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Tuesday, March 14.—The Annual Meeting for the reception and adoption of Reports from the Council, election of Officers, etc.

Meetings in Lecture Hall, Y.M.C.A.

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THE OTTAWA NATURALIST.

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ON THE ORIGIN OF SOME ARCHÆAN CONGLOMERATES.*

By ALFRED ERNEST BARLOW.

The writer, in collaboration with Dr. Frank D. Adams, is at present engaged in a geological examination of an area covering nearly 3500 square miles, including portions of the Counties of Hastings, Haliburton and Renfrew in the Province of Ontario, Canada.

These investigations and studies are believed to have a special importance because of their bearing upon some of the most intricate questions of Archæan geology, among the more important of which may be mentioned the character and relations of the so-called Grenville and Hastings Series, and their possible equivalency with other Archæan groups previously described from more remote districts. In addition, it was believed much information was desirable and could be secured in regard to the origin, relative age and composition of the gneisses and granites usually classified as Laurentian.

The work has been in progress for several seasons, but is now rapidly approaching completion, and it is confidently expected that another season will be sufficient to enable a report of an approximately final character to be written.

Several communications, either separately or conjointly, have already appeared regarding the progress of this work, indicaing not only the main conclusions likely to be reached, but also presenting some points of immediate and special scientific interest. It is in pursuance of this policy that the following is

*Read by title at the Geological Society of America, New York, Dec. 28th, 1898. Read before the Logan Club, Ottawa, January 21st, 1899. Published by permission of the Director of the Geological Survey of Canada.

offered to the Logan Club for the consideration and discussion of its members.

As stated by Dr. Adams and the writer in a previous paper, read before the Geological Society of America at the winter meeting of 1896, the rocks exposed within the area under examination belong to several sub-divisions of the Archæan.

1. Laurentian ; 2nd, Grenville Series ; 3rd Hastings Series.

The Laurentian covers by far the greater part of the area in question. Briefly stated it is now believed to consist of an extremely complicated series of intrusions, very approximately synchronous, representing plutonics of relatively greater or less basicity. These gave rise to a complex of irruptive rocks, which differ in no essential respect save that of a somewhat persistent foliation from the normal or massive types of the granite, diorite and gabbro families. The Grenville Series, on the other hand, comprises a great development of crystalline limestones, associated with certain fine-grained gneissic rocks whose general appearance and microscopic structure mark them as highly altered sedimentaries. In regions further to the east, where precisely similar rocks have been examined in detail by Dr. Adams, it has been shown that they likewise possess a chemical composition closely analogous to that of clay-slate.

The relations of these two members of the Archæan in Central Ontario, suggests in the strongest manner that in the Grenville Series we have a truly clastic group of strata which has slowly sunk down into and been invaded by much greater volumes of the granites and gneisses of the Laurentian when these latter were in a plastic condition. The limestones are very highly metamorphosed, having in most cases become thoroughly recrystallized, and now present the characters of coarse, although often more or less impure marbles. The contact between the gneisses and granites of the Laurentian on the one hand and the limestones and associated rocks of the Grenville Series on the other, is, wherever examined, one of intrusion.

Towards the south and south-east, the region is uuderlaid by rocks of the so-called Hastings Series, consisting principally

of thinly bedded limestones dolomites, &c., cut through by great massive intrusions of gabbro, diorite and granite. Detailed and critical examinations over the whole area have led to the belief that in the Grenville Series we have a more highly metamorphosed portion of the Hastings Series. This extreme alteration in the case of the Grenville Series is accounted for by the intimate presence of much greater volumes of the associated irruptives and their relatively much more acid character. In many of the previous geological descriptions of this and neighboring Archæan districts, it has been customary to refer in a rather positive manner to the existence of conglomerates as an evidence of the clastic origin not only of the Hastings and Grenville Series but also of the enclosing Laurentian gneisses. Localities were cited and descriptions given of such coarse clastics, and the often perfectly rounded character of the contained fragments was referred to as a certain indication of the wearing action of running water.

The fallacy of arguing the sedimentary origin of the whole series because of the presence of such comparatively insignificant inclusions of clastic material, has been clearly shown by recent Archæan work and is now very generally conceded. It is not however so widely known that many of the conglomerates so-called and described have no existence as such but are in reality autoclastic* rocks or dynamic breccias which have resulted in the main from the complex folding and stretching occasioned by the operation of the strong orogenic forces prevailing so intensely in pre-Cambrian times. Murray in 1853 and Macfarlane in 1866 refer to the presence of these coarse beds in the Archæan of Hastings County, while on page 31 of the Geology of Canada (1863) conglomerates are referred

* The term "autoclastic" originally proposed by H. L. Smyth (see Geology of Steep Rock Lake, Am. Jour. Sci. XLII, p. 331) is very applicable used as its author defines to rocks "which have formed in place from massive rocks by crushing and squeezing without intervening processes of disintegration or erosion, removal and depositon." Van Hise (see Principles of North American Pre-Cambrian Geology, 16th Ann. Rep. U. S. Geol. Surv. p. 679. 894-95) explains the use of the term, describes the method of formation of these rocks and the means of distinguishing them from basal conglomerates.

to by Sir William Logan as existing in the Laurentian. On page 32 and 33 of the same volume, somewhat detailed descriptions are given of conglomerates occurring in the Hastings Series then classified as Laurentian. Vennor, in 1869,* gives a three-fold classification of similar rocks occurring in the Hastings Series.

In most if not all of these instances, there seems to have been no well directed attempt to find the source of this coarse fragmental material, or a basement from the disintegration of which they might possibly have been derived. Of course at that time such search was deemed unnecessary as the pre-existence of the Laurentian was considered beyond question, and the granitic aspect of most of the fragments seemed to point unmistakably to their derivation from similar material although their exact source was not known. It will thus be evident that the precise nature of these reported coarse fragmental rocks cannot be here discussed as the descriptions at present available are necessarily vague and unsatisfactory so that further examination will have to be made at the several localities before a final decision can be reached.

In the region to the north of the occurrences mentioned in these old reports, several localities were however found where pseudo-conglomerates are very typically developed. The most noteworthy of these, showing very extended outcrops of these rocks, are to be found in the northern part of the township of Tudor between St. Ola Village and Gilmour Station on the Central Ontario Railway.

At this place also the true nature of these supposed conglomerates which it is the purpose of the present paper to describe was first clearly understood. Other exposures identical in origin were noticed on lot 18 con. III of Wollaston on the road between Coe Hill and The Ridge P.O., on lot 10 con. XIV of the same township a few miles east of Faraday P.O.; also on lot 26 Con. XIV of Carlow and on lot 2 con. XIX of Raglan. These by no means exhaust the localities where similar rocks

*See Rep. Geol. Surv. Can. 1866-69, p. 157.

are known to exist, but will serve to indicate a few of the more important and typical localities. Besides these, pseudo-conglomerates also occur near the line between Cons. VII and VIII in the township of Monmouth on the Monck Road, a short distance east of Hotspur P.O., and also to the east of the southern extremity of Pine Lake on lot 18 con. I of the township of Cardiff. With the possible exception of these two last-named occurrences, all of the exposures of these pseudo-conglomerates met with admit of a very adequate explanation as of autoclastic origin. It is proposed, in the light of recent experience, to re-examine the localities mentioned in Monmouth and Cardiff to determine if possible the exact nature and relations of these exposures, which seemed to present such strong resemblences to stretched conglomerates.

In the northern part of the Township of Tudor, several large areas are occupied by massive igneous plutonic rocks which are clearly batholitic in their origin and behaviour. In common with other known occurrences of similar material encountered throughout this district, these intrusive masses are believed to contain a great variety of irruptive plutonic material ranging from gabbro and diabase on the one hand through diorite and hornblende-granitite, to granitite, pegmatite and lastly quartz representing the last secretions of the magma from which all have successively crystallized. On the other hand, certain of these masses are relatively much more basic than others, with gabbro and gabbro-diorite as the prevailing rock type, while others again, in areas not far remote, are decidedly acidic with ordinary granitite as the representative intrusive. The batholites are wrapped around by great mantles of the limestones, shales and amphibolites of the Hastings Series. Usually a perfect conformity if such it can be called, exists between the two, although it is quite evident from the curved and divergent strikes that the stratified series has undergone considerable displacement, while in certain places the limestones, &c, abut against and are cut off by the intrusion of the batholite. Two of these batholites occur in the northern

part of Tudor, but it is with the more easterly of these that the occurrences to be described were noticed.

This batholite has an irregular, though somewhat oval, outline, presenting a series of bays with occasional small arms, the former occupied by wedge-like areas of the clastic rocks. It covers the northern portions of con. XIX of Tudor and the southern part of first concession of Limerick, extending from lot 16 in Tudor eastward to and beyond lot 9. The area characterized by its presence is exceeding rough and barren, presenting as usual a series of low rounded hills with occasional precipices and intervening swampy flats. Macroscopically the composing rock is medium textured, of a distinct though pale flesh colour, weathering white where exposed to atmospheric agencies. To the unaided eye it has every appearance of an ordinary granite and would undoubtedly be classified as such by most observers. Under the microscope, however, plagioclase is seen to be greatly preponderant while hornblende is the most abundant ferromagnesian constituent, although biotite altered to chlorite is likewise present. The rock must therefore be placed with the diorites although it evidently represents a rather acid type. Associated with this rock and apparently a differentiation product of the same magma is a massive gabbro-diorite. The coloured constituent shows the deep green borders and pale interiors characteristic of uralitic hornblende, although the alteration of the original pyroxene is quite complete. Many individuals show a tendency to assume the actinolitic habit, and areas and patches still more intimately associated with the more acid phases of the rock are rather typical amphibolites, the hornblende and other constituent minerals having undergone still more extensive deformation and dislocation.

The place where these supposed conglomerates were first noticed was on lot 13 in con. XIX of Tudor, a short distance north of Beaver Creek. At this locality, some angular boulders composed of this material and evidently carried thence from a source not far distant, were deposited from the drift-laden

ice along the base of the diorite cliffs which here forms the north side of the valley of Beaver Creek. A search was made, with the result of finding exactly similar strata in place, forming a small band completely enclosed in the intrusive mass and extending completely across lot 13 as well as a short distance east and west into the adjacent lots. Detailed examination revealed much more extended exposures on the hills to the northward of Gilmour Station, situated chiefly on lots 11 and 12 in the XVIIIth concession.

The so-called conglomerates may be included under two great classes.

1. Those which have a matrix of limestone or dolomite.

2. Those in which a greyish, sometimes almost black micaceous rock, forms the cementing material.

The limestones breccias may likewise be subdivided into two classes (*a*) those which readily show their origin as dynamic breccias and (*b*) those which more closely resemble ordinary conglomerates and may, following Van Hise, be called pseudo-conglomerates. (See Plate VII, Fig. 1 and 2.) Both varieties of these calcareous fragmentals are abundantly represented and are as would be expected most frequently to be met with at or near the line of junction with the intrusive granites, gneisses and greenstones, these places representing areas or zones of extreme disturbance.

In regard to the material constituting the supposed pebbles they likewise admit of a two-fold division:

(*a*) Those which are formed by the breaking apart of what were once fairly continuous bands of the rusty-weathering or greyish gneiss, already mentioned as so frequently and intimately associated with these crystalline limestones and dolomites.

(*b*) Those in which a series of approximately parallel dykes of intrusive material, chiefly granite, diorite and amphibolite have suffered the necessary deformation and dislocation.

The class first mentioned (*a*) are doubtless the most abundantly represented in this district, and a great many of the exposures show almost at first sight their origin as autoclastic

rocks. The true nature of the more unusual types and those which bear such a marked resemblance to ordinary conglomerates, is not nearly so evident, and much confusion has arisen in the past from their wrong interpretation. The explanation, however, of the formation of these limestone breccias is rather simple, and every gradation is discernible at one or other of the various localities where these rocks are exposed. Outcrops which have been subjected to only normal dynamic action show impure bands, more or less continuous, composed of the prevailing light greyish often rusty-weathering gneisses representing, hardened and altered interbedded mud or silt-like depositions. These impure gneissic bands are extremely brittle and thus very liable to break up, while on the other hand, with the application of the same dynamic or stretching force, the limestome is seen to "flow," filling in the most minute spaces and accommodating itself to every phase of its new position. With a continuation of the same force with more marked intensity, the limestone gradually recrystallizes and may even become quite massive. The first process in the deformation of these bands is the development of transverse joints as the result of the folding and stretching to which the whole series has been subjected. A further application of these processes of deformation, bands originally continuous become more widely separated, the intervening spaces being occupied at once by the extremely plastic and accommodating limestone. In exposures which have been very little subjected to dynamic action, the separated fragments are quite angular and are readily traceable as one continuous band, but where extreme modification has taken place the fragments have become so rounded and displaced, owing to differential movemeut and pressure, that the resulting rock-mass presents in great perfection the characters of an ordinary conglomerate containing well rounded fragments with every appearance of having been water-worn.

The pseudo-conglomerates belonging to the second division (*b*) of those having a limestone or dolomitic matrix seem to be confined as a rule to the vicinity of irruptive masses, and

the coarse material has been formed by the breaking apart of small dykes or apophyses of the intrusive rock. At one place in Tudor, on lot 12, con. XIX, an exposure of the usual crystalline limestone is seen in contact with the granitic-looking diorite. The junction between the two rocks is exceedingly irregular and jagged and re-entering angles of the limestone fill up the interstices in the diorite. On the other hand arms or points of diorite pierce the limestone and their continuation outward is seen to have been broken in the stretching to which the rock has been subjected, leaving a series of rounded lumps of the intrusive rock extending out into the limestone and entirely separated from the parent mass. In other instances, possibly a little more remote from the batholite, the limestones are often penetrated by a series of more or less parallel dykes, most of which are pegmatitic in origin and structure. The extreme deformation of these relatively much more brittle bands or dykes produce autoclastic rocks which are undistinguishable in many instances from the ordinary clastic conglomerates.

The psuedo-conglomerates, however, that have perhaps caused most confusion and misinterpretation are those which possess a dark grey, often almost black micaceious matrix, in which are embedded rounded or lenticular fragments, the most abundant of which were evidently composed of some species of fine-grained granite. (See Plates, VI, VIII and XIX.) In previous descriptions covering this and adjacent areas, precisely similar occurrences have been invariably described as excellent examples of undoubted clastic conglomerates, while the lenticular outlines of many of the contained fragments was referred to as interesting evidence of the intense squeezing and stretching to which the whole rock-mass had been subjected. All the exposures of rocks of this kind examined in the area covered by our map-sheet, furnished little or no evidence in contradiction of such a theory while the apparent identity of the coarse fragments with material composing certain plutonic masses in the immediate neighborhood, seemed to lend additional support to such a view. On the other

hand it appeared to be equally certain that the same plutonic igneous material was at other points, not far distant, intrusive through precisely similar strata. Such apparently contradictory evidence in regard to the geological relations of these rock masses, remained unexplained until the discovery of the extensive series of exposures of similar rocks in the northern part of the township of Tudor. Here, the evidence was very complete and convincing that the supposed conglomerates were in reality autoclastic rocks and the so-called pebbles extremely deformed portions of a series of more or less parallel dykes, evidently highly differentiated apophyses of the neighboring parent plutonic mass. The diversity in composition of the coarse fragments, at first urged as one of the strongest proofs of their clastic origin, is believed now to depend on the composition of the neighboring irruptive mass. The whole series of exposures illustrate in great perfection every gradation in the process of the formation of these seeming clastics, showing how exceeding difficult it is, if not impossible, in cases of extreme deformation and movement, to distinguish between these autoclastic rocks and the ordinary coarse fragmentals characteristic of littoral action.

Exposures of these rocks which have suffered least from dynamic action, show a series of very approximately parallel bands or dykes generally of whitish or very light greyish rock embedded in and apparently cutting a dark grey almost black micaceous schist. Precisely similar phenomena are rather familiar to most workers in Archæan geology, and are characteristic of intrusive contacts, where the more acid plutonics come against darker coloured schistose material. The contrast in colour is most marked, and this is further accentuated by the kaolinization of the felspar so abundant in the lighter coloured portion of outcrops which have exposed to atmospheric decay. The action of the weather seems to be relatively more severe with the darker portions of the rock, causing these to disintegrate more rapidly and leaving the lighter coloured areas in rather prominent relief. The length of these lighter coloured

bands along the planes of fissility in the schist, is often many times in excess of the breadth at right angles to the foliation. Indeed many of the outcrops representing the less modified phase of these rocks, very closely resemble exposures of the highly differentiated and parallel alterations of basic and acidic bands so persistently typical of the granite and diorite gneisses usually classed as Laurentian. The wider and more continuous of these more acid portions agree very closely with pegmatite in structure and composition, while the narrow dykes which greatly prevail are micro-granitic in appearance.

Under the microscope, thin sections show these fine-grained felsitic looking dykes to be composed of a micro-crystalline or granulitic aggregate, made up, it may be presumed of quartz and felspar, resembling very closely the groundmass of certain quartz porphyries. Cataclastic structure is so pronounced that all trace of larger individuals, if originally present, has disappeared and a very fine-grained mosaic, of sharply extinguishing felspar and quartz individuals, which are very difficult to distinguish from one another, remains. There is a very much smaller quantity of decomposed biotite, most of which occurs in dark wavy lines representing mechanically disintegrated portions of this mineral, producing in the rock a very recognizable micro-fluxion structure. The darker coloured portion of the rock is composed mainly of biotite with occasional scales of muscovite. Narrow alternating bands are composed of water clear felspar and quartz, while calcite, surrounded by larger individuals of quartz and felspar, characterizes certain lenticular areas. Besides these, small inclusions often occur representing the lighter coloured rock or micro-granite around which the individuals of biotite seemed to "flow" in long gentle curves corresponding very closely with their outline. The junction between the two rocks is rather sharp, but where these intrusions are larger and more numerous, there seems rather pronounced evidence of the commingling of the material of both rocks as a result of actual fusion. These are usually lenticular in outline narrowing down at either extremity and exhibiting small veinlets or tails of quartz, thus revealing their intimate

connection in origin with ordinary pegmatite. Stretching primarily develops a series of oblique transverse lines or joints which gradually widen with an increase in the amount of dynamic action. At times narrow arms or remnants may be seen connecting the severed portions of the once continuous band, but these gradually disappear. The breach becomes wider, the space thus created being filled with the more plastic schist, until finally, and in the same way as in the case of those autoclastics with the limestone matrix, the extreme of deformation is reached when the resulting rock seems perfectly indistinguishable from an ordinary clastic conglomerate.

EXPLANATION OF PLATES.

The illustrations are half-tone reproductions from photographs, taken by Mr. Joseph Keele and the author.

PLATE VI.—Autoclastic rock or pseudo conglomerate; from lots 13, con. XIX of Tudor township in the County of Hastings, Ont.

The matrix is a dark grey, in places almost black micaceous schist pierced by dykes of a micro-granitite, which more brittle than the enclosing matrix have become autoclastic by stretching. In places the original continuity of these more or less parallel igneous dykes is still preserved, but in most instances the rock bears a marked resemblance to occurrences, which have usually been described as "stretched conglomerates."

PLATE VII—Pseudo-conglomerate (autoclastic); from lots 12 con. XIX of Tudor township. The enclosing matrix is a dolomitic limestone which has undergone complete recrystallization. The supposed pebbles, which occur as a series of rudely parallel and detatched lumps, weathering out from the surrounding limestone were at one time fairly continuous bands and their identity in origin with igneous dykes may be plainly seen by reference to the large and unbroken pegmatitic dyke, which is shewn in the same illustration.

PLATE VII, Fig. 2.—Pseudo-conglomerate (autoclastic); lot 18, con. III of Wollaston on the road between Coe Hill and The Ridge P.O. The enclosing matrix is again a dolomite, but the fragments which were at first believed to be pebbles are more diverse in composition; granite is the most abundantly represented, but diorite, amphibolite, pegmatite and quartz were also noted. The irruptive plutonic masses in the immediate vicinity shew a corresponding diversity in composition.

PLATE VIII, Fig. 1.—Autoclastic rock; from lot 13 con. XIX of Tudor. The matrix is the dark grey mica-schist already mentioned, probably tufaceous in origin, pierced by small parallel dykes of micro-granitite. The oblique transverse lives representing small breaks, characteristic of the first stages in this process of deformation or stretching may be noticed in the more elongated individuals while in the same illustrations other portions of the rock resembles very closely ordinary clastic conglomerate.

PLATE VIII, Fig. 2.—Autoclastic rock ; lot 13 con. XIX of Tudor ; the illustration shows,in detail and on a much larger scale, a more advanced stage in the deformation of one of the elongated individuals of micro-granitite. It is evident from this that the rounded outline is imparted to the fragments at a very early stage in the process.

PLATE IX, Fig. 1.—Autoclastic rock ; lot 13 con. XIX of Tudor. The matrix is the same dark grey mica-schist already mentioned, while the lenticular shape of themore brittle dyke bands are shown. In cross section as also shown these same individuals exhibit a more or less perfect rounded outline.

PLATE IX, Fig. 2.—Autoclastic rock ; lot 13 con. XIX of Tudor. This specimen exhibits in great perfection one phase of the rock, where it has undergone the extreme of deformation. The supposed pebbles in reality represent what were once practically continuous more or less parallel dykes of micro-granitite, which owing to differential movement and stretching have become gradually so distorted and displaced that the resulting rock mass is undistinguishable from singular exposures of similar rocks which are clearly the result of littoral action.

ON SOME SPECIES OF CANADIAN PALÆOZOIC CORALS.*

By LAWRENCE M. LAMBE, F. G. S.

In the following paper on a few species of corals from the Palæozoic rocks of Canada attention is drawn to certain structural details overlooked or misinterpreted in the original descriptions of some of the species. Supplemental descriptions of others have been induced by the further study of the type specimens or by information derived from additional material available since the species were first described. A description is also given of a supposed new species.

COLUMNARIA RUGOSA, Billings, sp.

Palæophyllum rugosum, Billings. 1858. Rep. of Progress for 1857, Geol. Survey of Canada, p. 168.

Columnaria erratica, Billings. 1858. Ibid, p. 166.

The generic characters ascribed to the genus *Palæophyllum* were—"Corallum fasciculate or aggregate ; corallities surrounded by a thick wall ; radiating septa extending the whole length ;

* Communicated by permission of the Director of the Geological Survey of Canada.

transverse diaphragms either none or rudimentary ; increase by lateral budding."

The type specimen, by far the most perfect specimen in the collection, has been closely examined and by means of a longitudinal section of one of the corallites close set complete horizontal tabulæ are found to be present. The supposed absence or rudimentary condition of tabulæ being the only character distinguishing *Palæophyllum* from *Columnaria*, the knowledge that tabulæ exist removes the barrier to the union of these two genera.

Columnaria rugosa may be defined as follows,—corallum consisting of an aggregation of circular or rounded polygonal corallites, from about 3 to 9 mm. in diameter, which are in contact with one another or free for greater or less distances. Septa, numbering about forty in well developed corallites, alternately long and short, the long ones reaching to or almost to the centre, the short ones almost rudimentary. Tabulæ complete, horizontal, slightly irregular, at times slightly concave or convex and often turned downward at their edges, about four in the space of 2 mm. Increase by lateral calicular gemmation. Exterior of corallites marked by annular lines of growth and faint longitudinal lines corresponding with the septa within.

The corallites in this species vary considerably in size in some specimens, in others they are more uniform and when in contact whether circular or polygonal they still remain distinct one from another generally with interspaces between them.

Columnaria erratica, Billings was described as "forming large masses of corallites, either in contact or separate. The separate cells are round, those in contact more or less polygonal, the radiating septa rudimentary, forming about four sulci in the breadth of one line upon the interior ; diameter of corallites from two to five lines, in general about three and a-half lines. The transverse diaphragms are not visible in the specimens examined. The walls of the separate corallites are thick and concentrically wrinkled." This species is now represented in the museum collection by a single specimen labelled in the handwriting of Mr. Billings and consists of a corallum with corallites

that are circular when free or almost polygonal when crowded together; it unfortunately does not shew the septa but tabulæ are clearly distinguishable. Judging from the manner of growth of *C. erratica*, the presence of tabulæ and the stated presence of septa, the writer believes that the description of *C. erratica* was based on imperfectly preserved specimens of *C. rugosa* and that the two species are identical especially in view of the fact that out of a number of examples of the latter species only one shews the septa at all but fortunately in this case very well.

Trenton formation; Lake St. John, Que., Little Discharge, Point Blue, J. Richardson, 1857; near Point Blue, A. R. C. Selwyn and J. Richardson, 1870; two miles south of Point Blue, W. McOuat, 1871. All the specimens are silicified and the structure is best seen where weathering has taken place.

CYATHOPHYLLUM ARTICULATUM, Wahlenberg.

Madreporites articulatus, Wahlenberg. 1821. Nov. Act. Soc. Upsal., vol. VIII, p. 87.

Cyathophyllum articulatum, Milne—Edwards and Haime, 1851. Polyp. Foss. des Terr. Palæoz, p. 377; and 1855, Brit. Foss. Corals, p. 282, pl. LXVII, figs. 1, 1a.

To this species are assigned a number of specimens from the Niagara rocks of Lake Temiscaming; their general form, manner of growth and structure may be described as follows:—Corallum composite, fasciculate, with upright, slightly flexuous, subparallel corallites, increasing by lateral or by marginal calicular gemmation from an initial basal parent and forming clusters reaching a height of over eight inches and of variable breadth. Corallites subcylindrical, strongly expanded and constricted at unequal intervals with generally free thin margins to the expansions, coming together and adhering to each other where enlarged, of unequal size, the young corallites often proceeding upward with little increase in diameter, at other times rapidly gaining breadth; varying in diameter from about 5 to 20 mm., the larg-

est being sometimes slightly over 20 mm. in diameter. Outer surface covered by an epitheca with numerous slight rings of growth and with strongly marked septal furrows. Septa, tabulæ and dissepiments well developed. Septa numberiug from sixty to over seventy in the large corallites, of two alternating sizes, the primaries passing quite to or nearly to the centre of the visceral chamber, in the latter case leaving the tabulæ smooth at the centre, the secondaries small reaching generally less than half way to the centre. Tabulæ forming a definite central zone equal in breadth to about half the diameter of the corallite, flat or slightly concave often deflected at the margin. Dissepiments as a whole rather small but unequal in size, occupying the interseptal spaces between the tabulæ and the outside wall, encroaching at times on the tabulæ. Calyces moderately deep, with steeply ascending sides and most often with expanded thin margins.

In the description given by Milne-Edwards and Haime of this species (Brit. Foss. Corals) the septa are stated to be "about sixty in number, thin, equally developed." This is evidently a misprint as far as the equality of the septa is concerned, as in fig. 1a supplementing the description, the septa are shewn as of two orders, numbering in all about sixty, half of which almost reach the centre of the visceral chamber whilst the remainder are only about half that size.

Locality and formation.—Isle of Mann (Burnt Island), Lake Temiscaming, Que. A. E. Barlow, 1893; Niagara formation.

LITHOSTROTION MACOUNII. Sp. nov.

Favosites,——(?), Whiteaves. 1877. Geol. Survey of Canada, Rep. of Progress for 1875-76, p. 98.

Corallum astræiform, composed of long, upright, slightly flexuous, closely packed, distinct, prismatic corallites that have five, six or seven sides and average about 3 mm. in breadth, forming masses evidently of considerable size; represented by two fragments the largest of which is 8 cent. high and 6 cent. broad. The corallites are somewhat irregularly marked by decided transverse often slightly oblique growth ridges, and are

covered by an epitheca regularly striated longitudinally by septal furrows. Calyces not observed. Septa from eighteen to twenty-two in number, alternately long and short, the former passing to the centre and producing a slender columella, the latter extending only a short distance inward from the wall. Frequently a primary septum instead of passing to the centre joins the one next to it at a short distance from that point A narrow peripheral area formed of small upwardly and outwardly arching plates in one or two cycles surrounds a broad tabulate inner zone. Tabulæ flat or slightly raised at the centre where they are crossed by the columella, about fifteen occurring in a space of 5 mm.

This species resembles *Lithostrotion (Stylaxis) irregularis*, McCoy* from the Carboniferous limestone of Derbyshire but the corallites are smaller, the septa are less numerous and there are fewer rows of vesicles.

Locality and formation.—Fossil Point, Peace River, British Columbia, two fragments probably belonging to the same specimen, collected by Professor J. Macoun in 1875; lower Carboniferous formation.

ACERVULARIA GRACILIS, Billings, sp.

Strombodes gracilis, Billings. 1862. Palæozoic Fossils, vol. I, p 113, fig. 94.

Original description.—"Corallum in large masses, consisting of cells from 2 to 3 lines in diameter, most of them pentagonal. Cup about one line in depth, with an irregularly rounded central style ½ line in height, and one-third or one-half the whole width of the corallite. There appear to be thirty or forty septal striæ on the inner side of the cup."

The figure on p. 113 of the above quoted work represents about one-fourth of the surface of the only specimen of this species in the collection. The specimen is silicified and not preserved as well as might be desired but by a careful examination of natural longitudinal and transverse sections the structure can

*Brit. Palæoz. Fossils, 1855. p. 101, pl. 3A, fig. 5.

be made out sufficiently clearly to give the following data:—Corallum astræiform, made up of polygonal corallites from 3 to 7 mm. in diameter with deep calyces that join each other in sharp-edged outlines and that have steep sloping sides and a rounded boss, roughly 2 mm. in breadth, at the bottom. Each corallite is contained within its own walls from which spring lamellar vertical septa whose free edges are moderately conspicuous in the calyces. Septa, numbering from about thirty to forty, alternately long and short, the former continued to the centre where they are twisted, the latter about one-half or slightly more than one-half the length of the former. Dissepiments convex, arching evenly upward and outward and filling the interseptal loculi in a circumferential area whose breadth is equal to the length of the secondary septa or about one-fourth the diameter of the corallite. Within the outer area is a zone of dissepiments or vesicles that rise upward toward the centre and in combination with the proximal ends of the primary septa form a subvesicular mass that appears at the bottom of the calyx as a rounded projection.

The presence of continuous vertical septa such as the above in corallites that are enclosed by definite walls makes clear the necessity of removing the species represented by this specimen from the genus *Arachnophyllum (Strombodes)*; although some details of structure are obscured by crystallization yet sufficient characters are preserved to suggest affinities to *Acervularia* to which genus this species is for the present at least assigned.

Locality and formation.—Manitouwaning, Grand Manitoulin Island, Lake Huron, collected by A. Murray; Niagara formation

CHONOPHYLLUM CANADENSE, Billings, sp.

Ptychophyllum Canadense, Billings. 1862. Palæoz. Fossils, vol. I, p. 107.

" *Canadense*, Billings. 1866. Cat. Silurian Fossils of Anticosti, p. 34.

Corallum large, circular, much broader than high, expanding laterally from a small, obtusely pointed base into a broad thin, frill-like horizontal extension above whose upper surface rises abruptly a central calicular area about one-fourth the breadth of the corallum; attaining a breadth of over 19 cent. and a thickness at the centre of about 4 cent. Height of the central part enclosing the calyx, above the level of the surrounding surface, in large individuals, from about 1·5 to 2 cent. Calyx* about twice as wide as high, with a diameter of about one-tenth the breadth of the corallum, flat at the bottom with very steep sides. Septa, in the visceral chamber, lamellar, of two orders, primaries and secondaries, alternating, the former meeting at the centre with a slight amount of twisting, the latter not quite half the length of the former; ascending the sides of the calyx as sharp-edged lamellæ they pass down and over the extracalicular surface as gradually broadening, flatly convex, radiating ridges having a maximum breadth near the periphery of 7 mm.; they number in different individuals from about seventy-four to eighty-four. Well developed flat or concave tabulæ, turned down at their edges and as broad as one-half the width of the calyx, are seen in a radial section, beneath the bottom of the cup. The whole of the upper surface is marked by fine, raised, interrupted and concentric, ripple-like growth lines, generally less than 1 mm. apart, those of one septal ridge sometimes continuous with at other times alternating with those of adjacent ones; the basal surface presents a similar appearance except that here the septal radii are concave instead of being convex The structure of the walls of the calyx and of the extended frill-like margin appears to be very dense. In radial sections the gradual growth of the corallum outward is indicated by parallel lines approximately at right angles to, and joining the ripple-like markings on, the upper and lower surfaces. In vertical tangential sections the septa are seen to be made up of superimposed convex layers resembling the septal structure of *C. magnificum*, Billings, but denser.

*Originally described as the basal centre "excavated into a cup-like cavity."

Locality and formation.—South-west Point, Anticosti, division 4 of the Anticosti group, collected by J. Richardson, 1856.

CYSTIPHYLLUM NIAGARENSE, Hall, sp.

Conophyllum Niagarense, Hall. 1852. Palæont. New York, vol. II, p. 114, pl. XXXII, figs. 4a—n.

Cystiphyllum Huronense, Bill. 1866. Cat. Silurian Fossils of Anticosti, p. 92.

" *Niagarense*, Rominger. 1876. Geol. Survey Michigan, Fossil Corals, p. 137, pl. XLIX, fig. 3.

" *Niagarense*, Sherzer. 1892. A revision and monograph of the genus *Chonophyllum*, Bull. Geol. Soc. of Am., vol. 3, p. 266.

The type specimen of *C. Huronense* is from the Niagara rocks of Cockburn Island, Lake Huron and was collected by Dr. R. Bell in 1865. Rominger has pointed out that *Conophyllum Niagarense*, Hall is in reality a *Cystiphyllum* and mentions its occurrence in the Niagara group of Drummond Island, Lake Huron and at Point Detour as well as in the Niagara of Kentucky, Iowa and Indiana. The specimen from Cockburn Island is preserved in such a way as to shew the longitudinal ribbing of the surface, the form, size and direction of the cystose plates within and the radial rows of denticulations on the calicular margins as well as a root-like extension near the basal extremity: details of structure such as these, taken with the general form and manner of growth of the corallum, induce the writer to believe that *C. Huronense* should properly be referred to Hall's species from the Niagara of the State of New York.

Rominger's description of this species is comprehensive and accurately describes the Canadian specimen; it appears in the following words:—"Conical polyp cells attached to other bodies at the base, and by additional root-like prolongations from the sides. Stems elongated, subcylindrical, or shorter turbinate, annulated by superficial constrictions with tortuous flexions, or by periodical total interruptions in the growth of a calyx, and the

formation of a new cell from within. The calyces are moderately deep, uniformly spreading from an obtusely angustated bottom; margins erect: their surface is blistered, and is radially striate by spinulose crests, developed in some specimens with more distinctness than in others, The surface of the polyp stems in well-preserved condition is longitudinally ribbed by septal striæ, but it often happens that the outer walls are destroyed, and that the stems are of rough exfoliated aspect, exhibiting the concave side of the blisters composing the cell cups, and the free edges of the single invaginated cups composing the stems."

CYSTIPHYLLUM AGGREGATUM, Billings.

Cystiphyllum aggregatum, Billings. 1859. Canadian Journal, new series, vol. IV, p. 137, fig. 28.

" *aggregatum*, Rominger. 1876. Geol. Survey Michigan, Fossil Corals, p. 138.

" *cæspitosum*, Schlüter. 1882. Sitzungsberichte der niederrhein. Gessellschaft für Natur-u. Heilkunde in Bonn; and 1889, Anthozoen des rheinischen Mittel-Devon, band VIII, heft 4, p. 86, pl. VIII, figs. 1—3.

Original description.—"The only specimen of this very distinct species that has come under my observation is in the cabinet of the Canadian Institute. It consists of a mass of cylindrical corallites closely aggregated and in places united by projecting folds of the outer wall, as in the genus *Eridophyllum*. The individuals are completely enveloped in a thin epitheca which is obliquely wrinkled and filled with small sublenticular cells, one or two lines in width, Diameter of longest corallite in the group, one inch, and of the smallest, five-eights of an inch."

Since the above was written a number of very fine specimens of this species, some of them of large size, have been added to the collection of the Geological Survey, therefore it is thought desirable to amplify the original description by the following, the result of an examination of the additional material—Coral-

lum aggregate, forming large masses sometimes a foot and a half across and over a foot high, composed of upwardly directed, flexuous, subcylindrical corallites that increase rapidly by lateral calicinal gemmation from a single parent corallite. As a result of their mode of growth from a small basal beginning, the corallites are somewhat divergent, those near the confines of the corallum sometimes growing almost horizontally. Corallites strongly and irregularly annulated, growing close together, frequently touching each other, their coherence being often strengthened at the points of contact by an increased development of the ridges of growth, or from want of space they may be closely pressed against one another for some distance. Mature corallites varying in diameter from 1 or 2 to over 3 cent., the young ones beginning with an average breadth of about 5 mm, and growing upward beside the old stems with a very slow increase in size, Epitheca thin, complete, shewing minor, transverse growth markings. Inner structure vesicular, similar to that of *C. vesiculosum* from which this species apparently differs only in its aggregate form.

Locality and formation.—Abundant in the Corniferous formation of Ontario; Rominger mentions its occurrence in large clusters in the Hamilton group of Thunder Bay.

(*To be continued.*)

THE WATER OF THE ILLECILLIWAET GLACIER.

By FRANK T. SHUTT AND A. T. CHARRON.

It was our good fortune, through the kindness of Dr. Saunders and Dr. Fletcher, to obtain, during the past summer, samples of water produced by the melting of the ice of the glacier known as the Great or Illecilliwaet Glacier, which can be reached by a rather arduous walk of one and a half miles from Glacier Station, B.C., on the main line of the Canadian Pacific Railway. Both samples were collected within a few feet of the glacier's irregular face, down which at the time the waters

were taken (August) numerous streams of ice-cold water were flowing to form the milky torrent that rushes down the valley in the summer to join the Illecilliwaet River.

The analytical data are as follows :—

	No. 1.	No. 2.
	Coll. Aug. 7 Anal. Aug. 15	Coll. Aug. 19 Anal. Aug. 24
	Parts per million	Parts per million
Free Ammonia	·018	·018
Albuminoid Ammonia	·027	·037
Nitrogen as Nitrates and Nitrites	·0246	·0442
Oxygen absorbed in 15 miuutes	·0396	·0672
" " " 4 hours	·1056	·1744
Chlorine	·10	·10
Total Solids at 105 degrees C	30·8	12·0
Solids aftter ignition	30·8	8·0
Loss on ignition	None.	4·0
Phosphates	None.	None.

No. 1—When received at the laboratory (Aug. 15th.), the sample was quite murky, almost milky in appearance, from the presence of suspended mater. On standing 48 hours, a considerable amount of what proved under the microscope to be chiefly very fine fragments of quartz had settled to the bottom of the bottle. The supernatant water was, however, stlll turbid, and remained more or less so—though gradually clearing—for nearly two months.

No. 2—This sample also was milky and turbid when received, but not to such a degree as No. 1.

On Dec. 12th, the samples then being perfectly clear and brilliant, the "total solids" of the supernatant waters were again taken, with the following results:—

	No. 1.	No. 2.
	p. p. m.	p. p. m.
Total Solids at 105 degrees C.	16·8	1·6
Solids after ignition	12·0	none

These data show that the "total solids" in the waters as received consisted almost entirely of suspended rock matter. The amounts of dissolved mineral and organic matter are extremely small.

We may conclude from the analytical results obtained that the Glacier water is one of great organic purity. It is evident, however, that it cannot be considered as always constant as regards either the amount of its organic or mineral constituents; the latter, as we have seen, however are scarcely to be regarded as an intregral part of the water. The samples were collected twelve days apart, and probably at different points, which facts may allow us to understand the nature of the causes for the slight variations in the analyses.

The point of greatest interest, after establishing the high degree of purity of the water, is the large amount of finely divided rock matter in suspension. This is present in such quantities as to make the water quite milky in appearance, and is so fine that the water must stand for some weeks before thorough subsidence is effected. Microscopic examination of the deposit so formed proved it to consist almost entirely of fragments of quartzite.

For the following note on the geology of the district we are indebted to Mr. R. G. McConnell, of the Geological Survey.

"The rocks in the vicinity of the Glacier are of Cambrian age and consist largely of bluish quartzites and fine grained conglomerates holding pebbles of quartz and feldspar imbedded in a hard silicious matrix. In addition to these, greenish and dark schists of volcanic origin also occur in the neighbourhood."

Laboratory of the Experimental Farms.
Ottawa, Feb., 6th, 1899.

NOTES ON THE BIRDS OF KING'S CO., NOVA SCOTIA—PART II.

By HAROLD TUFTS, Esq., Wolfville, King's Co., N.S.

Dendragapus canadensis (*Linn.*) CANADA GROUSE.
Rather rare.

Bonasa umbellus togata (*Linn.*) CANADIAN RUFFED GROUSE.
Fairly abundant. They are now protected by law till October, 1901.

Circus hudsonius (*Linn.*) MARSH-HAWK.
Common from April till December.

Accipiter velox (*Wils.*) SHARP-SHINNED HAWK.
Fairly common throughout the year.

Accipiter cooperi (*Bonap.*) COOPER'S HAWK.
Not common. Absent in winter.

Accipiter atricapillus (*Wils.*) GOSHAWK.
Not very common. Present throughout the year.

Buteo borealis (*Gmel.*) RED-TAILED HAWK.
Fairly common except in winter.

Buteo lineatus (*Gmel.*) RED-SHOULDERED HAWK.
Not so common as the preceding species.

Archibuteo lagopus sancti-johannis (*Gmel.*) AMERICAN ROUGH-LEGGED HAWK.
Quite common on the Grand Pré in early winter and spring.

Haliæetus leucocephalus (*Linn.*) BALD EAGLE.
Rare. A few years ago a pair nested on Long Island.

Falco rusticolus obsoletus (*Gmel.*) BLACK GYRFALCON.
One specimen was taken at Long Island, Jan. 8th, 1898.

Falco peregrinus anatum (*Bonap.*) DUCK HAWK.
Not common. Sometimes seen at Long Island in August and September.

Falco columbarius (*Linn.*) PIGEON HAWK.
Not common. Present from March till January.

Falco sparverius (*Linn.*) SPARROW HAWK.
Fairly common from April till October.

Pandion haliaetus carolinensis (*Gmel.*) OSPREY.

Rare, except in May and June, when they are frequently observed along the Gaspereau River following the movement of the ascending fish.

Asio wilsonianus (*Less.*) LONG-EARED OWL.

Common except in winter.

Asio accipiterinus (*Pall.*) SHORT-EARED OWL.

Common on the Grand Pré from April till the middle of December.

Syrnium nebulosum (*Forst.*) BARRED OWL.

Fairly common in heavily wooded regions.

Nyctala acadica (*Gmel.*) SAW-WHET OWL.

Present throughout the year, but most common in winter. A nest was taken last April containing six eggs.

Bubo virginianus (*Gmel.*) GREAT HORNED OWL.

Uncommon. Found in densely wooded districts.

Nyctea nyctea (*Linn.*) SNOWY OWL.

Rare winter visitant.

Surnia ulula caparoch (*Müll.*) HAWK OWL.

Rare. An example was taken last October.

Coccyzus erythrophthalmus (*Wils.*) BLACK BILLED CUCKOO.

Fairly common from May 20th till September.

Ceryle alcyon (*Linn.*) BELTED KINGFISHER.

Fairly common about suitable places from May till October.

Dryobates villosus (*Linn.*) HAIRY WOODPECKER.

Fairly common throughout the year.

Dryobates pubescens (*Linn.*) DOWNY WOODPECKER.

Common throughout the year.

Picoides arcticus (*Swains.*) ARCTIC THREE-TOED WOODPECKER

Rare winter visitant.

Sphyrapicus varius (*Linn.*) YELLOW-BELLIED SAPSUCKER.

Fairly common summer resident.

Cephlœus pileatus (*Linn.*) PILEATED WOODPECKER.

Rare. One was taken in September, 1897.

Colaptes auratus (*Linn.*) FLICKER.

Abundant from April to October. Usually the flicker's nest is situated quite a distance from the ground, as one of the bird's names—"high-hole"—suggests, but last summer a nest was observed so low that the bottom was on a level with the ground outside the stump in which the nest was made. The nine eggs which this nest contained were also remarkable. One egg was no larger than a sparrow's and contained no yolk while the other eight varied greatly in shape, from spherical to extremely elongate.

Chordeiles virginianus (*Gmel.*) NIGHT-HAWK.

Abundant from May 20th till September.

Chætura pelagica (*Linn.*) CHIMNEY SWIFT

Abundant from May till the middle of September.

Trochilus colubris (*Linn.*) HUMMING-BIRD.

Common during the summer.

Tyrannus tyrannus (*Linn.*) KINGBIRD

Fairly abundant from the middle of May till the middle of September.

Contopus borealis (*Swains.*) OLIVE SIDED FLYCATCHER.

Fairly common from May 20th till October. Two sets of eggs of this bird from Wolfville are now in the National Museum at Ottawa.

Contopus virens (*Linn.*) WOOD PEWEE

Not very common, but pretty evenly distributed. Arrives here from the south, about the 1st of June, and leaves again about the 1st of September.

Empidonax flaviventris *Baird.* YELLOW-BELLIED FLYCATCHER.

Fairly common in dense low woods during the summer.

Empidonax traillii (*Aud.*) TRAILL'S FLYCATCHER.

Quite common from June till September.

Empidonax minimus *Baird.* LEAST FLYCATCHER.

Common from the middle of May till September.

Otocoris alpestris (*Linn.*) HORNED LARK

Very common from November till April.

Cyanocitta cristata (*Linn.*) BLUE JAY.

Common throughout the year. They are very destructive to the eggs and young of our small song birds.

Perisoreus canadensis (*Linn.*) CANADA JAY.

Rather uncommon, but present throughout the year.

Corvus corax principalis (*Ridgw.*) RAVEN.

Fairly common throughout the year. They often kill very young lambs, for which reason they are persecuted by the farmers.

Corvus americanus (*And*) CROW.

Exceedingly abundant throughout the year.

Dolichonyx oryzivorus (*Linn.*) BOBOLINK.

Abundant in summer about the meadows along the Cornwallis Valley. A set of eggs from this locality are now in the Museum at Ottawa.

Agelaius phœniceus (*Linn.*) RED-WINGED BLACKBIRD.

Rare.

Scolecophagus carolinus (*Mull.*) RUSTY BLACKBIRD.

Fairly common from the last of March till September.

Quiscalus quiscala (*Linn.*) PURPLE GRACKLE.

One observed May 3rd, 1895.

Pinicola enucleator (*Linn.*) PINE GROSBEAK.

Appears regularly about the first of December and remains till March.

Carpodacus purpureus (*Gmel.*) PURPLE FINCH.

Common in summer, while a few remain through the winter. Two sets of eggs from this locality are now in the Museum at Ottawa.

Passer domesticus (*Linn.*) HOUSE SPARROW.

Very abundant everywhere.

Loxia curvirostra minor (*Brehm.*) AMERICAN CROSSBILL.

Usually very abundant in summer when large roving flocks are to be met with everywhere. A nest containing three young birds was taken about the first of August, 1896.

Loxia leucoptera (*Gmel.*) WHITE-WINGED CROSSBILL.

Seen here only in winter and early spring and are of irregular occurrence. They frequent the tops of spruces and firs where they gather the seeds from the cones.

Acanthis linaria (*Linn.*) REDPOLL.

Are very common some winters, while during others they are rare or absent.

Spinus tristis (*Linn.*) AMERICAN GOLDFINCH.

Fairly common throughout the year.

Spinus pinus (*Wils.*) PINE SISKIN.

Breeds here regularly in May and June, and usually is common till September. At other times of the year it is very irregular. Two sets of eggs from this locality are now in the museum at Ottawa.

Plectrophenax nivalis (*Linn.*) SNOW BUNTING.

Common every winter, but not so numerous as formerly.

Poocætes gramineus (*Gmel.*) VESPER SPARROW.

Common from the middle of April till October.

Ammodramus sandwichensis savanna (*Wils.*) SAVANNA SPARROW.

Very common from the middle of April till October.

Ammodramus caudacutus subvirgatus (*Dwight*) ACADIAN SHARP-TAILED SPARROW.

Fairly common about the salt marshes at the mouths of the streams emptying into Minas Basin, from June till October.

Zonotrichia albicollis (*Gmel.*) WHITE-THROATED SPARROW.

Common from May till October. Two sets of eggs from this locality are now in the Museum at Ottawa.

Spizella monticola (*Gmel.*) TREE SPARROW.

Fairly common in winter.

Spizella socialis (*Wils.*) CHIPPING SPARROW.

Very common from May till September.

Junco hyemalis (*Linn.*) JUNCO.

Very common from March till November. A few spend the winter here.

Melospiza fasciata (*Gmel.*) SONG SPARROW.

Common throughout the year.

Melospiza georgiana (*Lath.*) SWAMP SPARROW.

Fairly common from May till October. One set of eggs from this locality is now in the Museum at Ottawa.

Passerella iliaca (*Merr.*) FOX SPARROW.

Usually quite common during the spring migration.

Habia ludoviciana (*Linn.*) RED-BREASTED GROSBEAK.

Uncommon, but a regular summer resident.

CONVERSAZIONE OF THE OTTAWA FIELD-NATURALISTS' CLUB.—JAN. 24TH, 1899.

The Annual Conversazione and Microscopical Soirée under the auspices of the O. F. N. C. was held on Tuesday, Jan. 24th, 1899, in the large Assembly Hall of the Provincial Normal School, kindly placed at the disposal of the Club by Principal MacCabe. Prof. E. E. Prince, B.A., F.L.S., President of the Club, occupied the chair. The hall was filled with a large concourse of members of the Club and friends, and the event was pronounced by all a decided success.

Among those present were: His Excellency the Earl of Minto, Patron of the Club; Capt. W.F. Lascelles, A.D.C.; Sir Henri G. Joly de Lotbinière, K.C.M.G.; Hon. Dr. Borden; Sir James Grant; Dr. G. M. Dawson, C.M.G., Director of the Geological Dept.; Colonel J. P. Macpherson; Dr. James Fletcher; Dr. I. Bradley; Prof. Macoun; Mr. F. T. Shutt; Mr. Henry Macleod, C.E.; Dr. R. W. Ells, F.R.S.C.; Mr. W. Hague Harrington, F.R.S.C.; Vice-Principal S. B. Sinclair, B.A.; Mr. Kemp; Mr. Andrew Halkett; Mr. D. B. Dowling B.A.Sc.; Mr. W. T. Macoun; Mr. W. J. Wilson, Ph.B.; Mr. W. C. Bowles; Mr. A. G. Kingston, Principal McBratney; Mr. and Mrs. W. Scott; Mr. and Mrs. E. B. Eddy; Mr. W. Campbell, B.A.; Mr. and Mrs. O. J. Joliffe, M.A.; besides many teachers and students of the Provincial Normal and Model Schools and other leading educational institutions in the city. In a very neat address, Prof. Prince, gave a hearty welcome to the vast audience present and thanked the authorities of the Normal School for the use of the Lecture Hall, so well adapted for such an occasion.

Mr. S. B. Sinclair, Vice-Principal of the Normal School, expressed his appreciation of the valuable collection of geological specimens recently presented to the Normal School by Dr. Ami of the Club, and also of the rare collection of plants presented by Professor Macoun. He congratulated the society upon the nature and extent of its work. He considered that its most hopeful feature lay in the spirit of original research fostered by contact with the leaders in its different departments. The true scientist imparts his enthusiasm to those about him.

> "What he has loved,
> Others will love, and he will teach them how."

He quoted from Agassiz and others to show that such independent investigation is not only the most essential element of all natural science study worthy of the name, but that it also affords the best gymnasium for the development of vigorous personality,

Dr. Ami then announced the various exhibits of specimens displayed upon the tables in the Hall, giving brief notes of interest on each. These exhibits included:

Diagrams of Deinosaur, N. W. Territories.....Mr. L. M. Lambe.
Rocky Mountain Plants and Butterflies .....Dr. James Fletcher.
Squirrels of Canada.....Prof. John Macoun.

Behring Sea Plants.....Mr. James M. Macoun.
Indigenous Trees and Shrubs .....Mr. Wm. T. Macoun.
Silver Bear, Skeena River Country, B.C., and a Rocking Microtome.....Prof. E. E. Prince.
Weathered Rock illustrating old Devonian sea bottom..Dr. H. M. Ami.
Specimens of Bones and Skull from Klondike gravels, collected by Wm. Ogilvie, Esq..... "
Shells, Fruits and interesting collections from Jamaica .Mr. W. S. Odell.
Tropical Shells.....Mr. Andrew Halkett.

The east end of the Hall was occupied by a long table, where the following gentlemen exhibited various objects of special interest under the microscopes: Professor Prince, Mr. Kemp, Dr. Dawson, Mr. W. J. Wilson, Dr. Fletcher, Mr. Walter S. Odell (living organisms,) Mr. F. T. Shutt and Dr. Ami. Electric drop-lights attached to ornamental lamps with opal shades, kindly furnished by the Ottawa Electric Co., afforded excellent light for the instruments on the table.

The central portion of the floor was occupied by the projection microscope and science lantern from which numerous microscopic preparations themselves were exhibited on the screen magnified many thousand times. This part of the programme proved very attractive inasmuch as the whole audience could see at one glance the same microscopical object or preparation projected on the screen, whereas in the case of the table microscope only one person could examine any one slide or object at a time.

Shortly after His Excellency's arrival, Prof. Macoun described the various kinds of Squirrels known in Canada,* after which Dr. Ami projected some thirty preparations on the screen, including palate of whelk, palate of snail, proboscis of blowfly, oak saw-fly, flea from white mouse, mosquito, larva of mosquito, deep sea dredgings (H.M.S. Challenger) scales of body of a moth, cross-section of spine of Echinus, stellate hairs from the leaf of Deutzia, cross-section of hairs of elephant, deer, and other animals, &c., &c,

Dr. G. M. Dawson then gave a very interesting and instructive address on "*The remarkable landslip on the Rivière Blanche, County Portneuf, Que.*" An abstract of this paper, which was well received, appeared in the January issue of THE NATURALIST, pp. 194-195. Prof. Macoun concluded the papers of the evening by a graphic dissertation (illustrated with lantern slides) on the forest trees of Canada, showing what glorious possibilities of forestry the Dominion possessed.

*We hope to be able at some future date to give the readers of THE OTTAWA NATURALIST an abstract of Prof. Macoun's address.—THE EDITOR.

NOTES, REVIEWS AND COMMENTS.

"REPORT ON THE MARBLE, SLATE AND GRANITE INDUSTRIES OF VERMONT," by G. H. Perkins, Ph. D., State Geologist.—This is a brief preliminary report on some of the economic resources of the State of Vermont issued in accordance with an Act of the State Legislature passed in 1896. It is the first official report published by this state since the well known report of "President Edward Hitchcock in 1861."

As the work has been only recently begun, the report is limited to the three industries mentioned in the title. The different varieties of the various products and their uses are described, as well as the methods of quarrying and manufacturing them. The report is well illustrated and contains much information of a thoroughly practical character.

According to the best information now available, Vermont stands first amongst the United States in the production of marble and granite, and second, only to Pennsylvania, in slate.

The value of the annual output of the first is now about $3,500,000, of the second $1,500,000 and of the third $850,000. These figures alone show the importance of maintaining a geological survey in this state.

The subsequent and complete reports of Prof. Perkins, will be looked for with much interest both for their economic and their scientific results. JOHN A. DRESSER, Richmond, Que.

GEOLOGICAL CONGRESS.—The Eighth International Congress of geologists is to take place in Paris, August 16th to 28th in the year 1900, in connection with the Universal Exposition. A circular letter has been communicated to all American geologists inviting them to take part. Monsieur A. Gaudry is president of the committee of organization, with Messrs. Michel Levy and Marcel Bertrand as vice-presidents and Dr. Charles Barrois, secretary. Special excursions to most interesting localities are already arranged for. It is to be hoped that Canada will be fitly represented at this World's Congress.

A WELL DESERVED HONOUR.—The many readers of THE OTTAWA NATURALIST, as well as his many other friends in Ottawa will learn with pleasure that, Mr. Wm. Scott, B.A., has been chosen by the Provincial Minister of Education to fill the position of Principal of the Normal School at Toronto, rendered vacant by the death of the late Principal, Mr. Kirkland, on Dec. the 31st last. Mr. Scott was for several years a most active member of the Council of the Club and, while living in Ottawa, was an enthusiastic and untiring member of the Botanical Branch, for which he did valuable service in working up the local flora and added several new records to the Flora Ottawaensis. We heartily congratulate Mr. Scott on his promotion to the important and responsible office which he has been selected to fill, knowing that he will carry out thoroughly and well anything he undertakes.

Fig. 1.

Fig. 2.

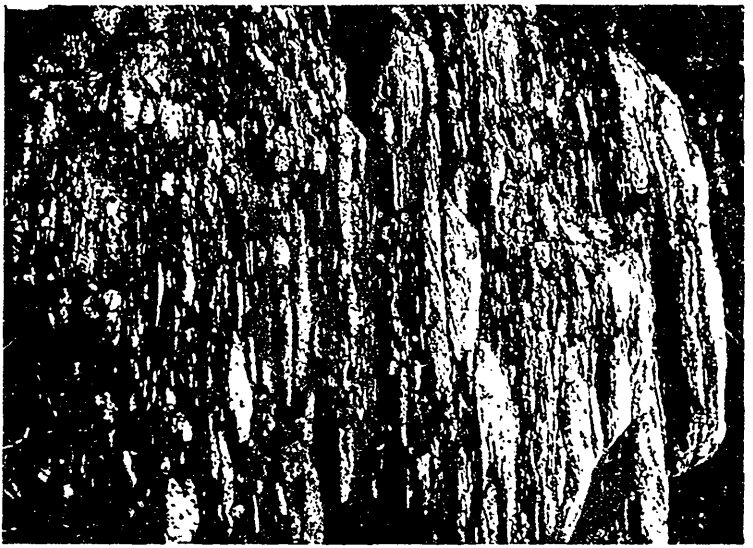

Fig. 1.

Fig. 2.

Fig. 1.

Fig. 2.

THE OTTAWA FIELD-NATURALISTS' CLUB, 1898-1899.

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