

at 656 Kirchhoff's scale precisely corresponding to an iron line in the solar spectrum—also 3 at 1601, 1605, and 1607, the reversal of a well-known group of *Chromium* lines. The latter I believe are new in prominence spectra.

C. A. YOUNG

Eozoön Canadense

I HAVE just observed that in your number for December 22 a correspondent revives some of the old but often refuted objections to the organic nature of Eozoön. As the mail closes in a few hours, and I have lectures in those hours, I cannot reply by this opportunity; but shall crave a small share of your space next week to show that the objections stated are unfounded; and to state what is now being done here in further illustration of this ancient and veritable fossil.

J. W. DAWSON

M'Gill College, Montreal, Jan. 16

THE battle for the *Eozoön Canadense* may be left to Messrs. Carpenter, Jones, King, Rowney, and other eminent microscopists, but perhaps an outsider may be pardoned if he asks some anomalies to be explained.

In the Ophytes of Bennabeola the mountain group in Connemara, or rather Yar-Connaught, Mr. Sandford proved the existence of the *Eozoön Canadense*, and his opinion was backed up by Mr. R. Jones and also, if I remember rightly, by Dr. Carpenter. There are acres upon acres of limestone in that country of the same age, and some of them on the same geological horizon as the Ophytes, Ophicalcytes, Ophimagnesytes and Ophidolomytes; yet, in no place, except where Ophyte or one of its varieties exist, has the Eozoöal structure been found. Furthermore, when the West Galway Ophytes are followed in depth they graduate into a Schistose-dolomite that may be micaceous, felsitic, or quartzitic, and contains more or less calcite; yet in these dolomytes there is no trace of the Eozoöal structure.

These rocks of Yar-Connaught are said to be of Lower Silurian (Cambro-Silurian) age, by Sir R. I. Murchison, Prof. Harkness, and other eminent geologists. In other parts of the world will be found square miles upon square miles of rocks, of the same geological age, often having inliers of limestones, yet in them there is no *Eozoön Canadense*, it only being found in a peculiar rock (pseudomorph dolomite) in this small tract of Lower Silurian rocks, in Yar-Connaught.

Yar-Connaught, Jan. 23

G. H. KINAHAN

If my previous letter, as alleged by Dr. Carpenter, exhibits a complete misapprehension of the state of our knowledge of the above fossil, I cannot plead in extenuation a want of familiarity with the arguments he again brings forward in support of the organic theory. Had he, instead of explaining away imaginary difficulties, addressed himself to those that really exist, his reply would have possessed greater value. Let us examine how my objections have been met.

Firstly, then, Dr. Carpenter cannot affirm that any specimen of Eozoön has been obtained from unaltered rocks. He can go no further than to say that his best specimens are from rocks that have undergone the *least* metamorphic change. Thus it appears after all, that it is only a question of *degree* in metamorphism; and when we consider that Logan, Dawson, Sterry Hunt, and himself, in their original papers, constantly alluded to these Eozoöal rocks as crystalline, highly crystalline, of serpentine marble, &c., we are enabled to judge of the value of the diminutives "little" and "least," now used when it becomes necessary to the argument to soften down these expressions. Sir W. Logan, who is an authority on the subject, says:—"Any organic remains which may have been entombed in these limestones would, if they retained their calcareous character, be almost certainly obliterated by crystallisation, and it would only be by the replacement of the original carbonate of lime by a different mineral substance, or by an infiltration of such a substance into all the pores and spaces in and about the fossil, that its form would be preserved." It would be strange indeed if, during the millions of years since the deposition of the Laurentian limestones, they had undergone no change, and notwithstanding Sterry Hunt's depositional views, the consensus of opinion is in favour of serpentine itself being a product of alteration.

* "Geological Journal," No. 81, p. 48.

Had Dr. Carpenter pointed out where serpentine pyroxene or loganite had been found in unaltered rocks, instead of dwelling upon the internal casts of foraminifera distinguishing the Greensand formation, his remarks would have been more relevant to the subject. These casts, it is well known, are in glauconite, a hydrous silicate of protoxide of iron and potash. Whether or not the silicates replacing the sarcoid bodies of the foraminifera dredged up by Capt. Spratt in the *Ægean*, are the result of precipitation from sea water, caused by the decomposition of the sarcoid substance, is quite immaterial to the argument; but if, as is assumed, the chambers of Eozoön were filled in the same manner with serpentine, and this chemical reaction was necessary to its precipitation, how are we to account for the serpentine investing huge blocks of pyroxene, and the solid bands of the same mineral intercalated in the limestone? If, therefore, I admit the possible infiltration of certain silicates into the *body* of Eozoön—did such an animal ever exist—it is no help to those who favour the organic hypothesis. I have, however, neither affirmed nor denied such a possibility, as it is entirely outside of my line of argument.

As regards *hydrothermal* action, which it appears is objected to if called in to aid my theories, I may say it is a matter of indifference what the *agency* be so long as the *alteration* is proved.

It would take up too much of your space for me to go into the details of the "canal system," "nummuline layer," "chamber casts," "Stolon passages," "pseudopodial tubules;" and such is unnecessary, as Profs. King and Rowney have pretty well exhausted the subject, and, to my mind, have conclusively proved the existence of identical forms of purely mineral origin. If, as is alleged, the canal system always crosses the cleavage planes, and is never between them, such would appear to be correlative mineral phenomena, and tells against the organic hypothesis. I object, however, to a question of such wide bearing being settled solely on the authority of Dr. Carpenter as a microscopist. If others are wrong, let him demonstrate the fact, which his great experience will more readily enable him to accomplish.

If I have misconstrued the following passage into an admission which he now repudiates, I am ready to make ample apology; perhaps, however, he will explain to what the term "elsewhere" refers. After combating the notion that the *nummuline* layer can be precisely parallel in a purely mineral production, he says he is "prepared to maintain the organic origin of Eozoön on the broad basis of cumulative evidence afforded by the combination in every single mass of an assemblage of features which can only be *separately* paralleled elsewhere."

Such is Dr. Carpenter's unbounded faith in Eozoön—though every hypothesis attempting to bring it into the category of organic beings is beset with difficulties—that he would not be surprised to find it existing now in the deep-sea bottom. There is, he says, no *a priori* improbability in such an event happening, and indeed there is not, for the persistence of types is one of the most remarkable of zoological facts. But as the area in which Eozoön is to be found is enlarged, and the duration of its time lengthened, our difficulties increase. If the infilling material of the chamber casts is due to substitution during decomposition, or to direct deposition as suggested by Sterry Hunt, there is no possible reason why we should not find Eozoön in some of the immense masses of unaltered limestone which still exist. I repeat that it has never yet been found in such rocks, but always in those that have been metamorphosed. If again serpentine is not a product of alteration, why do we not find it in unaltered rocks? The inference is obvious, they are correlative phenomena, and therefore Dr. Carpenter must pardon me if I decline at present to adopt his views. Still I am open to conviction, and will freely admit my error when, after some of his deep-sea dredgings, he brings home the modern Eozoön fossilised with a silicate, and when, in addition, it is discovered in an unaltered limestone fossilised with serpentine pyroxene or loganite.

T. MELLARD READE

Blundellsands, Liverpool, Jan. 9

The Eclipse Expedition

How about the Eclipse Expedition, which, I presume, you helped to sanction? I informed the public that it would prove a complete swindle, and so it has turned out. As long as such professional liars as the Astronomical Society are allowed to gull the nation, what chance is there of arriving at the truth?

JOHN HAMPDEN

* Geological Journal, vol. xxii, p. 224