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ARTICLE XXX.—*Notes on Egyptian Antiquities presented to the Natural History Society by Hon. Mr. Ferrier.* By a Committee of the Society.

(Read at Meeting of Oct. 31st.)

1. *Mummy of a Lady, from Thebes.*

This is the body of an aged female, in excellent preservation and in a highly ornamented case. Her name (fac-similed on a reduced scale in Fig. I.) is written opposite the portrait on the bottom of the coffin, and may have been " Abothloé."

The body has been prepared by some process (probably immersion in natron) which has had the effect of destroying the muscles, leaving only the fibrous tissues in a dry and spongy condition. The body has been disembowelled previous to embalming. The surface, especially of the lower extremities, has been smeared with some oily or resinous varnish, and above this has been spread a thick layer of ground spices, apparently applied as a paste, and most copiously on the face and chest, where this material has been moulded in such a manner as to restore, in some degree, the original form of the muscles. The spices are coarsely but uniformly ground, and, under the microscope, present slender stalks and fragments of the shell of globular seeds or berries, smooth or minutely pitted on the surface. The appearance is somewhat like that of Cassia buds, though not precisely. T· alcohol the spices yield a very small quantity of soluble matter, having a brown colour and heavy resinous and ammoniacal smell; and, after thorough washing in alcohol, the residuum is destitute of odour, and has merely a bitter taste.

Fig 1.

Externally to the spices a square plate of copper-foil had been moulded upon the face; and two smaller pieces had been placed on the upper part of the feet, at the base of the toes.

A quantity of lichen (see Note) had then been placed over the front part of the body to give it a more rounded contour, and to retain the odour of the spices; and it had been swathed in numerous linen cloths, folded over the front, and with many loose pieces put in to fill out the form.

The body lies upon a narrow board, which has previously been used for some other purpose, having a dovetail and pin at one end; but has been rounded on the lower side to fit it for its present use.

The coffin is elaborately ornamented on all sides, and covered with characters and figures of deities. It has also a figure of a lady in full dress, and a male figure lying on a bier; and in another part a similar male figure on the back of the bull Apis. The outer surface has been covered with linen, saturated with white paint or plaster before the figures were drawn upon it. The interior is thickly coated with white paint. The interior sides are inscribed with hieroglyphics, and a female figure, no doubt that of the occupant, is drawn in profile over the middle both of the cover and bottom.

The first finger of the right hand and the little finger of the left hand have been cut off previously to embalming, probably to obtain rings.

The head is finely proportioned, and the features regular; the feet very small and delicate. The measurements are as follows:

Height of body, 5 feet.
Occipital diameter of skull, 7 inches 2 tenths.
Parietal diameter of skull, 5 inches 8 tenths.
Length of foot, 7 inches 5 tenths.

The hair is quite white, straight but short. Its appearance under the microscope is similar to that of ordinary European hair, and its cross section apparently a flat oval.

2. *Mummy of a Man, from Thebes.*

This mummy has no case, and is wrapped in linen closely plied in many folds, and which has apparently been saturated with some resinous substance. The outer fold and bandages have been painted of a dull red colour. The head only was uncovered. It is in good preservation; is not covered with spices; but has been in part covered with bitumen, as if this had been poured upon it or into its cavities, and had in part run over the surface. The eyes have been extracted, and the lids have been carefully moulded so as to project in the natural form. There is abundance of straight brown hair on the scalp. Under the microscope it is similar to European hair. The head is finely formed, with a high and prominent forehead, and the nose straight and little prominent. The profile reminds one of Greek heads, or of those seen on the monuments of Egyptian priests.

Length of body, 4 feet 10 inches.
Occipital diameter of head, 7¼ inches.
Parietal diameter, 5⅜ inches.

3. *Head of a Mummy.*

The mummy to which this head belonged was probably prepared in the same manner with No. 2, but with less attention to the preservation of the expression of the features, the mouth being distorted and the tongue projecting. The skin has been smeared with resin or bitumen,—there are no indications of spices,—and the cavity of the skull is empty. The jaws are projecting and the brow receding, as in figures of the heads of low-caste Egyptians and modern Fellahs. It is a male head.

Occipital diameter, 7 inches 9 tenths.
Parietal diameter, 5 inches 6 tenths.

4. *Head of a Mummy.*

This head has been completely coated with bitumen, so that the inner cloths adhere and cannot be removed. The interior cavity seems to be partly filled with some solid substance, probably bitumen, which has also penetrated and hardened the tissues of the neck. The head is round, and the features and bones coarse.

Occipital diameter, 7 inches 3 tenths.
Parietal diameter, 6 inches.

These measurements may not be quite accurate, owing to the adhesion of the wrappers.

General Remarks.

No. 1 is preserved in a manner very different from the others and in what appears to be the oldest style of embalming. No bitumen has been used, and the preparatory process has evidently effected the removal rather than the preservation of the more perishable tissues, a result which corresponds very well with the probable results of an alkaline steep like natron, but does not accord with the usual statements of the effect of the process.* The others are prepared in the more usual manner,—with the aid of bitumen, and without the external layer of spices.

The heads of No. 1 and 2 are finely formed, and of the European type. No. 3 is a characteristic elongated African head, and No. 4 is short, and with prominent cheek-bones, tending to a Scythian or American conformation. These differences however are within the limits of those that occur in our own and other modern civilized races. J. W. D.

Note on the Pharonic Lichen, by Prof. Tuckerman, in a letter to one of the Editors:—

"EVERNIA FURFURACEA (L.) *Mann.*—Borrera, *Ach. Lichenogr.*; Parmelia, *Ach. Meth.*; Lichen furfuraceus, *L. and Authors.*

"Inhabits Europe, Asia, Africa, and America. The nearly-allied *E. prunastri (L.) Ach.* is said to have "a peculiar power of imbibing and retaining odours," and to be "in some request as an ingredient in sweet pots, and ladies' sachets." (Lindley, Fl. Med., p. 628.) It is likely the Egyptians found, or fancied that the present species would do as well; or perhaps they did not distinguish the two. Many now living lichens are probably of great age; but this is the oldest (so far as my knowledge goes) that we have any data about. The specimens would have lasted, so far as appears, almost indefinitely, if undisturbed and left in Egypt. It should be added that medical writers attribute the same value to *E. furfuracea* that they do to *E. prunastri*, and the plants are very likely identical in this respect."

Under the synonym *Physica furfuracea*, Dr. W. L. Lindsay thus speaks of our lichen: †

"It is found abundantly on the Himalayas and in many other parts of the world. From containing a considerable quantity of bitter principle, it has been used as a febrifuge instead of cinchona-bark or quinine. We have found it yield on ammoniacal maceration a red dye. The

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* Herodotus however appears to have been aware of this effect.—B. II., ch. 87.

† Popular History of British Lichens, by W. Lauder Lindsay, M.D London, 1856, Lovell Reeve, 1 vol. 16mo., pp. 352, with 22 col. plates, price 7s. 6d. An excellent little treatise, one of the best of a valuable series, which we take this opportunity of commending to our readers.

Egyptians at one time used it in the baking of bread as a substitute for another species, *P. prunastri*, * * * * for which purpose Forskuel says it (*P. prunastri*) was imported in shiploads from the Archipelago into Alexandria. A handful was steeped two hours in water, and the infusion added to the bread. It has been used also in the making of hair-powders." D. A. P.

List of the Egyptian curiosities recently brought to this City by the Hon. James Ferrier, and presented by him to the Natural History Society.

1 Mummy, woman, with coffin, from Thebes,
1 do man, " "
2 do heads, "
4 do hands, "
1 do foot, "
2 do Ibises, "
1 do Hawk, "
4 Small do. Crocodiles.
4 Jars, with the heads of Genii.
2 Jar covers, with heads of deities.
5 Small Jars containing Wheat from Mummy coffins.
2 Mummy shawls or cloths in which the bodies are wrapped.
1 Pair of Sandals, taken from a Mummy.
5 Dates, from date Palm. } From a Mummy Coffin.
1 Date, from Doum Palm. }
1 Curious Seed. }
4 Necklaces from Mummies, with image of Isis appended.
2 Necklaces from Mummies with Scarabaei.
1 Lamp of the dead, taken from a Coffin.
2 Antique Scarabaei, with extended wings.
1 do. do. of Blue Pottery.
4 do. Rings, taken off Mummies' fingers.
3 Fragments of Bread, with which the dead were supplied, found in a coffin.
1 Bronze Image of the God Osiris. } from Thebes.
1 " " of the Goddess Isis, nursing her son Horus. }
1 Papyrus Case, with the God Osiris standing with the Hawk God before him, having the Cartouche of Thothmes III, the Pharaoh of the time of Moses?
3 pieces Egyptian Writing on Papyrus.
3 Wooden Images of Egyptian Deities, from the Tombs at the great Pyramids of Ghizeh.
2 Stone do of do } from Tombs at Thebes.
8 Pottery do of do }
1 Fragment of Statuette, from the Temple of Koorneh, at Thebes.
1 Ivory Carving from a tomb at Thebes.
2 Sun-dried Bricks from Thebes, bearing the Cartouche of Rameses I. (the Great) 1311 B.C.

Halfeh Grass, taken from between the courses of a Brick Pyramid at Thebes, erected 1200 B.C.

1 Glass Eye from Statue of a deity at Thebes.

6 Fragments of Granite Images and Sphynx, from the Temple of Karnak.

2 Fragments of Granite, with Hieroglyphics from Karnak.

1 Fresco Painting, from an Arched Tomb at Dayr El Medeeneh.

6 Fragments of Hieroglyphics, from a Temple at Philæ, built 1500 B.C.

1 Fragment of Carved Pillar from do. do.

1 do of fluted Pillar from Karnak.

1 do of Winged Ibis, "

1 Fragment of Arm with bracelet, from a Statue at the Pyramid of Sakeara.

1 do with hieroglyphics, from the temple of Kom Ombus.

1 do of the Vocal Memnon.

2 do of Alabaster which lines the tombs near the Pyramids of Ghizeh.

2 do Water colour Painted Limestone, taken from an interior chamber in Belzoni's Tomb.

4 do of hieroglyphics from Petamunap's (the Priest's) Tomb at Thebes —this tomb covers an area of 1¼ acres.

1 do of Hieroglyphics from the Temple of Edfoo, U. E.

1 do of Hieroglyphics from the Temple at Karnak.

1 do of the Pyramid of Ghizeh [Nummulite Limestone.]

1 do of Mortar from do.

MODERN CURIOSITIES.

1 Long coloured Necklace from Nubia.

1 White Shell do from do.

1 Scarabæus, with hieroglyphics.

1 Nubian girl's dress.

1 do Pillow.

4 Egyptian Water Bottles from Sioot.

2 Nubian Ostrich Eggs, from Assouan.

11 dates from the Doum Palm Tree.

6 Specimens of Nile Mud, from different localities.

2 Nubian Spears.

1 do Bow.

1 do Quiver with 10 arrows.

1 do War Club.

1 small piece of Rope made from the Palm tree.

3 Egyptian Coffee Cups and stands.

1 Crocodile, killed near Kom Ombos.

3 Cones from the Cedars of Lebanon.

2 pieces of Pumice coloured by sulphur, from Mount Vesuvius.

2 fragments of Granite, from the obelisk in the quarries in Assouan. The obelisks at Karnak and the great statue of Rameses at Thebes are the same material.

4 specimens of Flint, from the Theban Mountains at the tombs of the Kings, Thebes

1 specimen of Nummulite Rock from the tombs of Beni Hassan.

7 do of Agates, from the Desert near Beni Hassan.

LIST OF A COLLECTION OF IMPRESSIONS TAKEN FROM THE TEMPLES AND TOMBS OF EGYPT.

Remeses IV., 1189 B.C., from Tomb at Thebes.

Shishak (of Scripture) 990 B.C., from Temple at Karnak.

Remeses VIII., 1171 B.C., from Tomb at Thebes.

Remeses II., 1311 B.C., from Temple at Koorneh, Thebes.

Sethi or Osirei (beloved of Pthah), 1322 B.C., from Belzoni's Tomb Thebes.

Ptolemy Philopater, 221 B.C., from Temple of Dayr el Medeeneh, Thebes.

Osirtasen I., 2020 B.C., from Tomb at Beni Hassan.

Remeses V., 1185 B.C., from Tomb at Thebes.

Thothmes III., 1463 B.C., from Temple of Dayr el Bahree, Thebes.

Remeses VI., 1180 B.C., from Tomb at Thebes.

Pisham, 1004 B.C., from Temple of Karnak.

Ptolemy Philometor, 180 B.C., from Temple of Dayr el Medeeneh, Thebes.

Ptolemy the Elder, 51 B.C., from Temple at Philæ.

Remeses VII, 1176 B.C., from Temple of Koorneh, Thebes.

Sethi or Osirei I., 1322 B.C., from Thebes.

Physcon, 145 B.C., from Temple at Philæ.

Ptolemy Philopator, 121 B.C., do do

Ptolemy Epiphanes, 204 B.C., do do

Nero Cæsar, 37 A.D., from Temple at Dendara.

Tiberius Cæsar, 34 A.D., do do

A Royal Cartouche, from Grottoes at Beni Hassan.

An Offering, from Temple at Dendara.

The Ibis, from Temple of Dayr el Medeeneh, Thebes.

An Offering, from do do do

Sacred Goose, 1185 B.C., from Memnon's Tomb, Thebes.

Scarabæus, from Belzoni's Tomb, Thebes.

Winged Scarabæus, from Temple at Dendara.

Head, from the Tombs of Assaseef, Thebes.

Head, from the Temple at Karnak.

Head, with Sacrificial Knife from Temple at Dendara.

Owl-headed Deity, from Temple at Kom-Ombos.

Head of the Deity of Justice, Dayr el Medeeneh.

Cynocephalue, do do

Hand presenting an Offering, from Temple of Karnak.

Assessor, from Temple of Dayr el Medeeneh, Thebes.

Hieroglyphics, from Grotto at El Kab.

Globes, Asps and Deities from Temple of Karnak.

Cartouche, from Dayr el Medeeneh.

A Judgment Scene from the Temple of Dayr el Medeeneh, copied and awn by Mr. R. W. Ferrier.

ARTICLE XXXI.—*On Ozone.* By CHARLES SMALLWOOD, M.D., LL.D., Professor of Meteorology in the University of McGill College.

(*Concluded from page 345.*)

In a short paper read before the American Association for the Advancement of Science, at the meeting held in Montreal in 1857, I expressed an opinion that the presence and development of Ozone was always attended by a humid state of the atmo sphere, and that observations of the psychrometer led to a certain indication of the presence or absence of Ozone. Since that time upwards of three thousand observations still confirm the opinion then expressed, and it has been shown that Ozone is not formed unless water or the vapor of water is present; for in perfectly dry air no Ozone has been detected. Even when Ozone is chemically formed by the means of phosphorus, its presence ceased to be appreciated in dry atmospheric air; and further when it is decomposed by heat, the vapor which it contained is set free. Phosphorus would seem to effect the combination of the vapor of water with the oxygen. This combination, and change in the particles of vapor, has also been attributed to electrical action.

Impressed, from these observations, with the importance of ascertaining if the corresponding periods of time indicating the greatest amount of humidity in the atmosphere, were really the true time of the daily ozonic periods, observations were instituted here for this purpose, by comparing these periods with other physical phenomena indicating the amount of humidity present. From observations carefully conducted up to the present date, it has been shown that the ozonic periods correspond in a striking degree to the bi-daily variations of the atmospheric humidity. During the progress of these investigations, strips of calico prepared with the starch and iodine solution, seemed to answer the purpose better than the prepared paper, owing, it may be supposed, to the fact that the cotton fibre absorbed with greater facility the moisture present, while at the same time it also seemed to retain the amount of Ozone collected better than the prepared test-paper.

It would seem now desirable to extend these observations, by keeping the ozonized calico always moist, which is easily accomplished by the capillary attraction of the cotton fibre, and thus furnish a medium for the decomposition of the aqueous vapor and the consequent development of Ozone. This should also be done by making time an element, which would also show the true time of the ozonic daily periods.

The action of direct light upon the ozonized paper would not seem to exert any great influence on the development of Ozone. By exposing the test-papers under different coloured glasses, and also to the action of polarized light, the following were the results. The expression of 1.00 being for saturation gives the ratio exposed to direct light, .73; to polarized light, .64; to white light, .57; to red, .58; to orange, .55; to purple, .51; to blue, .45; and to green, .41.

The following table of the properties of direct light through coloured media, is copied for the sake of comparison :—

	Light.	Heat.	Chemical Action.
White, ...	7	7	7
Red, ...	4	5	6
Orange, ...	6	6	4
Purple, ...	3	4	6
Blue, ...	4	3	6
Green, ...	5	2	3

The whole sunbeam consisting of luminous rays, heating rays, and chemical or actinic rays, light therefore passing through the above coloured media becomes deprived of one or more of these properties. In submitting the test-papers to these different coloured rays, it is shown that light passing through a green medium prevents the formation of ozone in the proportion .41 to .73. Polarized light would seem to possess the least influence on the development of ozone,—it gives in the proportion of .64 to .73. Next comes white light, then red, orange, purple, blue, and green. Green, it may be remarked, possesses but half the chemical or actinic action of red, purple, and blue. Orange, which possesses the greatest amount of luminous and heat rays, gave Ozone in the proportion of .55 to .73

The effects of the germination of plants on the amount of Ozone has also formed a subject of investigation here. The test-papers placed among vegetables and flowers, and also on branches of trees, have up to the present time given no decided results; except that during the prevalence of the potatoe rot, the test-papers placed between the rows of the diseased plant, were much more deeply coloured than those placed in the usual situation. But here, at the period of its outbreak, we had rain followed by a hot sun,—an atmosphere peculiarly suited for the development of ozone The influence of vegetation on its amount, whatever it may be during the spring and summer months, becomes sealed up in the icy bonds of winter. Returning spring, with its humid atmosphere, again affords ample means for the prosecution of the subject.

The influence of winds on the amount of ozone depends upon the quarter from which they come. Easterly and southerly winds may be called ozonic winds; while westerly and northerly winds barely indicate a trace. Rain and snow generally indicate a large amount. A north-easterly land-wind does not generally indicate ozone; and whenever there is ozone present during a north-east wind, it may be attributed to the sea-breeze passing over the land; for we have often a *dry* N.E. wind with a high barometer for some days, and no indication of ozone.

Its effects on animals and on the health of man require a system of registration, especially in the latter case, so as to present a comparative scale of disease and death in connection with the amount of ozone presented. During the last visitation of cholera, there was certainly a diminution in the amount; but at the same time there was a diminished amount of humidity. Its highly deleterious effects on the lower classes of animals are well ascertained, and have been turned to advantage in its poisonous properties, when produced by the slow combustion of phosphorus.

As a therapeutic agent, it can scarcely be said to have been administered Oil of turpentine exposed to light, has acquired a pungent taste like peppermint, owing to the formation of ozone, and has proved poisonous when given to small animals; it has been advised as a local application in rheumatism, and internally in chronic discharges from the mucous membranes in Man.

It is purposed still to prosecute the investigation of the effects of vegetation on the amount of Ozone, and also the effects due to the germination of plants. While the whole of the European continent is studded with observers, we are led to believe that little attention is paid to its investigation on this continent. A constant systematic form of observation is necessary; and it is to be hoped that but a few more years will pass before it takes its proper place in the annals of true science, and becomes alike interesting to the chemist, the physician, and the meteorologist.

St. Martin, Isle Jesus, Nov. 16, 1859.

ARTICLE XXXII.—*Notes on Land and Sea Birds observed around Quebec.* By J. M. LE MOINE.

(Presented to the Natural History Society.)

The plan followed by G. W. Allan, Esq., of Toronto, and W. S. M. D'Urban, Esq., of Montreal, of noting down *seriatim* the habits of land birds, observed in the vicinity of those respective cities in 1853 and in 1856–7, seems well calculated to throw additional light on the Canadian Fauna, yet so imperfectly known,

I intend briefly to notice the birds which are common to the Quebec, as well as to the Montreal District, together with some other facts connected with the natural history of the country generally.

Surnia nyctea, the Snowy Owl, and *Syrnium nebulosum*, the Barred Owl.—Both very common in the country parts of this district. In March, their hooting is very familiar to those engaged in maple sugar making on the slopes of the mountains. The burning of old leather in the sugar hut—is sure to call forth the snowy owl's most dismal notes, especially after nightfall.

Corythus Enucleator, Pine Grosbeak.—Plentiful in the winter season, when they live on the berries of the mountain ash.

Turdus migratorius, Linn., Robin.—Abundant in the month of May all round Quebec; nowhere, however, have I seen them in such numbers as in Gaspé, some years back. At the time I allude to, they were shot by dozens at Point St. Peter, Gaspé, in May and June, under the flakes, where they were attracted by the fish maggots which fell from the spruce boughs where the codfish were drying. In July they took to the woods to build.

On the 2nd January, 1858, whilst driving, in company with a friend, past Woodfield, near Quebec, the country seat of the late James Gibb, I noticed a very fine male robin on a pine tree. Robins, to a certainty, do not winter in this district. Whence came the interesting stranger, has ever to me been a subject of speculation and fruitless enquiry. Still I was too close to mistake an old friend. The Canada Robin, Bob-o-link, and Woodthrush, are, in my opinion, our best songsters. Several of our land-birds have exquisitely rich plumage, such as the scarlet bird, "le roi des oiseaux," to be found in the depths of the forest; the Indigo bird, common on the mountains and behind Montreal; the *Pivart*, all three old inhabitants of the country, as appears on reference to the description of Canada birds written in 1663, by

Pierre Boucher, the Governor of Three Rivers, in the "Histoire Naturelle du Canada." This small and interesting volume was prepared by the old governor for the information and amusement of his friends at the court of Louis XIV. In treating on the subject, I cannot refrain from comparing notes with the old chronicler. At pages 34 and 35 he states that "amongst the birds which are daily shot in Canada," there are ten kinds of divers, "swans and cranes." As to swans, we can lay claim to the white swan only, the black or Australian swan never having, that I am aware of, been seen in this country. The white swan is tolerably scarce now, however numerous the species may have been when Governor Boucher wrote. A very magnificent specimen, shot at Crane Island about 1825, was subsequently presented to the Governor General, by D. McPherson, Esq., the seigneur of the island. The beautiful stranger was, I believe, preserved by Chasseur, and measured six feet from wing to wing. As to cranes, they seem to us foreign birds as they were to the Romans: "*gruem advenam.**" Until a year or two back, two solitary wanderers were frequently seen during July and August of every year, feeding on the vast swamp which unites Crane to Goose island. More than one sportsman tried to get within shot, but these birds, which stood six feet high, were too watchful. Boucher also mentions bitterns, snipes, woodcocks, jack-snipes, sand-pipers or sea-larks, as he calls them, but says there are no field-larks; in this he is mistaken. Among other Canada birds, such as the *Utarde*, wild white goose, and fifteen species of birds of prey, he makes mention of the wild turkey, not however, he adds, "to be found either at Quebec, Three Rivers, or Montreal, but only in the regions inhabited by the Iroquois or Mohawks, where they are very numerous, and counted a delicious food." I believe the habitat of this noble bird is restricted entirely to the far west, Port Sarnia, &c. In noticing the wild turkey and Boucher's volume, I am led to point out an error committed by that benefactor of the human race, Brillat-Savarin, in his philosophical essay on gastronomy, "Physiologie du Goût;" after setting forth the common opinion respecting turkeys, viz. that turkeys were known to the Romans, that turkeys were served at Charlemagne's nuptials; he attempts to discredit this opinion, and asserts that such is not the case; that turkeys were imported from America to France by the Jesuits, about the end of the seventeenth century; that the

* Horace, Epodon Lib. Ol. 2.

Jesuits reared a great number on a farm they had near Bourges, in France; that this is one amongst the many blessings the Jesuits showered on France, and that this fact was so well known to the French people, that the common folk were in the habit of calling a turkey, "un Jesuite," a Jesuit. Notwithstanding the profound respect I entertain for Brillat-Savarin as an oracle second to none on points connected with gastronomy, I think his theory falls to the ground, since, far from having been imported into France about the end of the seventeenth century, Governor Boucher, in 1663, speaks of the "domestic turkey," as common in France long before he wrote.*

This old writer makes mention also of three kinds of partridges in Canada, the black or spruce with red eyes, the brown partridge or grouse (*Tetrao umbellus*), and the ptarmigan (*Tetrao lagopus*) or Hudson's Bay partridge, a most beautiful bird, entirely guided in its migration by laws of climate. It is seen near Quebec only when the winter is unusally severe, and was frequently for sale on our markets last winter; several were shot within a few miles of the city limits. This species had not before been seen since the winter of 1844, a very rigorous season. Nothing short of arctic cold will bring this snowy visitor from its northern fastnesses.

Little seems to be known concerning the breeding place of the *Utarde*. Many imagine they lay their eggs on small wooded islands in the northern lakes of the Saguenay district. Large flocks are seen winging their *wedge-like* flight over Cape aux Oies, on the north shore of the St. Lawrence.

The wild duck, until lately, was in the habit of rearing its young brood on the Crane Island swamps, and Sorel Islands, where the young birds, before they could fly, were caught with the assistance of dogs. Incessant annoyance has, however, driven them away from their old breeding places, except from the Sorel Islands, where they still breed. There is one of the Canada ducks, of which the country is justly proud; that is, the Wood-duck, a most gorgeously dressed individual, whose head quarters seem to be the Sorel Islands and the Upper Canada lakes.

I must not omit a singular occurrence during the late severe winter. Notwithstanding the inclemency of the weather, the

* Our correspondent of course does not intend to maintain that the Turkey, a strictly American bird, was known in Europe before the discovery of America.—(Eds.)

Canadian Linnet, contrary to its custom, was to be found in the woods, and was caught, and sold in the markets. Much inferior to the English linnet, still the song of this species is musical and agreeable.

Emberiza nivalis, Snow Bunting.—Very abundant all winter. One person in the Island of Orleans trapped in four days last winter sixty dozen. There is in Canada a bird of the size of the snow-bird, to be found in the flocks of snow-birds. The country folks call it *Ortolan de Niege;* it is prettily variegated with brown, white, and yellow.* Unlike the snow-bunting, it never roosts on trees, and is easily domesticated. Its note is a low, continuous warble, very pleasing to the ear, particularly so when proceeding from a flock of these birds feeding in a stubble field, their usual haunt, a few hours before sunset in April.

ARTICLE XXXIII.—*On Some Points in Chemical Geology.* By T. STERRY HUNT, M.A., F.R.S., of the Geological Commission of Canada.†

I. In a paper read before the American Association at Montreal in August 1857, as also in some previous communications to the Royal Society, and in the Report of the Geological Survey of Canada for 1856, I have endeavoured to explain the theory of the transformation of sedimentary deposits into crystalline rocks. In considering this process we must commence by distinguishing between the local metamorphism which sometimes appears in the vicinity of traps and granites, and that normal metamorphism which extends over wide areas, and is apparently unconnected with the presence of intrusive rocks. In the former case, however, we find that the metamorphosing influence of intrusive rocks is by no means constant, showing that their heat is not the sole agent in alteration, while in the latter case different strata are often found affected in

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* No doubt Philceremus cornutus, Bon. Alanda alpestris, Wils.—Eds.

† This paper, written and sent to the Geological Society of London in August 1858, was not read before that body until the 5th of January 1859. An abstract of it appears in the proceedings of the Society in the *Philosophical Magazine* for February, and it is published at length in the *Quarterly Journal of the Geological Society* for November 1859, pp. 488–496, from which it is now reprinted, with the addition, by the author, of a few notes, which are distinguished from those before published by being enclosed in brackets.

very different degrees; so that fossiliferous beds but little altered are sometimes found beneath crystalline schists, or even intercalated with them.

We cannot admit that the alteration of the sedimentary rocks has been effected by a great elevation of temperature, approaching, as many have imagined, to that of igneous fusion; for we find unoxidized carbon, in the form of graphite, both in crystalline limestone and in beds of magnetic iron-ore; and it is well known that these substances, and even the vapour of water, oxidize graphite at a red heat, with formation of carbonic acid or carbonic oxide. I have however shown that solutions of alkaline carbonates in presence of silica and earthy carbonates slowly give rise to silicates, with disengagement of carbonic acid, even at a temperature of 212° Fahr.,—the alkali being converted into a silicate, which is then decomposed by the earthy carbonate, regenerating the alkaline salt, which serves as an intermedium between the silica and the earthy base. I have thus endeavoured to explain the production of the various silicates of lime, magnesia and oxide of iron so abundant in crystalline rocks, and with the intervention of the argillaceous element, the formation of chlorite, garnet and epidote.† I called attention to the constant presence of small portions of alkalies in insoluble combination in these silicates, both natural and artificial—a fact which had already led Kuhlmann to conclude that alkaline silicates have played an important part in the formation of many minerals; and I suggested‡ that, by combining with alkalies, clays might yield feldspars and micas, which are constantly associated in nature with the silicates above mentioned. This suggestion has since been verified by Daubrée,§ who has succeeded in producing feldspar by heating together for some weeks to 400° C. mixtures of kaolin and alkaline silicates in the presence of water.

The problem of the generation from the sands, clays and earthy carbonates of sedimentary deposits, of the various silicious minerals which make up the crystalline rocks, may now be regarded as solved, and we find the agent of the process in waters holding in solution alkaline carbonates and silicates, acting upon the heated strata. These alkaline salts are constantly produced by the slow decomposition of feldspathic sediments, and are met with alike in the waters of

†Proceedings of the Royal Society, May 7, 1857.
‡Report Geol. Surv. Canada, 1856, p. 479.
§Bull. Soc. Géol. de France (2) vol. xv. p. 103.

the unaltered Silurian schists of Canada, and of the secondary strata of the basins of London and Paris. In the purer limestones however, the feldspathic or alkaliferous elements are wanting; and these strata often contain soluble salts of lime or magnesia. These would neutralize the alkaline salts, which infiltrating from adjacent strata, might otherwise effect the transformation of the foreign matters present in the limestones into crystalline silicates. By a similar process these calcareous or magnesian salts, penetrating the adjoining strata, would retard or prevent the alteration of the latter. These considerations will serve to explain the anomalies presented by the comparatively unaltered condition of some portions of the strata in metamorphic regions.||

II. As the history of the crystalline rocks becomes better known, we find that many which were formerly regarded as exclusively of plutonic origin are also represented among altered sedimentary strata. Crystalline aggregates of quartz and feldspar with mica offer transitions from mica-schist, through gneiss, to stratified granites, while the pyroxenic and hornblendic rocks of the altered Silurian strata of Canada pass, by admixtures of anorthic feldspars, into stratified diorites and greenstones. In like manner the interstratified serpentines of these regions are undoubtedly indigenous rocks, resulting from the alteration of silico-magnesian sediments, although the attitude of the serpentines in many countries has caused them to be ranked with granites and traps, as intrusive rocks. Even the crystalline limestones of the Laurentian series, holding graphite and pyroxene, are occasionally found enveloping broken beds of

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|| De Senarmont[1] in his researches on the artificial formation of the minerals of metalliferous veins by the moist way, has shown that by aid of heated solutions of alkaline bicarbonates and sulphurets, under pressure at temperatures of 200° or 300° C., we may obtain in a crystalline form many native metals, sulphurets, and sulpharseniates, besides quartz, fluor-spar and sulphate of barytes.

Daubrée[2] has since shown that a solution of a basic alkaline silicate deposits a large portion of its silica in the form of crystalline quartz when heated to 400° C. We have here, beyond a doubt, a key to the true theory of metalliferous veins. The heated alkaline solutions, which are at the same time the agents of metamorphism, dissolve from the sediments the metallic elements which these contain disseminated, and subsequently deposit them with quartz and the various spars in the fissures of the rock.

[1] Ann. de Chim. et de Phys. (3), vol. xxxii, p. 129,
[2] Bull. Soc. Géol. de France (2), vol. xv, p. 99.

quartzite, or injected among the fissures in adjacent silicious strata. From similar facts, observers in other regions have been led to assign a plutonic origin to certain crystalline limestones. We are thus brought, to the conclusion that metamorphic rocks, such as granite, diorite, dolerite, serpentine, and limestone, may under certain conditions, appear as intrusive rocks. The pasty or semi-fluid state which these rocks must have assumed at the time of their displacement is illustrated by the observations of Daubrée upon the swelling up of glass and obsidian, and the development of crystals in their mass under the action of heated water, indicating a considerable degree of mobility among the particles. The theory of igneo-aqueous fusion applied to granites by Poulett Scrope and Scheerer, and supported by Elie de Beaumont and by the late microscopic observations of Sorby, should evidently be extended to other intrusive rocks; for we regard the latter as being in all cases altered and displaced sediments.

III. The silico-aluminous rocks of plutonic and volcanic origin are naturally divided into two great groups. The one is represented by the granites, trachytes and obsidians, and is distinguished by containing an excess of silica, a predominance of potash, and only small portions of soda, lime, magnesia and oxide of iron. In the other group silica is less abundant, and silicates of lime, magnesia and iron predominate, together with anorthic feldspars, containing soda and but little potash. To account for the existence of these two types of plutonic rocks, Prof. J. Phillips supposes the fluid mass beneath the earth's crust to have spontaneously separated into a lighter, silicious, and less fusible layer, overlying a stratum of denser basic silicates. In this way he explains the origin of the supposed granitic substratum, of the existence of which however, the study of the oldest rocks affords no evidence. From these two layers, occasionally modified by admixtures, and by partial separation by crystallization and eliquation, Prof. Phillips suggests that we may derive the different igneous rocks. Bunsen and Durocher have adopted, with some modifications, this view; and the former has even endeavoured to calculate the composition of the normal trachytic and pyroxenic magmas (as he designates the two supposed zones of fluid matter underlying the earth's crust), and then seeks, from the proportion of silica in any intermediate species of rock, to deduce the quantities of alkalies, lime, magnesia and iron which this should contain.

So long as the trachytic rocks are composed essentially of orthoclase and quartz, and the pyroxenic rocks of pyroxene and labradorite, or a feldspar approaching it in composition, it is evident that the calculations of Bunsen will to a certain extent hold good; but in the analyses, by Dr. Streng, of the volcanic rocks of Hungary and Armenia, we often find that the actual proportions of alkalies, lime, and magnesia vary considerably from those deduced from calculation. This will necessarily follow when feldspars like albite or anorthite replace the labradorite in pyroxenic rocks. The phonolites are moreover highly basic rocks, which contain but very small amounts of lime, magnesia, or iron, being essentially mixtures of orthoclase with hydrous silicates of alumina and alkalies.

IV. In a recent enquiry into the probable chemical conditions of a cooling globe like our earth, I have endeavoured to show that in the primitive crust all the alkalies, lime and magnesia must have existed in combination with silica and alumina, forming a mixture which perhaps resembled dolerite, while the very dense atmosphere would contain in the form of acid gases, all the carbon, chlorine and sulphur, with an excess of oxygen, nitrogen and watery vapour. The first action of a hot acid rain, falling upon the yet uncooled crust, would give rise to chlorids and sulphates, with separation of silica; and the accumulation of the atmospheric waters would form a sea charged with salts of soda, lime, and magnesia. The subsequent decomposition of the exposed portions of the crust, under the influence of water and carbonic acid, would transform the felspathic portions into a silicate of alumina (clay) on the one hand, and alkaline bicarbonates on the other; these, decomposing the lime-salts of the sea, would give rise to alkaline chlorids and bicarbonate of lime—the latter to be separated by precipitation, or by organic agency, as limestone. In this way we may form an idea of the generation from a primitive homogeneous mass, of the siliceous, calcareous and argillaceous elements which make up the earth's crust, while the source of the vast amount of carbonate of lime in nature is also explained.*

When we examine the waters charged with saline matters which impregnate the great mass of calcareous strata constituting in Canada the base of the Silurian system, we find that only about one-half of the chlorine is combined with sodium; the remainder exists as chlorids of calcium and magnesium, the former predominating,—while sulphates are present only in small amount. If now we compare this composition, which may be regarded as representing that of the

* Am. Jour. Sci. (2) xxv. 102, and Canadian Journal for May 1858.

palæozoic sea, with that of the modern ocean, we find that the chlorid of calcium has been in great part replaced by common salt, —a process involving the intervention of carbonate of soda, and the formation of carbonate of lime. The amount of magnesia in the sea, although diminished by the formation of dolomites and magnesite, is now many times greater than that of the lime ; for so long as chlorid of calcium remains in the water, the magnesian salts are not precipitated by bicarbonate of soda.*

When we consider that the vast amount of argillaceous sedimentary matter in the earth's strata has doubtlessly been formed by the same process which is now going on, viz. the decomposition of feldspathic minerals, it is evident that we can scarcely exaggerate the importance of the part which the alkaline carbonates, formed in this process, must have played in the chemistry of the seas. We have only to recall waters like Lake Van, the natron lakes of Egypt, Hungary and many other regions, the great amounts of carbonate of soda furnished by springs like those of Carlsbad and Vichy, or contained in the waters of the Loire, the Ottawa, and probably many other rivers that flow from regions of crystalline rocks, to be reminded that the same process of decomposition of alkaliferous silicates is still going on.

V. A striking and important fact in the history of the sea, and of all alkaline and saline waters, is the small proportion of potash-salts which they contain. Soda is pre-eminently the soluble alkali ; while the potash in the earth's crust is locked up in the form of insoluble orthoclase, the soda-feldspars readily undergo decomposition. Hence we find in the analyses of clays and argillites, that of the alkalies which these rocks still retain, the potash almost always predominates greatly over the soda. At the same time these sediments contain silica in excess, and but small portions of lime and magnesia. These conditions are readily explained when we consider the nature of the soluble matters found in the mineral waters which issue from these argillaceous rocks. I have elsewhere shown that, setting aside the waters charged with soluble lime and magnesia salts, issuing from limestones, and from gypsiferous and saliferous formations, the springs from argillaceous strata are marked by the predominance of bicarbonate of soda, often with portions of silicate and borate, besides bicarbonates of lime and magnesia, and occasionally of iron. The atmospheric waters filtering through such strata remove soda, lime and magnesia, leaving behind the silica, alumina and

* See Report Geol. Surv. Canada, 1857, pp. 212–214, and Am. Jour. Science (2) xxviii. pp. 170 and 305.

potash—the elements of granitic and trachytic rocks. The more sandy clays and argillites being most permeable, the action of the infiltrating waters will be more or less complete; while finer and more compact clays and marls, resisting the penetration of this liquid, will retain their soda, lime and magnesia, and by subsequent alteration, will give rise to basic feldspars containing lime and soda, and if lime and magnesia predominate, to hornblende or pyroxene.

The presence or absence of iron in sediments demands especial consideration, since its elimination requires the interposition of organic matters, which by reducing the peroxide to the condition of protoxide, render it soluble in water, either as a bicarbonate or combined with some organic acid. This action of waters holding organic matter upon sediments containing iron-oxide has been described by Bischof and many other writers, particularly by Dr. J. W. Dawson† in a paper on the colouring matters of some sedimentary rocks, and is applicable to all cases where iron has been removed from certain strata and accumulated in others. This is seen in the fire-clays and iron-stones of the coal-measures, and in the white clays associated with great beds of green-sand (essentially a silicate of iron,) in the cretaceous series of New Jersey. Similar alternations of white feldspathic beds with others of iron ore occur in the altered Silurian rocks of Canada, and on a still more remarkable scale in those of the Laurentian series. We may probably look upon the formation of beds of iron-ore as in all cases due to the intervention of organic matters, so that its presence, not less than that of graphite, affords evidence of the existence of organic life at the time of the deposition of these old crystalline rocks.

The agency of sulphuric and muriatic acids, from volcanic and other sources, is not however to be excluded in the solution of oxide of iron and other metallic oxides. The oxidation of pyrites, moreover, gives rise to solutions of iron and alumina salts, the subsequent decomposition of which by alkaline or earthy carbonates will yield oxide of iron and alumina; the absence of the latter element serves to characterize the iron-ores of organic origin.‡ In this way the deposits of emery, which is a mixture of crystallized alumina with oxide of iron, have doubtless been formed.

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† Quart. Journ. Geol. Soc., vol. v, p. 25.

[‡ Hydrated alumina in the form of gibbsite is however met with incrusting limönite, and the existence of compounds like pigotite, in which alumina is united with an organic substance allied to crenic acid, seems to show that this base may, under certain conditions, be taken into solution by organic acids.]

Waters deficient in organic matters may remove soda, lime and magnesia from sediments, and leave the granitic elements intermingled with oxide of iron; while on the other hand, by the admixture of organic materials, the whole of the iron may be removed from strata which will still retain the lime and soda necessary for the formation of basic-feldspars. The fact that bicarbonate of magnesia is much more soluble than bicarbonate of lime, is also to be taken into account in considering these reactions.

The study of the chemistry of mineral waters, in connexion with that of sedimentary rocks, shows us that the result of processes continually going on in nature is to divide the silico-argillaceous rocks into two great classes,—the one characterized by an excess of silica, by the predominance of potash, and by the small amounts of lime, magnesia and soda, and represented by the granites and trachytes, while in the other class silica and potash are less abundant, and soda, lime and magnesia prevail, giving rise to pyroxenes and triclinic feldspars. The metamorphism and displacement of sediments may thus enable us to explain the origin of the different varieties of plutonic rocks without calling to our aid the ejections of the central fire.

VI. The most ancient sediments, like those of modern times, were doubtlessly composed of sands, clays, and limestones, although from the principles already defined in IV. and V., it is evident that the chemical composition of these sediments in different geologic periods must have been gradually changing. It is from a too hasty generalization that an eminent geologist has concluded that limestones were rare in earlier times, for in Canada the Laurentian system—an immense series of stratified crystalline rocks which underlie unconformably both the Silurian and the old Cambrian or Huronian systems—contains a limestone formation (interstratified with dolomites), the thickness of which Sir W. E. Logan has estimated at not less than 1000 feet. Associated with this, besides great volumes of quartzite and gneiss, there is a formation of vast but unknown thickness, the predominant element of which is a triclinic feldspar, varying in composition between anorthite and andesine, and containing lime and much soda, with but a small proportion of potash. These feldspars are often mixed with hypersthene or pyroxene; but great masses of the rock are sometimes nearly pure feldspar. These feldspathic rocks, as well as the limestones, are associated with beds of hematitic and magnetic iron-ores, the latter often mixed with graphite. Ancient as are these Laurentian rocks we have no reason to suppose that they mark the commencement of sedimentary deposits; they were doubtlessly derived from the ruins of other rocks in which the proportion of soda was still greater; and the detritus of these Laurentian felspars, making up our palæozoic strata, is now the source of alkaline waters by which the soda of the silicates, rendered soluble, is carried down to the sea in the form of carbonate to be transformed into chlorid of sodium. The lime of the feldspars being at the same time removed as carbonate, these sedimentary strata in the course of ages become less basic, poorer in soda and lime, and comparatively richer in alumina, silica, and potash. Hence in more recent crystalline rocks we find a less extensive development of soda-feldspars, while orthoclase and mica, chlorite and epidote, and silicates of alumina, like chiastolite, kyanite, and staurotide, which contain but little or no alkali, and are rare in the older rocks, become abundant.

The decomposition of the rocks is more slow now than formerly, because soda-silicates are less abundant, and because the proportion of carbonic acid in the air (an efficient agent in these changes,) has been diminished by the formation of limestones and coal. It will be evident that the principles above laid down are only applicable to the study of rocks in great masses, and refer to the predominance of certain mineral species at certain geologic epochs, since local and exceptional causes may reproduce in different epochs the conditions which belong to other periods.

VII. Mr. Babbage§ has shown that the horizons or surfaces of equal temperature in the earth's crust must rise and fall, as a consequence of the accumulation of sediment in some parts and its removal from others, producing thereby expansion and contraction in the materials of the crust, and thus giving rise to gradual and wide-spread vertical movements. Sir John Herschel|| subsequently showed that, as a result of the internal heat thus retained by accumulated strata, sediments deeply enough buried will become crystallized and ultimately raised, with their included water, to the melting point. From the chemical reactions at this elevated temperature, gases and vapours will be evolved, and earthquakes and volcanic eruptions will result. At the same time the disturbance of the equilibrium of pressure consequent upon the transfer of sediments, while the yielding surface reposes upon a mass of matter partly liquid and partly solid, will enable us to explain the phenomena of elevation and subsidence.

§ "On the Temple of Serapis." Proc. Geol. Soc., vol. ii, p. 73.

|| Ibid. vol. ii, pp. 548 & 596.

According, then, to Sir J. Herschel's view, all volcanic phenomena have their source in sedimentary deposits; and this ingenious hypothesis, which is a necessary consequence of a high central temperature, explains in a most satisfactory manner the dynamical phenomena of volcanoes, and many other obscure points in their history, as for instance, the independent action of adjacent volcanic vents, and the varying nature of their ejected products. Not only are the lavas of different volcanoes very unlike, but those of the same crater vary at different times; the same is true of the gaseous matters, hydrochloric, hydrosulphuric, and carbonic acids. As the ascending heat penetrates saliferous strata, we shall have hydrochloric acid, from the decomposition of sea-salt by silica in the presence of water; while gypsum and other sulphates, by a similar reaction, would lose their sulphur in the form of sulphurous acid and oxygen. The intervention of organic matters, either by direct contact, or by giving rise to reducing gases, would convert the sulphates into sulphurets, which would yield sulphuretted hydrogen when decomposed by water and silica or carbonic acid, the latter being the result of the action of silica upon earthy carbonates. We conceive the ammonia so often found among the products of volcanoes to be evolved from the heated strata, where it exists in part as ready-formed ammonia (which is absorbed from air and water, and pertinaciously retained by argillaceous sediments), and is in part formed by the action of heat upon azotized organic matter present in these strata, as already maintained by Bischof.* Nor can we hesitate to accept this author's theory of the formation of boracic acid from the decomposition of borates by heat and aqueous vapour.†

The almost constant presence of remains of infusorial animals in volcanic products, as observed by Ehrenberg, is evidence of the interposition of fossiliferous rocks in volcanic phenomena.

The metamorphism of sediments *in situ*, their displacement in a pasty condition from igneo-aqueous fusion as plutonic rocks, and their ejection as lavas with attendant gases and vapours are, then, all results of the same cause, and depend upon the differences in the chemical composition of the sediments, the temperature, and the depth to which they are buried: while the unstratified nucleus of the earth, which is doubtless anhydrous, and according to the calculations of Messrs. Hopkins and Hennessey, probably solid to a great

* Lehrbuch der Geologie, vol. ii, pp. 115–122.
† Ibid. vol i, p. 669.

depth, intervenes in the phenomena under consideration only as a source of heat.‡

VIII. The volcanic phenomena of the present day appear, so far as I am aware, to be confined to regions covered by the more recent secondary and tertiary deposits, which we may suppose the central heat to be still penetrating (as shown by Mr. Babbage), a process which has long since ceased in the palæozoic regions. Both normal metamorphism and volcanic action are generally connected with elevations and foldings of the earth's crust, all of which phenomena we conceive to have a common cause, and to depend upon the accumulation of sediments and the subsidence consequent thereon, as maintained by Mr. James Hall in his theory of mountains. The mechanical deposits of great thickness are made up of coarse and heavy sediments, and by their alteration yield hard and resisting rocks; so that subsequent elevation and denudation will expose these contorted and altered strata in the form of mountain-chains. Thus the Appalachians of North America mark the direction and extent of the great accumulation of sediments by the oceanic cur-

[‡The notion that volcanic phenomena have their seat in the sedimentary formations of the earth's crust, and are dependant upon the combustion of organic matters, is as Humboldt remarks, one which belongs to the infancy of geognosy (*Cosmos*, vol. v, p. 443. Otte's translation). In 1834 Christian Keferstein published his *Naturgeschichte des Erdkörpers*, in which he maintains that all crystalline non-stratified rocks, from granite to lava, are products of the transformation of sedimentary strata, in part very recent, and that there is no well-defined line to be drawn between neptunian and volcanic rocks, since they pass into each other. Volcanic phenomena according to him have their origin, not in an igneous fluid centre, nor an oxydizing metallic nucleus, but in known sedimentary formations, where they are the result of a peculiar process of fermentation, which crystallizes and arranges in new forms the elements of the sedimentary strata, with evolution of heat as an accompaniment of the chemical process. (*Naturgeschichte*, vol. 1 p. 109, also *Bull. Soc. Géol. de France* (1) vol. vii. p. 197.)

These remarkable conclusions were unknown to me at the time of writing this paper, and seem indeed to have been entirely overlooked by geological writers; they are, as will be seen, in many respects an anticipation of the views of Herschel and my own; although in rejecting the influence of an incandescent nucleus as a source of heat, he has, as I conceive, excluded the exciting cause of that chemical change, which he has not inaptly described as a process of fermentation, and which is the source of all volcanic and plutonic phenomena. See in this connection my paper on the Theory of Igneous Rocks and Volcanoes, in the Canadian Journal for May, 1858.]

rents during the whole palæozoic period; and the upper portions of these having been removed by subsequent denudation, we find the inferior members of the series transformed into crystalline stratified rocks.§

[§ The theory that volcanic mountains have been formed by a sudden local elevation or tumefaction of previously horizontal deposits of lava and other volcanic rocks, in opposition to the view of the older geologists who supposed them to have been built up by the accumulation of successive eruptions, although supported by Humboldt, Von Buch, and Elie de Beaumont, has been from the first opposed by Cordier, Constant Prevost, Scrope and Lyell. (See Scrope, *Geol. Journal*, vol. xii, p. 326, and vol. xv. p. 500; also Lyell, *Philos. Trans.* part 2, vol. cxlviii, p. 703, for 1858.) In these will we think be found a thorough refutation of the elevation hypothesis and a vindication of the ancient theory.

This notion of paroxysmal upheaval once admitted for volcanoes was next applied to mountains which, like the Alps and Pyrenees, are composed of neptunian strata. Against this view, however, we find De Montlosier in 1832 maintaining that such mountains are to be regarded as the remnants of former continents which have been cut away by denudation, and that the inversions and disturbances often met with in the structure of mountains are to be regarded only as local accidents. (*Bul. Soc. Geol.*, (1) vol. ii, p. 438, vol. iii, p. 215.)

Similar views were developed by Prof. James Hall in his address before the American Association for the Advancement of Science, at Montreal in August 1857. This address has not been published, but they are reproduced in the first volume of his *Report on the Geology of Iowa*, p. 41. He there insists upon the conditions which in the ancient seas gave rise to great accumulations of sediment along certain lines, and asserts that to this great thickness of strata, whether horizontal or inclined, we are to ascribe the mountainous features of North Eastern America as compared with the Mississippi valley. Mountain heights are due to original depositions and subsequent continental elevation, and not to local upheaval or foldings, which on the contrary, give rise to lines of weakness, and favor erosion, so that the lower rocks become exposed in anticlinal valleys, while the intermediate mountains are found to be capped with newer strata.

In like manner J. P. Lesley asserts that "mountains are but fragments of the upper layers of the earth's crust," lying in synclinals and preserved from the general denudation and translation. (*Iron Manufacturer's Guide*, 1859, p. 53.)]

ARTICLE XXXIV.—*Fossils of the Chazy Limestone, with de scriptions of new species.* By E. Billings.

(Extracted from the Report of the Geological Survey of Canada for 1858-59.)

The following paper contains an enumeration of the species of organic remains known to occur in the Chazy formation in Canada, so far as they can be ascertained from the collections made, up to the present date. The total number of species is 129, and they may be distributed as follows :—

	Species in Chazy Formation.	Species that pass upward.
Zoophyta	6	1
Cystideæ	7	0
Crinoideæ	14	0
Brachiopoda	21	8
Bryozoa,	4	?
Lamellibranchiata	17	1
Gasteropoda	21	4
Heteropoda	5	0
Cephalopoda	15	4
Trilobites	14	2
Entomostraca	4	1
Serpulites	1	0
	129	21

The species which pass upwards into the overlying formations are *Stenopora fibrosa*, *Lingula Huronensis*, *Strophomena alternata*, *S. incrassata*, *Orthis disparalis*, *O. perveta*, *O. subæquata*, *O. gibbosa*, *O. borealis*, *Ctenodonta nasuta*, *Helicotoma umbilicata*, *Murchisonia perangulata*, *Maclurea Logani*, *M. Magna*, *Orthoceras multicameratum*, *O. bilineatum*, *O. Allumettense*, *O. Minganense*, *Illænus arcturus*, *Asaphus platycephalus* (?), *Leperditia fabulites* (Conrad), var. (*nana*), Jones.

The genera, with the exception of some of those of the Cystideæ and Crinoideæ, all pass upwards into the more recent formations. The genus *Amphion* has not been found in any higher rocks in Canada ; but I think I have read an account somewhere of its occurrence in the blue limestone of the Western States. The genera of Cystidea, which thus far we find peculiar to the Chazy, are *Malocystites* and *Palæocystites*. *Glyptocystites* passes upwards into the Trenton, and I have also seen fragments of what I think a species of *Pleurocystites* in the Chazy. Of the crinoidal genera, we have *Hybocrinus* and *Rhodocrinus*, and without much doubt also *Glytocrinus and Dendrocrinus* in the Chazy; but *Palæocrinus*, *Pachyocrinus*, and *Blastoidocrinus* are not yet known in higher rocks. Nearly all the species are confined to that part of the country which lies east of Kingston. West of that city, nineteen of the species above given in the list of those that are common to the Chazy and higher rocks, have been found, and also *R. plena* and *M. parviuscula*. Out of 129 species, only 21 have been found west of Kingston.

Pleurotomaria staminea and *Bellerophon sulcatinus* have not been seen in the Chazy in Canada; but they both occur in the Black River.

I think it more than probable that when the fossils of these rocks shall have become better known, the above results will be modified somewhat; but to no great extent. It must be always borne in mind that many of the species are represented by mere fragments, and that although we are able in general to shew that they are distinct, yet they do not furnish the data for detailed specific descriptions. I shall, not therefore, for the present, name those imperfect specimens.

ZOOPHYTA. 6 Species.

STENOPORA FIBROSA. (Goldfuss. s.p.)

Chætetes lycoperdon,—branched variety.

This species is very abundant in the Chazy limestone in several localities on the island of Montreal, but more particularly about half a mile east of the village of St. Laurent. It also occurs at the Mingan Islands in the same formation. There is apparently no difference between the Chazy and Trenton specimens.

STENOPORA PATULA. (N.s.)

Description.—This species which perhaps should be regarded as only a variety of *Stenopora petropolitana*, consists of broad flat irregular expansions from one to six inches in diameter and from one fourth of an inch to one inch in thickness. The tubes are about the size of those of *S. fibrosa*.

Locality and formation.—Island of Montreal. Chazy. Not common.

STENOPORA ADHÆRENS. (N.s.)

Description.—Corallum consisting of wide flattened thin masses, usually incrusting other fossils and sometimes composed of successive layers. The cells in such specimens as I have seen are about one tenth of a line in diameter. I am not sure that this species should be referred to the genus *Stenopora*. It requires further examination.

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors—Sir W. E. Logan. J. Richardson.

COLUMNARIA PARVA. (N.s.)

Description.—This species occurs in large, globular, irregular, pyriform or wide depressed convex masses with the corallites about one third of a line in diameter. The interior of the tubes do not in general exhibit any radiating septa, but when well preserved and weathered out, the septa are distinctly visible, usually a more or less elevated vertical lines on the inner surface. In some specimens or in different parts of the same, the septa being more perfectly preserved, are seen extending nearly to the centre. There appear to be eight or ten of them. The corallites are generally five or six sided, and the size appears to be pretty uniform, at least it is so in all that I have seen. Some of the flattened masses appear to have been more than one foot wide, and often they have a thin stratified structure or are composed of successive layers, the divisional planes between which divide the corallites at right angles. There are three or four transverse septa in one line.

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

COLUMNARIA INCERTA. (N.s.)

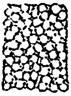


Fig. 1. Fig. 2.

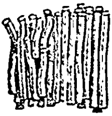


Fig. 1.—*Columnaria incerta.* End view of tubes.
2.— " " Side view.

Description.—This species occurs in large globular or depressed hemispherical masses composed of long slender cylindrical tubes which are either in contact or separated less than their own width from each other. These tubes are upon an average half a line in diameter and when well preserved appear to consist of a simple wall without pores, radiating septa or transverse diaphragms. The aspect of the species is remarkably like that of a *Syringo-*

pora and in some of the specimens I think I can see some traces of connecting processes between the tubes, but the indications are not sufficiently distinct to be relied upon. The tubes are usually filled,with white calcareous spar.

I strongly suspect that the tubes were during the period of their vitality filled with a delicate vesicular tissue similar to that of a *Syringopora* or *Cystiphyllum*, and should this structure be hereafter detected, the species must be either referred to *Syringopora* or a new genus must be formed for its reception. On the other hand, both transverse diaphragms and radiating septa may be discovered, in which case it must remain in the genus *Columnaria*.

Locality and formation.—Mingan Islands, Island of Montreal. and near the city of Ottawa. Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson, and E. Billings.

Figs. 3, 4, 5, 6.

Figs. 3, 4, 5, 6.—*Bolboporites Americanus.* Fig. 3 represents the small pit in the base.

BOLBOPORITES AMERICANUS. (N.s.)

Description.—These curious little fossils consist of a smooth solid hemispherical base surmounted by a conical projection which is celluliferous, the cells being about the size and shape of those of the common *Stenopora fibrosa.* In the centre of the base there is a small pit which appears to have been the point of attachment. The solid part, under the hammer, usually breaks up into rhomboidal fragments, but some specimens when fractured exhibit a prismatic structure, the prisms radiating from the centre and being about the size of the tubes in the celluliferous conical extremity. It is remarkable that the cells slope downwards instead of upwards as in all other zoophytes, and it is possible that the apex of the cone is the base: the greater size and the solidity of hemispheric extremity, however, would seem to favour the opposite conclusion.

The specimens are from three to eight lines in length, and about the same in greatest diameter. The cone is usually of the same height as the hemisphere, but sometimes it is either shorter or longer.

Locality and formation.—Abundant in Chazy limestone in the neighbourhood of Montreal, and more rarely at the Mingan Islands.

CYSTIDEÆ. 7 Species.

The following species of *Cystideæ* from this formation were described in Canadian Fossils, decade 3. *Glyptocystites Forbesi; Malocystites Murchisoni; M. Barrandei; Palæocystites tenuiradiatus; P. Dawsoni; and P. Chapmani.*

Among the fossils collected at the Mingan Islands during the present year 1859, there are a few detached plates closely resembling those of *P. tenuiradiatus*, and others similar to those of *G. Forbesi*, but they are obscurely preserved, and better specimens must be procured before the species can be determined. Associated with these there is a single plate of a new species of *Palæocystites*, which I propose to describe as follows:

PALÆOCYSTITES PULCHER. (N. S.)

Description.—The only plate that I have seen is pentagonal and in form somewhat like a low five-sided pyramid. The sloping faces are striated by deep narrow sulci at right angles to the edge of the plate as in *P. tenuiradiatus.* The five sloping angular edges which radiate from the centre to the angles of the plate have each a single deep sulcus and this character is the only one by which this species can be distinguished in detached plates The sloping angles in *P. tenuiradiatus* are in all the specimens I have seen, solid, and exhibit no trace of a furrow. In this specimen, although the form is that of a low pyramid, yet the apex is truncated, with a small concave space in the centre around which the upper ends of the sloping angles form five small elevations. The sloping faces are also a little concave, but these characters may be the effect of weathering. Length of the sides of the plate, about three lines, with from fourteen to sixteen sulci to each face. It is most probable that in the perfect plates, all the sulci are covered over as they are in *P. tenuiradiatus.*

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

CRINOIDEÆ. 14 species.

Of the Chazy Crinoids, the following are described in Decade 4: *Blastoidocrinus carchariœdens; Pachyocrinus crassibasalis; Hybocrinus pristinus; Palæocrinus striatus;* and *Rhodocrinus asperatus.* Besides these the columns of nine other distinct species are known to me in this formation.

BRACHIOPODA. 23 Species.

LINGULA LYELLI. (Billings.)

This species was published among the Calciferous Sandrock Fossils in the last number of the Canadian Naturalist and Geologist. At the time I prepared the article for the press, both Sir W. E. Logan and Mr. Richardson were absent. On their return, they informed me that upon stratigraphical evidence, they considered the conglomerate sandstones at the Allumette Rapids to be of the age of the Chazy. Afterwards, while examining a collection of Chazy fossils collected by Mr. Bell near L'Orignal during the present season, I found several specimens of *L. Lyelli* associated with abundance of *Rhynconella plena*, and also phosphatic nodules like those of the conglomerate sandstone. There can be no doubt but that the Allumette sandstone belongs to the Chazy formation. *Lingula Lyelli* must therefore be removed from the Calciferous fauna.

LINGULA BELLI. (N.s.)

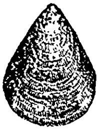


Fig. 7.

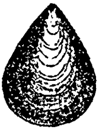


Fig. 8.

Fig. 7.—*Lingula Belli.* One of the forms of this species.
8 — " A convex form.
(In both figures the longitudinal lines represent shading.)

Description.—Oval, apical angle about 75°, lateral margins somewhat straight or gently convex for two thirds of the length, front angles and anterior margin broadly rounded, length one fourth or one third greater than the width; greatest width, at about one third the length or a little less from the front. Large specimens are one inch long and nine lines wide, but the usual size is one third smaller.

The form so far as regards convexity of the valves is somewhat variable. In general the specimens are strongly convex, or very obtusely carinate from the beak to near the centre of the shell, and have three flat slopes, one to each of the lateral margins and one to the front. The most prominent point is a little above the middle, and the anterior slope is always larger than the others. From this form, which is that of a very low three sided pyramid, with all the angles and edges broadly rounded, there is a series becoming more and more convex, until all trace of the anterior slope is lost, while the two lateral slopes are only visible for a short distance b-low the beaks. By taking the extremes, several species might be made out of this one, but I am satisfied that they would not in the end be sustained.

The surface is sometimes nearly smooth, but usually it is marked by concentric undulations of growth. I have not been able to detect any minute concentric striæ between the larger undulations, and on only one of all the specimens that I have seen are there any longitudinal striæ, and these are only faintly indicated on the cast of the interior. The specimens collected in the Chazy limestone in the neighbourhood of Montreal are of a jet-black colour and often exhibit a polished shining surface, but those in the same rock in the valley of the Ottawa above Carillon, are light brown.

This species is closely allied to *L. antiqua*, (Hall) but is not longitudinally striated. In the Potsdam Sandstone on Lots 21 and 22, in the 9th concession of the Township of Bastard, *L. antiqua* occurs in vast abundance, and among the specimens collected at that locality, there are a great many which have almost exactly the same form as *L. Belli*, the only difference being the longitudinal striæ.

I have also before me specimens from the Falls of St. Croix, in Wisconsin, said to be the *L. prima* of the Potsdam, and these also have the depressed pyramidal elevation, but are in outline sub-orbicular or obscurely sub-pentagonal. The elongated form sometimes referred to *L. antiqua* appears to me be *L. acuminata*, (Conrad) and differs from all the above by being convex from the beak all along the median line to the front.

Dedicated to the late Rev. A. Bell of L'Orignal, an enthusiastic geologist, from whose labours the science in this Province has received much valuable aid. The beautiful collection of Canadian Fossils bequeathed by him to the University of Queen's College, Kingston, must always be of great service to the students of that excellent institution.

Locality and formation.—Island of Montreal; near L'Orignal; Allumette Island. Chazy. Perfect specimens rare.

Collectors.—Sir W. E. Logan, J. Richardson, R. Bell.

LINGULA HURONENSIS. (N. S.)

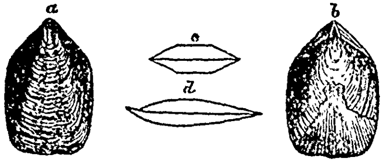


Fig. 9.

Fig. 9.—*Lingula Huronensis.* *a*, ventral valve; *b*, dorsal aspect, shewing the area of the ventral valve; *c*, transverse section; *d*, longitudinal section.

Description.—Sub-pentagonal, moderately convex, with three flat plane sloping faces as in *L. Lyelli.* Length nine lines, width six lines, dorsal valve half a line shorter than the ventral.

The beak of the ventral valve is obtusely pointed and the two posterior or upper margins diverge from it at an angle of about 70° and are straight or gently convex for a little more than one third the length of the shell, then turning an obtuse angle merge into the two lower lateral margins which are sub-parallel to the rounded front angles; anterior margin nearly straight.

Surface with concentric undulations of growth, and under the glass with minute concentric and longitudinal striæ.

This species approaches the *L. Davisii* (Mc Coy) of the Lingula Flags in Wales, but that species is a shorter and broader form, with an apical angle of from 95° to 100.° It is also closely allied to *L. attenuata*, (Sowerby) but according to the figures in *Siluria*, that species is smaller and more of an oval shape.

Each valve has three plane faces, the central one of which commences at the beak and gradually widens to the front. The other two slope to the lateral margins. In some specimens there is an obscure longitudinal ridge along the middle, running from the beak to the front. In a longitudinal section the valves are gently arched, the greatest convexity being nearer the beak than the front.

Locality and formation.—The most perfect specimens were collected on the island of St. Joseph in Lake Huron, in strata, which, from their holding *Columnaria alveolata*, I think must be regarded as of the age of the Black River Limestone. It also occurs near L'Orignal in the undoubted Chazy limestone, associated with *Rhynconella plena.* Professor Hind of Trinity College, Toronto, has sent us a small slab from the Hudson River group, near Toronto, in which there are numerous impressions of this or a closely allied species.

Collectors.—A. Murray, J. Richardson, and R. Bell.

ORTHIS PERVETA (Conrad), ORTHIS SUBÆQUATA (Conrad), and ORTHIS GIBBOSA (Billings).

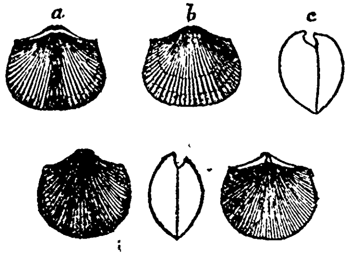


Fig. 10.

Fig. 10.—The above figures represent very nearly the species which I suppose to be *Orthis perveta*. *a*, *b*, and *c* are figures of a globose form, resembling some of the Tennessee specimens sent me by Prof. Safford, the director of the survey of that State.

In certain beds of the Chazy limestone there are multitudes of a small *Orthis* which have, as nearly as I can judge, precisely the form and dimensions of *O. perveta*, but, in consequence of their being imbedded in a rather compact sub-crystalline rock, I have not been able to procure any specimens with the surface well preserved. Although it is impossible to determine the species with certainty, yet I firmly believe it will, when perfect specimens are procured, turn out to be the true *O. perveta*. It occurs in the Chazy limestone two miles north of Montreal, and I have seen it in vast abundance in a rock that crosses the road two or three miles west of the Village of Chazy, in the State of New York.

Of *O. subæquata* I have seen only a single specimen. It was found in an old quarry two miles north of Montreal.

O. gibbosa was described by me, in the Report for 1856, from specimens collected in the Black River limestone. It is distinguished from *O. subæquata* by having a broad, shallow, mesial sinus in the front half of the ventral valve. It varies greatly in the amount of the gibbosity and in the length of the hinge-line, which is sometimes only half the whole width of the shell. I am not yet satisfied that it should constitute a distinct species. Prof.

Safford, State Geologist of Tennessee, has sent me some very gibbous forms of *O. perveta*, and they very much resemble *O. gibbosa*. It may be that, by comparison with extensive series of western specimens, these three species might be united. I shall for the present keep them separate provisionally. *O. gibbosa* occurs rarely in the Chazy limestone, island of Montreal; abundantly, but badly preserved, at the Pallideau Islands, Lake Huron, in rocks which are either Chazy or Black River. At La Petite Chaudière rapids near Ottawa, and at the Fourth Chute of the Bonne-chère, in the Black River limestone, and in the Trenton limestone at Belleville. The other two species I have seen in the Chazy only, but in the Western States they are known in higher rocks.

ORTHIS IMPERATOR, (N. s.)

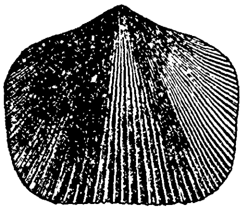


Fig. 11.

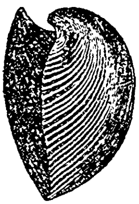


Fig. 12.

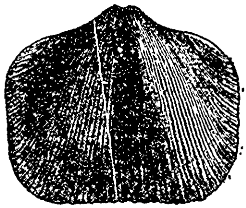


Fig. 13.

Description.—Subquadrate, large, very gibbous, hinge-line less than the greatest width of the shell; front margin gently convex, straight or slightly concave; front angles rounded; a portion of the sides, equal to about one third the length along the middle, usually straight, but sometimes a little convex, above which the sides curve inward to the cardinal angles.

The ventral valve is moderately and somewhat irregularly convex, the beak small, pointed, and much elevated. In most of the specimens a broad, low, mesial ridge or depressed fold extends from the beak to the front margin; sometimes this fold is barely perceptible or obsolete, and in such cases the whole of the valve, except a small space at the cardinal angles, is flat, and slopes with scarcely any curvature from the beak to the front; at each of the cardinal angles a portion of the shell is depressed towards the dorsal valve. Area large, triangular, a little arched. Foramen not large, extending nearly to the apex of the beak.

Dorsal valve very convex, most elevated in the upper half, and sloping abruptly to the sides, front and cardinal angles, the latter strongly reflected, as is also in some specimens a narrow border along the upper one third of the sides; the beak and area strongly incurved over the hinge-line. Along the middle of this valve a broad, shallow, mesial furrow extends from the beak to the front. The foramen is occupied by a sharp cardinal process.

The surface is covered with moderately coarse, radiating ridges, about four or five in the width of two lines, at the margin. They appear to be two or three times subdivided between the beak and the front.

Width from one inch to one inch and a half; length about one sixth or one fifth less than the width.

This magnificent Orthis attains the size of the largest specimens of *O. occidentalis*, and somewhat resembles that species, but is always easily distinguished therefrom by the position of the mesial sinus, which occupies the dorsal valve instead of the ventral.

Locality and Formation.—Near Cornwall and in the township of East Hawkesbury. Large loose blocks of the rock several feet in diameter are occasionally met with, which are entirely composed of imperfect shells of this species, with only a small admixture of others. Judging from the appearance of these boulders, it must occur in vast abundance in the beds from which they were derived. It has been found in beds *in situ* only in Hawkesbury. Chazy limestone.

Collectors.—A. Murray, J. Richardson, R. Bell.

Orthis borealis, (N. s.)

Description.—Transversely broad oval or sub-quadrate; width usually one fifth or one fourth greater than the length; both valves more or less convex, sometimes very gibbous.

Ventral valve rather convex; greatest elevation at about one fifth or a little less from the beak, thence sloping somewhat abruptly to the cardinal angles and more gently to the sides and front angles; the front margin more or less depressed by a broad concave, mesial sinus of variable depth, which extends about half the length or a little more towards the beak, and there gradually disappears. Cardinal area large, slightly curved, and sloping upwards at an angle of 115° with the plane of the margin.

Dorsal valve convex, the amount of the convexity varying greatly; cardinal angles compressed and reflected. Area narrow, in the same plane with the margin; umbo in the very convex individuals large, and projecting beyond the hinge-line.

Surface covered with strong, rounded, radiating ridges, which in general extend without subdivision quite to the beak, those near the cardinal angles much smaller than those in the central and front region. There are four or five ridges in two lines at the front margin, and ten or twelve in the first two lines of the lateral margin, below the cardinal angles.

Fig. 14.

Fig. 14.—*Orthis borealis.* *a*, ventral aspect; *b*, side view; *c*, dorsal aspect.

Specimens of this species with the surface well preserved are difficult to procure, and I think it highly probable that in many the radiating ridges are subdivided or increase by implantation; but in the only perfect ones I have seen they are simple quite to the beak. In a specimen nine lines in width there are fifty-one ribs, including the finer ones at the cardinal angles, but the average number is between forty and fifty.

This species is somewhat variable in form. Some of the specimens are sub-quadrate, with the cardinal and front angles rounded, the sides being nearly straight, and in these the greatest width is usually near the front. Others have the sides convex, and these have the greatest width about the middle. Often the dorsal valve has an indistinct mesial fold extending from the beak to the front, while others have a slight depression, the effect of which, together with the depression in the ventral valve, is to produce a gentle sinuosity in the anterior margin. In general, however, the dorsal valve has neither a mesial fold or sinus, but is broadly convex, except near the beak, where it is narrowly gibbous and suddenly depressed, to the flat or concave space at the cardinal angles.

In many respects this species resembles *O. imperator*, but is never more than one-fourth the bulk of that species, and differs from it constantly by the sinus in the front half of the ventral valve. It also occurs in the greatest profusion in localities where the other is not found at all, while in other places the two are associated.

It is closely allied to *O. pectinella*, but is always much more convex and more numerously ribbed.

The width is usually nine lines, length about seven lines; depth of both valves in a very gibbous specimen, six lines.

Locality and Formation.—Caughnawaga; St. Genevieve; Isle Bizard; near the village of St. Laurent, and near Cornwall. At Caughnawaga it occurs in vast abundance, but rarely perfect. Chazy limestone.

We have several specimens from the Trenton limestone at Ottawa and Belleville which seem to be of this species.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings, R. Bell.

ORTHIS PLATYS, (N. S.)

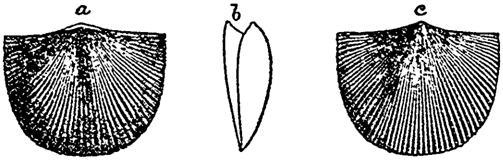


Fig. 15.

Fig. 15.—*Orthis platys.* *a*, dorsal aspect; *b*, longitudinal section; *c*, ventral valve.

Description.—Semi-oval, or sub-quadrate, both valves nearly flat; sides straight and sub-parallel for one half the length from the cardinal angles; front broadly rounded; hinge-line straight, equal to the greatest width of the shell; width one third greater than the length.

Ventral valve with the beak slightly elevated, depressed convex near the beak, gently concave all round near the margin; a broad, very shallow mesial depression extending from the front margin to about the centre of the shell; area moderate, forming an angle of about 115° with the plane of the margin; foramen triangular, extending to the beak, which is small-pointed and a very little depressed, not incurved at the point.

Dorsal valve gently convex, and with sometimes a barely perceptible mesial depression. Surface of both valves marked with fine radiating ridges, which bifurcate once or twice before reaching the margin; from eight to ten ridges in two lines of the width of the front. Width about one inch; length about nine lines.

This species somewhat resembles *O. subquadrata* (Hall), but is always flatter and more finely striated. It occurs in great abundance in the Chazy limestone, but is generally exfoliated, so that good specimens are rare.

Formation and Locality.—Chazy limestone, island of Montreal. Several specimens from Wolfe Island, near Kingston, appear to be referable to this species.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings.

ORTHIS PORCIA, (N. s.)

Figs. 16, 17, 18.

Figs. 16, 17, 18.—*Orthis Porcia.* Fig. 18 is a portion of the surface enlarged to shew the concentric imbricating striae.

Description.—Ventral valve conical, semi-oval; width a little greater than the length; hinge-line about equal to the width of the shell; area large, much elevated, at right angles to the plane of the margin, very slightly curved, beak erect and pointed; foramen narrow, extending to the beak; surface with thirty sharp elevated radiating ridges, with shorter ones between each two at the margin, crossed by fine, strongly imbricated concentric striæ which, although fine, give the surface a rugose appearance, Width four lines; length three lines; height of area from hinge-line to beak one line and a half; width of foramen at hinge-line half a line. Dorsal valve unknown.

Only a single valve of this beautiful little Orthis has been collected, and I am inclined to think therefore that it must be an exceedingly rare species. The form and size are very nearly those of *O. disparalis*, but it differs from that species in having the radiating ridges not so strong and in the more perependicular area and imbricating concentric striæ.

Locality and Formation.—Two miles north of city of Montreal. Chazy limestone.

Collector.—E. Billings.

ORTHIS ACUMINATA, (N. s.)

Fig. 19.

Description.—Of this species a single specimen only (a ventral valve,) has been found, but in good preservation. The hinge-line is much longer than the width of the shell, being produced so as to form extended ears, like those of many of the spirifers; the sides converge from the ears to the front angles; the front margin is nearly straight and parallel with the hinge-line, excluding the ears; the form is depressed conical, with a scarcely perceptible mesial sinus; the beak gently depressed, but not incurved; area large, and slightly curved; foramen very broad, open triangular, reaching to the beak. Surface covered with fine angular striæ, about six in one line at the margin; they appear to bifurcate near the beak. Length of hinge-line six lines; length of ventral valve from beak to front, two and a half lines.

This remarkable form differs from all the Orthides of the Silurian rocks of Canada except *O. Lynx*, some varieties of which have long acuminate ears. I am not satisfied that it is a true *Orthis.*

Locality and Formation.—Caughnawaga; Chazy.

Collector.—E. Billings.

ORTHIS DISPARALIS. (Conrad.)

ORTHIS DISPARALIS. (Conrad) 1843, *Proc. Acad. Nat. Sci. Philadelphia.* Vol. 1, p. 333.

———————(Hall) 1847, *Palæont. N. Y.*, Vol. 1, p. 119, *plate* 32, Figs. 4. *a. b. c.*

ORTHIS COSTALIS? (Hall) 1847, *Palæont. N. Y.*, Vol. 1, *plate* 4, (bis) Figs. 4. *a. b.*

Fig. 20.

Fig. 20.—*Orthis disparalis.*

Description.—Semi-oval, the ventral valve depressed conical, and the dorsal valve nearly flat. Surface with about twenty-eight rounded undivided ribs. Width at the hinge line a little greater than the length.

The ventral valve of this species is strongly elevated with a large area inclining upwards at an angle of a little more than 100,° and slightly arched. From the pointed beak the outline makes a nearly regular curve to the front. Some of the specimens have along the middle, from the beak to the front, a broad carination on each side of which the surface slopes with a gentle or flattened curve to the lateral margins; others are uniformly convex. The area is large, triangular, and with a very narrow foramen which extends quite to the beak.

Dorsal valve nearly flat, a shallow mesial depression along the middle from the beak to the front. On each side of this depression there is a very slight convexity, and then a flat slope to each of the cardinal angles. The area is narrow and sloping upwards and outwards at an angle of a little more than 100° with the plane of the lateral margin. It is divided in the middle by a small triangular foramen.

Width at hinge line four lines; length of dorsal valve three lines; length of ventral valve from beak to front, three and a half lines; height of area of ventral valve one line and one third.

The specimen from which the above description is drawn is the only one, except those procured at the Mingan Islands, that I have ever seen in the Chazy limestone. In its form and dimensions it agrees so nearly with the descriptions of Conrad and Hall, and with the figures in the Palæontology of New York, that there can be scarcely any doubt of its being the same species.

At the Mingan Islands a number of good specimens of an *Orthis* have been collected which are precisely the same as the one above described in every particular, except that they are upon an average two thirds larger, and in some of them the beak is not proportionately so much elevated. In others the beak is quite as prominent as it is in the Montreal specimen, and I do not think it possible, therefore, that they can constitute a distinct species.

Orthis costalis (Hall) has never been sufficiently described and illustrated to enable us to recognize it with certainty. It is said to have a flat dorsal valve and about 32 ribs, but the figures shew from about 32 to less than 20. It may be that when better specimens are procured, it will appear that *O. costalis* and *O. disparalis* are the same.

On comparing the Mingan Island specimens with small individuals of *O. tricenaria*, I find that the hinge line of the latter is proportionally a little shorter, while the dorsal valve has a scarcely perceptible concavity. Large specimens of *O. tricenaria* are one inch wide at the hinge line, but the more common width is nine lines. In the large individuals the beak is proportionally more depressed than it is in the small ones.

Locality and formation.—One specimen two miles north of Montreal. More common at the Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings.

ORTHIS PIGER: (N. S.)

Description.—Transversely semi-oval or sub-quadrate, hinge line equal to the greatest width of the shell or nearly so; lateral margins sub-parallel, straight or gently convex for a little more than half the length from the cardinal angles; front angles rounded, anterior margin straight or gently convex for half the width. Length one fifth to one fourth less than the width.

Ventral valve depressed conical, gently curved from the beak for one fourth the length, then descending with a somewhat flat slope to the anterior margin and cardinal angles. The beak in the small specimens is the most elevated point, but in the larger, the most prominent region is a little in front of the beak. Area large, triangular, and gently arched upwards and outwards at an angle of about 110° with the plane of the lateral margins. Foramen not observed.

Dorsal valve strongly and uniformly convex, with a moderate compression at the cardinal angles; area narrow, beak not very strongly incurved.

Surface with fine undivided radiating ridges of which there are three in one line at the middle of the front margin in a specimen seven lines wide, and four in a specimen five lines wide. These ridges are crossed by fine closely arranged imbricating concentric striæ.

Width of largest specimen seen, (a ventral valve) seven lines, length from beak to middle of front margin six lines; from hinge line to front margin five lines; height of area two lines; length of hinge line six and a half lines; greatest width at about one third the length from the front.

Width of small specimen five lines; length of dorsal valve four lines; height of area of ventral valve one line and a half; depth of both valves three lines.

In two of the specimens there is evidence of a very slight mesial sinus along the middle of the dorsal valve.

Closely allied to *O. grandæva* of the calciferous sandrock, but differs therefrom by being more closely ribbed. Should it, however, turn out that this species has a closed foramen, it may perhaps be united with *O. grandæva.*

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

GENUS STROPHOMENA.

Fossils of this genus have as yet been only rarely seen in the Chazy limestone in Canada and such as we have collected are with the exception of some half dozen specimons, in a very bad state of preservation. I think, however, that I can recognize the following:—

Strophomena incrassata. (Hall)—This shell in external form exactly resembles some of the smaller varieties of *S. alternata,* but, in the interior of the dorsal valve the muscular impressions are divided by two or three rather strong elevated ridges on each side, a character which appears to show that it is a distinct species. It occurs in the Chazy limestone at the Mingan Islands, and in the Black River limestone at the Fourth Chute of the Bonnechére. Specimens from the latter locality agree precisely with those sent me from Tennessee by Prof. Safford. The specimens from Mingan are a little more convex.

Stophomena alternata. (Conrad)—Occurs at Mingan, and I think near Montreal also in the Chazy.

There are two other species, one of which is resupinate like *S. planumbona*, but more specimens are required before they can be determined.

RHYNCONELLA ORIENTALIS. (N.S.)

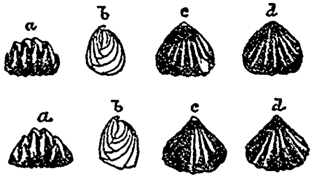


Fig. 21.

Fig. 21.—The above figures represent the different views of two specimens of *R. orientalis.*

Description.—Triangular, varying from moderately convex to sub-globular, apical angle from 80° to 100°; sides straight or nearly so for about two-thirds the length; greatest width at one-fourth or one third from front; front angles truncated; front straight or rounded. The ventral valve in the upper half is narrow or somewhat acute, with the beak in the more slender individuals prominent, and moderately arched, but in the globose forms incurved down to the umbo of the dorsal valve; in the front half strongly elevated at the angles on each side of the sinus; the latter is deep in front, but dies out at a little more than half the length. Dorsal valve the most convex; beak closely incurved; the umbo rather broad, rounded, divided into lobes by a narrow sulcus which extends from the beak one-fourth or little more of the length downwards, a strongly elevated mesial fold extending a little more than half the length. Surface with about nine acutely angular, strongly elevated ribs, of which there are usually three in the sinus and four in the mesial fold. The upper half of the shell is compressed laterally, so that just below the beak on each side there is a flat or concave oval space, which is smooth in the centre, but sometimes exhibits two or three small ribs on each valve. I have not detected any concentric striæ. Length three or four lines; width, either equal to or a little greater than the length.

This little shell is quite distinct from *R. plena*, differing therefrom in its smaller size and proportionally larger ribs. *R. plena* has from 15 to 20 ribs; bnt this species has only 9 or 10, excluding the small and short ones on the sides. It is found in great abundance in certain beds of the Chazy limestone at the Mingan Islands. I have seen no specimens of *R. plena* from that locality, and this species appears to be its representative there.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors.—Sir W. E. Logan and J. Richardson.

RHYNCONELLA PLENA. (Hall, S.p.)

ATRYPA PLENA, A. ALTILIS, A. PLICIFERA (Hall), Palæont., N. Y. *Vol.* 1, p. 21, 22, 23. Plate 4 bis.

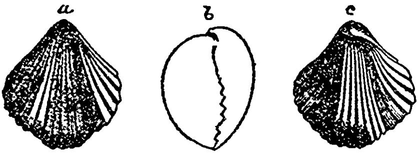


Fig. 22.

Fig. 22.—A large specimen of *R. plena*. Those that are found in such great numbers at Montreal are in general smaller than the above.

This species occurs in vast numbers in the Chazy Limestone, on the Island of Montreal, near Cornwall, and at many localities in the valley of the Ottawa. It varies in form and in the number of ribs in the mesial sinus and on the mesial fold. No sufficient distinction has been shewn between the three species above cited.

CAMERELLA LONGIROSTRA. (Billings.)

CAMERELLA LONGIROSTRA (Billings), Canadian Naturalist and Geologist. Vol. 4, p. 302.

Fig. 23.

Fig. 23.—*Camerella longirostra.* The specimen has the beak of the ventral valve covered by a small fragment of stone, which cannot be removed.

This species occurs at the Mingan Islands in the Chazy Limestone.

CAMERELLA VARIANS. (N.s.)

Fig. 24.

Fig. 24.—Different views of two specimens of *Camerella varians.*

Description.—Sub-triangular; apical angle varying from 75° to 100°; valves moderately and nearly equally convex; the ventral valve with a wide moderately deep sinus, which becomes obsolete at less than half the length; dorsal valve with a corresponding fold; sides straight from the beak for one-half or two-thirds the length; front angles rounded; front margin straight or gently convex; two to four short rounded ribs in the sinus and one or two on each side; three to five on the mesial fold and one or two on each side. These ribs become absolete at about one-third or one-half the length, and all the upper part of the fossil is smooth; beaks small sub-equal; that of the ventral valve a little more prominent than the other, and with apparently a small triangular foramen beneath it. Beak of dorsal valve incurved; Length four or five lines; the greatest width is at about one-third or one-fourth the length from the front, and is either equal to or a little less than the length.

This species resembles *Camerella hemiplicatus* (Hall, S.p.); but is always smaller and not so globose.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors.—Sir W. E. Logan and J. Richardson.

BRYOZOA. 5 species.

Three of the species appear to belong to *Fenestella* or *Polypora*; the others to *Ptylodictya*. They require further examination and comparison before they can be described.

LAMELLIBRANCHIATA. 17 Species.

These fossils are rare in the Chazy limestone, yet the species appear to be somewhat numerous. I think I can make out 17 species belonging to *Ctenodonta*, *Cyrtodonta*, *Vanuxemia*, *Modiolopsis*, and probably two or three other genera.

As the specimens consist mostly of casts, they must remain undescribed until better can be procured. The following are all that I have determined up to the present date:—

CTENODONTA NASUTA. (Hall, S.p.)

Tellinomya nasuta. (Hall.) *Ctenodonta nasuta*. (Salter.)

This well known species occurs in the Chazy sandstone at Lac Aurau River above the River Rouge and also at the Mingan Islands in the Chazy limestone.

MODIOLOPSIS PARVIUSCULA. (N.s.)

This species closely resembles *M. modiolaris* (Conrad); but is always less than half the size of that species. It occurs in the Chazy limestone at Montreal, near Cornwall, at the Mingan Islands, on the Islands at Lake Huron, and also at Punk Island, Lake Winnipeg.

CYRTODONTA BREVIUSCULA. (N.s.)

Description.—Sub-rhomboidal; hinge line straight elevated; anterior extremity broadly rounded; posterior extremity obliquely truncated and somewhat straight from the hinge line to within one-third the height from the posterior ventral angle, which is rather narrowly rounded; ventral margin gently concave about the middle; umbones small, obtuse, near the anterior extremity, valves rather strongly convex, most prominent about the middle;

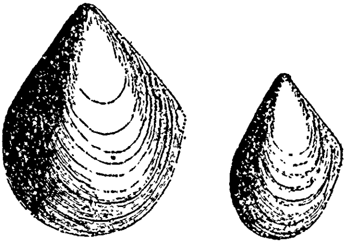
thence sloping abruptly to the hinge line and posterior and ventral margins.

Length from posterior ventral angle to anterior extremity six lines; height from ventral margin to posterior extremity of hinge line four lines; from beaks to ventral margin three lines; beaks within one line of most projecting point of anterior extremity; surface apparently concentrically striated.

Locality and Formation.—Chazy sandstone, three miles east of the city of Ottawa, half a mile back from the river.

Collector.—E. Billings.

VANUXEMIA MONTREALENSIS. (N. s.)



Figs. 25, 26.

Figs. 25, 26.—*Vanuxemia Montrealensis.*

Description. — Obliquely sub-oval or sub-rhomboidal, with an indication of a posterior wing; surface with fine concentric striæ; length about an inch and a-half.

The beaks are small, pointed closely, incurved and directed forwards; the umbo is rather strongly elevated and narrowly rounded; from the umbo the convexity of the valve gradually increases in width, is most prominent about the centre or a little nearer the beak than the centre and from that point diminishes in all directions towards the posterior and ventral margins. The anterior margin near the beak has not been observed; but, judging from the cast, it does not appear to be alated. From the beak it inclines backward at an angle of about 75° with the hinge line for three-fourths the whole length when it gradually curves to produce the broadly rounded postero-ventral extremity. The hinge line is straight, and its length appears to be about equal to three-fourths of the diagonal of the shell from the beak to the lower posterior angle. The posterior extremity of the hinge line has not been observed; but it probably forms an obtuse angle with the posterior margin, while the latter is only gently convex until within one-third of the base, then rounded to the lower margin. The wing is rather prominent and scarcely at all compressed.

Diagonal of the largest specimen fifteen lines.

A specimen of this species without the wing is rather acutely oval, and has an aspect very different from the perfect form.

I have placed it in the genus *Vanuxemia* provisionally, but it may be necessary hereafter to remove it to some other genus.

Locality and Formation—Island of Montreal and near L'Orignal. Chazy Limestone. Not common.

Collectors.—Sir W. E. Logan and R. Bell.

GASTEROPODA, 21 species.

There are in the Lower and Middle Silurian rocks of Canada upwards of thirty species of Gasteropoda that must be distributed among the genera *Pleurotomaria Scalites* and *Raphistoma*, provided these groups be retained as distinct from each other. But after giving the subject a great deal of consideration, I cannot see that the last two are possessed of any structural peculiarity of sufficient importance to warrant a separation from the first. It has always been supposed that *Scalites* and *Raphistoma* were destitute of a spiral band, yet the species which I have called *P. docens* has a band as strongly marked as it is in any known species of *Pleurotomaria*, while it has also a nearly flat spire, a largely developed conical base, and no umbilicus. The three latter characters, combined with the peculiar aspect of the shell, shew that we cannot separate it generically from *Scalites*, and yet the spiral band connects it with *Pleurotomaria*. This fossil had not been discovered at the time of the publication of Decade I., otherwise a view of the affinities of *Scalites* different from that put forth in the work would have been maintained.

In general the fossils of this group are not well preserved in our rocks; but in the large collections of the Geological Survey there are specimens of many species retaining the surface markings, and it is quite clear that all have either a spiral band, or a sharp bend in the lines of growth which is equivalent thereto. In connection with the band there is also in all the species a notch in the outer lip, and there cannot be the least doubt but that the band was formed by the progressive filling up of the notch during the growth of the shell, precisely as in the genus *Pleurotomaria.*

In some of these forms which have a very sharp outer angle, the band is situated exactly on the edge of the whorl, and it is then smooth in all the species in which I have been able to see it distinctly. In *P. calyx* it is double, or composed of a minute flat smooth band on the upper surface sloping downwards to the edge, and a similar one below sloping upwards, the two consituting what may be called a bevelled edge to the whorl. In none have I seen the striæ passing over the edge of the whorl; but it is evident that as they curve backwards both on the upper and under sides on approaching the edge, they must either pass over it or not; and in the latter case the band must be smooth, while in the former it must consist of a simple angular bend in the lines of growth. In several (and among these *P. docens*) the band is altogether on the upper surface, but close to the outer edge. Of *Scalites angulatus* we have no specimens, but, according to Professor Hall's description, the surface is, on the "upper side of the whorls, marked by striæ directed obliquely backwards, and which, on passing over the angle, are directed somewhat spirally forwards."* As these striæ indicate the form of the aperture, there must be a notch in the lip of *S. angulatus*, with the deepest point exactly at the angle of the whorl, and also an angular bend in the lines of growth equivalent to a band. So far, then, as the presence or absence of a band and notch can affect the question, there is no generic difference between *Scalites* and *Pleurotomaria*, and if the two genera are to be maintained as distinct, it must be upon some other characters not yet pointed out.

It might be thought that the difference between the forms of the Lower Silurian species and those of the more recent rocks would be sufficient to warrant their separation into two or more genera. But upon examination it will be seen that *Pleurotomaria* consists of more than 400 species, varying from pyramidal forms, or those with an elevated and pointed spire and flat base, through those that are nearly globose or with the base as greatly produced as the spire, to such as *P. docens*, with the spire nearly flat and the base conical. *P. Ramsayi*, which has a flat or slightly concave base, represents the pyramidal form in our rocks, and *P. docens* the opposite extreme. *P. Ramsayi* is all spire and no base, while *P. docens* is all base and no spire. If a plane

* Palæont. N. Y., Vol. I. p. 27.

be projected through the outer angles of these two species, it will be seen that in one the animal must have lived nearly altogether below this plane, and in the other nearly altogether above it. There are numerous species with about half the bulk of the shell above and half below, and others with every intermediate proportion.

Notwithstanding the great number of species in this genus, all attempts at a subdivision have hitherto failed. A number of small groups of species having some peculiarity in common might be pointed out, but these would not differ from each other generically. For convenience in classification, De Koninck makes two large groups.

1.—The ORNATÆ, with angular whorls and the surface richly ornamented with ridges and tubercles.

2. The GLOBOSÆ, of which the form is more or less globular, and the surface not at all or only moderately ornamented.

This last group is divided by D'Orbigny into the PERSPECTIVÆ, with the umbilicus so wide that all the whorls can be seen in it, and the FALCATÆ, with the umbilicus very small or altogether closed.*

Scalites is not a genus, but rather a small group of species distinguished by having the outer edge of the whorls angular, the upper surface sometimes flat and at right angles to the longitudinal axis of the shell, the spire sometimes elevated and consisting as it were of a series of rectangular steps and the umbilicus sometimes closed. The extreme form of the group is *S. angulatus*, which, by its elevated spire, indicates an approach to the genus *Murchisonia.*

The genus *Raphistoma* was originally founded upon three species of *Scalites*, and appears to have been designed to take the place of that genus, for we find that, in his generic description, Professor Hall has the following remark: "It is probable also that the generic characters here given may be so extended as to include the *Scalites* figured above, as I have some evidence of the existence of the characteristic markings upon that shell." Palæont. N. Y., Vol. I., p. 28. The following are the views of other authors upon the affinities of *Scalites*, so far as I can ascertain.

* See L. DE KONINCK, Description des Animaux Fossiles qui se trouvent dans le terrain carbonifere de Belgique, Vol. I. p. 364. Also ALCIDE D'ORBIGNY, Paleontologie Française, Terrains Crétacés, Vol. II. p. 239.

De Orbigny.—This author thinks *Scalites* allied to *Straparollus*, and only differing therefrom by having the umbilicus closed. He quotes *Raphistoma* as a synonym.*

Pictet places *Scalites* among the *Trochidæ*, and thinks that if *Raphistoma* is to be retained it must be differently defined.†

F. Roemer refers *Scalites* to the genus *Euomphalus*, and says that *Raphistoma* differs from *Scalites* only in having the spire more depressed.‡

S. P. Woodward makes of *Scalites* a sub-genus of *Pleurotomaria*. He cites *Raphistoma* as a synonim.§

Salter has given to *Scalites* the rank of a genus, and he makes *Raphistoma* a sub genus, which would include all such species as *P. qualteriatus, P. lenticularis*, &c., &c.‖

It must be observed that in forming their respective opinions, the above-named eminent Naturalists and Palæontologists had not before them specimens such as *P. docens*, exhibiting a well-defined spiral band.

Our collections confirm the opinion of Mr. Woodward, but I do not think it convenient to retain *Scalites* even as a sub-genus; because, as I shall shew hereafter in another publication, the transition from *Scalites angulatus* to such forms as *P. rotuloides* (Hall) is so gradual, through a perfect series of species, that, to determine whether certain forms should be placed in the genus or sub-genus, will be next to impossible, and occasion an useless expenditure of time and mental labour. When the lines between groups become so excessively inconvenient, they should be blotted out altogether. For the present, therefore, I shall place all our species in the genus *Pleurotomaria*. Judging from the number of species in the Canadian rocks, I think there must be a great many others in the extensive private or public collections of Lower Silurian fossils in the Western and Southern States; and until all these are described and figured we cannot have all the facts before us upon which the classification must be ultimately founded.

On examining the numerous species of *Euomphalus* or *Schizostoma*, figured and described in the works of Goldfuss, De Koninck,

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* Prodrome de Paléontologie. Vol. 1, p. 7.

† Traite de Paléontologie. Vol. 3, p. 153.

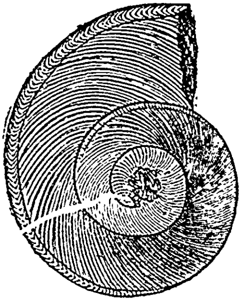
‡ Bronn's Lethaea Geognostica. Vol. 1, 456.

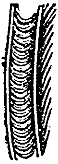
§ Woodward's Recent and Fossil Shales, p. 147.

‖ Salter, Canadian Fossils, Decade 1, p. 10.

De Orbigny, and others, lc will be seen that some, such as *Schizostoma delphinuloides*, *S. fasciatum*, *S. taeniatum*, *S. vittatum*, *S. costatum*, *Euomphalus*, *Dionysii*, *E. catillus*, and other allied forms, have a spiral band, with backward curving lines of growth, differing only from *Pleurotomaria* in their more slender cylindrical whorls and wide umbilicus. Many of these, although perhaps generically distinct, should, I think, at least be placed in the same family with *Pleurotomaria*.

PLEUROTOMARIA DOCENS, N. S.





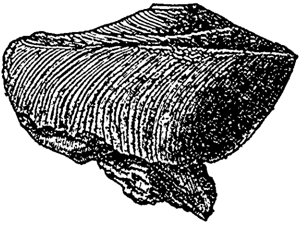


Fig. 27. Fig. 28. Fig. 29.

Fig. 27.—*Pleurotomaria docens.* View of the spire of a specimen from the Chazy Limestone near L'Orignal. On one side the band is partly worn away or concealed.

28.—A portion of the band a little enlarged.

29.—Side view of same specimen; the lower part of the base broken away.

Description.—Spire nearly flat; base sub-hemispherical; umbilicus closed; whorls about four, with a distinct spiral band all round on the outer margin; width, usually a little more than an inch and a half; height, about two-thirds the width.

On the upper side the whorls in the centre are gently convex and elevated, so that the apex is about three lines higher than the outer margin. As the whorls enlarge they gradually lose the slight convexity which they possess at the centre, and become more and more flattened, until at the aperture the last is either quite flat or even a little concave. The first whorl is very small, but the others somewhat rapidly enlarge so that at the aperture the last one is full six lines wide, where the whole width is eighteen lines.

The band forms the outer margin of the upper surface. At the aperture it is one line wide, but it becomes gradually smaller, and at the apex is reduced to a mere line. It is crossed by strong backward curving striæ, and has a fine elevated line-like ridge on each side.

On the lower side the whorls are ventricose, and constitute a sub-hemispherical or depressed conical base. At the aperture the outer lip is at right angles to the upper lip or upper surface of the whorl; but this angle decreases as we follow the margin of the whorl backwards towards the apex, at such a rate, that, at the commencement of the last whorl, it is not more than 75°.

In no specimen that I have seen is the aperture perfect; but, judging from the evidence of numerous fragments, the upper lip is straight and at right angles to the longitudinal axis of the shells. The outer lip in its upper half is at right angles to the upper lip, or very nearly so; but in its lower half it curves inward to the closed umbilicus. The inner side is gently concave, or nearly straight. The height of the aperture, as exhibited in the fracture across the last whorl in the specimen figured, is eight lines, and its width at the upper lip nearly six lines.

The surface is covered with coarse, but only slightly elevated, undulations of growth, the width of which is from one-sixth to half a line. Besides these it is striated with fine lines of growth, of which there are about ten or twelve in the width of one line. On the upper surface the striæ and undulations turn backwards at an acute angle from the inner to the outer edge of the whorl. On the lower surface they curve forward and then backwards.

The shell in the spire is thin, but below very thick. When the shell has been totally destroyed, the cast of the interior exhibits an umbilicus one-eighth of the whole width of the spire.

We are not yet in possession of a sufficient number of specimens to enable us to point out how far this species may vary from the description above given. It is probable that the principal variations will be in the height in proportion to the width. We know that other species of this group, such as *P. Laurentina* and *P. calcifera*, are variable in this respect; and we have some specimens, which, although their height is only half the width instead of two-thirds, I think should be referred to this species; but, of course, such a reference cannot be confirmed until individuals with the surface-markings preserved shall have been procured. Some of the specimens are two inches and a half wide.

Locality and Formation.—Near L'Orignal. Chazy Limestone.
Collector.—R. Bell.

PLEUROTOMARIA IMMATURA, N. s.

Description.—Spire nearly flat, the apex elevated four or five lines above the margin in specimens one inch and a half wide, the last whorl depressed one and a half lines below the preceding; base depressed sub-hemispheric or conical; whorls, four or five, with a narrowly-rounded outer edge; width, from one inch to one inch and a half; height, a little more than half the width.

The band in this species is apparently smooth, and placed precisely on the outer margin of the whorl, where it forms a rounded edge nearly a line in thickness, just above and below which the whorl is suddenly a little concave. The apex is not acute but rounded, and the suture for the first two or three whorls is not distinct, but afterwards becomes more apparent as the succeeding whorls become depressed. Owing to the depression of the outer whorl the spire is semi-turretted, the outer margin of the penultimate whorl forming a step-like elevation above the inner margin of the last. The surface is marked by rather fine backward curving striæ, and narrow irregular undulations of growth. The upper surface of the first and second whorls forming the rounded apex of the spire are gently convex, but the outer ones are flat, or a little concave.

I have seen no specimens of this species with the base well exposed, but the rounded edges of the whorls and semi-turretted spire are characters sufficient to distinguish it from any other Chazy species. From what I have seen, I think the umbilicus must be either very small or entirely closed.

The proportional width of the whorls is variable. In one specimen thirteen lines wide the outer whorl has a breadth on its upper flat surface of three lines, which is also its width in another individual with a spire sixteen lines wide.

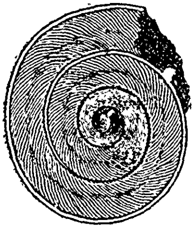
Locality and Formation.—Two miles north of Montreal. Chazy Limestone.

Collector—E. Billings.

PLEUROTOMARIA CALYX, N. s.

Description.—Spire nearly flat, with an acute or sharply-rounded outer margin; base conical, more or less produced below;

whorls, including a minute one in the apex, five; height, from one-half to four-fifths the width; no umbilicus.



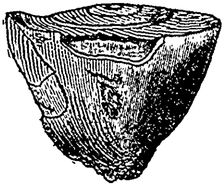


Fig. 30, 31, 32.

Fig. 30.—View of the spire of *P. calyx.*
31.—Side view of same specimen.
32.—Side view of a small specimen.

On the upper surface the first two or three whorls are gently convex or flat, and constitute a small elevation in the centre of the disc from half a line to two lines higher than the margin. The outer whorls are flat or gently concave, and the last one is in some individuals depressed a little below the margin of the next preceding. Just beneath the margin there is usually (not always) a shallow wide concave band, and below this the whorls are produced downwards with a gentle tapering convex slope, so as to form a conical base which is more or less acute. In some specimens the base is nearly hemispheric, its length being half the width of the spire; but in others it is more conical; and in the one represented by Fig. 31, the length is full four-fifths the whole width. In small specimens consisting of three or four whorls, the outer edge is exceedingly acute, and is bevelled, as it were, by two very narrow flat bands, one above and the other below. In large specimens the edge becomes a little more obtuse towards the aperture, and the small flat bands disappear.

The upper surface is marked by fine striæ and numerous small furrows or undulations of growth, the whole curving backward at an acute angle with the suture. The markings are interrupted or undulated about the middle of the whorl, so that in crossing the surface from the inner to the outer edge they make two obscurely sigmoid curves. Below the margin the surface is ornamented with similar striæ, which, in descending, curve forwards and then backwards. In most of the specimens they are undulated below as well as above the margin.

The specimens are from three to fourteen lines in width, and the length varies from a little more than one-half to four-fifths of the whole width. The variation in the proportional length and width is partly owing to differences in the thickness of the shell. Some have the shell so greatly thickened below that one or two lines is added to the length thereby. It is well known that many of the mollusca of the existing seas are subject to great variations in the thickness of the shell.

This species closely resembles the *Raphistoma staminea* (Hall); but as Professor Hall says in his description of the genus (Palæontology of New York, vol. 1, page 28) that the umbilicus is "moderately large," I infer that the three species described by him must be umbilicated. In page 29, he states that "the striæ (on the surface of *R. staminea*) bend abruptly forwards, and, curving gently round, pass into the umbilicus"; from which expression no other conclusion can be drawn than that *R. staminea* does possess an umbilicus. Our species is not umbilicated; and, therefore, I believe it to be distinct from *R. staminea*.

Locality and Formation.—Island of Montreal. Chazy Limestone.

Collectors—Sir W. E. Logan, J. Richardson.

PLEUROTOMARIA CREVIERI, N. S.

Figs. 33, 34, 35.

Fig. 33.—Side view of *Pleurotomaria Crevieri.*
34.—View of spie.
35.—Side view of a different specimen.

Description.—Shell small; whorls four; spire nearly flat; base sub-hemispherical; no umbilicus.

On the upper surface the first two whorls form a low, rounded elevation in the centre, rising a little above the outer margin; the others are gently concave, and a little depressed below the margin of those preceding. The base is sub-hemispherical or depressed conical, the length a little more than half the width of the spire. The surface is marked with fine striæ of unequal size, curved as in all the other species of this group. The outer margin is acutely rounded, not bevelled as it is in specimens of *P. calyx*, of the same size. Width of spire, five or six lines.

Dedicated to Dr. J. A. Crevier of St. Hyacinth, whose zeal in the science of geology promises to be productive of important results.

Locality and Formation—St. Dominique, Chazy Limestone.

Collectors.—Sir W. E. Logan, Dr. Crevier.

PLEUROTOMARIA PAUPER, N. S.

Description.—Shell small; whorls three or four, flat above, ventricose below, and obtusely angulated at the edge of the umbilicus; width, from four to eight lines; height, half of the length.

The spire is perfectly flat, and the outer margin in the cast acutely rounded. Below the margin the base tapers, with a gentle convexity, to the edge of the umbilicus. In a specimen five lines wide, the last whorl has a width of two lines on the upper surface at the aperture, the depth from the upper side to the lower angle of the aperture being also two lines, and the umbilicus one and a half lines wide. In the cast of the interior, the suture is deep, rounded at the edges, and the upper side of the whorls gently convex. Surface unknown.

About the size and shape of *P. Crevieri*, but with a perfectly flat spire and an umbilicus.

Locality and Formation.—Grenville. Chazy.

Collector—Sir W. E. Logan.

Besides the above there are six other species of *Pleurotomaria* in the Chazy, but they must remain until better specimens can be procured.

MURCHISONIA INFREQUENS, N. S.

Description.—Elongate, slender apical, angle about 20°; whorls five or six, depressed, ventricose smooth,—the last one large, and, when measured from the lower angle of the aperture, equal to half the whole length. Length of the only specimen collected, fourteen lines; diameter of last whorl, four lines. The surface, judging from the appearance of a small fragment of the shell, must be smooth, or very finely striated.

In this species the whorls are not so convex as they are in *M. gracilis*, and the last one is proportionally larger.

Locality and Formation.—Grand Isle, near Cornwall. Chazy Limestone.

Collector—J. Richardson.

MURCHISONIA PERANGULATA? (Hall.)

MURCHISONIA PERANGULATA (Hall), *Palæont. N. Y.* Vol. 1, page 41. Plate 10, Fig. 4.

Several specimens have been collected which closely resemble those found in the Black River Limestone, but are a little larger than the average size.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors—Sir W. E. Logan, J. Richardson.

MURCHISONIA ASPER, N. S.

Description.—Obtusely conical; apical angle about 70°; spire of four or five whorls,—the body whorl large, ventricose, with a prominent band about the middle, and a low angular carina at about two-thirds the distance between it and the suture above. The upper whorls small, rapidly tapering to an acute apex, and altogether forming only one-fourth or less of the whole length. The band on the body whorl of a specimen a little more than one inch and a half long is two lines wide, and consists of a central rounded ridge one line wide, with an obscurely angular carina on each side. The surface is ornamented with fine sharp lines of growth from six to eight in the width of one line, which, in descending, curve gently backward until they reach the band; below which they curve abruptly forward for about two lines, then become vertical or nearly so, and again curve backward on approaching the aperture. They are thin, sharp, imbricated, and very distinct. The aperture, as exhibited in a single specimen, is nearly circular, the lower part somewhat effuse, the inner lip entire and a little separated from the body whorl.

A full-sized individual is twenty lines in length, of which, on the anterior side, the aperture and body whorl occupy full fifteen line, and the remainder of the spire to the apex only five lines; but on the opposite side, the spire, from the body whorl upwards, is seven lines. The width, measured across at one line above the upper angle of the aperture, is eleven lines. The shell in this specimen, at the lower side of the body whorl, is one line and a half thick.

In some of the fragments of other specimens there appears to be a wide, but very shallow, concave band just below the principal band on the body whorl, and below this an obscure carina. The main band also varies a little in its proportional width and angularity. Owing to the thickness of the shell the sutures above the body whorl are not deep, and the upper whorls are in consequence not ventricose, but still encircled with the band—apparently, also,' with the upper carina. In the cast the whorls are smooth rounded ventricose, and exhibit scarcely any trace of either the band or the carina. In some specimens the shell on the body whorl exhibits some deep, irregular undulations of growth.

Resembles both *M. helicteres* (Salter) and *M. bicincta* (Hall); but these species have a distinct carina below the band.

Locality and Formation.—Mingan Islands. Chazy.

Collectors—Sir W. E. Logan, J. Richardson.

The other gasteropods of the Chazy are two species of *Holopea* and *Trochonoma umbilicata* (Hall, sp.)

MACLUREA ATLANTICA, (N. S.)

Description.—Whorls about four, flat or gently convex on the lower side, ventricose above, and obtusely angulated at the edge of the umbilicus. In a specimen with four whorls the diameter is three inches and seven lines; the width of the last whorl at the aperture, on the flat, lower side, is sixteen lines; at the termination of the third whorl six lines, and of the second whorl three ines. The first whorl occupies about two lines of the diameter in the centre. In the same specimen, if on a line drawn from the aperture straight across the shell, the width from the outside of the aperture to the centre is two inches and two lines, and from the centre to the termination of the line on the posterior side one inch and three lines.

When the above dimensions are compared with those of *Maclurea Peachii* (Salter), as figured in the Quarterly Journal of the Geological Society, vol. 15, plate 13, fig. 1*a*, the difference between the species at once becomes obvious. That figure represents a specimen of *M. Peachii*, which is exactly three inches and seven lines in diameter; but it has five whorls, the width of the last one at the aperture being twelve lines, and of the others measured on the same line 6, 3, 1½ and 1 lines respectively. *M. Peachii* is, therefore, a distinct species, differing from ours by its more numerous and more slender whorls.

The operculum found associated with the specimens is elongated, flat or a little concave on one side, moderately convex on he other, curved like a short Cyrtoceras, but not in the same plane,—the apical half being gradually turned towards the flat side, so as to constitute a sub-spiral curve. The width at the base of the most perfect specimen collected is sixteen lines, thickness nine lines; length along the outer curve four inches, from the apex in straight line to the inner angle at the base fifteen lines, and to the outer angle two inches and three lines. On the convex side the structure is seen to consist of successive thin laminæ at right angles to the length, the unequal development of which forms a sort of a squamose and transversely undulated surface. This operculum resembles that of *M. Peachii*, but it is larger and more strongly curved. I have seen no perfect specimens.

While the differences in the size of the whorls distinguished this species from *M. Peachii*, its operculum shews at a glance that it cannot be either *M. Logani* or *M. Magna.*

I have seen no specimens with the shell preserved. In the cast of the interior the inner whorls are quite ventricose, instead of flat, in some of the individuals; but in others, from the same locality, nearly flat.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors—Sir W. E. Logan, J. Richardson.

There are apparently two other species of *Maclurea* in the Chazy, one of which may be *M. Logani* and the other *M. Magna*; but they require further examination.

CEPHALOPODA (15 species).

ORTHOCERAS SHUMARDI, N. S.

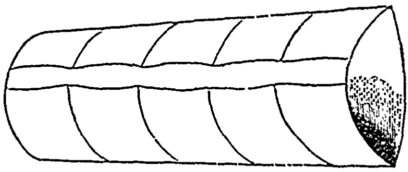


Fig. 36.

Fig. 36.—Longitudinal section of *O. Shumardi*, shewing the distance of septa and the position of siphuncle.

Description.—Elongate, cylindrical, section circular, tapering at the rate of a little more than half a line to the inch, septa rather strongly convex, distant nearly half the diameter; siphuncle about one fifth the whole diameter, and with its centre distant from the centre of the transverse section half its own diameter. Surface unknown.

In a specimen eight inches long the diameter of the larger extremity is ten lines and of the smaller five lines, and it tapers therefore at the rate of five eighths of a line to the inch. At the larger end there are two septa in nine lines, and at the smaller two in four lines. The siphuncle is cylindrical and but slightly inflated between the septa; its diameter at its passage through the septum at the large end one line and a half, and between the septa about two lines.

We have no species with which this Orthoceratite can be compared except *O. amplicameratum* (Hall), from which it differs in having the septa proportionally a little more distant, and the siphuncle a little larger and not so excentric.

Dedicated to the excellent geologist and palæontologist, Dr. B. F. Shumard, State Geologist of Texas.

Locality and Formation.—Mingan Islands; Chazy.

Collectors.—Sir W. E. Logan, J. Richardson.

Orthoceras Maro, N. sp.

Description.—Annulated, slightly curved, section circular, tapering at the rate of one line and a half to the inch; siphuncle about one eighth the whole diameter, and with its centre half its own diameter from the centre of the shell; septa rather strongly concave, two in five and a half lines where the shell is one inch in diameter, three in five lines where it is half an inch in diameter.

The annulations in general encircle the shell at right angles to the length, but in some of the specimens they appear to be gently sinuated on one side. They are rather abruptly elevated with rounded edges, and the spaces between them are either regularly concave or nearly flat for about one fourth or one third their width in the middle or at that part of the bottom of the space which is situated half way between the annulations. The thickness of the rounded edge of the annulations is about half a line and the height of the ridge about one line. Where the diameter is one inch the annulations are distant three lines, and where it is half an inch they are distant one line and a half.

The surface is ornamented with fine longitudinal striæ, about ten in the width of one line. These striæ are in some places alternately a little unequal in size, and they also appear to be crossed by minute transverse striæ, but this character has not been yet positively established. The longitudinal striæ are continuous over the edges of the annulations. The segments of the siphuncle are moderately inflated between the septa.

Where the diameter is one inch the depth of the concavity of the septa is equal to the distance between them, or a little less, but towards the smaller extremity the septa are not so strongly concave.

The amount of the curvature of the shell appears to be a little variable, but the average in the three specimens I have examined would be equal to that of an arch with a base of eight inches and an elevation of three lines in the middle.

This species seems to be allied to *O. annellum* (Conrad), but the figures given in the "Palæontology of New York," volume 1, plate 43, shew that the spaces between the annulations in that species are not concave. Figure *6a* on the plate cited has sharp-edged annulations with angular constrictions between. Fig. *6d* shews broadly-rounded annulations, with sharp angular constrictions. If these figures be correct they represent two very different species, and neither of them identical with the one above described. Neither Hall nor Conrad state whether the inter-annular spaces in *O. annellum* are concave or not.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS MULTICAMERATUM (Conrad).

This species occurs at the Mingan Islands, and also on the Island of Montreal in the Chazy limestone; also in the Black River limestone in the township of Westmeath.

ORTHOCERAS BILINEATUM (Hall).

Occurs in the Chazy at Mingan; in the Black River limestone at La Petite Chaudière near Ottawa, and at Pauquette's Rapids. In the Hudson River group at Cape Smith, Lake Huron.

ORTHOCERAS SUBARCUATUM (Hall).

This species has been found in the Chazy on the island of Montreal and near Cornwall. The surface characters are not well known, but one of the specimens exhibits the siphuncle, which is strongly moniliform, and situated half way between the centre and the outside. All the specimens that I have seen are curved.

ORTHOCERAS MINGANENSE (Billings.)

(O. MINGANENSE, *Report G. S. C.*, 1856, page 319.)

Occurs in both Chazy and Black River limestones at the Mingan Islands.

ORTHOCERAS ALLUMETTENSE (Billings).

(O. ALLUMETTENSE, *Report G. S. C.*, 1856, page 331.)

Description.—Section nearly circular, tapering at the rate of one line and a half to the inch; siphuncle moniliform eccentric, its centre distant from the centre of the shell half its own diameter; septa convex, from two to two lines and a half distant; surface apparently smooth.

In a specimen three inches long, thirteen lines in diameter at the larger and eight and a half lines at the smaller extremity, the dilations of the siphuncle are four lines wide, and the distance of the septa gradually diminishes from two and a half to two lines. On its passage through the septa the siphuncle is constricted to the diameter of one line, and the segments or expansions between the septa are discoid, with rounded edges, each being a sphere compressed at opposite sides. The inner margins of the segments of the siphuncle are in contact with a line drawn longitudinally through the centres of the septa. The outer margin is distant from the centres of the septa the whole diameter of the siphuncle. The segments of the siphuncle are not disposed at right angles to the length of the shell, but obliquely, sloping from the outside inwards and towards the apex or smaller extremity.

Locality and Formation.—Chazy sandstone at Aylmer and township of Clarence; Black River limestone, Pauquette's rapids.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings.

ORTHOCERAS ANTENOR, N. S.

Description.—The only specimen of this species that I have seen is eight inches in length, and tapers from fourteen lines at the larger to four and a half lines at the smaller. The two septa visible at the larger extremity are distant two lines and two thirds. The surface is beautifully cancellated by fine but distinct longitudinal lines, about twelve to one line, crossed at right angles by much finer but still distinct encircling striæ. The shell is curved so as to form an arch, of which the base is eight inches and the height in the middle eight lines.

Locality and Formation.—Chazy limestone, Mingan Islands.
Collectors.—Sir W. E. Logan, J. Richardson.

Besides the above, there are three other species of Orthoceras in Chazy limestone, of which one resembles *O. Ottawaense*, and may yet turn out to be the same.

Genus NAUTILUS.

In the genus *Trocholites* (Conrad) the siphuncle is internal, in *Nautilus* central, and in *Cryptoceras* (d'Orbigny) external. There are many palæontologists who think that the first and last of these should be retained as genera or sub-genera distinct from *Nautilus*, while others are of opinion that all should be comprised under one name. The position of the siphuncle can hardly be regarded as of generic importance. In *Cyrtoceras* and *Phragmoceras* it is dorsal, central, or ventral. If we should divide *Nautilus* into three genera, according to the position of the siphuncle, then *Cyrtoceras* and *Phragmoceras* must also be subdivided in order to make our genera of equal value. We would thus have nine genera where there are only three. Professor Chapman of Toronto was the first to direct attention to the fact that *Lituites undatus* (Hall), and another species which occurs at Lorette and which I had considered to be identical with Hall's species, do not belong to *Lituites*, but rather to d'Orbigny's genus *Cryptoceras**. This view is confirmed by several other specimens collected since Prof. Chapman's article was written; and should *Cryptoceras* be retained, at least two of the following species must be referred to it, since both have an external siphuncle. In the other, (*Nautilus natator*), it has not been observed. I have examined all our specimens carefully in order to ascertain the direction ot the bent portion of the septa around the siphuncle, but, owing to their imperfection, without success. Should it be found hereafter to be directed forward, then the species must be transferred to Barrandé's new genus, *Nothoceras.*

NAUTILUS JASON, N. s.

Description.—Discoid, planorbiform, all the whorls exposed in the umbilicus. Section of shell broad oval, the ventral and dor-

* On the occurrence of the genus *Cryptoceras* in Silurian Rocks. By E. J. CHAPMAN, Professor of Mineralogy and Geology in University College, Toronto. *Canadian Journal*, 2nd series, vol. 2, page 264; and in *Annals of Natural History*, 2nd series, vol. 2, page 114.

sal sides being depressed convex, the other two sides rounded, the two diameters being to each other as fifteen to seventeen. The tube increases in diameter at such a rate as to give to the coil a diameter of three inches and a half on the completion of the second whorl, at which point the septa are two lines distant from each other in their centres, two and a half lines in the middle of the ventral side, and a little less than one and a half lines on the dorsal or inner side of the whorl. They become gradually more approximate as they approach the apex, so that where the tube is half an inch in diameter they are one line distant in their centres. They are only moderately convex, and their edges cross the ventral aspect in a straight line, but on the sides with a gentle curve towards the apex of the shell.

The surface exhibits a series of rounded ridges which, starting from the umbilicus, curve backward, and make a deep rounded undulation towards the apex on the ventral aspect. The distance of the ridges from each other along the median ventral line is about five lines, and the intervening spaces are shallow and concave. The surface is also marked with obscure fine striæ, and smaller ridges all parallel with the larger.

The siphuncle is from one and a half to two lines in diameter, cylindrical, not inflated, and distant about two lines from the outer margin.

On comparing this species with the figures of *L. undatus* (Emmons), given in the Palæontology of New York, vol. 1, plate 13, we find that our best preserved specimen is exactly the size of figure 1; that the ventral aspect is not angular at the sides, nor do the ridges pass straight across, as shewn in fig. 1*b;* and that in fig. 3 the septa are more than three lines distant in their centres instead of two lines, as they are in our specimens. The specimen represented on plate 13 *bis* has the septa three and a half lines nearly distant about the completion of the second whorl, while those next the chamber of occupation are more approximate, as they usually are in all the Nautilidæ. Our species therefore, although closely allied, is a distinct species from *L. undatus.*

Locality and Formation.—Mingan Islands; Chazy limestone.

NAUTILUS TYRANS, N. S.

Description.—Discoid planorbiform, all the whorls exposed in the umbilicus. Shell increasing in size, so that at the completion of two whorls and a half the diameter of the coil is eight inches. Whorls contiguous, but in the cast of the interior not in contact; transverse section of the tube nearly circular; siphuncle ventral, and at the completion of second whorl, in which place only it can be seen in the specimen, about three lines in diameter, and one line or a little less from the margin. At the same point the septa, as marked upon the siphuncle, are six lines distant from each other. The shell is not preserved, but from the smoothness of the cast I think there can be no transverse ridges, as there are in *L. Jason* and *L. undatus*.

Only a single specimen of this fine species has been collected, and that is a cast in which none of the septa can be seen. Its great size, the separation of the whorls in the cast, and the absence of undulating transverse ridges, are abundantly sufficient to distinguish it from any other described species of the Lower Silurian rocks of North America.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

Nautilus natator, N. s.

Description.—Discoid planorbiform, all the whorls exposed in the umbilicus. Tube slender, gradually increasing in size, so that on the completion of the fifth whorl the diameter of the coil is four and one fourth inches. Section oval, the dorso-ventral diameter being greater than the lateral in the proportion of about 8 to 6 (?) Septa at the end of fourth whorl, three in about seven lines, measured on the side. Surface and siphuncle unknown.

The specimen is imperfect; but if it has not been compressed laterally, then, as nearly as I can determine, the dorso-ventral diameter at the end of the fifth whorl is sixteen lines and the lateral twelve; at the fourth whorl five to seven; and it would appear therefore that the third must be scarcely three lines in its greatest diameter.

I have not seen the first and second whorls, but as there is an empty space nine lines in diameter in the centre of the coil I presume that they did once exist and occupy that space. The whorls are in contact, but the outer ones are not indented by those next preceding.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

CYRTOCERAS MCCOYI, (N. s.)

Description.—Of this species I have seen no specimens with the smaller extremity preserved, and cannot therefore give the amount of curvature. The best specimen is fusiform, nearly straight, and two inches and a half in length. The section is oval, the greatest (dorso-ventral) diameter at the aperture is eleven lines, and the lesser apparently about eight lines. From the aperture the shell gradually increases in diameter until at the first septum or at the bottom of the body chamber, the dorsa-ventral diameter is 13 lines, and the transvesse diameter about 11. It then tapers to the diameters of 6 and 5 lines in the next 18 lines of the length. The ventral side is curved so as to form an arch, with a height of three lines in a span of 2½ inches; the dorsal side is much more gently arched. The septa are very gently concave, and one line distant from each other. The siphuncle is moniliform, 1 line in diameter, and almost in contact with the shell on the ventral side. Surface unknown. Differs from *Cyrtoceras* (Oncoceras) *constrictum* (Hall) in being proportionally more slender.

Dedicated to the eminent Palæontologist, Professor F. McCoy, author of that excellent work, the BRITISH PALÆOZOIC FOSSILS.

Locality and Formation.—Chazy Limestone, Mingan Islands.

Collectors.—Sir W. Logan, J. Richardson.

CRUSTACEA (14 species).

The trilobites of the Chazy limestone are usually found in fragments; but the abundance of the remains shews that the individuals were numerous. There appear to be about seventeen species.

Illænus Bayfieldii, *I. globosus*, *I. clavifrons*, *I. arcturus*, and *Amphion Canadensis*, have been already described: but besides these there are the following:—

Four species of *Asaphus*, one of which appears to be *A. platycephalus*.

Several fragments of a large species of *Lichas*.

One species of *Cheirorus*, and part of a head, genus not determined.

BATHYURUS ANGELINI (N. s.)

Description.—Oval, the posterior angles of the head produced into short spines; length from one to two inches.

Head convex, semicircular, or rather crescentiform, the posterior angles being produced backwards; glabella sub-cylindrical, rounded, and abruptly elevated in front, the sides nearly parallel, crossed by a narrow, rather deep neck-furrow near the posterior margin; two indistinct oblique lateral furrows. On a side view, the outline is nearly straight, or scarcely at all convex from the posterior margin to near the front, when it descends with an abrupt curve to the edge of the narrow marginal furrow which runs round the whole of the head, close to the edge.

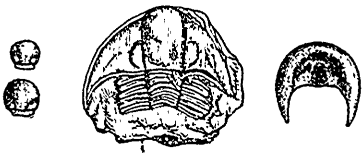


Fig. 36, 37, 38.

Fig. 36.—Two specimens of the glabella of a small trilobite from the Chazy Limestone; genus not determined.
37.—Fragment of *Bathyrus Angelini.*
38.—*Harpes antiquatus.*

The eyes as indicated by the course of the facial suture, are large, crescentiform, and a little more than one-third the whole length of the head. The anterior angles of the eyes appear to be a little in advance of a line drawn across the glabella at half its length, while the posterior angles are a little in advance of the neck-furrow.

The thorax is not well known. From several fragments of it the central lobe appears to be cylindrical, strongly convex, a little wider at the anterior than at the posterior extremity.

The pygidium is strongly convex, and closely resembles that of *B. extans.*

Allied to *B. extans* (Hall. sp.), but that species has the posterior spines of the glabella of great length, extending backwards to the pygidium.

Dedicated to M. P. Angelin, the eminent Swedish Palæontologist.

Locality and Formation.—Grenville; Chazy limestone, Grenville and Fitzroy Harbour.

Collectors.—J. Richardson, Sir W. E. Logan.

Harpes antiquatus.

Description.—Of this species we have only the head, with its horse-shoe-shaped border. The length from the front margin to a line connecting the two posterior points of the border is five lines, and to the posterior margin of the glabella nearly three lines; the width at the posterior margin of the glabella is five lines and one fourth.

The head, including all that portion of the border which lies in front of a line drawn across at the posterior margin of thé glabella is nearly a perfect semi-circle. Behind the same line the margin curves inward, so that the two posterior points are only three lines distant from each other. The glabella is small, conical, obtusely rounded in front, strongly convex, with a distinct neck-furrow crossing it close to the margin; length one line and one fourth, width at base five sixths of a line. There appears to be a small sharp tubercle situated on the neck segment, and also a small rounded lobe on each side of the glabella at the neck furrow.

The eyes are small, about one sixth of a line in diameter, each apparently situated on the top of a small eminence. A line connecting the eyes would cross the glabella at about one sixth of its length from the front. The distance between the eyes is about equal to the width of the glabella at the neck segment.

The upper surface of the border has not been seen, but judging from the lower side, its width must be about one line in a specimen of the size above described. On the underside it appears to be nearly smooth or minutely granulated, but under an ordinary pocket lens small, closely crowded, circular punctures make their appearance.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

Fragments of another species of *Harpes* have been found at Montreal, in Chazy limestone.

Entomostraca (4 species).

Leperdita Canadensis (var. *nana*,) (Jones), *Beyrichia Logani* (Jones), *Isochilina Ottawa* (Jones), and *Leperdita amygdalina* (Jones), have been described in Canadian Fossils, Decade 3.

Annelida (1 species).

SERPULITES SPLENDENS (N. s.)

Description.—This fine species is seven or eight inches in length and about one fourth of an inch in thickness at the larger extremity, usually gently curved, and gradually tapering apparently to an acute point; the surface beautifully ornamented with fine transverse striæ, of which there are ten or twelve in the length of one line. The colour of the shell is jet black and shining where the surface is preserved. The specimens are usually imperfect, and are sometimes found spirally twisted.

Mr. Hunt has ascertained that they are composed largely of phosphate of lime.

This species is much like *Serpulites longissimus* (Murchison), but not so much curved.

Locality and Formation.—Island of Montreal, and at Caughnawaga.

Collectors.—Sir W. E. Logan, E. Billings.

ARTICLE XXXV.—*Archaia; or Studies of the Cosmogony and Natural History of the Hebrew Scriptures.* By J. W. DAWSON, LL.D., F.G.S., Principal of McGill College; Author of Acadian Geology. Montreal: B. Dawson & Son· London: Sampson Low, Son & Co. With an Appendix, pp. 406.

We hail the publication of this book as the beginning of a new period in the Literary History of Canada.

The works that have hitherto been issued from our press have almost entirely pertained to historical and other questions of either local or provincial importance. Some of these have undoubtedly been of a high order of merit and have redeemed our country from the charge of literary barrenness. So far as Civil, Geographical and Natural History is concerned, we are not behind the age in which we live. We have added something to the sum of human knowledge in these departments, and our fame has reached the high places of European and American Science. In polite Literature we may not yet have contributed much that claims the attention of the civilized world, still we have done enough to show that the germs of literary life exist among us; and as this species of letters is rather the inflorescence, than the first growth of a nation's culture, we may expect that as our population increases and the influences of our Schools and Universities are more generally diffused, we shall attain to a respectable standing in the province of "Belles Lettres," The advent of "Archaia" indicates a decided step in literary progress. Here is a work not on any local question for which, irrespective of its merits, a circle of indulgent readers may be secured, but one embracing fields of investigation of universal interest and challenging the attention of both religion and science. We congratulate ourselves that a colonial author has been found capable of grasping with a firm hand questions at once profound and intricate and of treating them in their multifarious bearings with clearness and force. Whatever opinions may be entertained of the speculations which this volume contain, there will, we are persuaded, be but one opinion as to the thoroughness with which its topics have been discussed, the patient labour which has been bestowed on every section, the eloquence with which many of its truths are stated, and the wide and accurate knowledge of contemporary science which it manifests. Our author has not given crude and ill-digested speculations to the world, or claimed the attention of his fellows to that which he himself has not completely mastered or regarding which he has not something new and important to say. The reader may take up this book with confidence that he will find in it truths of vital importance to Christianity, together with the latest and highest inductions of science in its bearings on religious faith, detailed in well conceived and carefully expressed terms.

The preface informs us that "this work is not intended as a treatise on elementary Geology with Theological applications nor as an attempt to establish a scheme of reconciliation between Geology and the Bible. It is the result of a series of exegetical studies of the first chapter of Genesis in connection with the numerous incidental references to nature and creation in other parts of the Holy Scriptures." Undertaken primarily for the author's private information these studies "are now published as affording the best answer which he can give to the numerous questions on this subject addressed to him in his capacity as a teacher of Geology."

From this it will be seen that the book does not embrace all the references in Scripture to important physical phenomena. The field of view is, as we think, advantageously limited and confines attention to a particular circle of things and events which, if they can be satisfactorily interpreted and determined, will afford a key for unlocking the difficulties connected with other physical phenomena to which allusions are made in the Bible. The narrative of the creation is besides so complete in itself, so definite and precise, that it invites a special and individualized treatment. It has the advantage of being brief and yet profoundly comprehensive. Its sentences are themes which involve at once the highest objects of faith and science. It cannot but be regarded as an incidental evidence of inspiration that a subject of such vastness and sublimity should have been so fully delineated in a few bold and graphic sketches.

It augurs well for the science of the present day that in its rapid advances towards the conquest of nature, it is not content to detach itself from the revealed writings. There seems to be an underlying conviction in the minds of almost all scientific men that somehow the Book of Nature, whose characters it is their business to decipher, is the counterpart of that manifestation of the Creator which is contained in the Bible. The very general conclusion is therefore, that there can be no contradiction between the righty understood facts of the one and the statements of the other. This conviction has led men of science to give an unusual attention to biblical interpretation. We can remember scarcely a name of any note in the several departments of science, which is not also associated with speculations concerning the relations of science to the records of revelation. When further we look at the religio-scientific labours of men whose training has been purely or chiefly scientific we notice two tendencies in their views of the Divine Record. One is that which would make it mean less than has been generally supposed by the christian world, and another which would make it mean more. That this is the fact any one acquainted with the literature of science during the past twenty five years will at once admit. We know of no one eminent in science, (excepting it may be Mr. Gosse, and he is a zoologist) who has retained the old faith concerning the Cosmogony of Genesis. These opposite and contradictory tendencies among the interpreters of nature in the application of their own discoveries to the elucidation of Scripture have greatly confused and perplexed many devout and unscientific Christians. Holding, as most good men do, the facts of science in great respect, they know not what to make of the very confident statements of the scientific regarding that Record on which they place an undoubting faith. The result is that the common Christian mind looks with suspicion upon science and questions the veraciousness of its alleged facts. Whenever the statements of science are brought into collision with those of Scripture devout people hold by their Bibles, let science say what it list. Their motto is: "Let God be true but every man a liar." This is very much the state of the general christian mind at the present day regarding the scientific interpretation of the Mosaic account of the creation. It is remarkable that although attempts have been made for nearly half a century to reconcile the record in the Word with the record in the Rocks, christian men for the most part retain nevertheless very much the old convictions concerning the biblical account of creation, and none of the theories of interpretation which have yet been propounded have gained anything like a general acceptance. A few of the more enlightened may be prepared to modify old interpretations in accordance with the light of modern science, still, but few are quite clear as to the precise idea they ought, in deference to the teachings of science, to attach to the Bible record. Few ministers yet venture from the pulpit to teach any other than the old views, and we know of no commentator of any note who does more than allude to the scientific interpretations of creation. To some this state of things may appear to be a tacit acknowledgment on the part of religious men of the weakness of their position and of the potency of scientific facts—a kind of confession that the investigations of science are undermining the foundations of christian faith. Such an inference would however be a grand mistake. For at no time since the beginning of this æra have the foundations of religious belief been regarded as more secure that they are at the present day. At no time indeed since the revival of literature and science in Europe has religion more bravely welcomed into its temple of truth the clear inductions of science. Other reasons than those of weakness and fear must therefore be assigned for the general non-acceptance of scientific interpretations of Scripture.

The reason we would assign is one that has its seat deep in the christian consciousness of sincere men—it is that these scientific interpretations to a greater or less degree violate the plain common sense meaning of the language of Scripture. There are, it is allowed, certain modifications of the literal sense of words which ordinary minds can at once appreciate because they are in accordance with the forms of every day speech—figurative and secondary meanings of words, for example, within reasonable limits are at once understood and accepted, but when it is demanded, in obedience to scientific necessity, that words which appear as literal as language can make them, should be received in a figurative or tropical sense, then it is that the christian consciousness revolts, and arms itself in defence of the foundations upon which it rests its faith—it will not admit a principle of interpretation in Genesis which is not equally applicable in the Gospels or Epistles.

So long as Geology, or science of any kind, demands, as a condition of its alliance to religion, that violence should be done to the plain and obvious meaning of the words of Scripture so long will science find that the common christian consciousness of the world will be ranged against its authority.

It is to be regretted, as our author more than once mentions, that scientific studies have been so much neglected by the great mass of religious teachers and biblical expositors. Still it must be said in defence that our best divines were fully up to the science of their own day. If judged of not by modern standards, but by the standard of their time they will be found by no means despicable in their knowledge of nature. With contemporary physicians whose department was physics, they will bear a favorable comparison as to their knowledge of Natural History and general science. We allow that the science of the present day has rather gone ahead of the great bulk of christian teachers and of most of our popular commentators. Literary and theological studies have in many cases altogether excluded the study of Natural Science. In the regard of some, time is wasted that a student might spend among the objects of nature. And there are good people even now, who think disparagingly of a minister who is known to cultivate for the enlargement of his mind a scientific acquaintance with the works of the Creator.

But this state of things is fast passing away. Divines of this generation are treading closely on the heels of the professed cultivators of science. It is no uncommon thing to find the title of Revd. attached to the name of distinguished authors in many departments of science. Men are rising up as teachers of religion who can bring to their professional studies all the collateral lights of modern science.

Natural Science is after all but modern. In the realms of thought it is yet but an infant of days and has only recently been brought out of the wilderness. Or to change the figure its diffused and glimmering rays have only a few years ago been gathered into lights great and small in the firmament of truth. If the conservative religious spirit of the age has not quite been able to keep pace with its progress, this has been partly because science has somewhat broken loose from its natural espousals with religion, and partly because the sagacious spirit of christianity always climbs with a cautious step the airy heights of human knowledge. The princes of science need not therefore chide very sharply the more venerable if more tardy priests of the christian faith.

We have been led into these remarks partly in sympathy with many of the wise and truthful statements in the introductory chapters of "Archaia," and partly by the slightest possible objection we have to some sentiments which it contains bearing upon the treatment of science by the teachers of religion. Not that we decidedly object to any statements advanced by our author, but that we would wish to supplement them with kindly apologies for the cautious and it may be unscientific student of theology.

It is now time however to bring before our readers the *special* objects aimed at by this thoughtful and genial book. On this point we shall permit our author to speak for himself.

"There can be no question that the whole subject (Biblical cosmogony) is at the present moment in a more satisfactory state than ever previously; that much has been done for the solution of difficulties; that theologians admit the great service which in many cases science has rendered to the interpretation of the Bible, and that naturalists feel themselves free from undue trammèls. Above all, there is a very general disposition to admit the distinctness and independence of the fields of revelation and natural science, the possibility of their arriving at some of the same truths, though in very different ways, and the folly of expecting them fully and manifestly to agree, in the present state of our information. The literature of this kind of natural history has also become very extensive, and there are few persons who do not at least know that there are methods of reconciling the cosmogony of Moses with that obtained from the study of nature. For this very reason the time is favourable for an unprejudiced discussion of the questions involved; and for presenting on the one hand to naturalists a summary of what the Bible does actually teach respecting the early history of the earth and man, and on the other to those whose studies lie in the book which they regard as the word of God, rather than in the material universe which they regard as his work, a view of the points in which the teaching of the Bible comes into contact with natural science, at its present stage of progress. These are the ends which I propose to myself in the following pages, and which I shall endeavour to pursue in a spirit of fair and truthful investigation; paying regard on the one hand to the claims and influence of the venerable Book of God, and on the other to the rights and legitimate results of modern scientific inquiry." (page 14.)

After this we have a most valuable chapter on the "objects, character and authority" of the scriptural views of the physical phenomena of the world, in which are discussed with much fullness and force questions that lie within the domain of what in modern times is called Biblical Prolegomena. Every point is looked at with the eye of a Christian Naturalist. Topics of weighty importance are here introduced to the reader which do not generally come within the range of ordinary reading, and are presented in such relations as to interest and impress the mind. The regions of esoteric debate which though mainly interesting to scholars and belonging to a kind of third heaven of religious culture, are here opened up in many of their practical bearings upon religious faith. Attentive readers will we are persuaded rise from the perusal of this part of "Archaia" with a more profound reverence for the sacred volume, and with minds refreshed and enlarged with far-reaching and beautiful aspects of its cosmical truths. Of many passages marked for quotation we present the following as worthy of note :—

"The references to nature in the Bible, however, and especially in its poetical books, far exceed the absolute requirements of the reasons above stated ; and this leads to another and very interesting view, namely, the tendency of monotheism to the development of truthful and exalted ideas of nature. The Hebrew theology allowed no attempt at visible representations of the Creator or of his works for purposes of worship. It thus to a great extent prevented that connection of imitative art with religion which flourished in heathen antiquity, and has been introduced into certain forms of christianity. But it cultivated the higher arts of poetry and song, and taught them to draw their inspiration from nature as the only visible revelation of Deity. Hence the growth of a healthy "physico-theology," excluding all idolatry of natural phenomena, but inviting to their examination as manifestations of God, and leading to conceptions of the unity of plan in the cosmos, of which polytheism, even in its highest literary efforts, was quite incapable. In the same manner the Bible has always proved itself an active stimulant of natural science, connecting such studies, as it does, with our higher religious sentiments; while polytheism and materialism have acted as repressive influences, the one because it obscures the unity of nature, the other because, in robbing it of its presiding Divinity, it gives it a cold and repulsive, corpse-like aspect, chilling to the imagination, and incapable of attracting the general mind." (page 19.)

Again in speaking of the literary character of the scriptural cosmogony our author says:—

"The labours of the ablest biblical critics give us every reason to conclude that the received text of Genesis preserves, almost without an iota of change, the beautiful simplicity of its first chapter; and that we now have it in a more perfect state than that in which it was presented to the translators of most of the early versions. It must also be admitted that the object in view was best served by that direct reference to the creative fiat, and ignoring of all secondary causes, which are conspicuous in this narrative. This is indeed the general tone of the Bible in speaking of natural phenomena; and this mode of proceeding is in perfect harmony with its claims to divine authority. Had not this course been chosen, no other could have been adopted, in strict consistency with truth, short of a full revelation of the whole system of nature, in the details of all its laws and processes. Had this alternative been adopted, who could have read or comprehended the vast encyclopedia which would have been produced. The moral ends of a revelation would have been sacrificed, and we would have been excluded from the fresh and exciting exploration of actual nature." (page 29.)

On the difficult subject of the inspiration of Scripture, this book gives no uncertain sound. While insisting that science should enter upon its investigations with an untrammelled and fearless freedom, it at the same time bows with submission to the revealed word of God. It shows clearly "that there is no hypothesis short of that of plenary inspiration that will allow us to attach any value whatever to the biblical records," and that they could not have been the result of ancient scientific enquiries or intuitive knowledge. While the primitive civilization was by no means despicable it yet can not be said to have attained to such a knowledge of the laws and phenomena of the universe as could constitute a basis for the cosmogony of Scripture. Our author justly remarks that the narrative of creation "bears no internal evidence of having been the result of inductive enquiry, but appeals at once to faith" ......" it refers to conditions of our planet respecting which science has even now attained to no conclusions supported by evidence, and is not in a position to make dogmatic assertions." In regard to the mythical hypothesis, the great dream of German infidelity, he combats the views of Prof. Powell of England, and points out the fallacy of many of that able writer's positions. The mythic theory is however one that science is least competent to deal with. History and Philology are the true weapons with which to confront it. By these the Germans themselves have achieved a signal victory.

An important point now comes up for consideration in relation to the authority of the record, namely: in what sense the allusions to nature contained in it are entitled to be regarded as having the authority of inspiration? Do they merely represent the knowledge of nature existing at the time, or are they the result of a "divine afflatus?" Our author is disposed to take a higher view than the first, and as a naturalist, to form a much higher estimate of the references to nature embodied in the Scriptures. This we regard as a most satisfactory statement. It does not go the length of saying that the representations of nature in the Bible are *revelations,* but only that they have been recorded under the guidance of *inspiration.* This we conceive is the true position to take. We do not find the Creator revealing that which can be discovered by the faculties he has given us. In all His relations with men, he honors, much more than philosophers do, the wonderful organs of perception with which he has endowed the human race. The Creator has faith in human eyes and ears. He knows that they are "*very good.*" In regard to those things, therefore, which lie within their reach, he gives no *revelation,* but when such things stand related to the spiritual truths which pertain to the moral government of mankind, then he so guides the prophets that no human weakness or prejudice shall mar the perfect action of their perceptive organs. Besides this, we never find the Creator choosing fools for his prophets. Making every allowance for the exaltation of mind which inspiration must produce, we yet find in all the messengers of God evidence of high mental capacity and of a special mental training for the services to which they had been summoned.

Taking this view of the question we may expect to find in the Bible allusions to natural phenomena, which in their truthfulness rival the demonstrations of natural science.

But we must now, preparatory to some criticism, of our author's views on the meaning of the terms in the first chapter of Genesis, make a preliminary statement which we deem of the utmost consequence in the discussion of the topics contemplated, namely, *that the language of Scripture in all its allusions to and descriptions of nature is always and entirely the language of appearances—in its body and substance it is the result of actual experience—of "optical impressions of nature."* This statement has been frequently made by others, and is incidentally noted by our author, but it has not, as we think, been sufficiently insisted on, or faithfully applied, as a canon of sacred criticism. It is the canon which, to the universal satisfaction of the christian world, has reconciled the statements of Scripture with the Copernican theory and the final inductions of Astronomy. After mature reflection we are persuaded that it is the only canon by the sober application of which the statements of Scripture can be interpreted in perfect harmony with the facts and final determinations of geology. When the inspired writers speak of the heavens, the stars, the planets, the clouds; of storms, earthquakes and volcanoes; of mountains, valleys, seas and rivers; they, to our thinking, speak of them precisely as they appeared—their words are descriptive of what they saw; they give true evidence of the facts which nature presented to their eyes; they propound no theories as to the secondary causes of things, but when they advert to causes at all they at once "rise from nature up to nature's God." The Creator did not reveal to them mediate or secondary causes, and he preserved them from speculating like philosophers about them. If they had speculated the consequence would have been that, destitute as they were of both revealed and scientific knowledge of such things, they would have rendered the Bible no more trustworthy than the Shastres or the Koran.

Nor is there anything untrue or unscientific in the descriptions of nature as it really appears to our eyes, or is apprehended by our senses. That which we see of nature, however far short it may come of all that may be known concerning its interior properties, is yet an element of importance, and not unfrequently the synthesis to which scientific analysis directly leads. The language which describes things as they appear will always be true in fact, whatever may be the laws upon which such appearances depend. Back of these appearances there may, it is true, be whole regions of unimagined wonders which the unaided eye cannot see nor the ear hear, and which but for the steady and resistless march of scientific investigation would be all unknown to man. But the discovery of the unseen does not invalidate the truthfulness of that which is seen. This is still the visible outworks and magnificent portals of the kingdom of nature. Seeing therefore that it was not the purpose of the Creator to give revealed anticipations of nature, but to leave nature as a field for the exercise of human intelligence, we can conceive of no better form in which allusions could be made to nature in the Bible than that of a strict adherence to the language of appearances.

In the application of this principle to biblical interpretation we would, in terms slightly different from those of chapter third of "Archaia," in which the general views of nature contained in the Scriptures are noted, say:—1st. That Scripture represents nature as subject to invariable law, because such is the aspect in which it appears to the accurate observer;—2nd. That it represents nature as in constant progress and development, because such are the aspects in which it appears to ordinary perception;—3rd. That the Bible notes purpose, use, and special adaptations in nature, because such are apparent to sight and sense;—4th. That the law of type or pattern is just so far indicated in the Sacred Record, as it appears in the objects of nature themselves. All these are truths, from which science may start on its glorious mission of discovery into the veiled realms of creation.

Before proceeding to an examination of the exegetical part of "Archaia," we have yet to premise that in the objections we may take to its conclusion, we are not influenced by what its author quaintly styles a "pedantic hyperorthodoxy." Orthodox we profess to be in the highest and best sense of that term, but our orthodoxy has not yet led us to fear or tremble for the safety of our Ark. As regards the cosmical statements of Genesis we have always held ourselves free to accept of any light which might aid our understanding of them come from what quarter it may. We began our thinking on the subject with the rejection of the Cuvierian hypothesis of day-periods and a determination to keep by the old paths till more light dawned to guide us. We afterwards accepted the *first-verse* theory of the venerable Chalmers, fairly captivated under the influence of his commanding genius. Next, the powerful arm of Hugh Miller in his first Exeter Hall lecture came down upon us with such force as to shatter to pieces our former ideas, and constrain us to become his devoted disciple. At this we stood for many a day. But every time in the course of private reading that we came to the text in Genesis, we felt an uncomfortable consciousness of the insecurity of our position. We have since tried the theories of Pye Smith, Hitchcock and others, with an occasional attempt at an adjustment of our own. But the last expositions of Miller, together with a study of the profound views of Kurtz, has driven us to begin a new, inch by inch, investigation of the subject the results of which are conclusions somewhat different from those so ably stated by our author.

Instead of looking at the text in view of geological inductions and facts, or looking at geology with an eye on the sacred text, we have looked upon each by itself and interrogated each as to its contents.' The one we have subjected to scrutiny on the principles of grammar and philology, the other on the principles of scientific induction. It appears to us that much rubbish has been accumulated upon the text from the region of the rocks; and much folly charged upon the rocks at the presumed instigation of the text. To avoid confusion we have examined each by itself as we would examine a witness in a criminal court, and having got as clearly as possible the testimonies of each we have considered their relative values, and whether they may not be capable of such an adjustment as to constitute them one whole and harmonious display of creative goodness, wisdom and power.

It is impossible for us to go over in detail within the compass of this review, the steps of this somewhat elaborate process. All that we can do is to indicate briefly the results at which we have arrived, and the points in regard to which we differ from the conclusions of our author.

Applying then our grammatical apparatus to the leading and important words of the text, we conclude:—1. That "the *Heaven*" (*hashamayim*) means the expanse (*rakiah*) bounded by the earth and the blue empyrean upon which the eye seems to rest its upward gaze. The idea of confining the created heaven to the atmosphere of science, or limiting its upward boundary by the clouds is we judge neither scientific nor grammatical. Science does not yet know the limits of the atmosphere, and its latest conjecture is that it is illimitable as space itself,—that the same atmosphere which circumambiates our globe enfolds with varying densities the whole planetary system in its ample bosom. Further, the clouds gave no definite limits to the atmosphere, their altitudes must vary many thousands of feet. And what shall we make of the firmament when the waters which it contains are so comminuted that no clouds at all intervene between the earth and the deep blue sky? The mistake of regarding the clouds as the upward shore of the firmament arises from interpreting the word "*waters*" in the sixth verse as meaning *clouds*. Now upon no grammatical principle of interpretation can this be admitted. It does not appear from the narrative that the prophet saw any clouds at all after the evaporation of the waters which covered the surface of the yet unformed world. Not during the whole six days did any rain appear. A mist from the earth watered the whole face of the ground. What the prophet saw, and what he evidently describes in the creation of the expanse, is the vapour which hung over the waters rising up and dispersing itself into seemingly the clear sky. The statement of our author that in verse twenty the words "firmament of heaven" are two names of two things, the one the earth's atmosphere, the other the higher expanse in which the stars shine, is, we think not tenable, because:—1st. God called the firmament "*heaven*"; firmament and heaven in the verses following these words ought, therefore, to be regarded as strictly synonymous; 2nd. *Rekiah hashamayim* (firmament of heaven) are in what is termed the *status constructus*, or in the relation of one substantive governing another in the genitive. A similar expression would be the "height of the house," or the "length of the cord." In the first of the sentences "height" and "house" are not two separate things, but the one is limited by the other, and both are together one and the same thing. There is therefore no ground as we conceive to interpret the word "heaven" in any other sense than that of the optical expanse between the earth and the blue sky which is in fact the fountain of the waters that are above the earth. And for reasons which we shall note in relation to the word "earth," we hold that "the heavens" of the first verse means the same thing as "the heavens" of the eighth.

2. Earth (*aretz*). As regards this word we perfectly agree with the statement of "Archaia" in page 46, namely; "That in the tenth verse of Genesis there occurs a definition, as precise as that of any lexicon—"and God called the *dry land* earth." From these words our author thinks it a fair consequence "to assume that the earth, *afterwards* spoken of, is the dry land." If the word "afterwards" is here designed to cover the use of the term *everywhere*, and chronologically, after the time at which it was given to the dry land we would then consider the above application of the definition a perfectly correct one. But if "*afterwards*" is intended to limit the use of the term *earth* in the sense defined to the places in which it *subsequently* occurs in the text, thus leaving the word open to receive another meaning in those places in which it is *previously* used, we cannot then agree to the restriction. This last use is evidently the intention of our author, for, in page 6, he puts another meaning upon the word *earth* than the definition of verse tenth. He there makes the earth of the first verse to include

the "deep or the material from which the sea and atmosphere were afterwards formed." This, we think, an error into which our author has been led by the view he takes of the relation of the first verse to the whole narrative. That verse he considers as delineating the first step in the great work of creation. In page 61, he says: "The history opens at once with the assertion of a great fundamental truth,—the production from non-existence of the material universe by the eternal self-existent God." Now we are constrained to say with feelings of profoundest reverence for the text itself, that fascinating as the above doctrine may be, and nobly eloquent as the expressions are which our author, in page 339, has founded upon it, we yet cannot see that it directly expresses the doctrine of creation from non-existence which the above quotation alleges. In our view the *first* verse, but states in general terms that which the subsequent narrative gives in detail—that, in short, it is a brief prologue or proem. The conjunction "and" of the second verse does not present any grammatical hindrance to this idea, for there the *vav* (and) is, as Gesenius remarks "continuative of discourse." It indicates a consecution of sentences more than a relation of words. This consecutive use of *vav* is very remarkable in the whole of the narrative; it stands at the beginning of every verse but the first and in the twenty-sixth verse has been rendered "so" by our translators. There is therefore no grammatical reason why we may not regard the first verse as the proem of the sublime record of creation.

If further we look upon the first verse as an answer to the question: Whence came this earth and that heaven? What form of speech could be a more natural reply than that, "In the beginning, God made the heaven and the earth,"

Viewing the first verse in this relation, it cannot be alleged that the words "heaven and earth" are there used in a sense, different from that in which they are defined in the eight and tenth verses. The meaning of the verse would then be that God, in the beginning made this dry land and that expansion which were at first in a void and formless state. In this view the words succeeding the prologue will be the first step of the narrative in which the prophet describes the first aspect of those elements which by the power of the Divine Word, afterwards became "heavens and earth." If we, for example, were describing the process which, as geology informs us, stratified rock is formed, we would say that the rock was in the beginning, "without form and void." But no one could infer from this statement that we gave the name "rock" to the yet unformed condition of its elements. So neither can we see why the words "heaven and earth" should be regarded as appellations of the unformed and chaotic condition of their elements.

3. Create. (*bara*). From the view taken of the words "heaven and earth" it will follow that the word "*bara*" is not used here to express the idea of absolute creation. There is nothing in the text requiring that it should be so understood. Nor does the use of the word in other places lead us to infer that it ever was so understood by the Hebrew writers. "*Bara*" and "*asah*" are constantly used in this narrative and in other places as convertible terms. Of this we have manifest instances in verses 21, 25, 26 and 27. In the first of these "*bara*" is used in reference to the creation of great whales, &c.; in the second "*asah*" is applied to the creation of the beasts of the earth; in the third "*asah*" is taken to describe the last and highest act of creation, when God said "Let us *make* man"; and in the fourth "*bara*" is used to designate the same creative act. No claim can therefore be established for "*bara*" as a word of wider signification than "*asah*," Both are constantly used to designate the act of making, forming or creating. We know of no biblical critic of modern times who, on grammatical grounds, will say that "*bara*" means the act of absolute creation out of nothing. All that the *usus loquendi* will authorise is that "*bara*" is most frequently used to express the highest exercise of divine power—that it is somewhat more intensive than its synonym "*asah*," and that it is seldom used in reference to the acts or works of man. Whatever *deductions* may be drawn from the statement of the first verse, as to the creation of the heavens and earth out of nothing, it is to us obvious that the literal grammatical rendering of the words will not yield such a sense. Nothing therefore hinders that this first verse should be the prologue or proem of the biblical account of the creation.

4. Day. (*vom*). This is the word upon which the scheme of our author mainly rests. The idea that it means a long period was first started by Cuvier, and has since been adopted by Jameson, Miller and others. In chapter seventh of this book the subject is elaborately and ingeniously argued, and it would require more space than we can command to reply to all the statements

which it contains. Much of the reasoning is based on the supposition that the chief words of the narrative are used in different senses in different places. We have shown that in regard to three of the most prominent that such is by no means the case, nor can we think that this word "*yom*" is used in any other than one and the same signification throughout. In verse *fourth* it is stated that not till the light was definitely divided from the darkness did God on the fifth day call the "light day" and the "darkness night." Now just let us take our authors admirable explanations of the separation of the light from the darkness, and consider the conclusion to which it leads us. In page 89, he says: "To explain the division of the light from the darkness we need only suppose that the luminous matter in the progress of its concentration was, at length, all gathered within the earth's orbit, and then, as one hemisphere only will be illuminated at a time, the separation of light from darkness or of day from night would be established. This hypothesis suggested by the words themselves affords a simple and natural explanation of a statement otherwise obscure." If to this we add the diurnal revolution of the earth upon its own axis which on the hypothesis of Laplace, or any other, must have been established at this early time, we have then in the concentration of luminous matter within the earth's orbit, together with the earth's own revolution, all the elements to establish a *natural* day even before the creation of the Sun; and under such conditions the *first* day could not have been materially different from that of the *fourth.*

Besides this, the character of the light which was called "*day*" is precisely defined when it is said to have been an "*evening*" and a "*morning.*" Before the light was divided from the darkness, or was called day, this definition of its periodical duration is not given, but after this event the period of light is marked out by the distinct boundaries of "*evening* and *morning.*" This evening and morning defines therefore diurnal light with minute precision, and is that which the Creator calls "day" and of which it is said "Are there not twelve hours in the day?"

We have ever regarded the attempt to make "evening and morning" in the text mean the civil day of 24 hours as altogether futile. The position of the word *evening* before that of *morning* is not wonderful if we consider the language to be descriptive of the impression which the close of such a sublime vision would make upon the mind of the prophet. Let, for example, a splendid panorama pass before the eyes of a wondering multitude, and it will be found that the closing scene will be that which was most vividly impressed upon their minds.

The last scene of the several creative acts, recorded in Genesis, is therefore not unnaturally that which is recorded first : "The evening was and the morning was ONE day." We cannot agree therefore with our author that the word "day" (*yom*) "occurs in two senses (in the narrative) and that while it was to be the popular and proper term for the natural day, this sense must be distinguished from its other meaning as a day of creation." Nor can we regard the affixing of the name "*day*" to the light "as a plain and authoritive declaration *that the day of creation is not the day of popular speech.*" (p. 100.)

If we were so to regard the day (*yom*) of the text, then we would be driven to regard the "day of creation" as a long, even an illimitable period, of light; for nothing can be more clear than that only light bounded by evening and morning is *day.* On the other hand we would also be compelled to suppose that this *long long* day-light was followed by an equally long night-darkness. and that there was a succession of such days and nights during the whole six periods of creation.

What, in such a case, would become of the diurnal motion of the earth and even of the powers and purposes of the Sun himself? Unless to a geologist and an allegorical interpreter, we believe the *idea* that the word "*yom*" of the text, designates a period comprising, it may be, myriads of years, would never have been conceived. That the learned Origen, in the year 220 A.D., entertained some such an idea, was the result of his oriental culture, under the influence of which he attempted to make the creation, fall and deluge, a grand allegory which, if he had succeeded in doing, would have swept away the foundations of the Christian faith. As we reject his allegory of the fall so we reject his allegory of the days.

Nor do we consider any support to the day-period theory to be derived from the confessions of St. Augustine, a learned, but by no means critical writer of the 5th century, in which he speaks charmingly of the dispensation of grace being the Sabbath-day of the Lord, and the work of his rest as that of human redemption. That these are fine thoughts every christian will allow. So pleasing have they been that they have floated in christian literature from a very early date down to the present time. They originated doubtless from the fact that God is represented as ending his material creation on our planet on the sixth day, the inference is that God still rests. Notwithstanding the weight of Hugh Millar's arguments on this point, and the decided terms in which he insists that our Sabbath is a day proportional to the Sabbath of the Lord, we yet see no scriptural warrant for such an idea. More likely to our mind is that to have been the Sabbath of the Lord, when in the garden of Eden he walked with the perfect and unfallen man, and rested with holy complacency in the glory of his finished work. Here we have that which perfectly accords with the idea of Divine rest, and which constitutes sinless Paradise the most expressive emblem of that eternal rest prepared for the children of God.

The period of human redemption in which there is, as its most prominent feature, the sufferings and death of the Saviour is to our thinking a time in which there is more of Divine *working*, more signal displays of divine power, than in all the works of material creation. It was concerning this redemption period that Christ said: "My Father worketh hitherto and I work." These considerations do not well comport with the idea that the dispensation of grace is the Sabbath period of the Lord. A careful consideration of the text conveys to us the idea that the Sabbath on which God is *represented* as resting from all his works is the literal diurnal seventh day following in regular succession that which by way of emphasis is marked with the cardinal "ONE" and in which the perfect holiness of the world was undisturbed by sin.

That the words "in the day" (*beyom*) are used in chapter ii. 4, in a sense different from that in which day (*yom*) is used in the first chapter does not in the least affect our conclusion. The sentence in which "in the day" (*beyom*) is found is obviously a parallel to the first clause of the same verse which says. "These are the generations of the heavens and the earth *when* they were created." It thus appears that, "when" and "in the day" are used to mean one and the same thing; the one in fact according to the well ascertained principles of Hebrew grammar exactly explains the meaning of the other. In the chrestomathy of the scholarly and accurate Nordheimer the words "in the day" (*beyom*) are rendered by the phrase "during the time."

That such an adverbial form of "*yom*" in composition with the preposition "*beth*" was in use at this early time, the text itself is evidence sufficient. At the time the narrative was written the Hebrew language had already attained its classic fullness and precision. That the particular and the general, the concrete and the abstract use of words have been well understood from the earliest times is exemplified in all the most ancient writings. The Hebrew, Greek, and Latin tongues abound with instances in point and in our own speech these forms are as familiar as day. Such a use is founded upon the principles of thought which are antecedent to the forms of speech. In the mind's synthetic moods it rises from particulars to generals and in its corresponding analytic it descends from the general to the particular.

But even if contrary to all good criticism "*beyom*" (in-the-day) were to be understood as a substantive and not as an adverbial form of speech, and as describing a period of time, this would not invalidate our interpretation of the *yom*" (day) of the first chapter. "*Beyom*" (in-the-day) would then only stand in relation to "*yom*" (day) as a genus to a species, and its own meaning would come to be determined by the idea attached to the species which it includes, if, therefore, "day" (*yom*) was truly a long period then "in-the-day" (*beyom*) would be a period inclusive of all the day-periods, but if "day" was truly a diurnal and natural day then "in-the-day" would simply represent the time of six such days. No argument for the day-period hypothesis can therefore as we conceive be founded on the word "*beyom*" in Genesis ii. 4.

We have thus in as limited a space as possible gone over the leading words in the narrative of creation; and without attempting to answer objections or adduce all the arguments and illustrations which we might we have endeavoured to defend on grammatical and philological principles the literal rendering of the words in Genesis first, as also the one-sense in which they are used throughout. The conclusion to which we have come is that the language of the first chapter cannot be used in any other than the literal sense without altogether upsetting the well established principles upon which language is to be interpreted.

According to our plan we would now consider what the facts and acknowledged inductions of geological science teach us regarding the *formation* of the world.

Geology informs us that on a rough estimate the average thickness of the earth's crust is about fifteen miles. In this is included a considerable thickness of what for want of a better name may be called primitive rocks, regarding the formation of which geology can tell us little or nothing. Whence they came or how formed is a problem yet to be solved. They contain no distinct remains of organic life. Their occasional veins of graphite or bands of crystaline limestone afford but doubtful evidence of their having once been stratified or that they were the habitat of animal and vegetable life. To the strata superimposed upon these primitive rocks geology points us for its evidence of the way in which the earth's crust has been formed and as indices of the time that has elapsed during its formation. These stratified rocks have been divided into three great periods,—the Palœozoic or most ancient, the Mezozoic or middle and the Cainozoic or latest. These divisions are again subdivided into numerous minor strata each determined and in some sense seperated from the others by its peculiar organic remains. These strata are shown to be either the result of vegetation, as in the coal measures, or of animal life, as in the Silurian and other rocks, or of aqueous deposition. These three forces if we may so speak have been the agencies by which the earth's crust has been mainly formed. Now to any one who can form an idea of the succession of organic life, the remains of which these strata contain, and of the slow action of aqueous depositions it must be obvious that the crust of the earth is of immense antiquity—that from the period of the earliest Silurian seas up to the recent stratum upon which man dwells, there is the unquestionable lapse of countless ages. This is one of the certain inductions of geology concerning which there can scarcely be any dispute.

It is a further fact than in these strata we find evidences of a constant succession of animal and vegetable life.

First, there is a long period, the Silurian, in which the lower forms of marine animal life vastly predominate and in which but few traces of vegetable life are found and these exclusively marine or Algoid ?

A second step leads us into a region in which there is added to the invertebrate life of the first a large and magnificent group of Ganoid vertebrate fishes with some forms of the higher land plants recently discovered by Principal Dawson.

By a third step upwards we reach the great carboniferous or coal measures, in which we find a thickness of about 10,000 feet of fluvio-marine strata and for the first time a predominance of land plants, comprising the two lower members of the vegetable kingdom—the cryptogamic and gymospermic plants. Here also we are introduced to the oldest known reptiles, the discovery of which is in a great measure due to Principal Dawson.

A fourth step brings us among the great Batrachian reptiles and if in this step we include the whole secondary or Mezozöic period we have multitudes of great Saurians:

"Hydras and Gorgons and Chimeras dire."

With these we find allied in the vegetable kingdom, Conifers, Cycads and Ferns. Here too we first discover the lowest forms of Mammals in the Stonesfield and Purbeck marsupials.

A fifth step brings us to the highest developed forms of both plants and animals,—to genera and species in all the departments of organic life nearly allied to those existing at present.

A last and final step brings us to the remains of our present fauna and flora with those of recently extinct species, superimposed upon which we find human remains and works of act.

These six steps indicate a gradual progression in creation from lower to higher forms of organic life. In the vegetable kingdom we rise from the lowest Thallogens up to the highest forms of Exogens and in the Animal from the Protozoa up to the highest Mammal—MAN.

These steps also indicate certain epochs of life,—certain periods in which peculiar forms of life were predominant. 1. A Silurian period of Marine Molluscus and Radiate life. 2. A Devonian period of Vertebrate fish life. 3. A carboniferous period of vegetable Cryptogamic life. 4. A Mezozoic period of great Batrachian serpent life. 5. A tertiary period of monster Mammal life, to which there is closely allied, the genera and species of the present day.

These steps further indicate with a fullness and certainty of illustration that there has been a gradual disappearance of old species and a continuous creation of new up to the age of man. Along with well marked epochs of creation of special forms of life there has been a much more marked continuity of creation in all the forms of organic life. If we could suppose the period of special creation to be represented by horizontal lines placed at wide intervals then the facts of continuous creation might be represented by vertical lines crossing the others continuously up to the introduction of man. It was at first supposed by geologists, as may be seen in the writing of Hugh Millar, that there were great breaks or chasms in the upward lines of organic creation; that at several of its stages certain chaotic periods intervened and cut off forms of life above from forms of life below; but the more recent discoveries have shown this view to be quite untenable. Gaps have been filled up and those that remain are in process of yielding up their links of organic forms.

It is true that in this upward series of creation we do not find all the lines of life to begin at the same time. The lines of lower life are first. In the vegetable kingdom the order is: Thallogens Acrogens, Gymnogens, Exogens. But these lines when once severally begun are carried up to the close by the creation of new species in each, the whole bursting forth in our present magnificent flora. Again, in the Animal Kingdom the order of the lines is: Molluscus, Radiata, Articulata, Vertebrata. In each of these sub-kingdoms the generic and specific lines of creation increase in number as they ascend and in the human period emerge in a magnificent procession of animal life the leader and lord of which is MAN.

Although our author does not give much prominence to this phase of continuous creation observed in the geological record, he yet affords ample evidence of its truth. For this we would refer the reader to pages 116, 335 to 337 and to Appendix F, page 370. Reference may also be made to the 14th chapter of "Agassiz and Gould's Principles of Zoology."

From this sketch of geological facts we think that the periods of life revealed by the rocks do not correspond with our author's scientific interpretation of the day-periods of Genesis. Upon no scientific principle can it be said that we have in geology *first* the creation of plants and then in two stages or periods the creation of animals. To make geology agree with the day-period hypothesis it would require to be shown that all the plants were created at one period, all the fishes, birds, batrachians and serpents at another; all the mammals at a third, and all too in regular succession. Now we maintain that geological science can, upon no scientific arrangement of its materials, be made to yield such results. No advantage is therefore gained by interpreting the "day" of Genesis in the non-natural sense of a long period; for even then the long periods of the record will not agree with the long periods of the rocks.

In these circumstances we must therefore come to one of two conclusions:

1st, That geology has not yet reached that stage at which its inductions or results can be regarded as sufficiently determined or final as to permit their adjustment with the statements of the sacred record. This is the position which unscientific theologians and critics are very apt to assume. They consequently say to the geologists "agree as to the final inductions of your science, tell us when you have reached the limits of your discoveries, then, come to us and we will compare your work with the Scripture text." With thus view we have little sympathy. It can only be regarded as a decent refuge for scientific ignorance. The theologian and the critic are bound for themselves to discover what the works as well as the words of God say, and to teach the truth of both combined. They are the persons to whom the world will look for an adjustment of the two records, and the sooner they set about it the better, not in the way of guessing but in that of logical and scientific determination. Geology is we believe in a sufficiently advanced state to afford at least an approximate settlement of the vext question.

2. A second conclusion is, that there is a method of adjustment which does violence neither to the grammatical meaning and structure of the sacred text, nor to the well ascertained results of geological science. This method is to be found in the *form* of the record itself. If instead of regarding it as a verbal revelation, we regarded it in the light of a series of day-visions by which God revealed to his prophet the great leading facts in the past history of the world, many difficulties otherwise insurmountable will then disappear. The text may then be accepted in its most literal sense, and every description of natural phenomena be taken as the language of appearances. The Creator will then, as in other parts of Scripture, be said to do that which without reference either to time or to second causes he appears to do. In this view the text does not require us to believe that God literally created and made all things in six natural days, but only that in a series of natural day visions, there was exhibited, as well as could be to human eyes, the vast and wonderful processes and progress of creation.

Accepting the facts of geology as presenting to us both special epochs and continuous acts of creation, or, according to our illustration, interrupted horizontal, and continuous vertical lines of creation up to the human period, the question is how could this vast panorama and evolution of things be, for moral purposes, presented to unscientific human eyes? We can conceive of no better form than that which we find in the text. It contains a sufficient agreement with the facts to show that only He who knew the one could pourtray the other. The text wonderfully comprises in its divine generalizations all the facts yet discovered in the rocks, and in its typical forms represents the great leading epochs of organic life, of which we have a history in the rocks.

It represents too that order of progression from lower to higher conditions of the world, and of its tribes of organic life. These things lay quite beyond the reach of early human knowledge and the precision with which they are stated indicates that the narrative is vastly more than guesses at truth or anticipations of natural science.

The view which we have thus taken of scriptural cosmogony is that to which the learned writings of Kurtz has led the way—it is that, too, which in some of its features has been so grandly stated by Hugh Miller in his "Testimony of the Rocks." In some of its details it agrees with the views of Sime in his little work entitled "The Mosaic Record in harmony with the Geological." Whatever aid has been derived from these and other works, we have yet in our criticism followed an independent line of investigation, and presented views both of the text and of geology, which to us are somewhat new.

Space will not permit us further to enlarge on the other topics of deep interest to be found in "Archaia." We can only say that the second part of the book which treats of the unity of the human race and ably discusses the difficult questions which it involves, is worthy of attentive perusal. In this department our author is rather in advance of the naturalists of the present period. His treatment of the whole subject exhibits a ripeness of thought, clearness and acuteness of perception together with a sobriety of judgment, not often to be found in writers upon the discursive topics of ethnology. To those who wish to become acquainted with the present condition of ethnological science, we can recommend nothing better than the chapters which pertain to it in Dr. Dawson's book.

We cannot but commend the publishers for the enterprise and spirit which they manifest in the publication of this volume. It is well got up, and if not quite so good as can be produced in Engand, it is yet equal to anything of the kind on this continent. It can be read with comfort, and altogether it is a handsome book. We trust that the reading public will show their appreciation of this native production—it is all Canadian—by the speedy purchase of the entire edition.

A. F. K.

MISCELLANEOUS.

A Systematic List of Coleoptera found iu the Vicinity of Montreal. By W. S. M. D'URBAIN.

(*Continued from page* 320.)

III. *Lamiæ*, Lec.

(See Journ. Acad. Nat. Sci. Phila., Vol. II., second series, p. 139.)

1. Fam. *Lamiidæ*, Newm.

1. Monohammus, *Serv.* (Monochamus, *Kirby.*)
   M. scutellatus, *Say.* (resutor, *Kirby.*) Abundant everywhere, June to August.
   M. confusor, *Kirby.* Abundant about woodyards, July and August.
2. Saperda, *Fabr.*
   S. calcarata, *Hald.* Rare.
   S. vestita, *Say.* Not very common.
   S. mœsta, *Lec.* Very rare. Taken by sweeping grass on the Mountain, June.
   S. tridentata, *Oliv.* Not common, June to August.
3. Leptostylus, *Lec.*
   L. aculiferus, *Say.* One specimen taken under a stone on the Mountain, April 19th, 1858.
4. Graphisurus, *Kirby.*
   G. fasciatus, *Geer.* Not common, Montreal and Sorel.

PHYTOPHAGA.

1. Fam. *Crioceridæ*, Leach.

1. Donacia, *Fabr.* (See Proc. Acad. Nat. Sci. Phila., Vol. V p. 310.
   D. lucida, *Lac.* On aquatic plants, July.
2. Lema, *Fabr.*
   L. trilineata, *Oliv.* Very abundant on potatoe-vines, August.

2. Fam. *Cassididæ*, Westw.

1. Cassida, *Herbst.*
   C. unipunctata, *Say.* Abundant.
2. Chelymorpha, *Chevr.*
   C. cribaria, *Fabr.* Abundant on leaves of the Minor Convolvulus in gardens Montreal and Sorel.
3. Hispa, *Linn.*
   H. quadrata, *Fabr.* Rare, on thorn-blossoms, June.

3. Fam. *Galerucidæ*, Steph.

1. Galeruca, *Geoff.*
   G. baccharides? *Fabr.* Very numerous on flowers of *Solidago* and of umbelliferous plants, July and August.
   G. Americana? *Fabr.* Swept from herbage on the Mountain, June 1857.

2. Cerotoma, *Chevr.*
   C. caminea, *Fabr.* By sweeping herbage on the Mountain, June 1857.
3. Diabrotica. *Chevr.*
   D. vittata, *Fabr.* Very abundant on melon and cucumber vines, June to October.
4. Haltica, *Illig.*
   H. alni, *Harris MSS.* In vast numbers on alder-bushes on the common at Laprairie, September.
   H. splendida, *Dej. Cat.* Very abundant on grape-vines, June.
   H. collaris, *Fabr.* Rare.
   H. frontalis, *Fabr.* Abundant in heads of Thistles, July and August.
   H. pubescens, *Erichs.* Very abundant by sweeping grass, June.
   H. striolata, *Illig.* Very abundant, May and Jnne.
5. Psylliodes, *Latr.*
   P. punctulata, *Mels.* By sweeping grass, Logan's farm, June.
6. Dibolia, *Satr.*
   D. ærea, *Mels.* By sweeping herbage on the Mountain, June.

4. Fam. *Chrysomelidæ*, Leach.

1. Heteraspis, *Dej.*
   H. curtipennis? *Mels,* Swept from herbage on the Mountain, June.
2. Bromius, *Cherv.*
   B. vitis, *Fabr.* May.
3. Doryphora, *Fabr.* (See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 30.)
   D. trimaculata, *Fabr.* Abundant on the milkweed (*Asclepias cornuti*), June and July.
4. Chrysomela, *Linn.* (See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 32.)
   C. scalaris, *Lec.* Abundant.
   C. Philadelpeica, *Linn.* Abundant on Willows, June and July.
   C. Bigsbyana, *Kirby.* Not so numerous as the last species.
   C. (*Helodes*) trivittata, *Say.* Very abundant by sweeping grass, June.
   C. (*Phædon*) polygoni, *Linn.* (cæruleipennis, *Say.*) Very abundant on *Polygonum ariculare* (knot-grass) in waste places.
5. Chryrochus, *Cherv.*
   C. auratus, *Fabr.* Abundant on dogsbane (*Apocynum androsemifolium*), July.
6. Chalcophana.
   C. picipes. On elm-leaves; not very common. (Abundant at Sorel.)

PSEUDOTRIMERA.

1. Fam. *Endomychidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 357.)

1. Endomychidæ, *Leach.*

E. biguttatus, *Say*. Abundant under bark of stumps on the Mountain and Mile-end road.

2. Fam. *Coccinellidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 129.)

1. Brachyacantha, *Mulsant*.
   B. ursina, *Fabr*. Abundant on milkweed (*Asclepias cornuti*), July.
   B. 10-pustulata, *Mels* Rare, on flowers of umbelliferous plants on the Mountain, July.
2. Chilocorus, *Leach*.
   C. bivulnerus, *Mels*. Common on the bark of the white birch, Laprairie, in October.
3. Psyllobora, *Mulsant*.
   P. 20-maculata, *Say*. Abundant by sweeping herbage on the Mountain, June.
4. Hippodamia, *Mulsant*.
   H. 13-punctata, *Linn*. Common, June and July, Montreal and Sorel.
   H. quinque-signata, *Kirby*. Abundant on potatoe-vines, St. Hilaires end of August.
5. Coccinella, *Linn*.
   C. ophthalmica, *Mals*. Rare, June.
   C. bipunctata, *Linn*. Very abundant everywhere.
   C. novemnotata, *Herbst*. Abundant.

NOTE.—The Journal and the Proceedings of the Academy of Natural Sciences of Philadelphia contain numerous elaborate monographs by Dr. Leconte on various families and genera of North American Coleoptera, and, for the convenience of those wishing to name their collections, I have supplied references to them.

The following species which I have taken at Sorel, I have not yet met with near Montreal:

Platynus lutulentus, *Lec*. Under dry cow-dung, May.
" picipennis, *Kirby*. " " "
Anisodactylus rusticus, *Say*. " " " very abundant.
Agathidium exiguum, *Mels*. Under bark of dead pine-stumps.
Platysoma paralellum, *Say*. " " "
Ancylocheira fasciata, *Fabr*. Common, July.
Elater phænicopterus, *Germ*. Var. Under bark of dead pine stumps.
Lytta Fabricii, *Lec*. (cinerea, *Fabr*.) In great numbers on potatoe-vines.
Hypophlæus nitidus, *Mels*. Under bark of a dead pine-stump.

Montreal, June 2nd, 1859.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF OCTOBER, 1859.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer, corrected and reduced to 32° F. (English inches.)			Temperature of the Air. F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.			6 a. m.	2 p. m.	10 p. m.
1	29.894	29.758	29.786	50.6	60.4	55.7	.328	.487	.405	.89	.94	.94	S.	S. by W.	S. W.	0.46	0.76	2.16	0.187		Rain.	Rain.	Cu. Str. 9.
2	642	525	616	51.1	52.3	47.2	.348	.375	.298	.93	.93	.92	S. S. W.	S. by W.	W. by S.	2.35	10.22	8.11	0.556		Clear.	Cu. Str. 8.	Str. 4. Aurora Borealis.
3	800	701	620	40.3	52.9	51.6	.208	.354	.321	.82	.90	.86	W. S. W.	S. W.	S. W.	15.81	12.27	6.30			"	" 10.	Cu. Str. 2.
4	584	636	807	54.8	71.1	55.8	.362	.544	.335	87	73	80	S. W.	W.	E.	1.53	7.61	1.48			"	Clear.	Clear.
5	748	613	520	45.1	79.2	67.2	.275	.574	.362	92	58	89	N. E.	S. W. by W.	W. S. W.	4.51	1.50	7.53			"	"	C. Str. 3. Distant Lightning.
6	722	633	764	41.9	48.6	40.0	.197	.165	.183	78	49	77	W. by S.	W. by N.	W.	10.48	3.45	15.02	Inapp.		Rain.	C. C. Str. 6.	Clear.
7	776	758	846	34.1	50.2	42.0	.175	.309	.184	89	85	70	S. W.	W. by S.	W.	7.51	7.12	0.11			Clear.	C. Str. 4.	Cu. Str. 4.
8	900	851	916	30.6	48.7	36.2	.130	.165	.170	78	49	80	N. by W.	E. S. E.	N. E. by E.	0.06	1.43	0.51			Cu. Str. 6.	Clear.	C. C. Str. 9. Lunar Halo.
9	30.005	30.006	30.129	34.0	51.0	36.3	.126	.123	.170	65	30	80	N. E.	N. N. W.	S. S. E.	7.43	13.70	1.52			Clear.	"	Clear.
10	060	29.942	29.963	28.9	55.1	40.9	.111	.168	.197	71	39	78	N. N. E.	W. by S.	S. by W.	0.06	1.00	1.73			"	"	"
11	29.920	997	30.065	39.4	60.1	40.3	.216	.838	.182	91	65	73	S. W. by W.	W. S. W.	W. N. W.	16.01	0.62	0.63			"	Cu. Str. 8.	"
12	30.160	30.082	29.984	31.1	56.1	41.9	.185	.211	.206	89	48	78	N. N. W.	S. W.	S. by E.	0.83	1.17	1.48			"	Cirri 2.	Clear. Lunar Halo.
13	29.789	29.668	622	42.7	68.8	62.9	.237	.443	.392	87	68	69	S. S. E.	S. W.	S. W.	3.03	5.73	4.33			C. C. Str. 8.	C. C. Str. 8.	Rain.
14	514	466	562	51.5	59.7	49.8	.341	.323	.290	59	68	82	S. W.	W. S. W.	W. S. W.	14.00	22.60	2.11	0.406		Ni. 10.	Cu. Str. 4.	Cu. Str. 10.
15	694	799	940	34.2	54.2	32.1	.169	.256	.143	84	61	79	N. N. E.	N. W.	N. W.	0.93	5.57	17.21			Sleet.	" 4.	Clear.
16	30.134	30.148	977	25.7	43.0	37.8	.111	.137	.151	81	48	67	W. by N.	S. W. by W.	S. S. W.	3.35	12.86	0.71			Clear.	" 8.	Cu Str. 2.
17	29.901	29.806	708	36.2	59.4	52.1	.184	.296	.282	87	59	73	S. E. by E.	S. S. W.	S. S. W.	0.10	0.57	0.01			Str. 2.	" 10.	C. Str. 10.
18	405	241	419	50.2	57.0	38.0	.335	.413	.201	93	77	86	S.	W. S. W.	N. W.	0.21	1.10	11.45	0.580		Cu. Str. 10.	" 10.	Clear. Aurora Borealis.
19	654	669	700	31.0	44.6	32.2	.130	.189	.107	74	64	56	W. N. W.	W. N. W.	N. W.	11.61	21.23	32.61			Clear.	" 4.	Str. 4. Aurora Borealis.
20	510	500	601	29.8	35.0	29.0	.136	.162	.123	83	80	77	W. N. W.	W. by N.	W. N. W.	19.00	26.81	14.31		0.50	Cu. Str. 10.	" 10.	Snow.
21	487	484	520	24 2	30.5	28.2	.111	.142	.135	87	84	86	W. N. W.	W. by N.	W. by N.	27.00	17.17	8.00		2.30	Snow.	Snow.	Snow.
22	564	571	701	30.0	42.9	34 1	.135	.209	.175	83	78	89	W. by N.	W. by N.	W. S. W.	5.68	15.26	3.41			Cu. Str. 10.	Str. 4.	Str. 2. Faint Aurora Borealis.
23	781	799	870	30.0	45.0	38.2	.142	.101	.186	84	34	81	W. S. W.	W. S. W.	W. by S.	1.35	6.80	9.52			C. C. Str. 6.	Clear.	C. Str. 10.
24	774	710	760	39.2	40.2	29.3	.192	.160	.128	82	64	77	S. S. W.	W. N. W.	N. E. by E.	0.00	11.02	8.61	Inapp.		" 10.	C. Str. 8.	" 4.
25	764	650	647	24.1	31.8	25.0	.094	.130	.094	73	74	68	S. E.	W.	W. N. W.	3.35	0.70	16.21		Inapp.	Cirri Str. 4.	" 10.	Snow.
26	674	450	480	21.0	32.0	27.2	.089	.119	.111	63	64	78	W. N. W.	W. N. W.	W.	6.90	12.30	8.60			Clear.	" 2.	Cu. Str. 4.
27	254	251	320	23.9	33.2	32.2	.0[illegible]	.131	.143	72	70	79	W. by N.	W. N. W.	W.	10.16	4.60	14.36			C. C. Str. 4.	" 10.	" 10.
28	351	397	554	34.1	39.1	31.2	.158	.178	.149	79	73	84	W.	W.	W. by N.	19.23	13.50	32.30			Cu. Str. 6.	" 10.	Clear.
29	660	710	860	31.5	41.0	36.1	.136	.147	.177	78	57	85	W. N. W.	W. N. W.	N. W.	7.96	14.41	10.82			" 8.	" 6.	C. Str. 9.
30	900	897	926	32.6	41.9	36.2	.156	.190	.170	85	74	80	W. by N.	W by N.	W. S. W.	8.02	2.32	6.20			" 8.	" 4.	" 10.
31	900	874	960	31.6	33.9	34.1	.149	.180	.158	84	77	79	W. N. W.	W. N. W.	W.	0.56	14.40	2.47			" 10.	" 6.	" 10.

REPORT FOR THE MONTH OF NOVEMBER, 1859.

Day	Barometer 6 a. m.	2 p. m.	10 p. m.	Temp. 6 a. m.	2 p. m.	10 p. m.	Tension 6 a. m.	2 p. m.	10 p. m.	Humidity 6 a. m.	2 p. m.	10 p. m.	Wind 6 a. m.	2 p. m.	10 p. m.	Velocity 6 a. m.	2 p. m.	10 p. m.	Rain	Snow	Weather 6 a. m.	2 p. m.	10 p. m.
1	30.004	29.901	29.924	32.0	41.0	38.1	.142	.190	.186	.84	.74	.81	S. W.	S. S. W.	S. W.	0.36	1.03	4.05			Cu. Str. 9.	Cu. Str. 10.	Cu. Str. 10.
2	29.870	864	860	37.0	46.2	33.3	.199	.238	.168	.90	.77	.89	W. S. W.	S. W.	E. by S.	5.95	3.12	0.90	Inapp.		" 10.	" 2.	Ni. 10.
3	30.124	30.249	30.304	28.1	33.8	24.2	.117	.126	.094	.76	.75	.73	N. W.	N. W.	N. E. by E.	4.80	37.96	26.42		0.53	" 10.	" 4.	Cirri 4.
4	312	29.925	29.930	30.5	32.1	31.6	.142	.162	.168	84	89	94	S. S. E.	E. N. E.	E. N. E.	1.53	6.36	3.11	0.297	1.80	Snow.	Rain.	Regular.
5	29.820	768	951	31.0	34 3	42.0	.155	.190	.177	89	97	66	E. S. E.	S. E.	W. N. W.	11.05	0.00	5.40	Inapp.		Cu. Str. 10.	Cu. Str. 10.	Clear. Distant thunder at noon.
6	30.374	30.382	30.434	26.1	37.0	26.2	.099	.157	.094	69	70	68	W. N. W.	W. N. W.	W.	17.93	3.42	1.05			Clear.	Clear.	Clear.
7	439	324	270	22.0	34.2	28.1	.084	.125	.135	71	69	88	E.	N. E. by E.	N. E. by E.	2.31	4.27	9.46			Cu. Str. 10.	C. C. Str. 10.	Cu. Str. 10.
8	183	009	042	30.0	52.5	36.0	.148	.257	.191	88	66	89	E.	S.	S.	6.43	0.20	0.32			" 8.	Hazy.	Hazy. Lunar Halo at 8 p. m.
9	29.901	29.804	29.824	33.0	53.2	47.5	.144	.304	.290	70	76	82	S. E. by E.	W.	S. S. W.	0.21	0.57	3.80	0.100		Hazy.	Cu. Str. 10.	Rain.
10	800	521	499	33.4	33.7	30.2	.182	.182	.154	95	94	94	N. E. by E.	N. E. by E.	N. E. by E.	15.90	8.40	20.91	0.630		Rain.	Regular.	C. Str. 10.
11	634	984	30.100	24.0	31.9	19.2	.100	.144	.087	79	80	85	N. W.	N. W. by W.	N. E. by E.	14.15	8.02	0.00		0.70	Cu. Str. 10.	Cu. Str. 4.	Clear.
12	30.114	701	29.600	20.0	32.1	33.4	.091	.143	.184	85	79	96	N. E. by E.	N. E. by E.	N. E. by E.	0.00	7.06	5.51		3.70	Clear.	Snow.	Rain.
13	29.230	180	220	33.0	34.9	31.2	.174	.190	.142	94	95	84	N. E. by E.	S. W.	W. S. W.	4.75	2.77	18.37	2.157		Rain.	Cu. Str. 9.	C. Str. 2.
14	559	520	827	24.0	30.1	22.1	.111	.130	.064	87	78	86	S. S. W.	W. S. W.	W. S. W.	24.70	1.52	23.88			C. Str. 2.	" 2.	Clear.
15	30.132	30.229	30.317	17.0	23.0	21.0	.068	.089	.085	75	72	78	N. E. by E.	E. N. E.	S. E.	0.82	1.28	0.00			" 10.	" 10.	C. C. 9.
16	341	260	239	16.0	28.2	22.3	.065	.129	.195	74	82	79	N. E. by E.	N. E. by E.	N. E. by E.	6.41	4.92	4.72			C. C. 9.	Clear.	Clear.
17	081	048	090	30.1	49.1	12.2	.136	.278	.206	84	81	78	S. E.	S. E.	E. S. E.	0.81	2.90	8.23			Cu. Str. 9.	Cu. Str. 9.	Cu. Str. 10.
18	092	29.952	29.989	40.0	54.5	42.5	.210	.328	.244	86	77	91	E. S. E.	S. E. by E.	N. E. by E.	2.87	0.08	0.88	0.262		C. C. Str. 9.	" 10.	" 10.
19	29.611	406	219	41.4	42.3	40.6	.251	.261	.241	96	98	96	N. E. by E.	N. E. by E.	N. E. by E.	4.72	15.60	9.81	3.746		Rain.	Rain.	" 10.
20	700	901	30.232	28.2	27.1	20.1	.241	.093	.075	98	68	72	W.	N. W. by N.	N.	26.56	11.63	14.91	0.630	Inapp.	Cu. Str. 10.	Cu. Str. 9.	" 8.
21	30.435	30.301	224	16.3	25.0	23.2	.074	.100	.186	85	74	86	N. E. by E.	N. E. by E.	N. E. by E.	7.22	6.35	6.21			" 9.	" 4.	" 10.
22	29.904	29.840	29.750	23.1	32.9	31.4	.107	.168	.168	87	89	96	N. E. by E.	N. E. by E.	N. E. by E.	21.66	7.20	6.90		4.10	Snow.	Snow.	Snow.
23	842	909	30.054	25.2	31.0	25.2	.113	.161	.129	84	85	93	W.	S. W.	W. S. W.	7.80	2.01	8.93		2.70	"	Snow.	Snow.
24	30.254	30.270	378	22.2	26.9	17.3	.102	.117	.063	98	82	67	S. W.	W. S. W.	W. S. W.	9.86	6.66	6.00		0.50	"	Cu. Str. 10.	Clear.
25	345	224	29.910	7.1	22.4	21.5	.042	.079	.196	66	68	88	W. S. W.	E. by N.	N. E. by E.	4.03	0.36	6.63		1.40	Clear.	" 10.	Snow.
26	29.214	29.462	464	34.2	42.0	31.8	.190	.199	.162	95	74	89	N. E. by E.	S. by W.	S. W.	15.44	10.31	13.00			Snow.	" 8.	Cu. Str. 6.
27	661	679	600	30.6	35.6	30.0	.148	.162	.154	88	84	89	S. W.	S. W.	S. S. E.	2.80	0.00	2 23			Cu. Str. 4.	" 10.	Clear.
28	678	720	657	21.1	27.4	27.1	.080	.105	.126	74	70	88	S.	S. W.	S. S. W.	11.17	2.28	3.92		Inapp.	" 10.	Snow.	Cu. Str. 8.
29	30.104	30.019	30.047	8.0	22.0	11.9	.048	.084	.060	77	71	80	N. E. by E.	N. E. by E.	N. E. by E.	8.36	1.90	2.03		0.50	C. Str. 8.	Cu. Str. 6.	Snow.
30	29.814	29.800	29.804	12.1	31.1	21.0	.061	.118	.075	81	68	73	N. N. W.	E.	S. S. E.	10.61	0.57	0.00			" 10.	....	....

REMARKS FOR OCTOBER, 1859.

Barometer...... { Highest, the 12th day, 30·160 inches.
Lowest, " 27th " 29·251 "
Monthly Mean, 29·779 inches.
" Range, 0·909 "

Thermometer... { Highest, the 5th day, 83°1.
Lowest, the 25th day, 19°4.
Monthly Mean, 42°42.
Monthly Range, 63°7.

Greatest intensity of the Sun's rays, 105°8.
Lowest point of terrestrial radiation, 14°2.
Mean of humidity, .754.
Amount of evaporation in inches, 1·27.
Rain fell on 6 days, amounting to 1.629 inches; it was raining 20 hours 51 minutes, and was accompanied by thunder on 1 day.

Snow fell on 3 days, amounting to 2.30 inches; it was snowing 24 hours.
First snow of the season fell on the 20th day.
Most prevalent wind, the W. N. W.
Least prevalent wind, E.
Most windy day, the 19th day; mean miles per hour, 21.81.
Least windy day, the 17th day; mean miles per hour, 0·29.
Aurora Borealis visible on 4 nights.
Lunar Haloes " " 2 nights.
The Electrical state of the atmosphere has indicated high and constant tension.
Ozone was present in moderate quantity.

REMARKS FOR NOVEMBER, 1859.

Barometer. ...... { Highest, the 7th day, 30·439 inches.
Lowest, " 13th " 29·180 "
Monthly Mean, 29.940 inches.
Monthly Range, 1.259 "

Thermometer. { Highest, the 18th day, 57°6.
Lowest, " 25th " 4°6.
Monthly Mean, 29°38.
Monthly Range, 48°0.

Greatest intensity of the Sun's rays, 96°7.
Lowest point of terrestrial radiation, 5°1.
Mean of humidity, .819.
Rain fell on 9 days, amounting to 7.822 inches; it was raining 73 hours 55 minutes.

Snow fell on 11 days, amounting to 15.73 inches; it was snowing 68 hours 20 minutes.
Most prevalent wind, N. E. by E.
Least prevalent wind, E.
Most windy day, the 3rd day; mean miles per hour, 23.06.
Least windy day, the 27th day; mean miles per hour, 1·72.
Aurora Borealis visible on — nights.
Snow Birds ("Phlectrophanes nivalis,") first seen on 3d day.
Lunar Halo visible on 1 night.
The Electrical state of the atmosphere has indicated moderate intensity.
Ozone was present in large quantities.

INDEX.

ERRATA AND ADDENDA.

Page 198, 16th line from top, for "Martin" read Marten.
" " 8th " " bottom, for "who" read which.
" 211, 2nd " " " add *M. cinerea.*
" 213, 18th " " " for "*L. opacina*" read *L. apacina.*
" 219, 15th " " top, for "Assidium" read Ascidium.
" " 9th " " bottom, for "Bonechere" read Bonnechere.
" 220, 7th " " top, for "*Anodouta*" read *Anodonta.*
" " 16th " " " for "Marc" read Marl.
" 241, 13th " " bottom, for "*scutotum*" *scutatum.*
" 242, 15th " " top, for "*corumarius*" read *communis.*
" " 21st " " " for "St. Clair" read Ste. Anne.
" " 24th " " " for "*phantopus*" read *P. phantapus.*

Page 242.—The starfish referred to in the first sentence on this page is *Asteracanthion polaris* (Müller).

In Articles VI. and XVIII., "Marcouin" frequently occurs for Marsouin; "Ste. Ann" for Ste. Anne; and "Glande" or "Grande" for Glaude.

Biography of Henry G Vennor

Chap — 1860

With the close of the year 1859, another volume of 600 pages of the Canadian Naturalist and Geologist was completed. In this — any more than in the preceeding volumes there is no special reference to anything connected with the personality of young Vennor. We know however that he was still pursuing his studies at McGill College, that he read with eager attention the various articles of this magazine, and that in his various rambles through the city, on the banks of the St Lawrence, and in the woods and fields, over the mountain or among rocks and plains, his eyes and ears were ever open to see and hear every form of bird life that presented itself, or whose notes were wafted on the air, either in the summer sunshine, or when the chill blasts of winter were sweeping around.

Here we may pause and take a hurried glance at the different writers on the subject of the Avifauna of Canada, whose names — up to this period — we have been able to collect from the Natural History publications of this country.

The first intimation that we have that any person in Canada wrote on the subject of its avifauna is furnished by Mr Le Moine of Quebec city, who states that a description of Canada birds was written in 1663, by Pierre Boucher, the Governor of Three Rivers in his Histoire Naturelle du Canada" This small and interesting volume was prepared by the old Governor for the information and amusement of his friends at the Court of Louis the XIV. In this work Boucher mentioned that among the birds that were daily shot in Canada were ten kinds of ducks, swans and cranes; he also mentions bitterns, snipes, woodcocks, rock snipes, sandpipers, or sea-larks, as he calls them, but he does not mention any field-larks. He also mentions Outardes, or the white geese, fifteen species of birds of prey, and the Wild Turkey; the latter species, however, he stated were not found in the valley of the St Lawrence, but in the country of the Mohawks (near the southern parts of Ontario) where they were very numerous and constituted delicious food. He also mentions three species of grouse, which are now identified as the Spruce and Ruffed Grouse and the ptarmigan, and reference is also made to the beautiful plumage of the Tanager and the Indigo Bird.

Mr. Le Moine, a French Canadian resident, indicated [illegible]

Quebec is first introduced to the readers of "The Naturalist" as an observer of birds, by an article on the breeding of the Sky Lark in captivity, and which was published in the third volume of that Journal, and in the 4th volume he comes again into notice, having an article on "The Land and Sea Birds observed around Quebec." In the introduction to this article, Mr [illegible] refers to lists of birds made by Messrs G. W. Allen of Toronto, and Dr [illegible] of Montreal, the results of observations made at their respective cities in the years 1853 to 1857, as being well calculated to throw additional light on the Canadian fauna, as yet so imperfectly known. Then of [illegible] by stating his intention to briefly notice the birds that are common to the districts of Quebec and Montreal, he gives some information regarding the Snowy and Barred Owls, with the [illegible] then quotes the Work of Governor Boucher on the avifauna of Canada, and concludes his article by a reference to the breeding habits of the Wild Goose, some species of Wild Ducks, and the occurrence of the Pine Linnet, the Snow Bunting and the [illegible] at Quebec —

in regard to the list of Birds noticed in the Winter Season, in the vicinity of Mon-treal, by Mr D'Urban, and refer-red to by Mr Le Moine and publish-ed in volume 2 of the "Canadian Naturalist", the first 10 [illegible], Hawk Owl, Snowy Owl, Barred Owl, Brown Creeper, Chickadee, Robin, Snow bird, Junco, Red poll, Pine Linnet, Pine Grosbeak, Crow, Blue Jay, Northern Shrike, Northern [illegible], White Breasted Nuthatch, Downy Woodpecker, and Ruf-fed Grouse, - 18 Species; and he also mentions the report that a Goshawk, a Gold Finch [illegible] [illegible], had been seen. In this article Mr D'Urban also spe-aks of the paper by Mr Allan on the [illegible] at Toronto, and pub-lished in the Canadian Journal for March 1853 (five years before) as [illegible]-ding 24 Species, which the fol-lowing 12 Species were not found by him at Montreal, - Bald Eagle, Pigeon Hawk, Great Horned Owl, Gold Finch, Tree Sparrow, Red Crossbill, Canada Jay, Red-bellied Nuthatch, Hairy Wood-pecker, Quail and ~~[illegible]~~ Grouse, while the Brown creeper, and the Hawk Owl are not mentioned by Mr Allan. Of Mr Allan as a writer on Birds we will speak hereafter.

In volume 3 of the C N G - 1858 Edited by Mr E Billings is a [illegible] or articles by its Editor, on Canadian Birds, he, however, derives much of his information on these subjects from the ornithological writings of Alexander Wilson, J. J. Audubon, and Sir John Richardson, the latter author had personally travelled in the Hudson Bay territory and the Arctic regions, and is therefore among the first of Canadian Ornithologists, though the great Audubon himself [illegible] the Maritime provinces, and visited Labrador, and Newfoundland.

Besides those above named writers on Canadian birds, there are also to remark that the avifauna of Canada is more or less described in the writings of Linnaeus of Sweden, Blumenbach, and Cuvier and Vieillot of France, Vigors, Swainson, Temminck, Agassiz, and Gould. In his articles on Canadian birds, the Billings, after an essay on the Technical terms of Ornithology, writes on the Robin, the Black and Wood Ducks, the Green and Blue winged Teals, the Mallard Duck, and the Herring Gull, the Wild Pigeon, and the different species of Canadian Woodpeckers, the Bobolink, the Quail, the Ruffed Grouse and the Spruce partridge, the Snipe the Woodcock, and the Great Horned and Snowy Owls, and there is also in the same volume an article by Albr Wilson, on the Bohemian Waxwing.

In volume 2 of the Naturalist its
Editor gives another paper on Canad-
-ian birds, this gives a pleasing life
-history of the Rossignole, or Song Spar-
-row, and also notes on the White-
throated, white-crowned, and Fox-
-colored Sparrows, and in this vol-
-ume as already noted is pub-
-lished the article on the Winter
birds of Lower Canada, by Mr D'
Urban and also a short acc-
-ount of a Ruffed Grouse, by an-
-other writer.

In volume 3 of the Canadian
Naturalist and Geologist there is
no article devoted to Birds except
a short report on the Migration of
the Wild Pigeon, by a correspond-
-ent at Barrie, C.W. but in vol-
-ume 4 of this magazine there
is a long and very interesting list
with historical notes on the Birds
of the Lower St. Lawrence, by Mr
Robert Bell, Jr. of the Geological
Survey. In this list Mr Bell menti-
ons the following birds, - Bald Eagle,
Sharpshinned Hawk, Barred Owl, Night-
Hawk, White bellied Swallow, Cliff
Swallow, Barn Swallow, Snowbunting

Yellow-crowned Warbler, Winter Wren, Chickadee, Golden-crested Kinglet, Robin, pipit, Shore Lark, Snow Bunting, [illegible]ing Sparrow, Snow bird, Goldfinch, White-Throated sparrow, Purple Finch, Red-wing Blackbird, Rusty Grackle, Crow, Blue Jay, Canada Jay, Cedar Bird, Red-bellied Nuthatch, Humming bird, Kingfisher, Pileated Woodpecker, Hairy Woodpecker, Wild Pigeon, Ruffed grouse, Canada Grouse, Turnstone, [illegible], Red-breasted Sand Piper, [illegible] Sand Piper, Solitary Sandpiper, [illegible] Heron, Canada Wild Goose, [illegible] Goose, Velvet Duck, Surf-Duck, Merganser, Cormorant, Black-Headed Gull, Puffin, Razor-bill, Black Guillemot, Loon, Red-throated Diver, - 58 species - and a Kind of Sand Piper not identified -
In this volume is published the list of the birds observed about Quebec by [illegible] Le Moine - already referred to - and also a Scientific list of the birds seen at Woodstock - [illegible] by the [illegible] Cottel. This list comprises 146 species. In this volume is also published a paper on the "Natural History of the Valley of the River Rouge, by Mr D'Urban, in which that writer gives a list of some 78 species of bird observed by him in that region

and which is also otherwise interesting, for the first time, it records several species of Birds as being residents of that region not mentioned by previous writers, but space will not permit us here to give their names.
In volume V of the C. V & G there is no article on Ornithology, except the one by Mr Vennor, and to this attention will be directed in the next chapter, but all those articles that we have reviewed were carefully read by him, and did much to stimulate his studies of the subject, and prompt his avifaunian composition.
Here leaving this subject for future investigation we again take up the line of young Vennor's biographical narrative.