July-September.

Clitopilus primulus scop. (Edible.) On plot of made ground, Mount Royal Cemetery, October.

Entoloma jubatum Fries. On the ground in Bagg's Wood, September.

Entoloma grayanum Pk. In hollow in Mount Royal Woods, August.

Entoloma strictius Pk. On grassy plots in Mount Royal Cemetery, October.

Leptonia asprella Fries. On the grounds in Westmount Woods, September.

Leptonia incana Fries. In backyard, St. Famille Street, August.

Claudopus nidulans (Pers.) Pk. On side of fallen tree in Mount Royal Cemetery, September.

(OCHRE-SPORED AGARICS.)

Pholio'a praecox Pers. (Edible.) In grass, Cap-a-L'aigle, July.

Naucoria semi-orbicularis Bull. (Edible.) On lots in Mount Royal Cemetery, September.

Naucoria Vernalis Pk. In Woods, St. Michel, August.

Hebeloma crustinuliforme, Bull. In Mount Royal Cemetery, September.

Tubaria pellucida Bull. On top of rotten stump, St. Michel Woods, August.

Crepidotus Versutus Pk. On underside of rotten oak log, September.

Cortinarius Violaceus (L.) Fries. (Edible.) On the ground in woods near the St. Lawrence, Cap-a-L'aigle, August.

Cortinarius ochroleucus (Schaeff) Fries. On the ground in Mountain Woods, Cap-a-L'aigle, August.

Paxillus involutus (Batsch) Fries. (Edible.) In grass at edge of Mountain Woods, Cap-a-L'aigle, August.

Paxillus corrugatus Atkinson. On decaying spruce tree, Hochelaga Woods, September.

II. POLYPORACEÆ—TUBE-BEARING FUNGI.

Boletus edulis Bull. (Edible.) Common on ground, in hard woods, Mount Royal and Cap-a-L'aigle, July-September.

Boletus felleus Bull. (Bitter.) On hemlock stump, Cap-a-L'aigle, August.

Boletus retipes B. and C. In woods near St. Lawrence, Cap-a-L'aigle, August.

Boletus vermiculosus Pk. On the ground in high woods, Cap-a-L'aigle, August.

Boletus Americanus Pk. On ground under spruces, near St. Lawrence, Cap-a-Laigle, August.

Boletinus porosus (Berk.) Pk. On ground in woods, Cap-a-L'aigle, August.

Fistulina hepatica Fries. (Edible.) On oak stump, Westmount, September.

Fistulina pallida B. and Rav. At foot of elm stump, Longue Pointe, September.

Polyporus frondosa Fries. (Edible.) On stump of bass-wood, Mount Royal Cemetery, September.

Polyporus umbellatus Fries. At root of beech stump, Inverness, October.

Polyporus intybaceus Fries. At root of oak stump, Mount Royal Cemetery, July.

Polyporus sulphureus (Bull) Fries. (Edible.) On oak stump, Westmount, July.

Polyporus brumalis (Pers) Fries. On decaying maple log, Westmount, July.

Polystictus perennis Fries. On side of fallen oak, Mount Royal Park, September.

Polystictus connatus Schw. On fallen white birch, Salmon River, August.

Polystictus versicolor (L.) Fries. On decayed oak, Mount Royal Cemetary, August.

Polystictus hirsutus Fries. On fallen elm, Mount Royal Park, September.

Polystictus Pergamenus Fries. On fallen maple tree, Petite Cote Woods, August.

Polyporus giganteus Fries. At foot of a maple stump, Mount Royal Park, October.

Polyporus applanatus (Pers.) Fries. Common on wounded maple trees and dead trunks, September.

Polyporus sinuosus Fries. On decaying maple stump, Longue Pointe.

Polyporus lucidus (Leys.) Fries. On decayed trunk of white spruce, Hochelaga Woods, June.

Polyporus betulinus Fries. On decayed white birch, St. Anne's and Hochelaga Woods, September.

Polyporus leucophæus Mont. On wound in maple tree, Montreal, September.

Polyporus pinicola (Swartz) Fries. On dead spruce, Hochelaga Woods, August.

Polyporus igniarius (L.) Fries. On decayed birch, Mount Royal Park, September.

Dædalea ambigua. On side of a maple tree, St. Anne's, September.

III. HYDNACEÆ—HEDGEHOG FUNGI.

Hydnum coralloides Scop. (Edible.) On the ground, under spruces, near St. Lawrence, Cap-a-L'aigle, August.

Hydnum caput-ursi Fries. On wound on side of an Elm tree, St. Anne's, September.

Hydnum repandum L. (Edible.) On the ground in woods, Cap-a-L'aigle, August.

Hydnum imbricatum L. (Edible.) On the ground on the hillside, under white birch, Cap-a-L'aigle, August.

Hydnum putidum Atkinson. On dry hillside, under spruce, Cap-a-L'aigle, July and August.

IV. CLAVARIACEÆ—CORAL FUNGI.

Sparassis crispa Fries. (Edible). On stump off Greene Avenue, November.

Clavaria formosa Pers. (Edible.) On ground, under spruce trees, near St. Lawrence, Cap-a-L'aigle, August.

Clavaria botrytes Pers. (Edible.) In lane, under spruce, near St. Lawrence, Cap-a-L'aigle, August.

Clavaria pistillaris Linn. (Edible.) On the ground in high woods, Cap-a-L'aigle, August.

Clavaria mucida Pers. On top of rotten stump, Hochelega Woods, Cap-a-L'aigle, August.

V. TREMELLINEÆ—TREMBLING FUNGI.

Tremella frondosa Fries. On rotten wood, Cap-a-L'aigle, August.

Tremella fuciformis Berk. On ground, under spruce trees, near St. Lawrence, Cap-a-L'aigle, August.

Gyrocephalus rufus (Jacq.) Bref. From dead root, under ground, Cap-a-L'aigle, August.

V. TELEPHORACEÆ.

Craterellus cantharellus (Schw) Fries. (Edible). On the ground, Cemetery Woods, August.

GASTEROMYCETES.

VII. LYCOPERDACEÆ—PUFF-BALLS.

Lycoperdon giganteum Batsch. (Edible.) In pasture field, Cap-a-L'aigle, July.

Lycoperdon cyathiforme Bosch. (Edible.) In grassy fields, Cap-a-L'aigle, August.

Lycoperdon gemmatum Batsch. (Edible.) In goose-pasture, Cap-a-L'aigle, July and August.

Lycoperdon pyriforme Schaeff. (Edible.) On top of decayed basswood stump, October.

Bovista plumbea Pers. (Lead colored.) In pasture field, Cap-a-L'aigle, August.

Scleroderma vulgare Fries. On the ground, in woods, Cap-a-L'aigle, August.

Scleroderma verrucosum Fries. On the ground, in woods, Mount Royal Park, August.

VIII. PHALLOIDEÆ—STINK-HORN FUNGI.

Dictyophora ravenelii (B. & C.) Burt. On ground, Mount Royal Cemetery, October.

ASCOMYCETES.

IX. MORCHELLÆ—MORELS.

Morchella esculenta Pers. (Edible.) Woods at St. Anne's and Westmount, June.

X. HELVELLÆ—CUP-FUNGI.

Spathularia velutipes Cooke and Farlow. On the ground, Cap-a-L'aigle, August.

Leotia lubrica Pers. On rotting stump, Bagg's woods, August.

Sarcoscypha floccosa. On high bank of St. Lawrence river, Cap-a-L'aigle, August.

New Genera of Batrachian Footprints of the Carboniferous System in Eastern Canada.

By G. F. Matthew, LL.D., F.R.S.C.

The following article is based chiefly on material in the Redpath Museum of McGill University that was collected by the late Sir J. W. Dawson, mostly at the Joggins Mines and shore in Nova Scotia, and which remained undescribed at the time of his death.

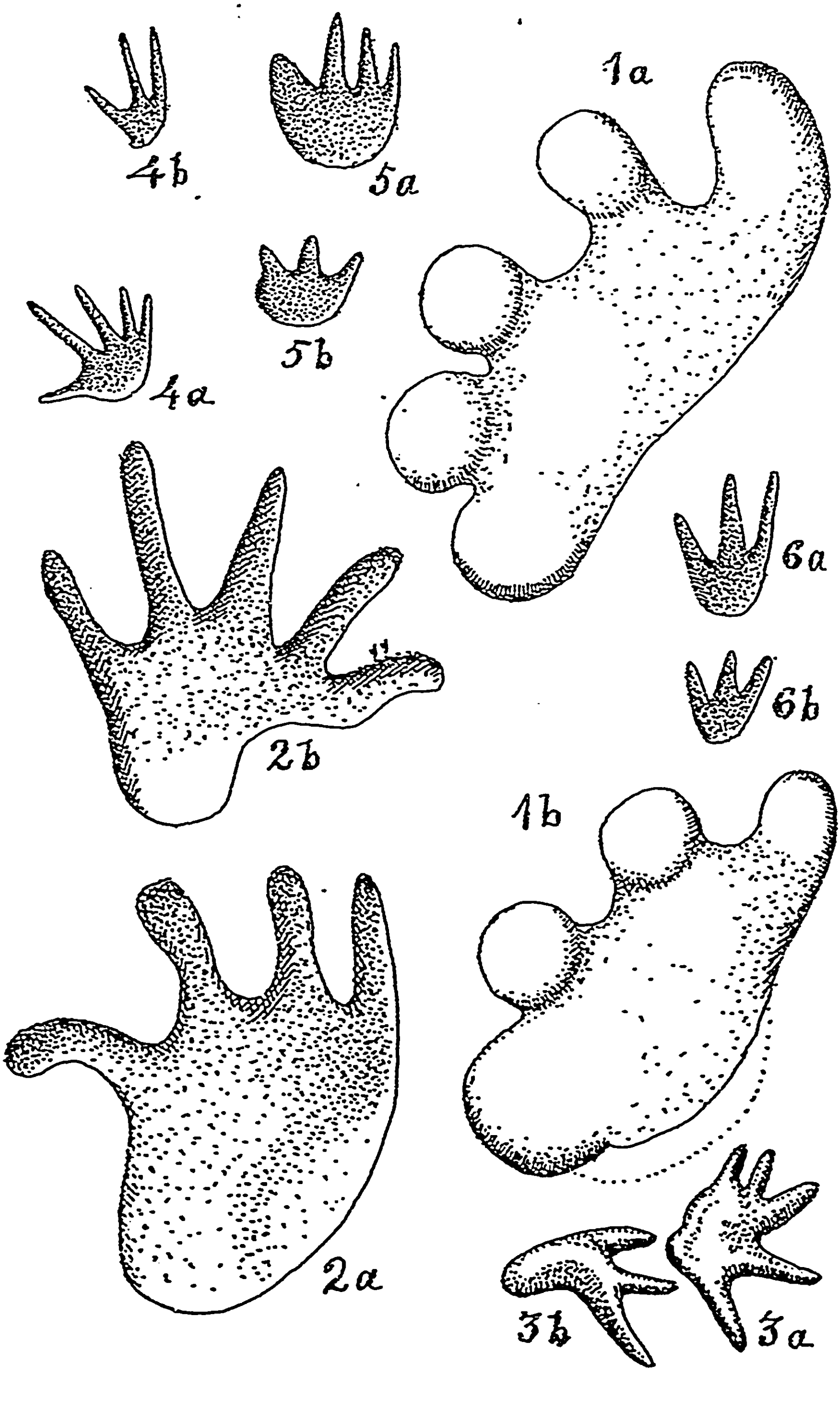
The collection contains a number of types which have not heretofore been described, chiefly among the smaller forms. They will serve to give greater fullness and variety to the series which have been described by other authors, and which are mostly of medium or larger size.

Asperipes n. gen.

This genus is characterized by having five toes on the supposed hind foot but only three on the supposed fore foot. The latter is usually placed behind the hind foot, sometimes midway between two prints of the latter.

In the hind foot the fifth toe sets off from the rest and is near the back of the footprint; the other toes also are widely spread and are progressively shorter to the first digit. The sole was large and rather deeply impressed.

The fore foot had three toes, of which the outer sets off from the other two, and the middle projects forward


1a
4b
5a
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2b
6a
6b
1b
2a
3b
3a

somewhat more than the others. The sole projects backward in a prolonged heel.

This form of footmark is not uncommon on the layers at the Joggins, and, like Hylopus, had often a rough surface, perhaps owing to the sharp claws with which the toes were furnished. It is necessary to separate it from Hylopus, because there are the impressions of only three toes to the fore foot, and because of the distinct impression of a sole to both fore and hind foot. The fact that there were only three toes to the fore foot also separates it from a number of genera that have been described by authors. On comparing the fore foot with the hind, it will be seen that the obsolete digits of the fore foot are probably the first and second.

The irregularity of the foot print in some species of this genus shows the flexibility of the toes, and the name of the genus alludes to the rough and irregular imprints left by animals of this kind.

Asperipes avipes n. sp. (Pl. Figs. *3a* and *3b*), is the type of this genus. Two other species are known.

It might be thought that in Asperipes the footprint showing the marks of only three toes is that of the hind foot. In many mammals, and in the alligator among the reptiles the foot with fewest toes is the hind foot. The long heel also of the footmark, determined as the fore foot, is a mark of the hind foot in many dinosaurs, as, for instance, in Anomepus and Otozoum, and it is therefore necessary to explain why it is supposed this anomalous relation of the two footmarks exist in Asperipes. We have not seen any consecutive series of footprints of the type species that will determine this relation, and the determination is based on the relation found to exist in the footprints of the other two species.

In the second species the disparity in size between the print of the fore and hind foot is somewhat greater than it is in the type species, in which we see some indication that the three-toed footmark, being the smaller, is that of the fore foot. But another character of greater importance appears in the footprints of this species, there is a series of tracks of this species, showing eight footmarks, but of these only one is that of the three-toed foot; from this one might suppose that the common gait of this animal was bipedal, and that it only occasionally touched the fore foot to the ground. If this was its usual method of progression, it would explain the larger size of the hind foot, and the way in which the toes are spread out.

There is a third species, which I refer provisionally to this genus, Sir Wm. Dawson's *Hylopus* (?) *caudifer.*' Here the disparity in size between the three-toed foot and the other is greater even than in the species last described, and the former has a lighter or shorter heel than the three-toed foot of the other two species. In this species also we note the infrequency with which the impression of the three-toed foot is found: on a slab showing eight footprints of a consecutive series, only one is that of the fore or three-toed foot.

As in the preceding species, one might infer that the animal was a biped. To this view, however, there is an objection, which arises from the presence of a groove which appears to represent the trailing of the belly or tail along the surface of the sand. If this animal were bipedal in its movement, it would not be unreasonable to suppose that this "tail" mark would sway from side to side: on the contrary, it continues strictly medial as far as it is impressed on the sand: a narrower median groove in the same track, however, is not strictly central.

In regard to the two last species, the evidence appears to indicate that the three-toed foot is the fore foot.

CURSIPES n. gen.

A series of footmarks, small and well preserved, appears to indicate another, but related genus. It is a light footprint, with long slender toes resembling Batrachites of

Woodworth, but in place of four toes on the fore foot, there are only three. It differs from Asperipes in having a small sole to the hind foot, and in wanting a long heel in the print of the fore foot; also in the length and slenderness of the toes of both feet.

The print of the fore foot was distinct from that of the hind, and placed some distance behind it, some times half way to the next posterior impression of the hind foot.

These footprints appear to have been made by active animals having comparatively light bodies and long slender toes.

Cursipes Dawsoni n. sp. (Pl. Figs. 4*a* and *b*), is the type of this genus, and there was one other species.

The name is in allusion to the supposed rapid movement of the animal.

In distinguishing the fore and hind foot of this genus, much the same criteria are available as in the preceding genus. To mention first the size of the foot. Although in the typical species there is a continuous series of the three-toed impressions, alternating with those of the footmark showing five toes, they are invariably considerably smaller than the latter, and more lightly impressed. In the other species assigned to this genus, the impression of the fore foot is so light that it may be entirely overlooked. Often only the tips of the toes touched the ground, and that very lightly; but if one were to observe the arrangement of these little pits, they would be seen to correspond to that of the three (or sometimes only two of the three) toes in the type species; and in the prints of the tips of the toes of the fore foot in species of Asperipes.

As in this latter genus, we must regard the foot which gives a three-toed impression as the fore foot; otherwise the weight of the body must have rested chiefly on the fore feet, which seems to be unnatural.

Barillopus n. gen.

Under the genus Baropus, Marsh, the writer, last year, described a neat little footmark from the Joggins shore, which, on further consideration, he thinks should be separated as the type of a new genus.

It is much smaller than Marsh's type of Baropus, and has a broad and rounded sole to the hind foot, while that of Baropus projects backward in a heel. The parallel grouping of the three inner toes, separate from the outer one, is also a distinctive character.

All the species were small, short legged, low-bodied animals, apparently of sluggish habit.

Barillopus unguifer, Matt. (Pl., Figs. 5*a* and 5*b*) is the type. There are two other species from the Joggins.

The name is a diminutive of Baropus = heavyfoot.

In Barillopus there seems less reason to question the relation of the two kinds of footmarks than in the two genera first described, because one is not only larger than the other, but the constant forward direction of most of the toes in this footmark would indicate a hind foot. If one examines the footprint left by a frog or an alligator, he will be struck by the radiate arrangement of the toes of the fore foot as compared with those of the hind; hence it seems quite in accord with the ordinary attitude of the toes in the Crocodilia and the tailless amphibians that these footprints should be relatively what we have assumed them to be.

ORNITHOIDES n. gen.

Under *Hylopus (?) trifidus*, Sir Wm. Dawson has described a peculiar little track in which the number of toes is reduced to three on each foot. It has thus fewer toes than any other form of this fauna, and seems worthy of a separate generic name.

The toes are all directed forward in a fan shape, and thus have a distant resemblance to those of the wading birds, but are much more massive.

The track left by this creature resembled that of Barillopus in two respects; first that the stride was short, and second that the print of the fore foot was close behind that of the hind and apt to be confused with it. But it differed from the footstep left by animals of that genus in having a small and narrow sole; so small that Sir Wm. Dawson referred it provisionally to Hylopus.

These little animals had broad bodies, and probably were sluggish in their movements. The track was as wide as the space between each footmark in the row of footsteps.

Hylòpus (?) *trifidus*, Dawson (Pl. Figs. 6*a* and 6*b*) is the type of this genus. The name is in allusion to the bird-like track, with three toes directed forward in a radiate manner like the wading birds.

Baropezia n. gen.

Sauropus [Lea ?], as defined by Sir Wm. Dawson, consisted of "large plantigrade animals, probably Labyrinthodonts, or allied. Hind foot usually larger, five toes."

The track described by Dr. Lea under this name was not very different from that which Dr. King had previously described inadvertently under the name of Sphaeropezium (changed by him in the same year to Thenaropus), either in size or in general appearance. There were, however, some important differences. Sauropus was represented as having a median "tail mark" or groove, and, so far as the figure shows, the fore foot left three toe prints in place of four as in Thenaropus.

Unless, therefore, Sauropus is made very broad in its scope, it will not include *S. Sydnensis*, in which the formula of the toes is 4—3; that is four on the hind and three on the fore. Also the form of the sole and toe prints is in many respects quite different from Lea's Sauropus, and more like King's Sphæropezium. There is also in *S. Sydnensis*, Dawson, no median furrow between the footprints; in this it differs from Lea's species. It would seem necessary, therefore, to separate Dawson's species from Sauropus.

But there is a cogent reason why Sauropus should be used neither for Lea's nor Dawson's species. The name was preoccupied, according to O. P. Hay, by E. Hitchcock for a genus of Triassic footprints of a different type.

Palæosauropus has lately been offered by Dr. O. P. Hay as a generic name for Dawson's species, above discussed, but as Dr. Hay refers to Lea's Sauropus as the type of his genus (being the first described) it obviously will not apply to Dawson's species, which is of quite a different type, as above shown. We therefore, propose the name Baropezia for this type.

Baropezia had the print of four toes on the hind foot and three on the fore; these toe prints were round, several were detached from the print of the sole, and all were without the trace of a nail. The impression of the sole was heavy, with usually apophyses or swellings on some part of the sole. The impression of the fore foot is smaller than that of the hind, and usually placed behind it.

Judging by the length of stride, these animals, notwithstanding their weight, were of active habit, and travelled rapidly over the sand.

Sauropus Sydnensis, Dawson (Pl., Figs. 1*a* and 1*b*) is *the type of Baropezia, and there is one other species.*

The generic name is in allusion to the heavy impression made by the sole of the foot.

In the type species of this genus the two footmarks are much alike; there is not a long heel on either foot to distinguish them; the number of toes, however, is distinctive. In both feet the normal number of digits is reduced, and the one with three toes may be seen to be smaller than the other.

It may also be mentioned (though not much weight can be laid upon this argument) that in the series of footprints which indicates this species, one of the three-toed footprints fails to appear; the series of footmarks runs across a strongly wave-marked slab, and this footmark has failed not in hollow of the ripple where the impression might naturally be wanting, but on the ridge of the wave mark; from this one might suppose that the weight of the animal was carried by the four-toed foot, which would, therefore, be the hind foot.

But when an examination of the footprints of the second species of this genus is made, there is much greater reason for concluding that the three-toed foot is the fore foot. The impression is not half as large as that of the four-toed foot; and, moreover, while in the latter the toe prints are arranged on one side of the print of the sole, in the former they are arranged radially around it.

MEGAPEZIA n. gen.

The peculiar shape of the print of the hind foot appears to separate this from any described genus, though there is a figure given by King in *American Journal Science*, without any name attached, which, in its very large sole, may be compared to Megapezia; that, however, is represented as having five toes to the hind foot, while in this new genus there are only four. Yet while the number of toes on this foot is four, that on the fore foot is five; it thus reverses the number observed in such Palæozoic footprints as have nine toes on the two feet collectively. To this relation, in the number of the toe prints, we have a parallel in the footprints of the alligator, which also has four toes on the hind and five on the fore. The resemblance extends to the attitude of the toes, which are turned forward in the hind foot, but radially arranged in the fore foot. There is this distinction, however, that the peculiar backward curve of the fifth digit of the hind foot in Megapezia is not found in the alligator.

In the hind foot of Megapezia the fifth digit sets off from the others, and the end is strongly curved backward The toes are rather short and blunt (though perhaps having claws); the second, third and fourth digits are somewhat grouped, and directed forward and the first appears to be the digit that is wanting. The sole of the foot is large, but not heavily impressed.

The fore foot has a short and weak fifth digit, and the others are progressively shorter than the first; they are proportionately longer than those of the hind foot. The sole is short, except behind the fourth and fifth digit, where it extends into a long heel somewhat as in Asperipes.

These animals were of good size and had a long stride, so perhaps were active in their habits; as the impression on firm sand was strong, they would have been rather heavy animals.

The type is *Megapezia Pincoi* of the Lower Carboniferous measures at Parrsboro, N.S. (Pl., Figs. 2*a* and 2*b*), and the generic name is in allusion to the large size of the sole of the hind foot.

In this genus the usual signs seem to designate without doubt which is the hind and which the fore foot. First the larger size of the sole in the foot bearing four toes shows that the weight of the body was born by this foot. The smaller number of toes and the forward direction of three point to a greater specialization of this limb for walking, &c.

On the other hand the full number of digits on the fore limb and the radial arrangement of the toes point to a varied use of this limb, for prehension as well as for walking, for which latter purpose it seems to have been habitually used. Every feature appears to point to this as the print of the fore foot of the animal.

If it be such, however, one cannot fail to note the strong resemblance between this which we have determined as the fore foot of Megapezia, and that which appears to be the hind foot of Asperipes. This is obvions on comparing Figure 2*b* of Plate with Figure 3*a* of the same plate.

It may be thought that we attach too much importance to the size and weight of the footmark as determining which marks were made by the fore, and which by the hind feet, since some amphibians show the fore limbs to be stouter, and in some (Siren) the hind limbs are quite wanting. But in such a possible condition amongst the extinct forms of the Carboniferous Time, we cannot but suppose that if the animal were walking on the land, very marked evidence of the unsupported posterior part of the body would be seen, in a groove or trail along the surface of the mud, made by the body or tail; the absence of a "tail" mark in most cases, as well as the disparity in size of the fore and foot prints in many species, supports us in the surmise that in some cases at least the body was sustained chiefly by the hinder limbs.

PSEUDO BRADYPUS n. gen.

This remarkable form was described by Sir Wm. Dawson under the name of *Sauropus unguifer*. He directs attention to the great claw on the fifth digit, of the hind foot, but seemingly did not notice that the claws on the other toes were also long. From the way these claws are tangled and crossed one might surmise that the creature did not habitually live on the ground, and that the foot was not adapted for such use. The hind foot, which is the one usually observed had a long sole and a prominent heel. The heel was not elongate longitudinally, but transversely; there was also a very decided instep or hollow in the sole in front of the heel. The hind foot in this animal was a powerful member for grasping, and would seem to have been adapted like that of the sloth for climbing in trees.

In walking this animal left a heavy tread which perhaps was partly caused by the weight being thrown on the hind feet, as it is only at intervals the print of the fore foot is seen. Notwithstanding the clumsy outfit for walking the animal appears to have moved rapidly, as the stride is twice as long as the space between the two rows of footmarks. The long interval between the footsteps also indicates legs of some length.

Sir Wm. Dawson's description states that there were *five toes to the hind foot, and four to the forefoot*, with a doubtful fifth toe.

The figure of this species, which is a rongh presentation of its form, will be found in Geol. Magazine, London, Series 1, vol. ix. p. 251-253.

The generic name is in allusion to remarkable grasping power possessed by the foot in which it resembled the sloths.

DESCRIPTION OF THE PLATE.

Fig. 1. BAROPEZIA—Type *Sauropus Sydnensis*, Dawson —*a*. Mould of the right hind foot—*b*. Mould of the right forefoot. Both natural size. The figures show the relative positions of the hind and forefoot. From Coal Measures, Sydney, N.S. See p. 105.

Fig. 2. MEGAPEZIA—Type *Megapezia Pincoi*, n. sp.—*a*. The left hindfoot—*b*. The left forefoot. Both natural size. (Mud has flowed into the footprints so as to narrow them in places and blunt the ends of the toes.) The forefoot in a series of footmarks is not so near the hind as here represented, they are crowded on the plate to save space. From Lower Carboniferous sandstone at Parrsboro, N.S. See p. 107.

Fig. 3. ASPERIPES—Type *Asperipes avipes*, n. sp.—*a*. Mould of left hindfoot—*b*. Mould of left forefoot. Both natural size. The figures are in their natural position. From Coal Measures, Joggins, N.S. See p. 101.

Fig, 4. CURSIPES—Type *Cursipes Dawsoni*, n. sp.—*a*. Left hindfoot—*b*. Left forefoot. The footprints are in their natural position; the line of the series of footprints if prolonged backward would pass between the two larger figures at the bottom of the plate. From Coal Measures, Joggins, N.S. See p. 103.

Fig. 5. BARILLOPUS—Type *Baropus unguifer*, Matt.—*a*. Left hindfoot—*b*. Left forefoot. Both mag. $\frac{2}{1}$. The forefoot in its natural position is close behind or partly

overlaid by the hind foot. From Coal Measures, Joggins, N.S. See p. 104.

Fig. 6. ORNITHOIDES—Type *Hylopus* (?) *trifidus*. Dawson—*a*. Left hindfoot—*b*. Left forefoot. Both mag. $\frac{2}{1}$. The two feet are usually close together, and usually the print of the forefoot is obscured by that of the hind. From Coal Measures, Joggins, N.S. See p. 104.

RESURRECTION PLANT.

LEWISIA REDIVIVA PURSH—ORDER PORTULACACEÆ.

By A. J. HILL, M.A., C.E.

This is unquestionably one of the most beautiful of the British Columbia flora and well worthy of cultivation, which its rare tenacity of vitality renders comparatively easy. Its name, *Rediviva*, is derived from the fact of its springing into active growth, even when dried for months in a herbarium, on the admission of dampness, or as a result of the change from the drying air of summer to the less arid atmosphere of autumn. It is a complete surprise to the unwarned collector to find on opening his crisp and dessicated specimens that the Lewisia roots have started their tiny plumules into vigorous growth.

The plant is limited in range, as far as known, to the arid plateau above the Cascades and to the meridian of Ashcroft, extending thence South into Eastern Washington and Oregon. (See Macoun's Canadian Catalogue). Its favorite habitat is the soddy trenches formed of the detritus of the adjoining trap mountains which are impregnated with potash salts—the source of the general fertility of the arid belt.

The plant gives notice of its presence in early spring by a plumule of small fleshy cylindrical leaves which appear above the surface, and attain a height of not more than 1½ to 2 inches, followed late in May and June by the flowers that open only in the hot sunshine, after the manner of their type, into the most lovely waxen blossoms, ranging in tint from the purest white to a deep carmine pink, set off by the centre of crimson stamens.

The whole plant is sessile, the flowers resting upon the ground, the leaves withering as the flowers come into bloom, so that a colony of Lewisias appears on a clear warm day like a myriad of tiny water lilies in clumps of fives and sixes, scattered thickly over the arid bank. The effect is indescribably beautiful, and the lover of flowers feels a pang of compunction as he treads perforce upon the perfect blooms. The only drawback is the want of perfume, to make the Lewisia the veritable flower of Paradise.

The root of the Lewisia resembles a branching carrot in form and colour, and contains a large amount of farinaceous nutriment of wholesome quality. It is, or was, extensively used by the Indians of Oregon as food, under the name of *Spætlum*, much as the Camass and Wapatoe of the lower coast lands.

The plants have been brought without difficulty into perfect bloom and ripened seed in New Westminster, and roots sent to England have yielded a profusion of choicest flowers.

The Theory of the Formation of Sedimentary Deposits.[1]

A Deductive Study in Geology and Its Application.

By Alfred W. G. Wilson, McGill University, Montreal.

After the completion of the study of the geology of any considerable superficial area of the earth's crust the geologist usually attempts to interpret the various form-

1 The discussion is confined chiefly to the sub-aqueous deposits.

ations which he has found within the district under discussion—to read the history told by its fauna or flora, whether of land or sea—and upon this foundation to construct a more or less elaborate account of the history of the region and to outline the various changes that it has undergone. There are many well recognized and generally accepted criteria, for the most part based on the study of present geologic process, by which the history of any region may be inferred from the nature of the deposits found within or adjacent to its boundaries, and from the character of the fossil remains which they contain. A primary pre-requisite to the interpretation of any sedimentary series must necessarily be a knowledge of the conditions under which the given series may be produced. The formation of sedimentary deposits under what may be termed normal conditions is a function of many varying factors and it not infrequently happens that similar formations may be produced in two localities at the same time, or in the same locality at different times, by a totality of conditions in each locality, although the factors contributory to their production were not precisely alike in the two places, or at the two different times.

The general conception of the origin of sedimentary deposits, and of the relations of the various types of deposits to each other, which is set forth in this paper, is one which has been long and widely entertained. In restating what has so long been generally held, the writer has but repeated the work of others. The method of presentation varies somewhat from that usually adopted in that it is deductive rather than inductive. The paper is offered rather as an illustration of the application of the deductive method to geologic problems than as a direct contribution to our knowledge. In the latter part of the paper direct application of the inferences from the study is made to two minor problems of local interest. In the present paper the writer attempts to present the subject in a systematic manner, and in so doing to lay special emphasis upon certain processes of formation of sedimentary deposits which, though apparently departures from the normal method of formation, have apparently been the dominant processes in the growth of our greater sedimentary formations. The problem of the formation of sedimentary deposits (chiefly aqueous), is considered from a deductive standpoint, but it is based upon studies, more or less defective as to detail, of present geologic processes as they are in progress in our Great Lakes and elsewhere. First assuming certain elementary conditions of general occurrence in the formation of sedimentary deposits, the effects of variation in either of these factors, singly, or in both simultaneously, are considered. Later, secondary factors—since they are less important or are less widespread in their operation—are introduced, and a very few of the many complications which they would produce in the nature of the resulting deposits are considered. Naturally it will be found that the increase in the number of variant factors results in an increased complexity of product, and it is under the operation of these complex conditions that similar results may be produced by processes which are not exact equivalents.

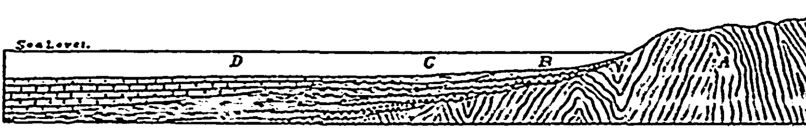


FIGURE 1.

At the present time it is generally conceded that all the great sedimentary formations were laid down around the margins of great ocean bodies and upon a gradually sinking land surface. In the generally accepted hypothesis of the formation of sedimentary deposits along the margin of a slowly sinking land area what may be termed the normal distribution of material, supplied by the waste of that land area and by which the sedimentary formations are built up, will be the formation of arenacious deposits (including, for convenience in discussion, the coarser varieties, breccias and conglomerates), at or near the shore line. As distance from the shore line increases (temporarily assuming a gradually deepening of the water seaward) these arenacious materials will grade gradually through areno-argillaceous to argillaceous, and thence through argillo-calcareous to calcareous, as the distance from the shoreline increases. In Figures 1, 2, and 3 (omitting zones of transition) A represents the sinking oldland upon which the sediments are being laid down and from which the detritus is derived, B represents the arenaceous zone, C the argillaceous, and D the calcareous, the relatively narrower transition zones between B and C, and between C and D, being conveniently represented by lines. During the course of time these deposits become more or less coherent, according to the conditions to which they may be subjected. In the subsequent discussion these separate zones of deposition may be referred to as the sandstone, the shale or the limestone zone, it being, however, recognised that there are also zones of transition between adjacent pairs.

It would seem that any given stratum must have three synchronous members, each merging gradually into the adjacent member or members. The beds composed of strata, which have been deposited successively must also each consist of these three members. The fact that the thickness of the stratum must, in each of the zones, be dependent upon the amount of material present must necessarily lead to the recognition of the other fact that under certain conditions of supply a stratum of considerable thickness might be laid down in one zone, while the strictly synchronous equivalent in either of the other zones might be represented by a very small amount of deposit, or by *none at all.* Through the operation of certain imperfectly understood causes, probably climatic, directly or indirectly, strata are found grouped together into beds, and it is conceivable, though *not always prob-*

able, that strictly synchronous beds may be found in each of the three zones, though the thickness *may vary considerably and the strata of some beds may not have synchronous representatives in the other beds.*

During the time of the formation of any given bed (or group of beds formed within a given small interval) the forms of life existing at that time will be distributed over the surface of that bed, each in its appropriate locality, the sand-loving forms in the sand zone, the mud-loving forms in the areas which afterwards become shale, and the forms which thrive best in deeper or clearer water, beyond. At the transition zones where there is a merging of conditions there will be a merging of forms. It may happen also that a form normally a habitant of one zone is accidently carried to another. These may be regarded as accidents in the normal distribution. Occasionally a form migrating from one zone to another will, in the process of its migration, take on different features because of its environment, eventually undergoing such changes that it would be classed as a species different from the descendants of its parent forms which remained in the original habitat. Some few forms may exist in all three zones, and fossil forms of these types will be of special value in the correlation of beds of different zones. It must be noted, however, that in the study of fossil forms which are found common to all three zones the question whether the forms have migrated during the course of time from one zone to another must be considered, and the beds in which such similar forms are found need not necessarily be of the same age, but may be successively older or younger than the bed in which the like forms are found.

In the production of a series of deposits the final product is the function of many varying factors. The two most important of these factors, and which for this reason may be termed primary factors, are the *Rate of Depression of the Land* and the *Rate of Supply of Detritus.* Such a factor as the *Character of the Material* may, by contrast, be considered of secondary importance, while the factors which determine the character of the material as to kind (source) and as to condition (processes of erosion and transportation) may be regarded as factors of a third order. It is easily seen that factors of a fourth or even higher order are in constant operation in the actual formation of sedimentary deposits, and that the complete consideration of the history of an area involves the consideration of diverse and complex factors; and although the final result of the operation of these factors is apparent, the share to be assigned to each is often indeterminate.

Considering now the two primary factors, *Rate of Depression* of the Land and *Rate of Supply* of detritus, we find that the former may be *uniform*, while the latter is either *uniform* or *variable*, or the rate of depression may be *variable*, while the rate of supply of detritus is either *uniform* or *variable*. In each of the four possible relations one of three results must obtain, according to the interrelations existing between the two factors. The ocean over the area of deposition may be *gradually deepening*, may retain a *constant depth*, or it may be becoming *gradually shallower*. In the first case, for convenience in discussion, the rate of depression will be said to be *greater than the rate of supply of detritus*, in the second *to equal it*, and in the third *to be less than it*. The first six of this series of twelve possible relationships which may thus exist between these two factors may be tabulated thus:—

1. The uniform Rate of Depression may be greater than the Rate of Supply of Detritus which is uniform.

2. The uniform Rate of Depression may be greater than the Rate of Supply of Detritus which is variable.

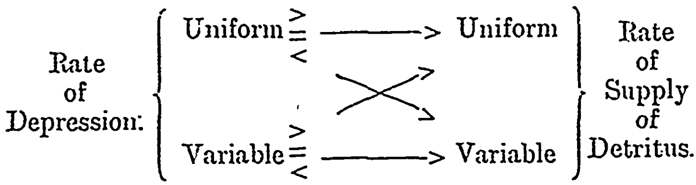
3. The uniform Rate of Depression may be equal to the Rate of Supply of Detritus which is uniform.

4. The uniform Rate of Depression may be equal to the Rate of Supply of Detritus which is variable.

5. The uniform Rate of Depression may be less than the Rate of Supply of Detritus which is uniform.

6. The uniform Rate of Depression may be less than the Rate of Supply of Detritus which is variable.

The remaining six relationships, when the Rate of Depression is not uniform but variable, may also be tabulated in a similar way; or all twelve relationships may be indicated graphically, thus:—



When there is uniform rate of depression and uniform rate of supply of detritus, the rate of the latter being less than the rate of depression, the seaward zones will gradually encroach upon the shoreward zones, the materials of the shale and sand zones will become commingled, and it may even happen that the limestone will be deposited directly upon what was the oldland surface. In this latter event the lower beds would be apt to become calcareous grits or conglomerates. Such conditions seem to have existed at one time in the vicinity of Kingston Mills, Ontario, where a calcareous conglomerate of Black River age, carrying angular quartz fragments, casts of a Cameroceas, and fragments of crinoid stems is found resting directly upon an Archean red granite.[1] Similar conditions seem to have existed in the Hudson Bay Basin during a portion of Devonian time. Parks describes the occurrence of certain Devonian corals in the basin of the Moose River with their bases attached to an Archean boss.[2] In the instance cited the boss of Laurentian gneiss probably formed an island in the Devonian sea at some distance from the shore of the oldland. The rate of depression was slow enough for the formation of a sandstone conglomerate near the shore.

1 Wilson, Phys. Geol., Central Ontario, Can. Inst., Trans., Vol. VII., p. 148.
2 Parks in Report of the Bureau of Mines, Ontario, 1899, p. 183.

Where the rate of depression is equal to the rate of supply of material, whether each is uniform, or whether they vary, provided they vary by the same amount and in the same sense, there will be a uniform shoreward overlap of the zones of deposition. (Figure 1.) Such an equality between the two primary factors seems to have existed in many localities during the periods of deposition of the various sedimentary deposits as we find a gradual encroachment of the limestone upon the shales and of the shales upon the sandstones.

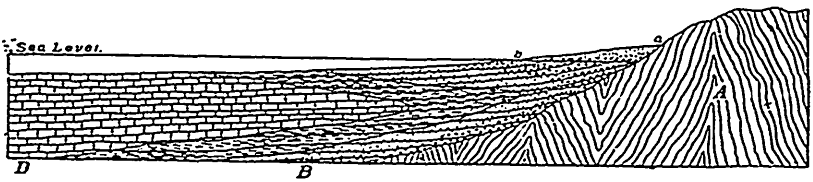


FIGURE 2.

If the rate of depression is uniform or variable but less than the rate of supply of detritus, there will be a continuous overlap, but in the opposite sense, i.e., seaward, and it may even happen that a series of land deposits overlying the older marine deposits may be formed. (Figure 2, ab.) These conditions are also frequently represented in the palaeozoic and later sediments of central North America and elsewhere. In Ontario and New York the conditions cited in the two previous paragraphs seem to have existed until the close of the Trenton, when there was a gradual shallowing of the water (accompanied probably by climatic changes), as indicated by the overlap of the Utica shales upon the Trenton limestones. This shallowing continued for a considerable length of time, so that during the Medina we find there were, in certain areas, broad tidal flats on which more or less arenaceous deposits were laid down. The fact that the argillaceous beds are separated by layers of more or less arenaceous material indicates that there were slight oscillations in the operation of one or other of the two primary factors concerned in their deposition. Whether, under these conditions of a more rapid rate of supply of detritus than rate of depression, it happened that a series of land deposits, the shoreward extension of the sandstones, was formed, is at present doubtful. It seems, however, that when there were such broad sandy tidal flats as existed during the Medina, dry at least at low water, as shown by the mud cracks, that the lighter siliceous sands may have been blown up on the beach in the form of sand dunes, leaving the heavier ferruginous sands as a residuum. Such a suggestion may possibly account for the single band of grey sandstone, usually called the grey band which extends across Ontario from Niagara Falls to near Collingwood. This band caps the Medina deposits, and is a fine textured compact sandstone, with an average thickness of about twelve feet. It is traceable from east of the Niagara gorge to Hamilton, and thence northward it is seen at intervals from Flamborough West to Nottawasaga, varying in thickness from ten to twelve feet, but preserving a nearly uniform lithological character. On lot 24, concession 10, of Nottawasaga, the maximum thicknesss of thirty-five feet is reached. West of the townships of Nottawasaga and Collingwood the grey band is wanting and the Clinton is found in several places to rest directly upon the red and green shales of the Medina. Where the surface of the band is uncovered (and it may be seen in many places, as the softer overlying Clinton has been eroded away) it presents a peculiar undulating surface quite comparable to that found at the present day in localities from which a sand dune has recently migrated. In one locality at least, in a cutting transverse to the grey band, by which a roadway ascends the Niagara escarpment, near Grimsby, the band shows excellent cross bedding on a very much larger scale than is usually seen in typical water laid deposits of similar texture. (See figure 3.) The occurrence of this large scale cross bedding, the undulatory character of its surface, the irregularity of its thickening, and the fact that westward of the Niagara escarpment, near Collingwood, the beds, which further east and south overlie the band, are found to rest directly on the red shales and sandstones of the Medina,[1] suggest that this grey band may be an old sand-dune belt subsequently evened off by the Clinton sea—the landward extension of the Medina beds found

The top of the "Grey Band near Grimsby, Ontario, showing cross-bedding. The hammer is leaning against the lowest member of the Clinton, and rests upon the top of the Medina.

FIGURE 3.

further west beneath the overlying Clinton and Niagara' In Ontario a very few fossils have been found in the band but whether their position was such as to indicate that the band must have been formed under water is unknown. Modern forms are frequently found in modern sand-dune

1 The sandstone has not yet been examined microscopically to determine the character of the grains.

belts along the seashore, and along the lake shores (Ontario and Erie);—we should expect the supposed dune belt to carry fossils in its upper portion since it was manifestly transgressed by the ocean.

During the course of time the rate of depression may vary to the opposite sense, i. e., the land may begin to rise. Under these circumstances the landward end of the strata previously deposited will be subjected to erosion. During a subsequent depression the new deposits would rest uncomformably upon them, while further seaward, where the earlier deposits had not emerged, there would be structural conformability. Such conditions seem to have existed during a portion of Palæozoic time in eastern and central North America, where, in the east, unconformities are found between the various formations making up the Palæozoic series, while further west the various members of the whole series are found with the younger conformably overlying the older, indicative of the fact that there was here continuous deposition.

Relatively slight variations of either factor, alone, or of both in opposite senses willl produce interdigitation of the three principal members along the lines of the transition zones.

The individual consideration of the remaining combinations is unnecessary as the final results will be similar to those produced by the variations already considered. Inequalities in the supply of material in the different zones to synchronous portions of the same bed (or series of beds), will lead to many irregularities in the thickness of the bed in its different parts. The final product may thus be very complex, though the general principles will still be applicable.

In the previous discussion it has been tacitly assumed that the material supplied from the oldland area is of such a nature that all three zones, including their transition phases, will receive each its quota of deposit. Material suitable to fulfil this condition will normally be supplied by an oldland area whether it be a region of metamorphosed rocks, such as we find in the great Archean areas of Canada, or by an oldland area consisting of sediments deposited at some preceding time, but subsequently uplifted. In this latter case there may be temporary irregularities in the supply of material for any one or two of the different zones, and it is quite probable that the coarser material in its $(n + 1)th.$ transportation, assuming that the sedimentary beds supplying it represent the *nth* series of beds of which it has formed a part, will be in a somewhat finer state of division. Hence that material which in the *nth* series of sedimentaries occurs in the shore zone, may in the $(n + 1)th$ series be found in part, at least, in the two outer zones. Quite frequently also, material derived from beds formed in a preceding cycle of deposition will retain, in its new position, certain characteristics (of color, form, structure, content) which make it possible to recognize that it belonged to a preceding cycle of sedimentation. On the other hand, it will often lose these characteristics, and then it will be impossible to infer the number of cycles of sedimentation through which it has passed to its present resting place.

Directly or indirectly, the materials which go to form the sub-aqueous deposits are derived chiefly from the waste of the land. In the case of the limestones of various types and, in part, of some of the shales, the material of which they are composed is less often a direct derivative of the waste of the oldland, more frequently it is a secondary product due to the intervention of organic life or to chemical action. In the previous discussion reference was made to the normal existence of a zone in which limestone would be formed. When we consider the usual manner of the formation of this limestone it became necessary to *modify*, to a certain extent, our primary theoretical concept. Along the margin of the land within the zones of deposition of sands and shales, the materials being deposited, are, to a large extent, inimical to the existence of abundant organic life, but in the clearer waters beyond these zones, provided there is a sufficient food supply, various forms will normally, be more abundant. These types, by the growth of their hard parts and the subsequent comminution of these, transfer the lime from a solution of calcareous compounds in the sea water to the ocean floor to eventually form limestones. Again, under certain conditions the calcareous materials are deposited without the intervention of organic forms. For the formation of limestone beds in these ways *deep* water is thus *not always essential* (and, in the former case, beyond a certain maximum depth, fixed by the depth of water at which a fauna can thrive, detrimental). So long as the lime-producing forms are not hindered in their growth by deleterious material or lack of food supply, they will continue to grow. Hence, under favourable oonditions, there will be frequently formed off-shore reefs, usually chiefly of corals, but many other forms will also thrive here, *e.g.*, Barrier reefs of Australasia. These reefs may also be covered with comparatively shallow water, and the older parts might in places be exposed. Under these conditions, the action of the wind and waves will lead to the comminution of the materials of which they are composed and the formation of all the various types of limestone rock, included within the types recently designated calcirudite, calarenite, calcilutite by Grabau.[1] The distribution of these various types of rock will bear the same relation to their source, the coral reefs, as does the normal distribution of sedimentary formations to their source, the oldland. Such conditions seem to have prevailed during the period of the formation of the Silurian and the Devonian limestones in New York and elsewhere.

Still another secondary consideration now suggests itself. If the supply of material detrimental to the existence of a great abundance of organic forms diminishes or

1 Bull. Geol. Soc. Amer. Vol. XIV., 1903, p. 349.

ceases, other conditions remaining constant, one naturally expects that the forms will spread from many centres outward, or towards the land at least, and that during the continued depression of that land area the sea may transgress upon it and the material formed by the comminution of the hard parts of these organic forms will form a series of deposits resting directly upon the oldland. Such formations are now being formed along parts of the Florida coast at the present day. It seems quite probable that such also, on a somewhat greater scale, may have been the condition of affairs during Devonian time when the corals, which Parks found with the bases attached to an Archean boss, were living in the Hudson Bay basin, and such was the case in many other localities. In the case of the example cited as occurring at Kingston Mills, the fragments of the crinoid stems are sometimes several inches in length. The pebbles of the conglomerate with which these and the Camoceras casts are associated vary in size up to about two inches in diameter, and the fossils are found in the beds not only quite close to the Archean, but also in the upper beds some distance above it. That under these conditions the forms were not comminuted suggests that here at least the water must have been comparatively quiet, and hence we may draw the not unnatural inference that the waters were moderately deep. The calcareous material was probably derived from the comminution of organic forms elsewhere, or it may be in part a chemical precipitate.

A consideration of the foregoing propositions indicates that a feature which one would expect to find in any series of deposits is a zonal arrangement of the various members. Not only may there be two lithological extremes and a mean of synchronous beds (or series of strata) but during the period of continuous depression and deposition there may be formed a continuous band of each of the lithological types, and each of these bands will be composed of beds and each bed may contain forms successively older or younger than the beds of the same zonal band above and below. When there has been (more or less) continuous depression of the land for a long interval, with (more or less) continuous supply of material suitable for all three zones, then subsequent uplift and erosion over extensive areas, the formation resting upon the oldland surface will normally be a sandstone. The earlier formed portion of this sandstone will naturally carry fossil forms appropriate to the age in which they lived, and the later formed likewise. *Ami has recently drawn attention to* arenaceous character of the formations resting upon the older rocks, along the axis of the Appalachian system, and to the progressive change in faunas from Cambrian types in New Jersey northward to Ordovician types in Canada, as illustrating the progressive depression of the land areas during the progress of early palaeozoic time.[1]

Further, it must be noted that, although the normal type of deposits would show the threefold lithological grouping, yet irregularities in the supply of material and variations in the character of that which is supplied, variations which will be of very frequent occurrence, will mean that in the field truly *contemporaneous beds in the three zones will be rare*, that *all three types of deposit* may be composed of the *same kinds* of material, a feature frequently seen in the limestone deposits, and, thirdly, that *one or more* of the types may be *completely wanting.*

After a long interval of time during which a succession of deposits has been formed under varying conditions, the sea bottom becomes uplifted, *and the new formed rocks* are subjected to long continued disintegration, degradation, and dissection. The greater part of the deposits are worn away; fragments only remain here and there, scattered over the area where they were once continuous,

1 Ami, Geo. Soc. Amer., Winter meeting 1902-03, "The Eparchean Formation." see Bull., G.S.A., Vol. 14.

this being especially true along the ancient shore-line which probably emerged first. If the erosion continues long enough, the complete series of products formed under a certain series of uniform conditions may entirely disappear, or, if the uplift is not great enough, only their shoreward ends may vanish.

In either case, their removal must expose the shoreward ends of strata belonging to an earlier cycle of deposition. The later (as regards exposure, earlier as regards deposition) deposits may themselves be also more or less dissected, and the different portions remaining will be thus more or less isolated. Such, indeed, seems to be the relations existing between the limestones belonging to the Trenton area, found in the Province of Ontario on both sides of the Frontenac axis (and in New York State to the south), and some of the associated sandstones which were until quite recently usually designated Potsdam.

Where these fragments of the old beds are distributed along the line of the ancient land from which the material was derived, it will happen that portions of synchronous deposits occur in widely separated districts. For example, a small amount of sandstone might remain in a protected hollow near B (Figure 1.), and all the rest of the deposit be eroded away, as far back as D, where the limestones would form an infacing escarpment, the lower deposits being covered with soil. The limestone, which was synchronous with the sandstone left at B, may carry fossils, while the small remnant of sandstone is destitute of them, or carries forms of a different type, due to the different environment when the forms were living, as suggested in a preceding paragraph.

It may happen that at the base of the cliff the earlier sandstone beds can be found. Now in the cliff alone evidently the limestone is younger than the immediately underlying sandstone. This underlying sandstone may be lithologically identical with that at B, since they come from the same source, and may even contain similar fossils. Still it would be obviously incorrect to say that the two sandstones were of the same age. This would be equally true were each of the beds represented in the figure a series of similar beds, instead of a single one.

When the exposures are far removed from the oldland shore, and there is very little doubt that the old landward extension of the beds is completely gone, the order of superposition in the cliff, or across country in a region of lightly inclined dips, may be taken as the order of succession. Such a series as that represented by the Medina-Niagara series in Central Ontario and Western New York will serve as a case in point. In areas *adjacent* to the margin of the ancient sea the correlation of the widely separated deposits on lithological or even palæontological grounds must be made with great care. Where lithologically similar deposits carry similar fossils contemporaneity of epoch may generally be postulated. If, on the contrary, the forms are not identical, and the deposits are lithologically unlike, they may still be contemporaneous deposits of different zones.

Where a small exposure of rock is found carrying fossils which are normally considered to be characteristic of two different terranes, and as a consequence the beds are inferred to be transitional ones between the two terranes, it must also be *recognized that this portion of* the bed may mark a transition in a horizontal direction, being but a portion of a synchronous bed of varying members.

Applying these considerations to the correlation of the sedimentary deposits along the margin of the Frontenac axis, so far as the writer is aware, no single bed has been traced through various zones. Whether it is possible to do this is problematical, because of the discontinuity of the outcrops. Inasmuch as this has not been done, there must be a factor of uncertainty in any conclusions which may be reached. There remains, however, the question as to what interpretation does the balance of probabilities tend, a balance upon which, in the incompleteness of the geological record, the solutions of many problems depend.

Because of the uneven character of the floor upon which the sediments are laid down the dips of the beds near the floor are unreliable as criteria with reference to the general dip. Where there is evidence that the sediments are some distance vertically above the crystalline floor the dip may be measured with some degree of certainty that it represents the average dip of the sediments in that locality.

Near Battersea, at which place some of the sandstones are found, the average dip is a little over half a degree to the east of south. What the gradient of the floor upon which they rest may be is not known It possibly is the same as that of the overlying sediments, it may be even inclined towards them, or what seems to be the more justifiable assumption, it may dip in a similar direction at a somewhat greater angle. If the generally accepted interpretation as to the method of the formation of deposits is correct, the sandstone beds whose shoreward ends are here exposed will gradually merge into argillaceous beds and finally into calcareous members. The argillaceous beds which vertically overlie them will also merge into the limestones further out from the oldland shore. In many of the localities, because of the unevenness of the floor these sandstones are not thick enough to pass over the crystalline ridges, but are limited by them. In some cases at least the sandstones are probably subaerial deposits rather than subaqueous.[1]

In the vicinity of Kingston the limestones are found to rest directly upon the crystallines, which, from their associations probably formed islands in the Palaeozoic sea. Between Kingston Mills and Gananoque there are a number of Archean exposures, some of them several square miles in area. Between them and the main crystalline area to the north the sediments rest in more or

1 Wilson, Phys. Geol., Central Ontario, Tran. Can. Inst., Vol. VII., p. 159, 1901.

less ellipsoidal basins. Across the basins, though the average depth has been stated to be half a degree, because of the unevenness of the floor, the actual inclinations vary considerably. This local variation, combined with the discontinuity of the outcrops, renders exact correlation exceedingly difficult, if not impossible.

In any attempted correlation of widely separated beds by aid of their inclination it must not be forgotten that the beds originally existed, each as a continuous sheet over large areas, *in toto* probably lens shaped, and not only must the maximum inclination or dip be known, but the inclination in the direction of the line between the two beds whose correlation is attempted must be ascertained. The evidence at present available makes even a correlation of this kind in the area under discussion impossible.

With our present available knowledge it cannot be proven that the limestones or argillaceous beds in the one locality are synchronous or contemporaneous with the sandstone in the other; nor can it be proven that the sandstones antedate the limestones, except in the few places where both occur together, in which event it becomes necessary to show that these limestones are also younger than the sandstones elsewhere.

To the writer the possibility that the sandstones in one locality are synchronous with the argillaceous beds and the limestones in another seems more plausible than that they antedate them. This interpretation also obviates the necessity of assuming a time interval of some duration between the deposition of the sandstones and the Black River limestone, during which interval the Calciferous and the Chazy were deposited elsewhere, and during which the non-fossiliferous beds below the Black River and above the sandstone may have been deposited here.

Were fossils present in the sandstone this possibility would be in no way diminished by the fact, even were some of them Potsdam forms. In the locality east of the axis, in the township of Landsdown and elsewhere where the Potsdam types of fossils are found associated with types characteristic of the Calciferous, the portion of the bed in which they occur may justifiably be considered as a transitional phase in a horizontal as well as a vertical direction towards the latter formation. To make the proposed tentative interpretation clearer, Fig. 4 diagramitally represents a portion of an ellipsodial basin in which deposition, accompanied by slow depression of the oldland surface, has been going on for some time. The earlier shore lines are shown in cross-

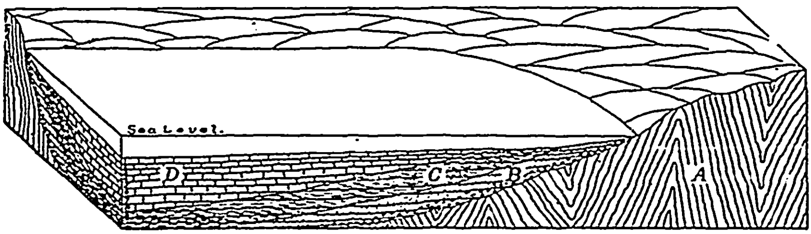


FIGURE 4.

section at the points where the younger strata overlap them to rest upon the crystalline area. Subsequently in the history of the basin the land may rise somewhat, and may be even slightly tilted, and the sea withdraws. During the progress of degradation the greater portion of the sediments are removed; but suppose small remnants of these are still to be found, it can readily be seen that a small portion of the shales or limestones of, say, bed number five might be left along the front of the section of the basin, while towards the back a portion of the sandstone of bed number three remains in a protected hollow among the crystallines. It would be exceedingly difficult, if not impossible, to correlate the two, particularly if they were some miles apart. But since the sandstones beneath the remnant of bed number five are identical in composition with the remnant of bed number three, because formed from the same source, these two which are not synchronous but successive would in the usual practice be correlated. The same would be true if each bed, as shown in the diagram, represented a series of similar beds.

The writer would then suggest that that there is a strong a priori reason for assuming that these beds are contemporaneous with the beds of limestone and argillaceous shales below the Trenton, and probably synchronous with some of them. From the general direction of the dips there is a remote possibility of some of the more distant outliers to the north being synchronous with the lowest beds of the Trenton, but this cannot be proven.[1]

Naturally the question might be asked, would you make all Potsdam contemporaneous with the lower Trenton? Certainly not. Potsdam, as a formational name, was introduced to denote a horizon which is supposed to be geologically older than the Trenton and which possesses certain definite types of fossils, and should be limited in it's use to horizons where these two relations are proven to hold. The extension of the term to horizons in areas where the relations do not hold is apt only to lead to confusion. At present in Ontario much that has been classed as Potsdam, particularly on lithological grounds, is probably contemporaneous with limestones referred to later horizons now exposed elsewhere. The Potsdam sandstone undoubtedly should merge into limestone horizontally, unless our ideas of the processes of deposition are incorrect. Where the line of division comes in it would be difficult to say.

1 Wilson, Phys. Geol. Central Ontario. In this paper, on the basis of the above deductions, the writer advanced the views outlined here in more detail. Subsequently Dr. Ami, of the Geological Survey Department, described the Rideau Formation, which is made to include the formations here referred to, but the greater part of which lies to the east of the Frontenac axis, as being the shoreward extension of the Calciferous and Chazy. Dr. Ami's paper (Geol. Soc. Amer., Rochester, 1902) has not yet come to hand, but the writer understands that the results of his studies on the eastern side of the axis in general confirm the conclusions reached by the writer after a study of the smaller exposures on the west. The latter the writer considers as probably the shoreward extension of the early Black River rather than the Chazy.

Proceedings of Natural History Society.

Annual Meeting.

The adjourned annual meeting of the Natural History Society of Montreal was held in the hall of the Society on Monday evening, June 8th, 1903, the President, Dr. C. W. MacBride, in the chair. There was also present among others the following members: Hon. Justice Wurtele, C. S. J. Phillips, H. Holden, J. Harper, J. A. U. Beaudry, A. E. Norris, J. Stevenson Brown, Joseph Fortier, W. Smaill, Prof. Bemrose, C. E. Phillips and F. W Richards, the Secretary.

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

Reports covering the year's work were presented by the Council, the House Committee, the Editing and Exchange Committee, the Lecture Committee, the Librarian, the Curator and the Treasurer.

On motion of Mr. Joseph Fortier, seconded by J. A. U. Beaudry, the several reports were adopted, with the request that they be published in the Record of Science.

The President then delivered his annual address, taking for his subject "Heredity."

A vote of thanks to the President, moved by Mr. C. J. S. Phillips, seconded by Hon. Justice Wurtele, was carried unanimously.

The election of officers then took place, and resulted as follows:

President—E. W. MacBride, M.A., Sc.D.

Vice-Presidents—F. D. Adams, Ph.D., F.R.S.C., Rev. Robt. Campbell, M.A., D.D., Dr. Wesley Mills, B. J. Harrington, Ph.D., F.R.S.C., A. Holden, Hon. Justice Wurtele, J. H. Joseph, Prof. D. P. Penshallow, Hon. J. K. Ward.

Hon. Recording Secy.—F. W. Richards.

" Corresponding Secy.—C. E. H. Phillips.

" Treasurer—J. A. U. Beaudry.

Hon. Curator—A. E. Norris.

Members of Council—C. T. Williams, J. S. Buchan, K.C., B.C.L., Alex. Robertson, John Harper, Edgar Judge, H. McLaren, C. S. J. Phillips.

Superintendent—Alfred Griffin.

REPORT OF COUNCIL.

To the Officers and Members of the Natural History Society of Montreal:—

Ladies and Gentlemen,—

Your Council would submit the following report for the year ending May 31st, 1902:

The usual meetings of the Council have been held, and the business intrusted to its care has been attended to regularly.

We regret to report the removal by death of three members of the society, Messrs. E. L. Clarke, W. A. Hastings and Mr. H. J. Tiffin. Seven new members have been added to the roll during the year. The Council would suggest that our members bear in mind the fact that a large part of the regular income of the society depends upon its membership, and much help in this direction could be given by the members of the society.

We are glad to report increased attendance at the various meetings of the society during the year, and the Somerville course of lectures, and the Saturday afternoon talks to the young people have been particularly well patronized.

The following is a list of the papers presented at the various monthly meetings:

Oct. 27. "Some Mushrooms of the Island of Montreal." —Rev. Robert Campbell, D.D.

Nov. 24. "Studies in the History of the Sea Urchin."—Prof. E. W. MacBride, M.A., D.S.C.

Jan. 26. "Reptilia of the Island of Montreal."—Mr. J. Simpson, of McGill Zoological Laboratory.

Feb. 23. "Trematode Parasites of Man and the other Vertebrates."—J. Stafford, M.A., Ph.D., McGill Zoological Laboratory.

Mar. 30. "The Lichens of the Island of Montreal."—Rev. G. Osborne Heine, B.A.

"Some additional Notes on the Flora of Montreal."—Rev. Robt. Campbell, D.D.

Apr. 27. "Native Arsenic discovered in Montreal."—Prof. Norton Evans, M.A., Sc.

"Some Rare Nova Scotia Plants."—Rev. Robert Campbell, D.D.

The Annual Field Day Excursion was held on June 14th to Piedmont. It was quite successful as regards attendance, although the enjoyment of the day was a good deal marred by the rain.

The attendance on the Musem has been better through the year than usual, and lack of space for the proper display of the specimens and room for visitors has been very apparent.

Taken as a whole, we have had a very successful year, receipts from membership showing an increase, with an improved income from rentals.

A short time ago the society was approached on the question of selling its property, but after due consideration the Council felt that it would be impossible to place it in an equally good position elsewhere for any amount of money that would be offered, and therefore has taken no steps in the matter.

During the year the Microscopical Society has become a part of the Natural History Society, and your Council would suggest to this meeting the propriety of appointing a special committee of microscopical work. Arrangements have also been completed with the committee of the teachers' course of lectures, for the amalgamation of the Teachers' and Somerville courses under conditions that were mutually satisfactory.

It will be well for the incoming Council to consider whether it is possible to add to the accommodation, and therefore to the finances of the society, by a re-arrangement or addition to the present rooms occupied. The church authorities who now occupy rooms in our building, are asking for more space, and are ready to increase the rental if they can be accommodated. As these parties are very desirable tenants, the Council is anxious to do what it can to meet their wishes.

Your Council is glad to bear testimony to the zeal and faithfulness of Mr. and Mrs. Griffin in caring for the work of the society.

Respectfully submitted,

C. T. WILLIAMS,
Chairman of Council

REPORT OF THE EDITING AND EXCHANGE COMMITTEE.

Your Editing and Exchange Committee beg to report that two numbers of the RECORD OF SCIENCE were issued in the year just ended, one in July, 1902, and the other in January of this year. At least they were nominally issued on those dates, although very undesirable delays occurred in giving them to the members of the society delays which, in future, we must try to avoid. The July number of 1902 completed Volume VIII. of the new series. The number last issued was the commencement of Volume IX. Much valuable matter reached the scientific world through those two issues, consisting mainly of the papers read before the society at its monthly meetings.

The Exchange list remains in about the same condition that it was in twelve months ago. Many of the reports and publications received have been of great value.

In name of the Publication Committee.

ROBERT CAMPBELL,
Chairman.

MUSEUM REPORT—SESSION 1903-1904.

MR. PRESIDENT, LADIES AND GENTLEMEN,—I have the honor to submit the following statement concerning the Museum: The number of visitors has increased over last year. Several schools came, and the crowds of children present, especially on Saturdays, afford evidence that there is something beyond mere play that can attract and hold their interest, even in these days of commercialism.

All of the birds have been cleaned and treated with benzine, a task that occupied Mr. A. Griffin with assistance nearly four months. The birds require usually more attention than any other department. It would be a great advantage to have the Museum lighted by two arc lights. The present gas system dries up the cases, and the effect on all specimens is bad.

The donations of the past season have been varied, and are recorded in the minutes. We especially call attention to the large additions to the Botanical department by the Rev. Dr. Robert Campbell. Owing to want of space many of the donations cannot be exhibited to the best advantage, and the donors are liable to feel hurt at not seeing their gifts in place. I must again direct your attention to the fact that the windows require painting white to prevent the sun's bleaching the specimens.

Respectfully submitted,

A. E. NORRIS,
Honorary Curator.

REPORT OF THE LECTURE COMMITTEE.

In the absence of the acting chairman of the Lecture Committee, it falls to me to report on behalf of the Committee.

The two series of lectures arranged for the last season were of the usual high class, and were duly appreciated by the patrons of the Natural History Society. The Somerville Course of six lectures dealt with different aspects of human Physiology, a subject which always calls forth a large measure of popular interest. The subjects were treated by several of the rising young physicians of the city, and the attendance throughout the season was very good. The thanks of the society are eminently due to the lecturers for the time and thought bestowed on their treatment of the several subjects covered by the course, given without fee or reward, for the benefit of the public.

Perhaps the Saturday afternoon talks to children did even more than the Somerville Course to promote the objects aimed at by the Natural History Society. These half hour talks, seven in all, drew large crowds of young people, with a sprinkling of older folk among them. The keenest interest was displayed by the children in the several topics discussed. Good seed was sown at these meetings, and it may reasonably be hoped that not a few young persons may have got started on a career of scientific study that will hereafter reflect credit on the Natural History Society.

In name of the Lecture Committee.

ROBERT CAMPBELL,
Chairman.

INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE.

First Annual Issue, M. Botany, Part I., Vol. I., 1902 (May), Harrison and Sons, London, pp. XIV.+378.

The great and increasing rapidity with which scientific literature accumulates, and the consequent difficulty which investigators everywhere experience in maintaining familiarity with the literature of their specialities, has given rise to various efforts for the systematic and complete arrangement of titles in such a way as to render them directly available. Perhaps the most recent of these efforts is that represented by the newly reorganized *Botanisches Centralblatt*, which represents a complete summary of current botanical literature, together with short reviews indicative of the nature of the contents of each article. A somewhat earlier and more comprehensive effort is that represented by the present volume which expresses the final development of an idea, the origin of which carries us back very nearly half a century.

In 1855, Prof. Joseph Henry, of the Smithsonian Institution at Washington, U.S.A., suggested to the Glasgow meeting of the British Association for the Advancement of Science, the desirability of publishing a catalogue of scientific papers. This suggestion bore fruit in the Catalogue of Scientific Papers issued by the Royal Society, the first of which appeared in 1867. This exceedingly useful publication now comprises twelve large quarto volumes, covering the period from 1800-1883, while the period embraced in the years 1884-1900 will be covered by volumes now in course of preparation. It soon came to be felt, however, that the scope of the work was much too restricted, and it was recognized that (1) an author's catalogue could not supply the requisite information, (2) that it was essential that scientific workers should be kept fully and quickly informed of all new discoveries by means of subject indexes, and (3) that such a work was beyond the resources of the Society or of any single body. These considerations gave rise to the idea of international co-operation which, first suggested in 1893, was given a practical bearing through a conference held in London in 1896, at which there were present delegates from twenty-one countries, including Canada. The important work of this first conference was extended and brought to completion by successive conferences, until at the first meeting of the International Council held in London in December, 1900, it was decided to commence the preparation of the Catalogue from January, 1901. The plan as finally matured, contemplated the formation of Regional Bureaus for each country represented, the duty of such a bureau being to assume responsibility for the cataloguing of all scientific literature within i ~ region, and to arrange for the distribution of catalogues. At present twenty-nine such regional bureaus have been formed under the directorship of H. Forster Morley, M.A., D.Sc., London, while the Director of the Regional Bureau for Canada, is Dr. J. G. Adami, McGill University, Montreal.

A very large amount of labor was expended in arranging and determining the subject headings of the catalogue, with the result of an efficient completeness which is most gratifying. The branches of science represented are Mathematics, Mechanics, Physics, Chemistry, Astronomy, Meteorology (including terrestrial magnetism), Mineralogy including Petrology and Crystallography), Geology, Geography (Mathematical and Physical), Palaeontology, General Biology, Botany, Zoology, Human Anatomy, Physical Anthropology, Physiology (including experimental Psychology), Pharmacology and experimental Pathology and Bacteriology. Each complete annual issue therefore comprises seventeen volumes. In order to meet any preference the scientific workers may have for a particular language, and also to remove any doubt which may attach to the meaning of a word, or expression, the index and schedule of classification are presented in English, French, German and Italian, while entries in the subject indexes may be in the language of the original paper, provided it is in either Latin or one of the four languages specified above.

The original scheme of the catalogue contemplated that it should comprise all original contributions to the various branches of science coming within its scope, whether published in periodicals, in the journals of societies, or as independent pamphlets, memoirs or books. While this feature is realized in the present volume, financial considerations have necessitated a limitation of the number of subject entries. It is much to be regretted that circumstances impose this necessity upon the bureau, and it is to be hoped that the difficulty may eventually be overcome. This can certainly be accomplished if the various periodicals would uniformly adopt the suggestion that, as is now the practice with some, all should carefully index each article at the time of publication. This is a very reasonable suggestion and one which, if carried out, would not only enhance the value of the Journal for scientific purposes, but would also greatly facilitate the work of preparing the catalogue, and prove of great advantage to scientific workers generally.

The present volume embraces a total of XIV. + 373 pages, including special instructions to those who have occasion to make use of it, and it gives great promise of the wide usefulness which such a publication may attain to.

In Canada, the Dominion Government has arranged for the purchase of seven copies of the Catalogue for deposit in the libraries of the leading universities and the Parliamentary Library at Ottawa. Individual subscribers may obtain the complete set at a cost of £18, while separate volumes may be had at prices ranging from ten to thirty-five shillings, according to size.

D. P. PENHALLOW.

Catalogue of Canadian Birds.

CATALOGUE OF CANADIAN BIRDS, PART I.—WATER BIRDS, GALLINACEOUS BIRDS and PIGEONS, including the following orders: PYGOPODES, LONGIPENNES, TUBINARES, STEGANOPODES, ANSERES, HERODIONES, PALUDICOLÆ, LIMICOLÆ, GALLINÆ and COLUMBÆ. By John Macoun, M.A., F.R.S.C., Naturalist to the Geological Survey of Canada Ottawa: 1900. Price, Ten Cents.

Also PART II.—BIRDS OF PREY, WOODPECKERS, FLY-CATCHERS, CROWS, JAYS and BLACKBIRDS, including the following orders: RAPTORES, COCCYGES, PICI, MACRO-CHIRES, and part of the PASSERES. By the same Author. Ottawa: 1903. Price, Ten Cents.

Not students of Ornithology alone and sportsmen, but bird-lovers generally, and their name is legion, will be delighted at the appearance of these latest contributions of the veteran Naturalist to the Geological Survey of Canada to the science of the Dominion. Professor Macoun tells us in his preface that he has been collecting materials for these publications since 1879. They are all the more valuable on this account. It was possible to bring together so much information about the birds found in Canada, only after a series of observations continued for many years, by a large number of interested persons, spread over the entire northern half of the continent. The author in this study on Canadian birds has made use of the matter furnished by every other writer on the ornithology of our country, as in his larger works on botany he embodied the published lists of all the plant collectors of Canada, crediting each with what he had appropriated. In addition, he has been fortunate enough to be able to enlist individual observers throughout the Dominion who have furnished him with information not hitherto given to the public, regarding the birds frequenting their neighbourhood. The aggregate result is that we have mentioned in the two parts of the catalogue indicated above, a complete list of the bird fauna of the Dominion, including Newfoundland, in the several families embraced in these publications.

Part III. to complete the catalogue, with an index, it is promised, will be issued shortly.

There are described in Parts I. and II., altogether, the habits, nests and eggs of 463 kinds of birds, 307 in Part I. and 156 in Part II. They are numbered in the catalogue to correspond with the numbers employed in the check-list of the American Ornithologists' Union, for the sake of identification by the ornithologists of the continent. All the species embraced in the afore-mentioned check-list, included in Part I., are found in Canada, with 51 exceptions; but in addition there are 42 varieties listed. In Part II. there are, of the species numbered in the check-list, 100 represented in Canada, but 88 are unrepresented, but in addition there are 56 varieties. It is interesting to note that the birds that have to do with water are so largely represented in the Dominion—divers, swimmers, waders and shore birds, no doubt owing to the vast solitudes, with enormous sheets of water, embraced in our section of the continent, affording safe nesting retreats and ample stores of fish food for the young. On the other hand, birds of prey, crows, jays, blackbirds and kindred species find better provision for their needs in the settled districts of the continent.

On the whole the bird-lover has ample cause of satisfaction with the number of species to be found in our country. Many of them, of course, are only birds of passage, going north in spring to the extensive breeding fields in the covered rocks of Hudson's Bay, Labrador and Greenland, returning south with their broods later in the season. But not a few remain for the summer in our orchards and in the woods bordering on cultivation, to cheer us with their airy forms, bright plumage and sprightly movements. More persons take delight in birds than in any other natural objects, animate or inanimate, because of these qualities which our winged friends possess. The interest of the sportsman and the pot hunter is of another kind ; but both of these classes will also rejoice to own copies of Professor Macoun's lists. There is no country lad or backwoodsman who does not possess a considerable stock of bird-lore ; and no rural delight is equal to that of roaming through the forests with gun in hand in pursuit of the ruffed grouse, that gamiest of birds. One noticeable fact is that the passenger pigeon which used to migrate in millions, as late as the fifties, in the last century, going north in the spring and south in the fall, are no longer seen within our borders. It is also matter of unfeigned regret that the superb bird, the wild turkey, has become extinct in Canada.

The notes accompanying the mention of each species are of an extremely interesting character, and the fact that the common names of birds obtain the highest prominence will go to make Professor Macoun's catalogue most popular with the masses. Our readers cannot do better than each order a copy of the two parts of the catalogue already issued, which they may secure for the modest sum of twenty cents. For this trifle they will be in possession of a list of the birds to be found between Newfoundland and Labrador on the East, to British Columbia and Alaska on the West, and from the parallel of 43° on the South to Hudson's Bay and the Yukon on the North. And should they visit Ottawa they will be able to gratify their curiosity by inspecting the specimens of the birds and their eggs, of which detailed mention is made in these most readable publications.

R. C.

ABSTRACT FOR THE MONTH OF FEBRUARY, 1903.

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 relative humidity.	WIND. General direction.	Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	16.1	21.8	10.1	11.7	30.05	30.13	29.97	.16	78	xE.	....	65	....	....	....	1..........SUNDAY
2	19.2	22.1	14.5	7.6	29.88	29.99	29.65	.34	94	xN.	....	20	....	2.4	0.30	2
3	25.4	33.3	18.0	15.3	29.96	30.05	29.65	.40	91	xS.	....	23	....	0.8	0.16	3
4	24.0	31.4	17.2	14.2	29.42	29.92	29.14	.78	95	N.	x 12.	..	0.40	4.3	1.04	4
5	18.2	21.6	13.3	8.3	29.39	29.76	29.14	.62	86	N.W.	x 15.	..	....	0.6	0.08	5
6	15.3	18.9	9.0	9.9	30.03	30.11	29.76	.35	85	S.W.	x 10.	82	....	....	....	6
7	13.6	19.0	8.2	10.8	30.32	30.39	30.09	.30	86	S.W.	x 10.	55	....	....	....	7
SUNDAY........ 8	10.4	22.0	− 0.5	22.5	29.90	30.37	29.42	.95	87	xN.	...	..	....	12.0	1.41	8..........SUNDAY
9	20.7	25.1	15.8	9.3	29.74	30.04	29.41	.63	83	W.	x 10.	41	....	1.7	0.10	9
10	25.7	32.8	10.0	22.8	30.06	30.12	29.99	.13	91	S.W.	x 8.	02	....	....	....	10
11	34.8	39.6	21.0	18.6	29.68	29.99	29.24	.75	88	S.W.	x 21.	..	0.53	....	0.53	11
12	31.8	37.2	23.0	14.2	29.56	29.97	29.14	.83	91	S.W.	29.2	61	0.34	...	0.34	12
13	14.7	24.9	8.0	16.9	30.09	30.14	29.97	.17	74	xN.	14.1	..	....	0.0	0.00	13
14	7.4	15.0	0.8	14.2	30.34	30.41	30.14	.27	65	xS.W.	25.4	81	....	....	....	14
SUNDAY........15	10.2	14.8	3.3	11.5	30.21	30.39	29.93	.46	77	xW.	4.8	..	....	....	....	15..........SUNDAY
16	12.1	16.8	7.1	9.6	29.77	29.93	29.65	.28	81	xE.	12.1	00	....	1.6	0.12	16
17	−1.1	13.2	−9.0	22.2	29.55	29.76	29.43	.33	63	xN.E	21.9	..	....	1.2	0.16	17
18	1.1	9.3	−11.0	20.3	29.80	29.95	29.72	.23	72	xS.W.	20.1	..	....	0.0	0.00	18
19	−2.2	5.6	−11.8	17.4	30.29	30.37	29.95	.42	57	W.	27.0	91	....	....	....	19
20	11.4	18.0	0.8	17.2	30.35	30.39	30.32	.07	82	S.W.	18.7	68	....	...	....	20
21	18.5	25.9	10.0	15.9	30.18	30.39	30.03	.36	85	S.	14.7	..	....	0.5	0.04	21
SUNDAY...... 22	20.2	25.7	16.0	9.7	30.18	30.31	30.05	.26	75	S.W.	21.0	47	....	....	....	22..........SUNDAY
23	26.7	30.6	18.0	12.6	30.18	30.29	30.10	.19	88	S.W.	20.7	..	....	1.1	0.11	23
24	23.7	29.6	18.8	10.8	30.20	30.27	30.12	.15	83	S.W.	11.3	64	....	....	....	24
25	24.1	28.0	20.2	7.8	30.19	30.25	30.12	.13	84	S.W.	26.5	85	....	....	....	25
26	30.5	35.9	23.9	12.0	30.23	30.31	30.18	.13	87	S.W.	32.9	87	....	....	....	26
27	35.9	41.0	29.1	11.9	30.10	30.26	29.84	.42	68	S.W.	23.2	35	....	....	....	27
28	40.1	46.5	37.0	9.5	29.28	29.84	28.97	.87	94	S.W.	32.3	..	0.89	....	0.89	28
Means......	18.86	25.2	11.5	13.7	29.962	30.146	29.754	.392	81.2	S 37° W.	18.4	32.7	2.16	26.2	3.28	...............Sum.
29 Years means for and including this month	15.73	23.5	7.8	15.8	30.009	......	......	.309	80.7	....	§ 18.2	¶ 41.2	0.81	23.6	3.16	29 Years means for and including this month.

ANALYSIS OF WIND RECORD FROM 12th TO 28th.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	356	526	266	27	755	4938	1368	280	
Duration in hrs..	27	24	24	3	51	187	87	13	2
Mean velocity....	13.2	21.9	11.1	9.0	14.8	26.4	14.6	21.5	

Greatest mileage in one hour was 55 on the 28th.

Greatest velocity in gusts was 72 on the 28th.

x Estimated. m For 17 days only.

Resultant mileage, x9,100.

Resultant direction, S 37° W.

Total mileage, m8,516.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 16 years only.

The greatest heat was 46.5 above zero on the 28th. The greatest cold was 11.8 below zero on the 19th, giving a range of temperature of 58.3°.

Warmest day was the 28th. Coldest day was the 19th.

Highest barometer reading was 30.41 on the 14th; lowest barometer was 28.97 on the 28th, giving a range of 1.44 inches.

Minimum relative humidity observed was 45 on the 19th.

Rain fell on 4 days. Snow fell on 12 days.

Rain and snow on 1 day.

Fog on 1 day.

No. inches snow on ground 20.

ABSTRACT FOR THE MONTH OF MARCH, 1903.

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

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	* BAROMETER. ǀ Mean.	* BAROMETER. Max.	* BAROMETER. Min.	* BAROMETER. Range.	ǂ Mean relative humidity.	WIND. General direction.	WIND. Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
SUNDAY........ 1	18.1	38.2	9.8	28.4	29.91	30.24	29.38	.86	63	S.W.	27.0	87	....	0.4	0.03	1..........SUNDAY
2	21.1	28.7	9.2	19.5	30.34	30.64	30.18	.46	78	S.W.	16.3	20	....	0.1	0.01	2
3	10.2	18.3	—0.6	18.9	30.58	30.71	30.37	.34	76	N.E.	12.8	33	....	0.0	0.00	3
4	28.4	36.0	13.6	22.4	30.33	30.37	30.30	.07	92	S.W.	17.7	17	....	0.3	0.03	4
5	32.6	34.3	30.4	3.9	30.16	30.34	30.02	.32	98	S.W.	8.7	..	....	2.3	0.23	5
6	29.5	34.4	24.8	9.6	30.41	30.52	30.10	.42	73	N.W.	11.7	84	....	....	....	6
7	32.4	40.8	19.0	21.8	30.34	30.52	30.09	.43	78	S.E.	22.0	44	0.05	...	0.05	7
SUNDAY........ 8	40.2	42.5	37.3	5.2	30.17	30.35	30.03	.32	83	S.W.	19.2	..	0.54	....	0.54	8..........SUNDAY
9	34.5	40.0	30.2	9.8	30.57	30.61	30.35	.26	82	N.E.	24.9	84	....	....	....	9
10	33.9	38.7	29.1	9.6	30.46	30.59	30.31	.28	81	N.E.	13.6	15	....	....	....	10
11	38.0	42.6	32.1	10.5	30.23	30.32	30.12	.20	86	S.W.	11.0	30	0.39	....	0.39	11
12	37.7	41.5	34.9	6.6	30.28	30.33	30.20	.13	86	S.W.	26.4	56	....	....	....	12
13	36.3	39.0	33.6	5.4	30.23	30.27	30.19	.08	86	S.W.	17.2	01	....	....	....	13
14	36.2	39.0	33.3	5.7	30.26	30.35	30.22	.13	87	S.W.	16.3	20	....	....	....	14
SUNDAY........15	28.5	38.8	23.7	15.1	30.47	30.52	30.35	.17	86	N.E.	19.5	82	....	....	....	15..........SUNDAY
16	33.1	42.1	22.1	20.0	30.33	30.45	30.15	.30	68	S.	15.0	10	0.01	....	0.01	16
17	38.4	41.7	35.7	6.0	30.18	30.34	30.11	.23	93	S.W.	12.3	..	0.25	....	0.25	17
18	36.1	44.4	29.0	15.4	30.34	30.42	30.20	.22	87	N.E.	14.2	..	....	....	....	18
19	53.3	62.0	37.0	25.0	30.10	30.20	30.00	.20	81	S.W.	19.9	49	0.02	....	0.02	19
20	38.3	60.0	31.6	28.4	30.05	30.10	30.00	.10	93	N.E.	20.8	..	0.01	....	0.01	20
21	35.0	40.2	30.9	9.3	29.95	30.00	29.91	.09	96	N.E.	11.4	..	0.26	....	0.26	21
SUNDAY........22	38.3	43.4	31.6	11.8	30.21	30.29	29.98	.31	68	W.	13.9	49	0.04	....	0.04	22.... .... SUNDAY
23	36.5	39.0	33.8	5.2	30.05	30.29	29.81	.48	95	N.E.	15.8	..	1.15	....	1.15	23
24	37.1	44.0	33.8	10.2	29.93	30.00	29.85	.15	98	S.W.	11.5	..	0.35	....	0.35	24
25	36.5	41.3	32.8	8.5	29.77	29.91	29.68	.23	72	W.	25.0	54	0.00	0.0	0.00	25
26	37.9	45.5	28.5	17.0	29.92	30.00	29.86	.14	67	S.W.	28.8	80	....	....	....	26
27	39.1	42.0	31.0	11.0	29.92	30.10	29.76	.34	77	S.W.	15.3	22	0.12	....	0.12	27
28	31.2	36.5	27.0	9.5	30.18	30.38	30.10	.28	77	N.E.	12.8	18	....	0.0	0.00	28
SUNDAY........29	28.7	35.0	21.8	13.2	30.52	30.61	30.38	.23	65	W.	10.7	86	....	....	....	29 .... SUNDAY
30	38.0	47.2	26.2	21.0	30.14	30.46	29.85	.61	65	S.	12.9	61	....	....	....	30
31	43.4	52.7	35.0	17.6	29.61	29.85	29.49	.36	65	S.W.	13.1	51	....	....	....	31
Means......	34.15	40.96	27.36	13.60	30.188	30.325	30.043	.282	80.7	S 64° W.	16.7	34	3.19	3.1	3.49	................Sum.
29 Years means for and including this month	25.00	32.08	17.64	14.45	29.978	......	......	.274	77.3	....	§ 17.7	¶ 45.4	1.39	23.2	3.87	29 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	730	3049	170	658	1311	3796	2129	576	
Duration in hrs..	59	184	18	46	87	194	118	38	
Mean velocity....	12.4	16.6	9.4	14.3	15.1	19.6	18.0	15.2	

Greatest mileage in one hour was 42 on the 1st.

Greatest velocity in gusts was 60 on the 1st.

Resultant mileage, 2,695.

Resultant direction, S 64° W.

Total mileage, 12,419.

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

† Mean of bi-hourly readings taken from self-recording instruments.

ǂ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 16 years only.

The greatest heat was 62.0 above zero on the 19th. The greatest cold was 0.6 below zero on the 3rd, giving a range of temperature of 62.6°.

Warmest day was the 19th. Coldest day was the 3rd.

Highest barometer reading was 30.71 on the 3rd; lowest barometer was 29.38 on the 1st, giving a range of 1.33 inches.

Minimum relative humidity observed was 46 on the 31st.

Rain fell on 13 days. Snow fell on 7 days.

Rain and snow on 1 day.

Fog on 2 days.

Snow only here and there in places.

ABSTRACT FOR THE MONTH OF APRIL, 1903.

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 relative humidity.	WIND. General direction.	Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	41.2	49.8	36.6	13.2	29.91	30.05	29.67	.38	59	N.W.	15.7	73	....	....	....	1
2	43.8	53.5	31.8	21.7	29.86	30.10	29.54	.56	61	S.E.	23.0	..	0.08	....	0.08	2
3	45.8	55.1	30.8	24.3	29.41	29.54	29.34	.20	91	N.E.	21.0	..	0.61	1.2	0.84	3
4	23.9	40.2	20.0	20.2	29.75	30.04	29.44	.60	75	N.	20.5	..	....	2.8	0.35	4
SUNDAY........ 5	21.9	28.6	12.8	15.8	30.30	30.40	30.04	.36	83	S.W.	19.5	87	....	....	....	5..........SUNDAY
6	30.7	36.2	21.0	15.2	30.35	30.48	30.17	.31	67	S.E.	10.8	..	....	...	....	6
7	40.2	44.5	33.0	11.5	29.87	30.17	29.73	.44	95	S.	20.8	..	0.79	....	0.79	7
8	46.6	56.1	38.0	18.1	29.80	29.84	29.75	.09	73	S.W.	15.1	27	0.13	...	0.13	8
9	45.3	53.3	36.2	17.1	29.81	29.86	29.77	.09	74	W.	11.8	86	0.00	....	0.00	9
10	44.3	52.6	38.8	13.8	30.03	30.16	29.84	.32	65	N.E.	11.6	41	....	....	....	10
11	41.3	48.0	33.8	14.2	30.15	30.21	30.11	.10	60	N.	11.0	75	....	....	....	11
SUNDAY........12	44.0	54.7	34.5	20.2	29.99	30.11	29.88	.23	55	N.E.	12.4	85	....	....	....	12..........SUNDAY
13	43.3	54.1	32.4	21.7	29.96	30.00	29.92	.08	73	N.E.	17.0	70	....	....	....	13
14	48.6	59.5	36.8	22.7	29.92	29.96	29.89	.07	63	E.	15.4	64	....	....	....	14
15	47.0	54.4	39.5	14.9	29.89	29.94	29.85	.09	67	N.E.	19.1	75	....	....	....	15
16	45.4	51.8	39.5	12.3	29.82	29.85	29.78	.07	65	N.E.	16.2	..	0.00	....	0.00	16
17	42.1	52.1	32.5	19.6	29.79	29.88	29.67	.21	54	N.	18.4	52	....	....	....	17
18	39.5	46.0	31.0	15.0	29.62	29.68	29.54	.14	61	N.W.	17.5	05	....	0.3	0.03	18
SUNDAY........19	40.1	49.5	33.9	15.6	29.67	29.70	29.62	.08	53	N.W.	18.3	2'	....	....	....	19 ....SUNDAY
20	38.0	46.0	30.2	15.8	29.71	29.74	29.67	.07	64	N.W.	13.8	42	....	....	....	20
21	39.0	46.7	30.9	15.8	29.75	29.80	29.72	.08	67	W.	11.9	29	....	....	....	21
22	46.5	52.6	40.8	11.8	29.83	29.87	29.80	.07	61	N.	10.1	..	....	....	....	22
23	47.1	54.2	42.0	12.2	29.91	29.99	29.86	.13	63	S.W.	7.1	07	....	....	....	23
24	47.2	57.2	38.8	18.4	29.93	29.97	29.88	.09	57	S.W.	16.0	63	....	....	....	24
25	43.7	52.0	35.1	16.9	30.03	30.10	29.97	.13	49	N.	13.1	67	....	....	....	25
SUNDAY...... .26	45.5	54.4	32.9	21.5	30.09	30.16	30.02	.14	50	N.E.	5.1	27	....	....	....	26..........SUNDAY
27	52.5	64.0	37.0	27.0	30.14	30.18	30.05	.13	49	S.W.	12.9	90	....	....	....	27
28	58.6	69.8	42.5	27.3	29.89	30.17	29.81	.36	53	S.W.	30.1	80	....	....	....	28
29	63.7	73.0	54.9	18.1	29.99	30.02	29.83	.19	55	S.W.	17.0	52	....	....	....	29
30	65.2	82.2	47.9	34.3	29.70	29.94	29.42	.52	50	S.W.	18.7	62	....	....	....	30
Means......	44.06	53.07	34.86	18.22	29.895	29.997	29.786	.211	63.8	N 51° W.	15.75	43.0	1.61	4.3	2.22	................Sum.
29 Years means for and including this month	40.84	49.27	33.03	16.24	29.961	......	......	.201	65.7	....	§ 16.25	¶ 50.1	1.737	5.06	2.258	29 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	2223	1734	597	503	982	2259	1489	1554	
Duration in hrs..	146	109	52	25	61	117	117	90	3
Mean velocity....	15.2	16.0	11.5	20.1	16.1	19.3	12.7	17.3	

Greatest mileage in one hour was 48 on the 30th.

Greatest velocity in gusts was 72 on the 30th.

Resultant mileage, 2,574.

Resultant direction, N 51° W.

Total mileage, 11,341.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 16 years only.

The greatest heat was 82.2 above zero on the 30th. The greatest cold was 12.8 above zero on the 5th, giving a range of temperature of 69.4°.

Warmest day was the 30th. Coldest day was the 5th.

Highest barometer reading was 30.45 on the 6th: lowest barometer was 29.34 on the 3rd, giving a range of 1.14 inches.

Minimum relative humidity observed was 33 on the 26th.

Rain fell on 6 days. Snow fell on 3 days.

Rain and snow on 1 day.

Fog on 1 day.

Thunderstorm on 2nd.

No snow on ground.

ABSTRACT FOR THE MONTH OF MAY, 1903.

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 relative humidity.	WIND. General direction.	Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	36.8	73.0	31.3	41.7	30.15	30.46	29.58	.88	71	N.W.	27.4	67	....	....	....	1
2	42.0	52.8	27.9	24.9	30.41	30.52	30.26	.26	45	S.E.	11.9	57	....	....	....	2
SUNDAY........ 3	49.9	57.4	40.0	17.4	30.09	30.26	29.93	.33	52	S.E.	24.5	25	0.00	....	0.00	3..........SUNDAY
4	48.6	55.6	44.0	11.6	30.16	30.32	29.94	.38	68	S.W.	20.8	41	0.00	...	0.00	4
5	49.8	61.3	36.2	25.1	30.28	30.36	30.22	.14	56	N.E.	14.9	87	....	....	....	5
6	54.2	67.0	38.9	28.1	30.14	30.24	30.01	.23	58	N.E.	7.0	80	....	....	....	6
7	53.7	65.5	41.7	23.8	30.01	30.10	29.97	.13	68	N.E.	10.5	09	....	....	....	7
8	60.5	69.2	48.3	20.9	30.16	30.23	30.10	.13	46	S.W.	14.0	94	....	....	....	8
9	63.2	76.0	50.0	26.0	30.16	30.24	30.08	.16	52	S.W.	11.6	92	....	....	....	9
SUNDAY........10	64.8	76.7	53.1	23.6	30.12	30.16	30.07	.09	51	S.W.	20.6	57	....	....	....	10..........SUNDAY
11	66.4	74.7	52.5	22.2	30.21	30.25	30.13	.12	54	S.W.	16.5	35	....	....	....	11
12	63.7	78.2	50.8	27.4	30.28	30.35	30.21	.14	69	N.E.	7.8	76	....	....	....	12
13	61.5	75.5	45.8	29.7	30.15	30.24	30.03	.21	62	S.W.	15.4	64	....	....	....	13
14	50.2	66.0	43.6	22.4	30.05	30.15	29.94	.21	73	N.E.	13.8	22	0.02	....	0.02	14
15	60.4	73.5	46.8	26.7	29.96	30.07	29.91	.16	58	S.W.	12.7	67	....	....	....	15
16	58.5	73.8	41.2	32.6	30.15	30.23	30.07	.16	59	N.E.	10.7	92	....	....	....	16
SUNDAY........17	69.7	80.5	55.0	25.5	30.05	30.13	29 95	.18	62	S.W.	19.6	87	....	....	....	17 ....SUNDAY
18	70.6	82.0	60.2	21.8	29.94	30.00	29.87	.13	62	S.W.	15.4	52	0.00	....	0.00	18
19	70.2	84.8	56.4	28.4	29.85	29.91	29.77	.14	65	S.W.	13.8	43	0.00	....	0.00	19
20	66.4	82.6	48.8	33.8	29.81	29.85	29.74	.11	69	S.W.	16.0	64	0.00	....	0.00	20
21	67.1	79.2	55.8	23.4	29.85	29.90	29.77	.13	65	S.W.	13.0	55	0 07	....	0.07	21
22	59.9	66.0	52.2	13.8	29.91	30.01	29.79	.22	58	N.W.	12.5	91	....	....	....	22
23	48.6	57.2	39.8	17.4	30.11	30.18	30.01	.17	48	N.E.	12.1	98	....	....	....	23
SUNDAY...... .24	48.5	58.0	36.8	21.2	30.20	30.27	30.15	.12	52	N.E.	8.6	92	....	....	....	24..........SUNDAY
25	54.7	64.4	40.0	24.4	30.26	30.34	30.22	.12	53	S.E.	6.3	90	....	....	....	25
26	60.7	71.2	45.7	25.5	30.17	30.26	30.08	.18	51	S.	13.6	43	....	....	....	26
27	66.0	75.7	54.8	20.9	29.97	30.09	29.85	.24	72	S.	17.5	29	0.02	....	0.02	27
28	69.3	78.9	54.1	24.8	29.83	29.92	29.79	.13	70	......	....	31	0.00	....	0.00	28
29	51.2	68.0	41.1	26.9	30.13	30.19	29.92	.27	63	......	....	65	....	....	....	29
30	51.1	60.0	42.0	18.0	30.17	30.23	30.12	.11	56	......	....	72	....	....	....	30
SUNDAY....... 31	53.6	62.5	42.8	19.7	30.30	30.34	30.23	.11	63	......	....	87	....	....	....	31..........SUNDAY
Means......	57.79	69.91	45.73	24.18	30.097	30.19	29.99	.20	59.7	S. 46° W.	14.38	63.5	0.11	....	0.11	....
29 Years means for and including this month	54.77	64.14	45.81	18.34	29.935	......	......	.177	66.2	......	§ 14.57	¶ 51.3	2.84	....	2.85	29 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	525	1825	71	796	995	3764	470	873	
Duration in hrs..	48	144	14	52	76	215	36	63	
Mean velocity....	10.9	12.7	5.1	15.3	13.1	17.5	13.1	13.9	

Greatest mileage in one hour was 52 on the 1st.
Greatest velocity in gusts was 72 on the 1st.

x Resultant mileage, 2,932.
Resultant direction, S 46° W.

x Estimated. *m* For 27 days only.

m Total mileage, 9,319.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 16 years only.

The greatest heat was 84.8 above zero on the 19th. The greatest cold was 27.9 above zero on the 2nd, giving a range of temperature of 56.9°.

Warmest day was the 18th. Coldest day was the 1st.

Highest barometer reading was 30.52 on the 2nd; lowest barometer was 29.58 on the 1st, giving a range of .94 inches.

Minimum relative humidity observed was 33 on the 2nd.

Rain fell on 9 days.

ABSTRACT FOR THE MONTH OF JUNE, 1903.

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

DAY	THERMOMETER.				* BAROMETER.				‡Mean relative humidity.	WIND.		Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
	† Mean.	Max.	Min.	Range.	† Mean.	Max.	Min.	Range.		General direction.	Mean velocity in miles per hour.					
1	60.9	73.1	46.5	26.6	30.31	30.38	30.23	.15	47	*x* N.W.	....	81	....	....	....	1
2	63.9	73.7	53.2	20.5	30.22	30.31	30.08	.23	44	*x* W.	....	83	....	....	....	2
3	65.6	78.2	55.3	22.9	30.03	30.13	29.98	.15	46	N.W.	18.0	20	....	....	....	3
4	58.0	67.0	49.3	17.7	30.27	30.33	30.13	.20	47	N.W.	11.8	21	....	....	....	4
5	64.0	77.3	57.9	29.4	30.29	30.35	30.21	.14	77	S.W.	10.3	71	....	....	....	5
6	71.2	84.2	58.8	25.4	30.15	30.23	30.07	.16	66	S.W.	17.0	67	....	....	....	6
SUNDAY....... 7	68.7	79.9	56.6	23.3	29.99	30.08	29.89	.19	61	S.W.	11.0	11	....	....	....	7..........SUNDAY
8	68.2	75.4	64.0	11.4	29.84	29.91	29.79	.12	86	S.W.	14.8	12	0.04	....	0.04	8
9	70.8	80.5	62.0	18.5	29.83	29.87	29.80	.07	81	S.W.	9.5	33	....	....	....	9
10	70.6	76.9	65.2	11.7	29.93	29.96	29.86	.10	78	N.E.	12.3	25	0.00	....	0.00	10
11	66.2	76.5	58.0	18.5	29.96	30.02	29.90	.12	70	N.E.	11.4	30	0.20	....	0.20	11
12	61.5	66.3	55.1	11.2	29.75	29.90	29.58	.32	93	S.E.	17.0	..	1.49	....	1.49	12
13	62.7	67.1	58.0	9.1	29.70	29.74	29.65	.09	91	S.	11.0	01	0.17	....	0.17	13
SUNDAY........14	61.2	67.2	54.0	13.2	29.76	29.77	29.73	.04	73	S.	8.1	51	....	....	....	14..........SUNDAY
15	62.1	72.4	55.9	16.5	29.80	29.86	29.76	.10	78	N.E.	15.2	39	0.00	....	0.00	15
16	58.7	66.5	52.9	13.6	29.86	29.90	29.82	.08	75	N.E.	13.7	44	0.02	....	0.02	16
17	61.3	72.0	51.3	20.7	29.84	28.88	29.80	.08	69	S.E.	11.3	75	0.23	....	0.23	17
18	57.1	62.8	50.2	12.6	29.90	29.93	29.88	.05	81	S.W.	7.4	25	0.23	....	0.23	18
19	60.2	70.0	52.1	17.9	29.83	29.88	29.80	.08	72	S.W.	7.0	58	0.03	....	0.03	19
20	62.6	72.5	52.8	19.7	29.80	29.83	29.75	.08	70	S.E.	6.0	70	0.00	....	0.00	20
SUNDAY........21	56.1	66.0	54.0	12.0	29.80	29.89	29.75	.14	97	S.E.	12.9	..	1.56	....	1.56	21..........SUNDAY
22	61.4	69.7	51.8	17.9	29.93	29.98	29.89	.09	70	S.E.	8.5	41	....	....	....	22
23	62.0	69.4	56.5	12.9	29.91	29.95	29.88	.07	58	S.E.	15.0	24	0.00	....	0.00	23
24	57.2	03.8	51.5	12.3	29.98	29.04	29.93	.11	75	S.E.	11.8	05	0.18	....	0.18	24
25	57.8	65.6	50.8	14.8	29.93	29.98	22.88	.10	85	S.E.	11.1	14	0.12	....	0.12	25
26	62.6	72.5	55.6	16.9	29.91	29.97	29.86	.11	84	W.	11.5	51	0.44	....	0.44	26
27	62.0	66.0	59.9	6.1	29.91	29.96	29.86	.10	62	N.W.	11.4	66	....	....	....	27
SUNDAY........28	65.0	75.2	53.1	22.1	29.86	29.89	29.82	.07	64	S.W.	12.3	93	....	....	....	28..........SUNDAY
29	64.7	74.2	55.6	18.6	29.85	29.87	29.83	.04	67	*x* S.E.	....	25	....	....	....	29
30	62.8	69.5	57.9	11.6	29.80	29.86	29.75	.11	87	......	....	01	0.05	....	0.05	30
Means......	62.90	71.7	54.9	16.8	29.931	29.99	29.87	.12	70.5	*m* S. 1° E.	*m* 11.81	38	4.76	....	4.76	.......Sums.........
29 Years means for and including this month......	64.73	73.5	56.21	17.3	29.903	......	......	.16	70.4	......	§ *m* 11.92	¶ 53.7	3.65	....	3.65	29 Years means for and including this month.

m ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	112	1345	175	1906	626	1990	568	644	
Duration in hrs..	10	101	18	174	59	164	45	53	
Mean velocity....	11.2	13.3	9.7	11.0	10.6	12.1	12.6	12.2	

Greatest mileage in one hour was 31 on the 12th.
Greatest velocity in gusts was 36 on the 6th and 12th.
m Total mileage, 7,366.

x Resultant mileage, 2,148.
Resultant direction, S 1° E.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 16 years only.

x Estimated. *m* For 26 days only.

The greatest heat was 84.2 above zero on the 6th. The greatest cold was 46.5 above zero on the 1st, giving a range of temperature of 37.7°.

Warmest day was the 6th. Coldest day was the 21st.

Highest barometer reading was 30.38 on the 1st: lowest barometer was 29.58 on the 12th, giving a range of .80 inch.

Minimum relative humidity observed, was 20 on the 4th.

Rain fell on 17 days. Lightning on 5 days. Thunderstorms on the 18th and 26th.

ABSTRACT FOR THE MONTH OF JULY, 1903.

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 relative humidity.	WIND. General direction.	Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	69.0	77.6	60.0	17.6	29.69	29.78	29.52	.26	89	x S.W.	....	20	0.01	...	0.01	1
2	72.0	78.2	65.1	13.1	29.60	29.81	29.46	.35	67	x N.W.	....	82	0.89	....	0.89	2
3	65.0	72.8	54.7	18.1	29.91	29.99	29.81	.18	64	x W.	....	96	....	....	....	3
4	66.1	75.7	60.3	15.4	30.08	30.11	29.99	.12	62	x S.E.	....	96	....	....	....	4
SUNDAY....... 5	68.6	76.8	59.0	17.8	30.07	30.13	29.99	.14	73	S.E.	7.2	36	0.04	....	0.04	5..........SUNDAY
6	71.9	80.0	64.4	15.6	30.01	30.04	29.98	.06	73	N.W.	11.7	77	0.00	....	0.00	6
7	74.4	81.6	69.0	12.6	30.05	30.13	29.95	.18	60	S.W.	15.6	65	0.00	....	0.00	7
8	75.3	84.5	66.8	17.7	29.88	30.00	29.80	.20	71	W.	25.7	81	....	....	....	8
9	78.8	88.0	70.0	18.0	29.84	29.87	29.82	.05	69	W.	20.0	85	....	....	....	9
10	79.7	86.9	70.6	16.3	29.72	29.82	29.65	.17	69	W.	23.9	66	....	....	....	10
11	74.6	80.5	69.0	11.5	29.71	29.75	29.66	.09	73	W.	13.3	75	....	....	...	11
SUNDAY........12	70.1	76.3	62.4	13.9	29.67	29.69	29.66	.03	70	W.	14.5	70	0.01	....	0.01	12..........SUNDAY
13	68.7	76.2	61.9	14.3	29.69	29.70	29.66	.04	67	W.	13.1	86	....	....	....	13
14	64.4	72.3	57.7	14.6	29.72	29.75	29.70	.05	71	W.	14.2	80	....	....	....	14
15	61.6	69.2	55.2	14.0	29.72	29.74	29.70	.04	82	N.W.	13.4	61	0.08	....	0.08	15
16	64.8	74.0	57.8	16.2	29.79	29.88	29.74	.14	72	N.W.	14.0	49	0.01	....	0.01	16
17	68.5	78.0	59.3	18.7	29.93	29.97	29.87	.10	64	W.	10.7	91	....	....	....	17
18	68.9	79.9	58.0	21.9	29.84	29.94	29.77	.07	63	S.W.	8.1	65	....	....	....	18
SUNDAY....... 19	63.6	70.2	61.6	8.6	29.78	29.80	29.77	.03	86	N.E.	8.0	..	0.21	....	0.22	19..........SUNDAY
20	64.5	71.8	58.9	12.9	29.82	29.85	29.77	.08	84	E.	5.4	13	0.13	....	0.13	20
21	66.1	73.0	62.0	11.0	29.87	29.92	29.84	.08	87	S.E.	6.0	07	0.00	....	0.00	21
22	67.0	73.3	60.6	12.7	29.88	29.97	29.88	.09	89	S.E.	6.4	05	0.06	....	0.06	22
23	65.7	69.5	63.4	6.1	29.99	29.90	29.85	.05	91	N.E.	7.1	17	0.22	....	0.22	23
24	67.2	76.0	59.1	16.9	29.91	30.06	29.90	.16	58	N.W.	11.1	90	....	....	....	24
25	67.5	78.1	60.0	18.1	29.93	30.02	29.83	.19	82	N.W.	13.1	11	0.26	....	0.26	25
SUNDAY...... .26	64.2	72.0	54.8	17.2	29.85	29.94	29.79	.15	64	N.W.	13.0	64	0.09	....	0.09	26..... .....SUNDAY
27	57.2	65.3	46.9	18.4	30.00	30.03	29.94	.09	57	N.W.	15.8	82	....	....	....	27
28	61.4	68.0	54.0	14.0	30.01	30.05	29.93	.12	63	N.W.	7.9	44	....	....	....	28
29	62.4	68.6	56.3	12.3	29.73	29.93	29.62	.31	96	S.W.	10.8	..	0.18	....	0.18	29
30	69.6	77.2	64.1	13.1	29.63	29.68	29.59	.09	87	S.W.	15.2	29	0.67	....	0.67	30
31	62.1	69.1	55.4	13.7	29.94	30.16	59.68	.48	64	N.W.	16.1	82	....	....	....	31
Means......	67.72	75.50	60.59	14.91	29.847	29.916	29.782	.135	73.1	N. 84° W.	12.64	56.0	2.87	....	2.87	.... ..Sums.........
29 Years means for and including this month......	....	77.22	60.79	16.43	29.897	......	......	.143	71.8	......	§ 12.91	¶ 58.9	4.20	....	4.20	29 Years means for and including this month.

m ANALYSIS OF WIND RECORD.

Direction.......	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	503	284	320	244	316	1193	3627	1705	
Duration in hrs..	46	41	57	36	42	78	228	120	
Mean velocity....	10.9	6.9	5.6	6.8	7.5	15.3	11.5	14.2	

Greatest mileage in one hour was 33 on the 8th.
Greatest velocity in gusts was 48 on the 8th.
m Total mileage, 8,192.

x Resultant mileage, 5,754.
Resultant direction, N 84° W.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 17 years only.

x Estimated. *m* For 27 days only.

The greatest heat was 88.0 above zero on the 9th. The greatest cold was 54.0 above zero on the 28th, giving a range of 34.0 degrees.

Warmest day was the 10th. Coldest day was the 27th.

Highest barometer reading was 30.16 on the 31st; lowest barometer was 29.46 on the 2nd, giving a range of .70 inches.

Minimum relative humidity observed, was 41 on the 26th.

Rain fell on 17 days.

Thunder and lightning on 4 days.

ABSTRACT FOR THE MONTH OF AUGUST, 1903.

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 relative humidity.	WIND. General direction.	Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	61.9	69.5	50.0	19.5	30.25	30.32	30.21	.11	64	N.W.	9.5	86	0.00	...	0.00	1
SUNDAY....... 2	63.2	70.0	57.1	12.9	30.40	30.43	30.32	.11	62	N.E.	7.5	66	....	....	....	2.......... SUNDAY
3	62.2	68.7	54.5	14.2	30.35	30.43	30.23	.20	67	N.E.	6.0	80	....	....	....	3
4	59.3	67.8	54.2	13.6	30.12	30.23	30.05	.18	86	S.E.	10.0	..	0.08	....	0.08	4
5	62.0	68.9	56.1	12.8	30.00	30.05	29.94	.11	74	S.E.	9.2	17	....	....	....	5
6	62.9	69.8	58.2	11.6	29.79	29.95	29.68	.27	81	S.E.	15.8	02	0.03	....	0.03	6
7	59.4	64.0	54.9	9.1	29.79	29.93	29.67	.26	72	W.	14.6	57	....	....	....	7
8	61.3	70.8	51.0	19.8	29.87	29.93	29.82	.11	59	S.W.	16.6	73	....	....	....	8
SUNDAY........ 9	60.2	67.0	54.5	12.5	29.78	29.86	29.73	.13	93	S.W.	11.3	..	0.71	....	0.71	9.......... SUNDAY
10	64.1	71.6	56.8	14.8	29.91	29.96	29.77	.19	77	W.	8.7	75	....	....	....	10
11	61.2	68.0	56.5	11.5	29.82	29.96	29.70	.26	89	S.W.	10.4	07	0.32	....	0.32	11
12	61.3	66.2	56.5	9.7	29.80	29.91	29.72	.19	74	N.W.	15.7	62	....	....	....	12
13	59.8	68.5	51.1	17.4	30.00	30.06	29.91	.15	72	N.W.	14.9	68	....	....	....	13
14	61.5	70.5	53.6	16.9	30.07	30.11	30.04	.07	68	W.	11.5	60	....	....	....	14
15	64.6	74.3	56.1	18.2	30.09	30.13	30.06	.07	80	N.W.	8.2	62	0.01	....	0.01	15
SUNDAY....... 16	64.0	74.8	54.6	20.2	30.04	30.07	30.00	.07	73	N.W.	5.5	32	....	....	....	16.......... SUNDAY
17	64.7	73.9	57.1	16.8	29.99	30.02	29.95	.07	76	N.W.	9.8	84	....	....	....	17
18	62.0	70.4	52.0	18.4	29.96	30.04	29.84	.20	83	....	....	30	0.03	....	0.03	18
19	69.0	77.0	62.7	14.3	29.77	29.84	29.73	.11	80	S.W	....	22	0.06	....	0.06	19
20	64.5	74.2	61.7	12.5	29.72	29.79	29.69	.10	89	N.W.	8.6	..	0.70	....	0.70	20
21	63.1	69.8	53.5	16.3	29.86	29.96	29.71	.25	63	S.W.	11.9	83	....	....	....	21
22	68.6	80.2	61.0	19.2	29.57	29.73	29.45	.28	61	S.W.	23.6	84	0.57	....	0.57	22
SUNDAY...... 23	61.8	70.1	52.8	17.3	29.79	29.87	29.77	.10	59	N.W.	12.6	81	....	....	....	23.......... SUNDAY
24	59.6	67.4	43.3	24.1	29.06	29.99	29.87	.12	63	N.W.	6.5	80	....	....	....	24
25	57.7	61.1	53.5	7.6	29.91	29.99	29.85	.14	82	N.E.	6.8	..	0.17	....	0.17	25
26	61.4	69.0	53.4	15.6	29.97	30.02	29.90	.12	69	N.E.	6.3	70	....	....	....	26
27	62.8	69.6	52.7	16.9	30.05	30.08	30.02		68	N.E.	6.2	77	....	....	....	27
28	61.3	69.4	51.6	17.8	30.10	30.12	30.07	.05	67	N.W.	11.2	66	....	....	...	28
29	60.9	68.1	53.8	14.3	30.14	30.17	30.11	.06	76	N.W.	6.1	25	....	....	....	29
SUNDAY........ 30	59.0	64.2	56.0	8.2	30.13	30.16	30.10	.06	79	N.E.	8.7	..	0.30	....	0.30	30.......... SUNDAY
31	59.3	60.2	51.8	8.4	30.01	30.10	29.94	.16	93	N.E.	6.0	..	0.19	....	0.19	31
Means.......	62.00	69.52	54.60	14.92	29.969	30.006	29.898	.108	74.3	N. 87° W.	10.30	47.1	3.17	....	3.17	.......Sums.........
29 Years means for and including this month	66.55	74.78	58.65	16.10	29.942	......	......	.133	73.6	......	§ 11.91	¶ 57.5	3.59	....	3.59	29 Years means for and including this month.

m ANALYSIS OF WIND RECORD.

Direction........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALM.
Miles	106	695	316	583	486	1639	1098	2303	
Duration in hrs..	16	104	46	54	41	111	111	215	
Mean velocity....	6.6	6.7	7.0	10.8	11.9	14.9	9.9	10.7	

Greatest mileage in one hour was 39 on the 22nd.
Greatest velocity in gusts was 42 on the 22nd.
Resultant mileage, 2,701.

Resultant direction, N 87° W.
Total mileage, 7,296.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 17 years only.

m For 22½ days only.

The greatest heat was 80.2 above zero on the 22nd. The greatest cold was 50.0 above zero on the 1st, giving a range of 30.2 degrees.

Warmest day was the 19th. Coldest day was the 31st.

Highest barometer reading was 30.43 on the 2nd and 3rd; lowest barometer was 29.45 on the 22nd giving a range of .98 inches.

Minimum relative humidity observed, was 47 on the 5th and 23rd.

Rain fell on 13 days.

Thunder and lightning on 5 days.

ABSTRACT FOR THE MONTH OF SEPTEMBER, 1903.

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

DAY	THERMOMETER. † Mean.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. Range.	* BAROMETER. † Mean.	* BAROMETER. Max.	* BAROMETER. Min.	* BAROMETER. Range.	‡Mean relative humidity.	WIND. General direction.	WIND. Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	DAY.
1	62.4	68.1	57.6	10.5	29.98	30.03	29.94	.09	91	S.E.	5.2	2	.15	....	.15	1
2	67.6	74.0	60.0	14.0	30.07	30.10	30.03	.07	78	S.E.	10.4	76	....	....	....	2
3	68.3	75.0	59.9	15.1	30.08	30.14	30.00	.14	80	S.E.	9.2	47	.00	....	.00	3
4	68.8	79.0	62.7	16.3	29.93	30.00	29.84	.16	79	S.E.	12.5	63	.12	....	.12	4
5	58.9	65.4	54.3	12.1	29.99	30.03	29.95	.08	66	S.W.	8.7	74	.02	....	.02	5
SUNDAY....... 6	55.3	62.0	47.4	14.6	30.06	30.10	30.02	.08	61	S.W.	8.0	53	....	....	....	6.........SUNDAY
7	53.0	59.0	48.2	10.8	30.21	30.30	30.13	.17	54	W.	5.5	80	....	....	....	7
8	53.9	61.5	44.8	16.7	30.34	30.39	30.30	.09	65	N E.	5.0	89	....	....	....	8
9	58.1	68.0	45.0	23.0	30.24	30.32	30.11	.21	73	E.	10.3	67	....	....	....	9
10	67.7	75.0	59.0	16.0	29.95	30.11	29.83	.28	83	E.	13.5	64	.01	....	.01	10
11	66.5	71.2	60.6	10.6	30.08	30.19	29.89	.30	72	S.	12.5	89	.00	....	.00	11
12	65.5	74.0	57.0	17.0	30.21	30.27	30.14	.13	70	S.E.	9.5	86	....	....	....	12
SUNDAY.......13	72.5	83.0	60.9	22.1	30.00	30.14	29.87	.27	69	S.E.	19.7	70	....	....	....	13..........SUNDAY
14	68.1	76.4	61.2	15.2	30.05	30.11	29.93	.18	62	S.W.	10.2	61	....	....	....	14
15	65.1	68.8	62.5	6.3	30.08	30.12	30.03	.09	84	N.W.	8.5	12	.05	....	.05	15
16	69.9	81.2	60.0	21.2	29.98	30.09	29.86	.23	82	E.	8.8	72	....	....	....	16
17	66.7	74.8	57.9	16.9	29.65	29.86	29.48	.38	87	S.E.	19.6	19	.35	....	.35	17
18	50.1	59.0	45.1	13.9	30.07	30.24	29.75	.49	75	S.E.	17.0	74	....	....	....	18
19	52.1	59.0	43.1	15.9	30.38	30.43	30.24	.19	71	S.E.	11.8	90	....	....	....	19
SUNDAY.......20	55.6	65.0	45.1	19.9	30.35	30.43	30.27	.16	74	E.	5.9	84	....	....	....	20..........SUNDAY
21	61.0	68.8	49.0	19.8	30.13	30.27	30.02	.25	72	S.E.	15.3	86	....	....	....	21
22	62.9	68.2	58.5	9.7	30.11	30.17	30.02	.15	54	S.W.	15.0	90	....	....	....	22
23	65.5	76.3	52.0	24.3	29.82	30.06	29.58	.48	64	S.E.	21.6	88	....	....	....	23
24	49.5	66.7	44.5	22.2	29.82	29.94	29.63	.31	69	S.W.	18.7	65	.04	....	.04	24
25	49.7	55.5	43.2	12.3	30.01	30.06	29.94	.12	69	S.E.	12.0	35	....	....	....	25
26	58.8	70.1	46.0	24.1	29.98	30.06	29.90	.16	75	E.	13.8	84	....	....	....	26
SUNDAY.......27	59.7	71.2	49.0	22.2	29.79	29.91	29.68	.23	83	S.E.	25.8	33	.53	....	.53	27.........SUNDAY
28	46.7	58.0	42.0	16.0	30.00	30.18	29.86	.32	75	S.W.	17.5	40	.00	....	.00	28
29	45.3	50.5	39.6	10.9	30.24	30.28	30.18	.10	65	S.W.	17.5	57	....	....	....	29
30	54.3	64.0	43.2	20.8	30.22	30.30	30.15	.15	67	S.E.	22.1	60	....	....	....	30
Means..........	59.99	68.32	51.98	16.54	30.062	30.15	29.95	.20	72.3	S. 32° E	13.1	64	1.27	....	1.27	.......Sums.........
29 Years means for and including this motnh......	58.63	66.63	50.95	15.69	30.016	......	......	.186	76.2	......	‖ 12.55	¶ 54.15	3.21	....	3.21	29 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	45	79	1439	4691	1049	1649	149	324	
Duration in hrs..	9	15	115	304	69	136	30	42	
Mean velocity....	5.0	5.3	12.5	15.4	15.2	12.1	5.0	7.7	

Greatest mileage in one hour was 37 on the 17th.
Greatest velocity in gusts was 48 on the 27th.
Resultant mileage, 6,141

Resultant direction, S. 32° E.
Total mileage, 9,425.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. ‖ 17 years only.

The greatest heat was 83.0 above zero on the 13th. The greatest cold was 39.6 above zero on the 29th, giving a range of 43.4 degrees.

Warmest day was the 13th. Coldest day was the 29th.

Highest barometer reading was 30.43 on the 19th and 20th; lowest barometer was 29.48 on the 17th, giving a range of .95 inches.

Minimum relative humidity observed, was 39 on the 7th.

Rain fell on 11 days.

Thunder and lightning on 2 days.

Fog on 1 day.

Auroras on 2 nights.

ABSTRACT FOR THE MONTH OF OCTOBER, 1903.

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

Day	Thermometer. † Mean.	Thermometer. Max.	Thermometer. Min.	Thermometer. Range.	* Barometer. † Mean.	* Barometer. Max.	* Barometer. Min.	* Barometer. Range.	‡ Mean relative humidity.	Wind. General direction.	Wind. Mean velocity in miles per hour.	Per cent. possible Sunshine.	Rainfall in inches.	Snowfall in inches.	Rain and snow melted.	Day.
1	59.1	65.0	5 .0	14.0	30.03	30.14	29.96	.18	91	S.E.	17.5	08	.22	...	.22	1
2	56.2	64.5	49.0	15.5	30.26	30.38	29.97	.41	65	N.W.	14.4	94	.05	....	.05	2
3	56.3	65.6	44.0	21.6	30.31	30.41	30.17	.24	70	N.E.	7.9	69	....	....	....	3
Sunday...... 4	57.3	60.1	53.8	6.3	30.05	30.17	29.97	.20	81	S.E.	17.8	....	.11	....	.11	4..........Sunday
5	61.1	66.8	57.4	9.4	29.99	30.08	29.96	.·2	73	S.E.	15.7	52	.10	....	.10	5
6	55.0	64.0	47.0	17.0	30.19	30.22	30.08	.14	64	N.W.	9.0	93	....	....	....	6
7	56.1	65.2	46.0	19.2	30.09	30.21	29.98	.23	70	N.E.	15.3	....	.44	....	.44	7
8	56.2	65.1	49.2	15.9	29.88	29.98	29.79	.19	88	N.E.	18.4	....	.35	....	.35	8
9	51.7	54.9	49.0	5.9	30.00	30.07	29.94	.13	97	N.W.	6.6	....	.85	....	.85	9
10	51.2	55.6	46.0	9.6	30.20	30.29	30.07	.22	77	N.W.	17.4	32	.03	....	.03	10
Sunday.......11	49.2	54.1	42.0	12.1	30.20	30.28	30.09	.19	74	N.W.	22.0	92	....	....	...	11..........Sunday
12	51.1	56.7	44.8	11.9	30.05	30.09	30.01	.08	75	N.W.	13.8	08	....	....	....	12
13	52.8	59.5	45.5	14.0	30.05	30.14	29.96	.18	74	S.W.	13.3	87	....	....	....	13
14	51.2	56.4	46.2	10.2	29.95	30.01	29.91	.10	64	S.W.	11.0	53	....	....	....	14
15	47.8	51.0	40.4	13.6	30.03	30.10	29.94	.16	63	N.E.	7.9	74	....	....	....	15
16	54.3	59.3	47.0	12.3	29.89	29.96	29.83	.13	89	S.E.	15.3	04	.03	....	.03	16
17	56.6	64.0	52.2	11.8	29.70	29.84	29.49	.35	96	S.E.	15.0	23	.65	....	.65	17
Sunday.......18	44.2	57.8	33.9	23.9	29.63	29.91	29.42	.49	64	S.W.	18.5	29	.20	.00	.20	18..........Sunday
19	36.8	47.3	30.1	17.2	29.88	29.96	29.74	.22	85	S.E.	12.1	....	.03	.00	.03	19
20	52.0	60.7	42.2	18.5	29.69	29.95	29.55	.40	59	S.E.	20.0	39	....	....	....	20
21	40.9	51.5	34.5	17.0	30.13	30.24	29.95	.29	63	S.W.	11.8	68	....	....	....	21
22	46.9	57.0	35.5	21.5	29.99	30.26	29.71	.55	71	S.E.	22.2	63	.29	....	.29	22
23	45.7	57.0	39.2	17.8	29.94	30.07	29.80	.27	79	S.W.	12.3	....	.06	....	.06	23
24	34.7	43.3	30.0	13.3	30.07	30.12	30.02	.10	67	S.W.	13.6	01	....	....	....	24
Sunday.......25	40.2	47.0	30.0	17.0	29.80	30.02	29.57	.45	80	S.E.	14.3	03	.03	....	.03	25..........Sunday
26	33.0	45.0	28.0	17.0	29.76	29.92	29.57	.35	77	S.W.	24.7	52	.05	1.5	.20	26
27	31.7	34.9	29.0	5.9	30.05	30.11	29.92	.19	86	S.W.	22.1	13	....	.00	.00	27
28	32.0	37.8	25.2	12.6	30.08	30.12	30.05	.07	68	S.W.	16.5	45	....	....	....	28
29	43.6	56.2	30.6	25.6	29.94	30.06	29.81	.25	78	S.E.	26.3	69	....	....	....	29
30	50.6	58.2	43.0	15.2	30.00	30.05	29.90	.15	77	S.	25.3	76	....	....	....	30
31	51.2	58.5	45.3	13.2	30.03	30.10	29.97	.13	77	S.E.	25.0	27	.07	....	.07	31
Means......	48.58	56.2	41.5	14.7	29.995	30.10	29.87	.23	74.6	S. 8° W	16.4	38.4	3.56	1.5	3.71	......Sums........
29 Years means for and including this month......	45.99	53.0	39.1	13.9	30.013	......	......	.22	77.0	......	§ 13.4	¶ 41.3	3.03	1.0	3.13	29 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	265	848	541	3096	2320	2577	997	[illegible]	
Duration in hrs..	37	59	32	168	116	143	91	98	
Mean velocity....	7.2	14.4	16 9	18.9	20.0	18.0	10.9	16.1	

Greatest mileage in one hour was 35 on the 29th.
Greatest velocity in gusts was 48 on the 29th.
Resultant mileage, 4,392

Resultant direction, S. 8° W.
Total mileage, 12,223.

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

† Mean of bi-hourly readings taken from self-recording instruments.

‡ Humidity relative, saturation being 100. Mean of observations at 8, 15 and 20 hours.

¶ 22 years only. § 17 years only.

The greatest heat was 66.8 above zero on the 5th. The greatest cold was 25.2 above zero on the 28th, giving a range of temperature of 41.6 degrees.

Warmest day was the 5th. Coldest day was the 27th.

Highest barometer reading was 30.41 on the 3rd: lowest barometer was 29.42 on the 18th, giving a range of .99 inches.

Minimum relative humidity observed, was 34 on the 2nd.

Rain fell on 17 days.
Snow fell on 4 days.
Rain and snow on 3 days.
Lunar halos observed on 2 nights
Auroras were observed on 3 nights.

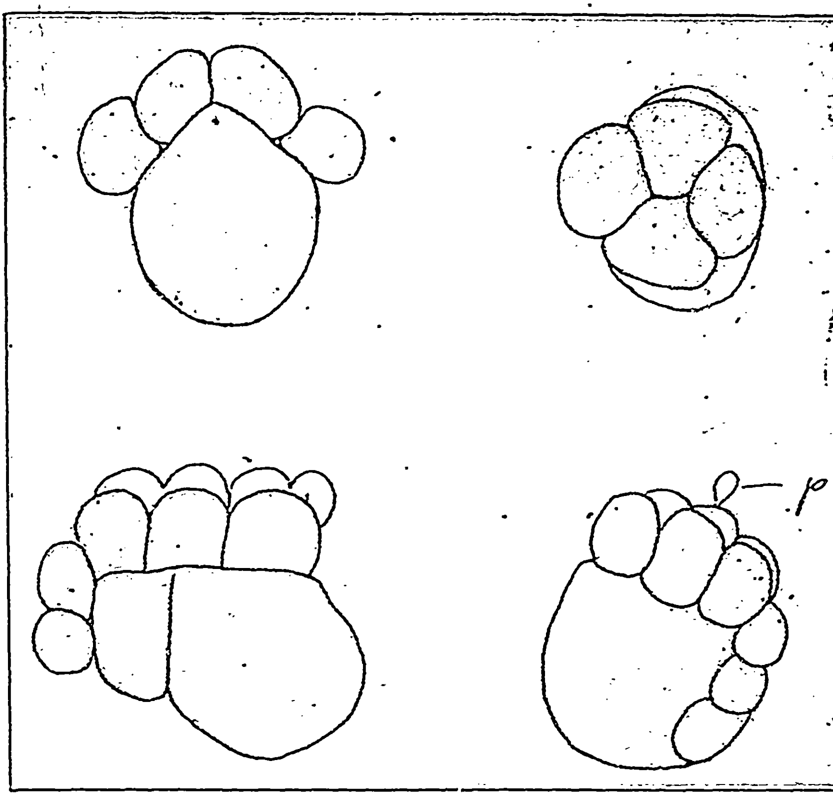


Fig. 1.—Segmenting Eggs of the Canadian Oyster.
p., polar globule.

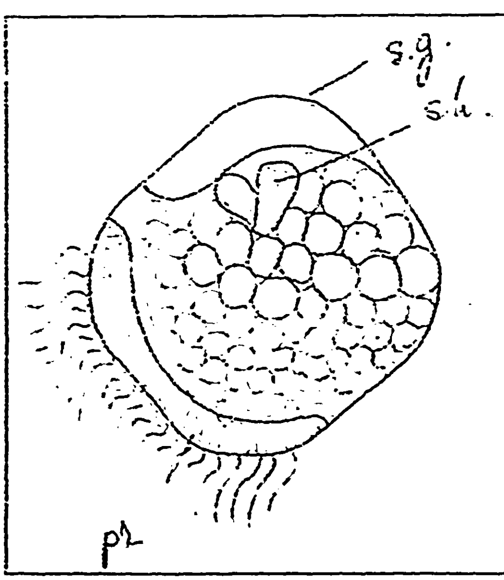


Fig. 2.—Larva of Malpeque Oyster. 24 hours old.
pr., prototroch. *s.g.*, everted shell-gland. *sh.*, rudiment of shell

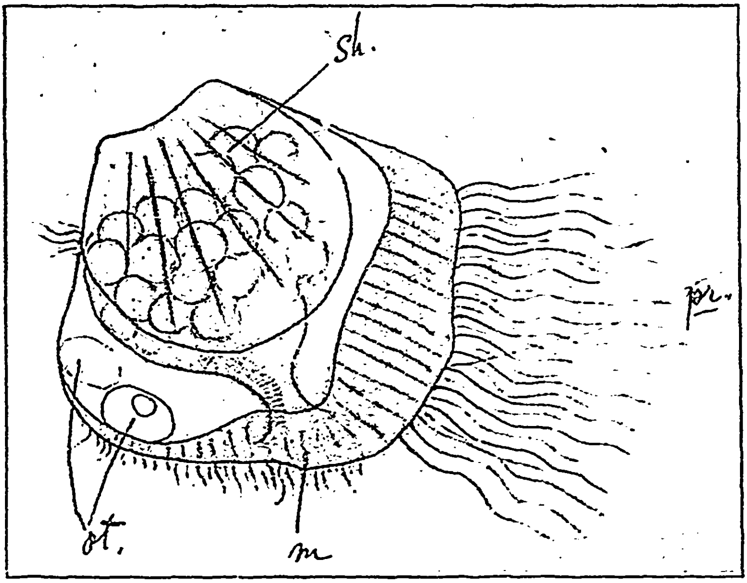


Fig. 3.—Larva of Oyster, 6 days old.

pr., prototroch. *m.*, mouth. *sh.*, shell. *ot.*, otocysts.

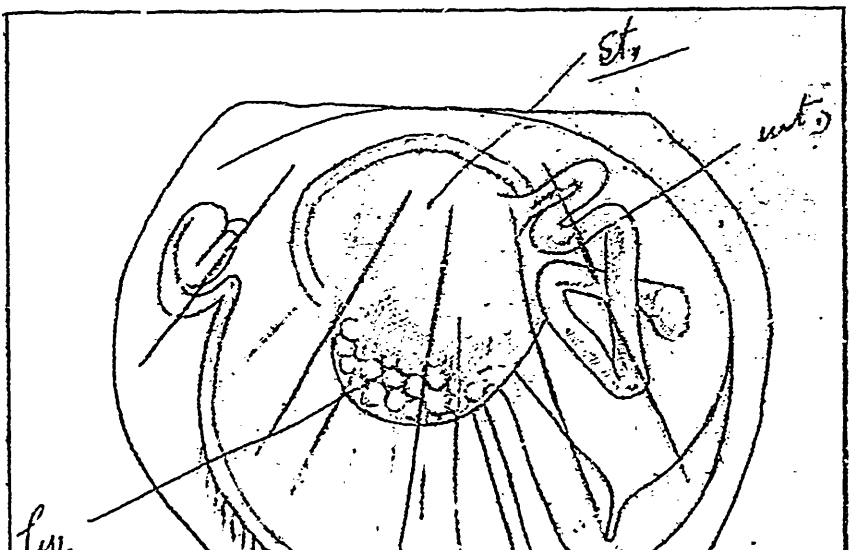


Fig. 4.—Date Larva of the Oyster captured by the Surface-net.

v., velum. *st.*, stomach. *int.*, intestine. *liv.*, liver.