IX.—Additional Note on *Loricula*.

By H. Woodward, LL.D., F.R.S.

SINCE the appearance of my paper on *Loricula Darwini* in the November Number of this Magazine (pp. 491–9) my attention has been called by Mr. C. D. Sherborn to two American *Loriculæ* described by W. N. Logan, "On some new Cirriped Crustaceans from the Niobrara Cretaceous of Kansas," U.S.A., published in the Kansas University Quarterly (series A, October, 1897, vol. vi, No. iv, pp. 187–9, 8vo) and in the University Geological Survey of Kansas (vol. iv (Paleontology), pt. viii, 4to, Arthropoda, pp. 498–501, pl. cxi) under the names of *Stramentum haworthii*, Williston, type-specimen figured much enlarged, and *S. tabulatum*, Logan. The other two species on pl. cx, figs. 3–5, of the same work, described under the name of *Squama spissa* and *S. lata*, Logan, are quite distinct from *Loricula*, but are said to have been found adhering to a fragment of shell of *Inoceramus* by their entire length. The arrangement of the capitulum and peduncle differ very widely from those of *Loricula* and resemble *Pollicipes*.

The type of *Stramentum haworthi*, Williston, is said to be attached to a shell of *Ostrea congesta*, "by the extremity of its peduncle." (Possibly this remark applies to the genus *Squama*, as the description of the mode of attachment of *Squama* certainly applies to *Stramentum*.) The series of *Stramentum* preserved in the British Museum (Nat. Hist.) are certainly attached by their entire length upon the surface of some curious strap-like organism which might have been once a vegetable substance such as a *Laminaria*, but of which now only a stain remains on the slab. The specimens are very minute, only a few lines in length, but are illustrated by a copy of an enlarged figure of the type. The rostrum is certainly absent as in *Loricula* from the English and Bohemian Chalk, with which the type of *Loricula* (*Stramentum*) *haworthi* from the Yellow Chalk of Gove City, Gove County, Kansas, closely agrees. The other species mentioned, *Loricula* (*Stramentum*) *tabulatum*, is from the Upper Niobrara Chalk of the Smoky Hill River.

NOTICES OF MEMOIRS.

I.—Is China Clay a Mineral?

OF considerable interest to geologists is the judgment delivered by Mr. Justice Eve in the case of the Great Western Railway Company *v.* the Carpalla United Clay Company. The action was brought by the Railway Company to restrain the working of china clay in certain lands—the right to work the clay depending upon the question whether china clay was a mineral within the meaning of the Railway Clauses Consolidation Act, 1845. The following are the concluding portions of the judgment:—

This is the substance which the defendants contend is a mineral within the statute, and which the plaintiffs allege to be the soil or

subsoil which they have already purchased, and on which their railway has been built. In order to determine which of these contentions is right it is necessary to inquire into the composition and origin of the china clay. As I have already said, the china clay rock occurs in the granite formation only. Granite is an igneous rock the mineral constitution of which differs in various places, but which may be said to be practically of general uniform crystalline constitution composed of felspar, quartz, and mica. Granite when exposed to atmospheric or other agencies becomes decomposed to an extent varying with its mineral constitution, and the first element which is the subject of decomposition is the felspar. The decomposed felspar results in the formation of a clayey material, and china clay rock is granite in which the felspar has been wholly decomposed and replaced by this clay. Different opinions are held by geologists and others as to the agency by which this complete decomposition has been brought about. Some contend that the decomposing agent is the carbonic acid in the rain-water. Others, again, reject the rain-water, or subaerial theory, and insist that all the known facts combine to prove that the agency by which such complete decomposition has been brought about had its origin in subterranean depths, and that the agent penetrated to the decomposed mass by means of cracks and fissures, many of which are now filled up with minerals which admittedly came from lower depths. A third class of scientists, represented by some of the most eminent who have given evidence in this case, incline to the view that both causes—subaerial and subterranean, or pneumatolytic as the latter has been called—may have contributed to the result. Between these conflicting opinions it is fortunately not necessary for me to decide. It is sufficient for my purpose to find as a fact that there are in the granite formation in the part of the country with which I have to deal in this case nests or pockets of varying superficial areas, and in most instances of unknown depths, wherein is to be found a granite in which the felspars have been wholly decomposed and replaced with the clayey material I have already mentioned. It is further established by the evidence that these nests or pockets are sporadic, and that their existence adds materially to the value of the land, and that their presence or absence is not to be accounted for by any apparent differences in the overlying granite or other materials. As a general rule it may, I think, be said that they occur under an overburden of less decomposed granite, but, as I have already stated, they have been found under hard undecomposed granite, and under a wholly alien overburden such as the killas. Even when it occurs under an overburden of decomposing granite china clay rock has, I think, characteristics apart from colour which differentiate it sufficiently from the overburden to enable those acquainted with the local formation to fix approximately the line of demarcation between the overburden and the china clay rock. The decomposed felspar—the clayey substance which has replaced the felspar—constitutes, say the defendants, the china clay. All we do, they add, is to extract this clayey substance by a sifting or washing process, whereby we disengage it from the other material with which it is found in

mechanical combination. I cannot myself see that it is any answer to this contention to say that in the china clay of commerce there is still to be found a proportion of the other materials with which the clayey substance was originally completely combined. Take, for example, the presence of mica crystals in the commercial china clay. It is admittedly one of the objects of the washing process to separate the clayey substance from the mica, and this to a large extent is achieved, but because it is not wholly effected, and because the china clay is merchantable, notwithstanding the continued presence of some mica crystals, can it logically be asserted that mica is an essential constituent of china clay? I cannot bring myself to adopt any such view. In my opinion china clay or kaolin is the clayey substance in the china clay rock representing the decomposed felspar, and the mere fact that in the process of separating and extracting it from the rock a condition of disengagement is reached which is sufficient for practical commercial purposes, and beyond which it is therefore unnecessary to prolong the process, cannot, in my opinion, alter the real nature of the substance or convert the resultant product from a natural substance into an artificial combination of diverse elements originally combined in wholly different proportions.

On the evidence, therefore, I come to the conclusion that china clay is a natural product—that is, the substance representing felspar in granite which has been converted into china clay rock by the complete decomposition of one of its three essential constituents. The question I have now to decide is whether such a clay as I have described is a mineral. It is common ground that it has been so regarded by geologists, mineralogists, and textbook writers for very many years past, not only in this country, but in America, France, and Germany. Jameson as early as in 1820, Professor Lapworth himself as late as in 1899, and Dr. Hatch and Professors Dana and Miers—the latter the well-known Professor at Oxford—at intermediate dates are all responsible for well-known and authoritative works, wherein it is classed as a mineral. It is true that when the witnesses for the railway company were confronted with these authorities they drew a distinction between kaolin and the china clay of commerce, and suggested that the former might possess attributes which would qualify it as a mineral, but which were not to be found in the latter; but I attach no importance to this distinction, in that I regard kaolin and china clay as convertible terms, and the mere fact that the clay can be turned to commercial uses without being altogether dissociated from foreign substances cannot, in my opinion, alter its real character. But the question does not really rest on the printed authorities to which I have just alluded. The scientific witnesses who were called on behalf of the railway company frankly admitted that down to some time in the latter part of last year they shared in the generally accepted view that kaolin or china clay was a mineral. Indeed, in a case tried in 1904—North British Railway Company *v.* Turners (Limited)—Professors Boyd Dawkins and Lapworth, two of the witnesses who in this case have been called to prove that it is not a mineral, gave evidence that kaolin or china clay—treating the two words as synonymous—is a mineral of a definite chemical composition,

and having very frequently a definite crystalline form. These views they have been led to discard, so they told us in the box, by more careful microscopic and local examinations of china clay, and the sources from which it is derived, and the conclusions to which these examinations have led them are directly opposed to those in which they shared with the scientific world generally down to the summer of last year. They now degrade china clay to an artificial product, a heterogeneous compound or mixture of everything that is in the china clay rock, and unredeemed by any one of the qualities which Dr. Hatch says are the essential characteristics of a mineral—that is to say, definite mineral composition, definite physical qualities, and definite crystal form. On the other hand, Professor Gregory, with whose evidence I was much impressed, would be no party to what I have called the degradation of kaolin or china clay. In his opinion it is a mineral, the main bulk of which is kaolinite—a crystalline substance which all parties agree is in all senses of the word a mineral. It is right that I should add that none of the plaintiffs' witnesses would admit the presence of kaolinite in the Carpalla kaolin, and on the evidence as it stands I should not be prepared to hold that this has been conclusively established. But again I am not really called upon to decide between the conflicting views of scientific men as to the exact category in which this china clay should be included to secure that accuracy of expression at which science is always aiming. What I have to determine is whether the substance is a mineral within the meaning of the Act of Parliament. Having heard all the evidence and listened to the forcible arguments which have been addressed to me, I cannot entertain any doubt as to its being such a mineral. It is found in intimate combination with elements which go to make up the subsoil of the district, and it owes its origin to the decomposition in past ages of constituent parts of that subsoil; but in its present condition, occurring sparsely and sporadically, and always under an overburden of a character distinctive from the rock in which it is found, it cannot, I think, with any justice be regarded as constituting the land soil. It is a sedentary deposit occupying the space formerly occupied by the felspars. It can only be abstracted by the disintegration of that wherein it is deposited, and when so abstracted it is a thing which (to use Mr. Justice Buckley's words, 1901, 2 Ch., at p. 638) "has a value of its own apart from the soil in which it is found." It is not, in my opinion, the soil itself. Whatever be the true scientific definition of a mineral, and whatever be the correct classification of kaolin thereunder, I cannot bring myself to hold that a substance universally regarded as a mineral before, and for more than sixty years after the passing of the Act which I am construing, ought now to be treated as not falling within the class of substances therein referred to as minerals. Under all the circumstances, therefore, I do not consider the facts of this case bring it within either of the authorities which have been so fully discussed, and holding as I do that the china clay is a mineral within the meaning of the Act of 1845, I have no alternative but to dismiss the action with costs.—Abstracted from the *Times*, 1908.

II.—Brief Notes on Nova Scotian Geology.

1.—A Review of the Flora of the Little River Group. By G. F. Matthew, D.Sc., etc. Trans. Roy. Soc. Can., Second Series, 1906, vol. xii, sec. iv, p. 99.

THIS is the first of a series of articles by Dr. Matthew on the ancient flora, the species of which were described by Sir W. J. Dawson many years ago. The present paper is devoted to the Equisetales, and a number of new forms are described in it. Two new genera are described, found in the lowermost group of plant beds—*Ramicalamus* and *Lepidocalamus*. Dr. Matthew finds *Calamites Suckovii* common, a species which is found in the uppermost beds of the Carboniferous, and therefore must have had a great vertical range. The genus *Asterocalamites* (*Calamites transitionis* of Dawson) is found to be common.

Asterophyllites and Annularia are represented in a number of species, including some in which the leaves are clustered in whorls, and so not evenly distributed. The early development of the Equisetales, as shown by this flora, is commented on in the closing paragraphs of this article.

2.—A New Species and a New Genus of Devonian Plants. By G. F. Matthew, F.R.S.C. Bull. Nat. Hist. Soc. of New Brunswick, 1906, vol. v, pt. iv, p. 393.

THE plant here described is referred to the Ferns, and thought to be related to *Eremopteris* and *Triphyllopteris*. The leaves of the barren frond were narrowly wedge-shaped, and there was a fertile pinnule with pod-like receptacles. The name adopted for this plant is *Pseudobaiera McIntoshi*. With this occurs a vigorous-growing mutation of *Annularia longifolia*, Brong., and other species of plants. The locality is near St. John, N.B., Canada.

3.—On some Species of Silurian and Devonian Plants. By G. F. Matthew, LL.D., etc. Trans. Roy. Soc. Can., Third Series, vol. i, sec. iv, p. 185.

A FEW Acrogens from various localities in the provinces of New Brunswick and Nova Scotia in Canada are described in this paper. A cone of Lepidodendron of Eo-Devonian; a supposed lichen of the same age or older, and plants from the Upper Devonian of Nova Scotia and N.B. Two interesting fungi which grew between the wood and epidermis of certain large ferns are described, and also a new species of *Psilophyton* which may have been of greater antiquity. *Lepidodendron corrugatum* and *Aneimites Acadica* are common forms of the Upper Devonian flora.

4.—Notes on Archæozoon. By G. F. Matthew, LL.D., F.R.S.C. Bull. Nat. Hist. Soc. of New Brunswick, 1906, vol. v, p. 547.

A LOW type of calcareous organism found in the pre-Cambrian rocks of St. John, N.B., Canada, and thought to be related to the Cryptozoon found in the pre-Cambrian deposits of the Rocky

Mountains by officers of the United States Geological Survey. It consists of calcareous columns with convex layers. Three localities are known where it has been found, and in a plate accompanying the paper its structural characters are exhibited.

5.—A New Genus and a New Species of Silurian Fish. By G. F. Matthew, LL.D., etc. Trans. Roy. Soc. Can., Third Series, vol. i, sec. iv, p. 7.

THIS is a description of an ancient and interesting type of fish of early Silurian age. The form is related to *Phaneropleuron*, from which it differs in the arrangement of the fins, etc. It is from strata in King's County, New Brunswick, Canada.

6.—The Physical Evolution of Acadia. Part I: The Insular Stage, etc. By G. F. Matthew. Bull. Nat. Hist. Soc. of New Brunswick, 1907, vol. vi, p. 3.

IN this article the bearing of the geological changes which occurred in the maritime provinces of Canada prior to Devonian time is shown. The history is divided into several periods by the physical revolutions that occurred. The first period (called the Laurentian phase) is marked by the occurrence especially in Southern New Brunswick and in Cape Breton of abundant limestones, which are compared to the Granville limestones of the Ottawa valley.

The second great period (Huronian phase) is marked in Nova Scotia by the enormous deposits of the gold-bearing series of that province, and is compared to clay slates, chloritic slates, and other rocks in Southern New Brunswick, which are thought to be a deep-water representation of the gold-bearing series of Nova Scotia.

The third great period of deposition of sediments is marked by the widespread Cambrian deposits of the Atlantic region of Canada, which are best shown in Southern New Brunswick and Cape Breton Island in Nova Scotia. This great series in both provinces runs up into and includes the lower part of the Ordovician.

This series is followed by an important geological hiatus, the upper Ordovician being absent from all this region, and the first rocks which succeed the Cambrian series are of the age of the Ludlow or thereabouts. This is the Silurian phase, and extends upward to include the base of the Devonian (if the Upper Helderburg formation be regarded as such).

Up to this time in its geological history Acadia when submerged in part was insular, or divided from the rest of the American continent by one or more sounds, extending from the present Gulf of St. Lawrence to the Gulf of Maine, and further inland in New England. Southern Acadia up to this time was dominated by insular conditions, and for most of the time prior to the Devonian age was an island cut off from the mainland of America.

Two maps are given to illustrate this history, one showing the conditions in the middle Lower Huronian time, and the other drawn to show its aspect in Upper Silurian time (Clinton to Niagara).