TRANSACTIONS

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SESSION OF 1894-95.

I.—Notes on Concretions found in Canadian Rocks.—By T. C. Weston, F. G. S. A., late of the Geological Survey of Canada.

(Read 14th January, 1895).

Every student of geology is familiar with concretionary matter. I purpose in this short paper giving descriptions and illustrations of a few of the more interesting forms.

The resemblance of many concretions found at various horizons of our Canadian rocks, to some of the Monticuliporidæ and Stromatopora of the Trenton, Chazy and other formations has often caused them to be mistaken for these fossils. Notes by the writer in Trans. of the Nova Scotian Inst. of Science. Ser. 2, Vol. 1, Fig. 1, reproduced supposed *Oldhamia* of the Huronian Rocks of Newfoundland.

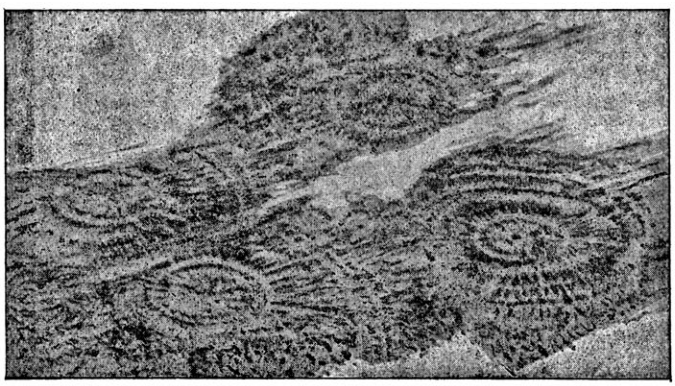

Fig. 1.

Concretions are most commonly spheroidal, or nearly so in shape, and range in size from that of a grain of sand to twenty and thirty feet in diameter.

1. On the coast of Arisaig, N. S, in the argillaceous slates and shales of the Clinton formation, slightly flattened spheroidal forms are abundant. Two of these, about two feet in diameter when broken through the centre, showed no concentric layers or nuclei, while many others, varying in size from the eighth of an inch to two inches in diameter, contained invariably a nucleus ; sometimes a grain of sand, but generally the brachiopod, *Lingula oblonga*, Hall.

2. The largest concretions seen by the writer were found in the Fox Hill and Pierre shales and clays of the North-West, and a very interesting exhibition of giant forms may be seen three miles north of Irving station-house on the Canadian Pacific Railway. Here, huge boulder-like spheroidal and ovoid concretions once held in the rocks but removed by great denudation (probably in the glacial epoch, for glacial striæ are seen on some of the flat beds), stand out in bold relief, resting on the flat and upturned edges of shales and sandstones ; and on the top of one of them, about twenty feet high, an eagle had built its nest of buffalo-bones and the roots of the wild sage, for want of a more elevated situation, which does not occur in this locality.

In composition they appear to be chiefly argillaceous and calcareous sandstones. Many of them have fallen to pieces, and the debris shows that they have been formed in layers which increased in thickness from the centre outward. Portions of the beds from which they were derived were found enclosed in several of them, and the stratified pieces of the bed-rock were found to be prolific in fossils. Among the genera and species found in these were : *Lingula nitida ; Protocardia subquadrata ; Liopistha undata, etc.*

3. Mr. R. G. McConnell, of the Geological Survey, describes

similar concretions in a Cretaceous rock of Grand Rapids, Athabasca River*, as follows :—

"It is remarkable for the large number of spheroidal siliceous concretions which it contains, and which range in size up to ten feet or more in diameter. No fossils were found in the concretions or in the rocks which hold them."

The same agency which produced these great concretions no doubt formed the smaller pipe-stem concretions, so numerous in the Miocene rocks at the head waters of Swift Current, N. W. T., and which are now being formed on the shores of Lake Champlain.

4. Another interesting concretion locality lies half a mile west of White Mud River, near the Fort Walsh trail, in the Assiniboine district, N. W. T., the rocks belonging to the Laramie formation. Here a small butte was pointed out to me by my half-breed Indian guide, who called the place gun-shot butte, and said a few years ago when he, with others, hunted buffalo in that locality, they sometimes, when ammunition was scarce, used these "balls" in their guns and rifles. I found the hill, or butte, to consist largely of calcareous sand, which contained enormous quantities of spheroidal concretions, varying in size from that of buck-shot to an inch in diameter ; the ordinary size being that of rifle balls. A great number of these are compound forms representing two halves of a sphere coalescing together, sometimes a number of these marbles (as the Indians call them), are clustered together into pieces as large as one's head. They are all more or less covered with nodes. About one-third of each is carbonate of lime, which dissolves out with muriatic acid, leaving a residue (as seen under the microscope), of grains of pure silex, with a few of feldspar, magnetite, and mica. There are no concentrie layers and no nuclei.

5. The Animikie argentiferous rocks of the Thunder Bay district are remarkable for "bombs," so called by the miners. At the Beaver silver mine, a few miles from Port Arthur, many concretions resembling cannon balls may be seen in the black carbonaceous slates which are largely developed at this locality.

* Geological Survey Report for 1889-90-91.

They appear to be composed of cherty argillite, and are slightly calcareous, and some when broken through the centre show concentric layers, chiefly of pyrites. No distinct radiating structure, and no nuclei were seen in any of the specimens broken.

6. In the Devonian rocks of Kettle Point, in Bosanquet, on Lake Huron, forms similar to the foregoing in outward appearance exhibit different internal structure. They are described in the Geology of Canada, 1863, p. p. 387-88, as: "Peculiar spheroidal concretions whose fancied resemblance to inverted kettles has probably given its name to the point. They vary in size from three inches to as many feet, and are sometimes nearly spherical, and others sometimes flattened, generally on the under side. Occasionally a smaller spheroidal mass is implanted on the top of a larger one. These concretions are readily broken, and are then seen to be composed of brown crystalline carbonate of lime, which is confusedly aggregated in the centre, and sometimes contains blende. Around this are arranged slender prismatic crystals which extend from the nucleus to the circumference; the whole having a radiating columnar structure, which, not less than the terminations of the prisms, at the surface of the spheroidal masses, gives them very much the aspect of fossil corals"

7. The Upper Devonian fish and plant bearing beds of Scaumenac Bay, New Brunswick, are prolific in fossiliferous concretions, which are composed of calcareo-arenaceous rock, and take various forms according to the shape of the nucleus, which is often so well preserved that every bone can be seen. One of these concretions obtained by A. H. Foord measures over twenty-one inches in length, and contains the skeleton of a fish almost as long. It is *Chirolepis Canadensis* (Whiteaves). In other concretions from this locality the writer and Mr. A. H. Foord found: *Glyptolepis microlepidotus* (Agassiz), *Phaneropleuron curtum*, *Pterichthys Canadensis* (Whiteaves), *Eusthenopteron Foordi*, *etc.*

In the coal bearing rocks of Skidegate Inlet of the Queen Charlotte Islands, concretionary nodules are found, in which

Ammonites and crustaceans occur. Among these are Ammonites (Desmoceras), Sacya (Forbes), and Ammonites (Haploceras), Beudanti, Brongniart.

8. The Huronian rocks, which I have described above, Fig. 1, contain many curious concretions. Some of the small islands in Georgian Bay are composed of a calcareous greenstone, in which an aggregate of quartz, feldspar, chlorite, epidote, etc., are found. In this rock concretionary balls an inch in diameter occur, microscopic sections of which show them to be composed of the same material as the matrix in which they are imbedded, both being highly crystalline, and the concretions having a scoriated appearance.

9. A soft, whitish limestone from the Cambrian deposits of Cow Head, Newfoundland, is composed chiefly of rounded grains of irregular shape and size, many of which might readily be taken for Ostracod crustaceans, or have a close resemblance to the species *Conodona Tateana*. The microscope, however, shows them to be concretious, generally partly hollow and filled with crystalline limestone. In the beds from which the specimens examined came, ten species of trilobites have been found by Dr. Ami of the Geological Survey of Canada.

10. An oolitic limestone from the Cambrian rocks of the Selkirks, B. C., two miles west of Donald, shows under the microscope concentric layers, slight radiating lines and crystalline fibres arranged at various angles transverse to the concentric structure. Fig. 2 is from a micro-drawing of one of these forms, enlarged about 20 diameters.

FIG. 2.

11. In Cape Breton, and at Arisaig, N. S., there are bands of limestone composed entirely of concretions no larger than mustard seeds, and sometimes much smaller. They represent our oolitic rocks. Those of Cape Breton belong to the carboniferous formation, and those of Arisaig are associated with the lower carboniferous conglomerates and sandstones of the coast rocks. In my notes of 1873 of a portion of the Arisaig rocks, I wrote: "At Grant and McDonald's Cove the sandstones are in contact with a band of light gray limestone (Photo. No. 18), resting on six feet of bluish gray calcareous shale, holding a *Lingula* and two small bivalves resembling *Modiolopsis*, but not determinable with certainty. In the limestones of which there is a thickness of about twenty feet, I found two species of *Rhynchonella* and one *Athyris*. A great part of this limestone is oolitic, or made up of minute concretions." Fig. 3 is a micro-drawing from a thin slice of the Cape Breton limestone magnified about twenty times.

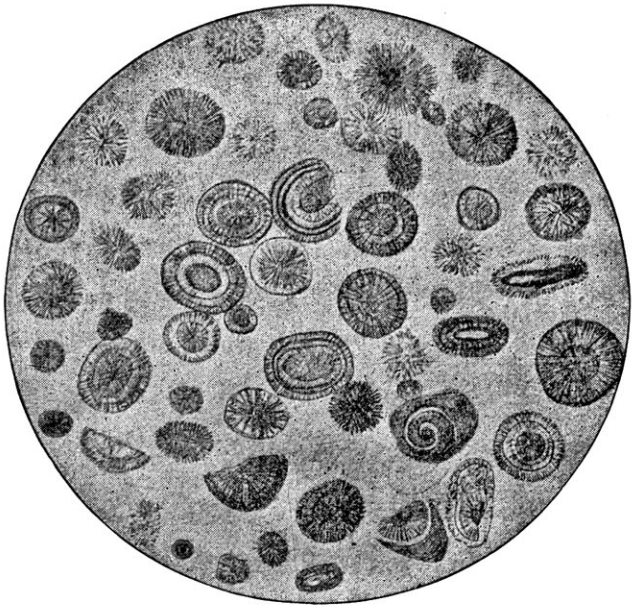

FIG. 3.

It will be seen that each concretion has a radiating structure, and most of them show concentric layers.

12. Pisolitic limestone (so-called from *pisum* a pea), has, so far as I know, only been found in Canada in rounded pieces in the conglomerates of the "Quebec Group." These contain many fossils, which are supposed to belong to the Upper Cambrian zone; the pebbles belong to the same geological horizon. I have found no radiating structure in any of these pisolite forms; but this peculiarity is seen in all sections of oolitic limestone. Sections of pisolite limestone from St. Anne, Bic, Point Levis, and other localities in the province of Quebec, show each concretion to be formed of concentric layers, in some cases little or no nucleus is found, while in others the nuclei forms three parts of the whole.

FIG. 4.

Fig. 4 shows several of the pisolitic forms cut through the centre. In the rock these little round balls are cemented together with so little calcareous matter that a slight tap with the hammer will detach them.

13. In 1892 a piece of oolitic limestone, collected from the Trenton rocks of Ottawa by W. R. Billings, was sent me for microscopic examination. Sections showed these minute concretions to be precisely like those of the limestones of Cape Breton and Arisaig. Fig. 3.

14. A limestone from the lower carboniferous of New Brunswick is partly made up of concretionary forms which, when weathered, might readily be taken for small stromatoporids, but which in thin slices under the microscope show a nucleus of crystallized calcite and concentric rings, between

which is a series of prismatic or vacerous lines See fig. 5, enlarged about ten diameters.

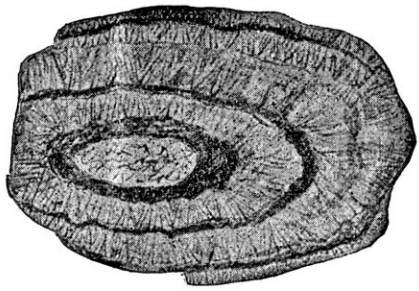

FIG. 5.

15. On the flat surface of the Potsdam sandstones, Upper Cambrian, of the coast of Labrador, fine examples of concretionary structure may be seen, some of them a yard or more in diameter, showing fine concentric lines of various shades of color which, when weathered, look like the lines of growth in a section of a tree, but no radial lines are seen. The sandstone is pierced by *Scolithus Canadensis*, (Billings). Fig. 6 is from a sketch of a detached piece lying on the shore.

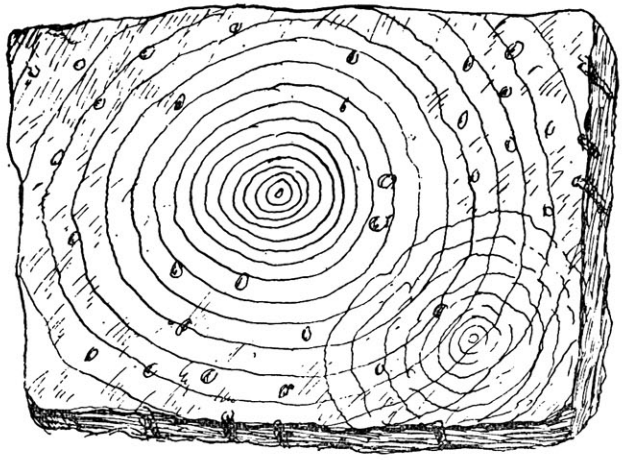

FIG. 6.

16. Besides the large trunk-like cylindrical concretions found in the Potsdam sandstones on the banks of the Rideau Canal, near Kingston, Ont., (Trans. Nova Scotian Inst. of Sci., Ser. 2, Vol. I.), there are many "stone potatoes," so-called by the quarrymen. These are spheroidal forms generally distorted, varying from the size of a rifle bullet to three inches in diameter, and composed of fine grains of translucent quartz. Many of them are stained with oxide of iron, while others are of a dirty white, the colour varying according to the tint of the rock in which they are enclosed. In some of these, concentric layers are faintly seen, but no radiating lines.

17. Hard calcareous concretions (nodules, as they are generally called), are among the most interesting objects of the Post-Tertiary (Leda Clay) deposits of Canada. The clay banks of Green's Creek, and the south shore of the Ottawa River, a little below Ottawa city, have been known for many years, and the fossils contained in the concretions of these localities recorded by many writers; but a few words here may not be out of place. The kidney form is the most common shape taken by these concretions, which generally enclose the skeleton of the well-known Green's Creek fossil fish, hundreds of which may be collected in a few days. It is a capelin, *Mallotus villosus* (Cuvier), in some cases so well preserved that every bone can be seen. Other forms are spheroidal, and contain for a nucleus a fragment of bone, a shell or grain of sand, or an insect. A large collection of these fossil bearing nodules or concretions was made by Dr. Ells of the Canadian Geological Survey during the summer of 1893, from Besserer's wharf, on the Ottawa River, near the mouth of Green's Creek. In one of these a fine leaf of *Populus balsamifera* was found.

In Sir J. W. Dawson's "Canadian Ice Age," a detailed account is given of our Post-Tertiary rocks, with illustrations of some of the principal fossils. Besides the common capelin before mentioned, we find the well-known mussel shell, *Mytilus edulis*, Linn., and two or three beetles, among which is *Byrrhus Ottawaensis*, the latter collected by Dr. Ami of the Geological Survey.

OTTAWA, March, 1894.