J W Dawson. Montreal 1895

NOTE ON A PAPER ON "EOZOONAL STRUCTURE OF THE EJECTED BLOCKS OF MONTE SOMMA." *

I desire to make a few remarks on the above paper, not for the purpose of entering into the general questions relating to the organic structure of Eozoon, but to indicate certain reasons for the belief that the appearances described in the paper have no relation to Eozoon Canadense, either in mode of occurrence and mineral character or in microscopic structure, and consequently that, whatever the interest and value of the paper in other connections, the references to the Laurentian fossil are wholly gratuitous and unnecessary, while they are also in very important respects incorrect.

In making these criticisms, I shall, for the sake of simplicity refer only to those typical specimens of Eozoon in which the laminæ remain as calcite, while the chambers are filled with serpentine or more rarely with malacolite, and the canals and tubuli with serpentine or dolomite.

1. *Mode of Occurrence and Mineral Character.*—The paper states in three distinct places that the typical Eozoon is enclosed in a pyroxenic igneous rock, as follows:—

Page 260. "The typical Eozoonal nodules occur enclosed in a rock of which a white pyroxene is the leading constituent."

Page 275. "Concentric Eozoonal masses are included in a coarse-grained rock which is composed of white pyroxene and which therefore may safely be regarded as igneous in origin."

Page 277. "The Cote St. Pierre spheroids (of Eozoon) are probably cases of blocks included in either a volcanic or plutonic mass."

By implication this mode of occurrence is also assumed throughout the paper. The statement is however entirely without foundation, and I am at a loss to understand whence it has been derived. It certainly could not have been from any competent observer who has studied Eozoon in situ. In point of fact the best specimens have all been found in a thick limestone, the Grenville Limestone of Sir William Logan, estimated by him at 750 feet in its average thickness, though with a few intercalated thin bands of gneiss and quartzite.† In the vicinity of Cote St. Pierre in the Seigniory of Petite Nation, where some of the best specimens of Eozoon are found, the outcrop of this limestone has been traced continuously and mapped by the Geological Survey for twenty-five miles, and in the same district it occurs over an extent of more than one hundred miles on the reverse sides of synclinal and anticlinal folds, where it may be recognized by its character and associations as well as by its holding Eozoon.‡ It is true that grains, nodules and thin interrupted bands of a white variety of pyroxene (malacolite) occur sparingly in this limestone; but neither in their chemical composition nor in their mode of occurrence have we any proof or even probability of an igneous (intrusive) origin. This was the matured conclusion of the late Dr. Sterry Hunt; and Dr. F. D. Adams, at present our best authority on these rocks, is of the same opinion.

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* By Dr. Johnston-Lavis, F.G.S., &c., and Dr. J. W. Gregory, F.G.S., &c., Trans. R. Dublin Society Vol. V., Series II. Oct. 1894.

† Geology of Canada, page 45. See also "Life's Dawn on Earth," and Memoir on "Specimens of Eozoon Canadense" by the Author. Montreal, 1888.

‡ It must be evident that the singular opinion quoted on page 277, that even these great continuous Laurentian limestones may themselves have been "inclusions in intrusive igneous rocks" is too monstrous to be entertained for a moment, especially in opposition to the judgment of all the ablest geologists who have studied them.

The Grenville limestone has been much bent and folded, and with its accompanying beds has been subjected to regional metamorphism. In the Petite Nation localities, however, it has, not, as far as known, been invaded by igneous dykes or masses.

The specimens of Eozoon are included in this limestone, and vary from single individuals ranging from an inch to six inches in diameter to aggregated groups of a foot or more; and microscopic examination shows that, in some of the beds in which they occur, there are innumerable fragments showing the same structures scattered on the strata planes, and associated with the minute globular chamberlets which I have named *Archaeospherinæ*. The specimens of Eozoon may be seen weathered out on the surfaces of the limestone exactly in the manner of Stromatoporæ on the surfaces of the calcareous rocks of the Cambrian, Ordovician and Silurian, though I have not seen them so crowded together as in some of the beds of these later formations.

From the statements quoted from Mr. Blake (p. 274) and some remarks on p. 275, I would infer that the authors possibly contemplate Eozoon in an inverted position, with the acervuline part within or below, and the thicker and more regular laminæ above or without. I need scarcely say that this would be in direct opposition to the descriptions of Dr. Carpenter and myself, based on the study of a great number of specimens in situ. I observe, however, that Zittel (Palaeontologie, Fig. 47) places Eozoon in this inverted position, which may have led to the error in question.

It is proper perhaps to repeat in this connection that in certain layers of the Grenville limestone grains and concretions of serpentine and malacolite occur without Eozoon, and specimens of Eozoon with only so much of such minerals as may be contained in their chambers. There are also instances in which specimens of Eozoon occur attached to or partially imbedded in such nodules, just as sponges and other organisms occur associated with flints in chalk, or as stromatoporæ occur in connection with concretions of chert in Palaeozoic limestones. As to the origin of the concretions themselves, from whatever source their materials may have been originally derived, their isolation in the limestone and the manner in which they occur in connection with surfaces of deposition, render it certain that their introduction as well as that of the individuals of Eozoon was contemporaneous with the formation of the limestone.

The above plain statements of facts are, I think, sufficient to show that the specimens of Eozoon found in the Laurentian limestones of Canada in no respect resemble in their associations and mode of occurrence the banded forms from Mt. Somma described in the paper in question. Additional details may be found in my Memoir on the "Specimens of Eozoon in the Peter Redpath Museum" and in other publications referred to in that work.*

2. *Form and Structure.*—In so far as can be judged from the plates, some of the forms described in the paper lie in bands parallel to igneous veins, like the laminated borders or selvages common in every part of the world, and of which we have good instances in the trappean dykes of the Montreal mountain; or they appear as rounded masses in the manner of nodules or geodes. Thus in so far as mere lamination or banding is concerned, they have a certain resemblance to Eozoon, but on closer inspection essential differences may be observed which I have no doubt would be farther accentuated by comparison of actual specimens.

I have already referred to the apparent inversion of the acervuline and laminated structures, but there is a more important difference than this. The Vesuvian specimens

* Montreal, 1888, pp. 106. See also "Salient Points in the Science of the Earth" by the same author, 1893.

consist of continuous laminæ of crystalline igneous matter, including interrupted or lenticular layers of calcite. Eozoon on the contrary consists of a continuous skeleton of calcite consisting of broad layers slightly pitted on their surfaces, and connected at intervals; while the silicious material appears as a substance filling wide flattened mammilated chambers more or less limited and presenting amœboid lobes at their extreme edges, and passing finally in the upper part into rounded chamberlets. This difference should commend itself to any palaeontologist, but I am aware that it may be overlooked by cursory observers. Scores of specimens have been sent to me of banded rocks, supposed by their finders to resemble Eozoon.

The authors of the paper seem to have peculiar ideas respecting even the general form of Eozoon. I have repeatedly shown, and have illustrated this by photographs, that when we find perfect detached individuals of Eozoon, these are usually of inverted conical form, springing from a narrow base and widening upward in the manner of some sponges and corals. When close together they often become confluent, and when these confluent masses or layers appear to be hollow or doubled, I believe that this usually results from the folding of the containing bed. This can indeed often be seen to be the case, and the laminæ may be observed to be bent and crushed at the flexures.

In the specimens figured in the paper, the characteristic microscopic structures of Eozoon are entirely absent. There is no trace of the beautiful and complicated system of canals, and the fibrous structures compared with the minute tubulation are merely prismatic fibrous crystals like the secondary veins of chrysotile which sometimes cross and deteriorate our specimens of Eozoon. With reference to these chrysotile veins, while their filling of minute and often transverse and branching cracks shews that they are merely aqueous deposits of later origin than the structures which they traverse, and while their appearance under high powers is very different from that of the tubuli of the calcite layers, they have no doubt been when parallel to the layers, and in poor specimens, fertile causes of error. Fortunately however, they are absent from the more perfect specimens. I may also explain that while the finely tubulated margin of the calaceous layers can be seen to terminate abruptly against the filling of the chambers, it passes gradually in the interior of the layer into the larger canals when these are present. Naturally also, the finely tubulated wall often fails to show its structure, just as any one who has examined large series of sections of Nummulites may observe in these fossils: and the tubuli are often filled with dolomite or calcite very difficult to distinguish from the substance of the calcareous lamina.

The authors of the paper refer (page 272) to the late Dr. Carpenter as having failed to distinguish the chrysotile veins from the proper wall; but when in England, not long before his lamented decease, I had the pleasure of going over his collection of slices with him, and of ascertaining that he quite understood the distinction between the veins of asbestiform serpentine and the organic structures. At that time he hoped to have prepared an exhaustive memoir on the subject, including my material as well as his own. Had he been permitted to fulfil this intention, many subsequent mistakes might have been avoided. Even his collections, though varied and admirable are, in a case of this kind, of comparatively little value without their skilled interpreter, so full of varied knowledge.

The writers of the paper do not seem to notice that in the St. Pierre specimens the fine canals and tubuli are often filled with transparent dolomite, difficult to perceive without very good preparations and properly managed light, but of extreme beauty when

these conditions are fulfilled. In roughly prepared specimens indeed, and without careful attention to illumination, these delicate structures are often quite invisible. I have sections properly prepared which shew the finest and most complicated tubulation in a manner equal to anything I have seen in any fossil foraminifera from more recent formations while other slices cut from the same specimen but possibly slightly heated or subjected to mechanical jars in polishing, show little except the curdled appearance of the serpentine and a multitude of cleavage planes in the calcite. In like manner in preparing decalcified specimens, a little heat or an acid too strong or not quite pure may remove all the dolomitic casts of tubuli, and may erode those of serpentine. From causes of this kind I fear many who have pronounced very decided opinions on Eozoon have not actually seen perfect examples of its structure.

While therefore I must agree with the writers of the paper that their specimens from Somma belong to the category of those banded structures found in concretions and geodes and at the lines of contact of igneous and aqueous rocks, which are not unfamiliar to those who have advocated the organic origin of Eozoon and which they have all along been solicitous to distinguish from it, I must emphatically deny that they resemble either in composition, mode of occurrence or form and structure, the Laurentian Eozoon of Canada. The present writer indeed regards it as little complimentary to his long experience of rocks and fossils to suppose him guilty of the error of judgment implied in such a resemblance, and therefore begs to say that had he been privileged to examine the now celebrated specimen from Somma in the British Museum, or had he seen such things in the escarpment of that old volcano, or had his friend Dr. Johnston-Lavis been kind enough to show him such specimens in his collection at Naples, he would probably have declined to acknowledge their true affinity to Eozoon. But of course we must bear in mind the organic possibilities in metamorphosed rocks which Brögger has so well illustrated in Norway; though even in Canada we cannot yet parallel his *Orthis calligramma* moulded in garnet.

Even at my advanced age, I would gladly undertake the labor and expense of fighting over again the battle of this grand old harbinger of life on our planet, for the benefit of some of my younger confreres; but I fear most of them are too much of specialists to give attention to the evidence. Perhaps the most available method would be to take advantage of some large scientific gathering to exhibit a quantity of lantern slides and ask them to believe what they could see, and put their own interpretation on it. I believe, however, that the gradual discovery of new forms of Pre-Cambrian life which is now proceeding both in Europe and America will soon compel Palaeontologists to give more attention to this neglected portion of their science. The discoveries of Billings, Cayeux, Walcott, Matthew and others have already established a probability that, besides Eozoon, the Pre-Cambrian rocks contain other stromatoporoid forms *(Archæozoon, Cryptozoon)* as well as Sponges, Radiolarians, Worms, and possibly elementary types of Mollusks and Crustacea. Dr. Adams has also made much progress in separating the truly sedimentary beds of the Canadian Laurentian from those that may be referred to the crushing and deformation of igneous products. Perhaps, however, the time has scarcely yet come for summing up the evidence.

[As the paper has been so late in reaching me, I shall consider myself at liberty to send copies of the M.S. of this note to such periodicals as may have noticed or commented on the paper.]