

REMARKS ON SOME FOSSIL REMAINS CONSIDERED AS PECU-
LIAR KINDS OF MARINE PLANTS.*

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(With Plate I.)

The fossil remains described below belong to two different geological periods, and are very unlike in their appearance and composition. One of these organisms, the more interesting (Fig. 1, 1a), is like a long flexuous tubular stem embedded in a large piece of hard compact gray limestone, the label attached to the specimen indicating the locality as "Upper Helderberg limestone, Sandusky, Ohio." The others are of much larger size, either (Figs. 2, 3) cylindrical fragments traced in relief upon gray, hard, yellowish sandy shale, of the so-called Erie shale formation, exposed in cliffs bordering Lake Erie near Cleveland, Ohio, and referred by Dr. Newberry to the Portage Group of the Chemung,† or (Figs. 4-9) short, oval, utricular bodies, rounded at one end, bilobate at the other, mostly seen in relief, entirely destitute of any kind of roots, seemingly dropped here and there upon large flattened pebbles or lenticular masses of argillaceous iron ore, locally distributed in the shale. Though all are evidently of the same facies and character they are totally independent, more or less distant from each other, abnormal in form and position, and without recognized affinity to any kind of living plants or animals. They belong to that class of ill-defined fossil remains fitly called problematic organisms by Saporta, and therefore their nature is differently regarded by paleobotanists. By some they are regarded as the remains of marine plants of old types that have been gradually effaced and are now extinct, like those for example which have been generally described as Fucoids; others, refusing to find in them any trace of vegetable nature, even of organization, regard them as the result of mere mechanical mouldings produced by the movement of water or the tracks or burrows of different kinds of animals upon soft muddy surfaces, either near the shore or at the bottom of the sea.

Though apparently of little importance to science, the discussion of the true nature of these fossil remains has been and is still pursued with persistence by some of the highest authorities in vegetable paleontology, and has given occasion to the publication of very creditable and conscientious memoirs; those of Saporta, for example, one upon the fossil Algæ,‡ another upon the problematic organisms of the an-

* This paper was prepared and submitted for publication some months before the death of the author—Editor.

† Report of the Geological Survey of Ohio, vol. 1, Part 1, Geology, 1873, p. 163.

‡ A propos des Algues fossiles, par le Marquis de Saporta. Paris, 1852.

cient seas;* one also by Delgado on the Bilobites and other fossil remains of the Silurian of Portugal;† and still others in opposition to the opinion of these authors, especially the memoirs of Professor Nathorst, of Stockholm, on the tracks of invertebrate animals and their paleontological importance.‡ The first two paleontologists named, admitting the vegetable origin and nature of the fossil remains in question, have supported their opinion by splendid figures and admirably detailed descriptions of these fragments, especially the Bilobites, which they consider as vegetables of the ancient seas; while Professor Nathorst, following an original and quite different method of research, has produced upon sand, soft clay, or muddy matter, by mechanical agency, the tracks of insects, mollusks, crustaceans, etc., the movement of water upon the shores, the action of rain, of currents, etc., traces in relief or impressions very similar in appearance to many of those which have been described by botanists as fucoidal remains, and has presented by photography upon numerous plates the remarkable result of his experiments.

I am not called upon to discuss in this short article the nature of the evidence afforded by these memoirs in support of the conclusions of these authors, as both opinions are legitimate when partially applicable or sustained by facts, while they are in the same way rightly contradicted by others.

In generalizing on a subject like this the evidence is interpreted according to the views of each of the contesting parties, and partly supported by facts unknown or not examined by the others. The student called to determine the nature of as yet unknown fossil remains has to use his own judgment, and to describe as reasons for his opinion the characters on which his determinations are based.

DESCRIPTION OF THE SPECIMENS.

Halymenites Herzeri sp. nov.

Pl. 1, Figs. 1, 1a.

Fragment of stem or frond, cylindrical, simple, undulately curved, as flexible in its original state, immersed in the limestone, split lengthwise and exposing its inner structure, which is composed of a tubular, central hollow, filled in its petrified state by amorphous hard calcareous matter, bordered with a thick coating or cortex of less compact cellular matter, intermixed with a large number of black, perfectly round dots, spores, or reproductive gemmules, one-fourth of a millimeter in diameter or less.

The preserved part of the frond is 18^{cm} long, 6^{mm} in diameter; the central (originally hollow?) part 2½^{mm}; the spores, extremely numerous,

* Les organismes problématiques des anciennes mers, Paris. 1884.

† Étude sur les Bilobites et autres fossiles des Quartzites de la base du Système Silurien du Portugal, par J. P. N. Delgado. Lisbonne, 1886.

‡ Om spår af några evvertebrerade, etc., in Koenigl. Svenska Vetenskaps-Akademiens Handlingar, B. 18, No. 7, 1886, [with separate edition of this work translated and abridged in French as "Nouvelles observations sur des traces d'animaux et autres phénomènes d'origine purement mécanique décrits comme Algues fossiles," par A. G. Nathorst. 1886.]

globular, or round-flattened, one-fourth of a millimeter in diameter or less, are irregularly spread, but more abundantly along the borders of the tubule or in the thickness of its peripheric horizontal filaments, but seen also upon the exposed surface of the matter filling the tube.

The fossil fragment is that of an Alga referable by its texture to the *Chordariaceæ* Agardh, an order of the *Melanospermae* or olive-colored algæ, agreeing in its essential characters with those of the genus *Chordaria* of Agardh, as described in "Nereis Bor. Am.," by Harvey, I, p. 123, as having "*Fronde cylindrical, cartilaginous, solid, hollow in the center coated with a pile of radiating horizontal peripheric filaments, spores clavate or obovate arising from the base of the filaments and concealed among them.*" Adding to this the remark in the description of the genus *Halymenites* in Schimper's *Paléontologie Végétale*, Vol. I, p. 193, "*sporangia punctiform, immersed in the texture of the frond,*" the affinity is forcibly recognized. For as seen marked upon the enlarged part of the fossil organism, figured at 1a, even the radiating filaments are observable with the lens as well as the numerous black sporangia.

The specimen is remarkable and of great value, for until now very few fossil remains of marine plants have been discovered with their internal texture in such a state of preservation that its characters were possibly discernible. One or two specimens only of that kind are recorded by paleobotanists.

HABITAT.—Upper Helderberg limestone, Sandusky, Ohio. Collector, Rev. H. Herzer, to whom the species is dedicated.

Cylindrites striatus sp. nov.

Pl. I, Figs. 2, 3.

Fronde forking at base in two cylindrical simple branches obliquely diverging, 1 to 1½ cm in diameter; surface striate lengthwise; stria thick, filiform, generally continuous, parallel, straight, but traced like short irregular wrinkles, curved or obliquely serpentine at some places.

Two specimens partly figured represent the species. The branches emerging from an irregularly nodose or tuberculose protuberance, forking near the base, diverge at an acute angle (20° to 25°), are exactly cylindrical and apparently simple. The preserved parts in both specimens, 8 cm long, do not bear any branches, but in specimen No. 2 they are traversed at various angles by other stems, also simple, passing under or above them.

The branches are clearly detached from the surface or merely superposed upon it by the lower face, so that as seen in Fig. 2 the cross section is exactly circular and therefore appears in relief, and the spaces between the stems remain free of deposited matter as deep, irregular concavities. The stems are entirely petrified, the inner part of the cylinder being filled by amorphous matter of apparently the same compound as that of the rock under them, a hard calcareous or argillaceous soft-grained stone mixed with minute scaly shining micaceous particles.

Of these shining scales, observable as well upon the surface or cortical envelopes of the branches as upon the stone whereupon they are superposed, I can not see any in the matter filling the stems. The striæ are mostly regular and parallel, and are in some places here and there inflated, obliquely flexuous or serpentine, much like those covering the surface of *Gyrolithes*, which are beautifully figured by Saporta in his work on the problematic organisms (*Op. cit.*, pls. V and VI). These wrinkles, according to this author, represent in relief a netting of the cells composing the outer cortex of the tube, or the inner cavity remained empty by the disappearance of a vegetable organism of which the character is unknown; for the substance filling the tube is homogeneous, or like that of the stone in which the organisms are embedded. To this ingenious explanation of the origin of the irregular striæ observed upon the surface of cylindrical bodies as inference of their vegetable origin, may be added the presence and peculiar position of small short stem-like bodies, vertically upraised 6 to 8^{mm} above the surface of the stone, by the side of the large prostrate cylindrical remains and evidently of the same nature. Two of these vertical branches are seen in Fig. 3a. They are slightly enlarged toward the base as passing to radicular appendages; their surface is obscurely marked by striæ, and horizontally, 6 to 8^{mm} above the base, their top transversely cut is truncate, marked by a scar like that produced by the rupture of a small branch.

As tending still to evince the vegetable origin of the fossil fragments considered here, it may be remarked that if the bodies, which are exactly cylindrical and apparently contiguous only by a narrow rim to the flat surface upon which they are superposed, are represented in their original position, neither their petrification by penetration of solid materials nor their construction by animal agency, the work itself, the procuring of matter for the composition of the cortex of a tube, can be considered possible.

If *per contra* the specimen represents the lower face of a shale upon which is seen in relief the cast, molded upon the impression of objects of which the original matter has been, after its destruction, replaced by stony substances, how explain the impression of a complete cylinder and its representation in relief or as a cast entirely free of the surrounding matter?

The fossil fragments described above have some likeness, at least in form and size, to those of *Cylindrites rimosus* Heer, Fl. Foss. Helv., p. 115, pl. XLVI, fig. 9. The figures of this species represent cylindrical molds of various sizes, more or less flexuous, not regularly or distinctly striate. Their position relative to the stone on which they occur is not indicated in any way. Heer remarks only that the organized substance of the remains is gone and that their surface, which is narrowly ribbed lengthwise, appears rimose or cracked. Concerning the genus *Cylindrites* of Goeppert, Schimper says that it was established upon

fragments of molds or casts which do not show any characters indicating even approximately the form of the plant to which they belong, and Nathorst remarks, that to the group *Cylindrites* are referred all the fossil bodies more or less regular, cylindrical, simple, or rarely branched, straight or sinuous, or spirally twisted, from one-half to 2^{cm} in thickness, which are supposed to belong to algæ. He considers some of them as tracks or borings of some kinds of animals creeping within the deposits of muddy, clayey matter or upon the surface, while others are referable to sponges. Hence the genus has no precise characters, and though I have used the name for the description of tubulose fragments, which in my opinion belongs to marine vegetables, I admit that I do not know to what kind of fucoïdal plants described by botanists this fossil may have distinct affinity.

HABITAT.—Portage group, in cliffs bordering Lake Erie, near Cleveland, Ohio. Collector, Rev. H. Herzer.

Physophycus bilobatus sp. nov.

Pl. I, Figs. 4-9.

Fronde utricular, rounded, oblong in outline, strangled above the middle, inflated on one side, compressed, obtusely bilobate at the other, traversed inside by a medial axis emitting bundles of filaments passing toward the borders and apparently constituting the internal structure, sometimes exposed by erosion of the smooth cortical tegument. These bodies are represented in relief upon the surface of large, smooth, concretionary pebbles of soft-grained argillaceous iron ore, upon which they appear superposed and incrustated by one side without trace of roots. They are raised above the surface of the pebbles from 3 to 10^{mm}, according to their size, being convex and therefore gradually higher toward the middle, indicated sometimes by a thin vertical line traced upon the surface.

These bodies, thirty-six in number, are all irregularly disposed at various distances from each other upon fourteen specimens, some of them bearing only one of the organisms, others a few; eight of them, the greatest number on a single specimen, being scattered upon a surface of about 150 square centimeters.

Considering their texture, as far as it can be determined by the traces of curved filaments traversing from the axis to the borders, these fossil remains may be compared to the vesicular or undeveloped fragment of a leaf of *Physophycus marginatus* Schp. Pal. Vég., Vol. I, p. 206,* which as seen in Fig. 4, *l. c.*, seems to be the primary utricle from the development of which are derived the other leaves or forms represented upon the plates. Though the relation between the leaves of *Physophycus marginatus* and the bodies described as *Physophycus bilobatus* is distant, I regard it as an evidence of their organized nature. And indeed those fossils of peculiar forms which appear with mere trifling variations upon a large number of specimens can not have been produced

* *Caulerpites marginatus* Lx., Trans. Amer. Philos. Soc., vol. 13, 1869, p. 314, pl. vii; reproduced as *Taonurus marginatus* Lx., Coal Flora, Second Geol. Survey Penn., P, 1880, p. 7, pl. A, figs. 1-6.

by the work of animals, nor by the water in its motion, nor by a kind of deformation or crystallization in the clay by chemical agency. I see in them odd or exceptional forms of marine plants like those discovered at the base of the coal measures between the Devonian and Carboniferous, five of which are represented in the Coal Flora, *l. c.*, pl. B, figs. 1–8, all organisms whose relations or affinity to any kind of vegetable remains is as yet undiscovered, and which for that reason have been described under the new generic names *Conostichus* and *Asterophycus*. Their reference to marine vegetables has not been contested.

In pursuing my researches for the same purpose of procuring evidence on the real nature of the bodies under consideration, I have represented upon the plate six of them whose essential difference, merely in their size, appears to be the result of a gradual development or of growth, and of their texture, which is an agglomeration of cellular filaments. They seem to have been originally simple globular, vesicular rootless hydrophytes, like globular Ulvaceæ, growing or increasing in length, dividing at one end into two incipient small lobes, either inflated or flattened by compression and enlarged as in Fig. 4, the whole body of which measures 2^{cm} broad, 2½ to 3^{cm} long. In Fig. 5 the inflated oblong part is twice as long though of the same width, and the lobes of the same character and composition; the size of the whole organism being 5^{cm} long and 2^{cm} broad. Fig. 6 is altogether broader, but the lower part is represented by a hollow impression, while the upper part or the lobes remain exposed in relief. It is the only one of these numerous fossil bodies of which the place of the lower or inflated part is a concavity as deep as is the prominence in relief of the other specimens. The modification is clearly the result of a casual splitting of the tough leathery tegument of the vesicular part, and the destruction of its internal filaments or cellular matter. The cortical pellicle is seen irregularly folded and crumpled by compression upon the concave surface, like the skin of an emptied bladder. The borders of the pellicle are seen at *b*, and a lacerated part of it at *a*. In Fig. 7 the outlines of the inflated oblong bag are preserved; but part of the tegument being destroyed by erosion it exposes to view the internal organization of the body in irregularly curved bundles of filaments passing at right angles from the axis toward the bodies. This internal organization is still more clearly seen in Fig. 8, which has the texture of the body exposed in its whole length by the more prolonged process of erosion. In Fig. 9 the organism has taken a different form by the addition of a third or intermedial lobe and the narrowing downward of the bladderly part, which leaves the central axis exposed like a pedicel. In this case the basilar inflated part seems to have been absorbed for the formation of the third lobe protruding between the lateral ones. The tegument of the body is obscurely wrinkled, especially in the part covering the lobes, the wrinkles appearing as if produced by the exposure in relief upon the pellicle of the filaments underneath. It is in the same manner

that is explained the appearance of the irregular flexuous filaments covering the surface of the cortex of the tubes of the *Gyrolithes* of Saporta and also of those of *Cylindrites striatus* described above.

These remarks in support of my belief in the vegetable nature of these bodies are not conclusive. Indeed, no positive proof that the so-called problematic organisms represent fossil *Algæ* can be furnished except by a microscopical analysis of their texture. But the *Algæ* are cellular plants, rapidly destroyed by maceration, and therefore their tissue is rarely preserved by the penetration of mineral elements, as it is, for example, by the siliceous matter in the fossilization of vascular plants. It is for the same reason that remains of *algæ*, even in accumulation, can not be transformed into coal, and that as fossils they do not show, except in rare peculiar cases, traces of coally matter; for the cellular compounds of their tissue is, by decomposition of the plants, disseminated as bituminous fluid even under the same circumstances of slow burning, which gradually transforms the woody or vascular tissue into coal. In rare cases only the bituminous elements of the *Algæ* become fixed and solidified. It is, where marine plants of thick tissue or in massive agglomeration become embedded, decomposed, and flattened in compact argillaceous or clayey materials, impenetrable to the fluid produced by decomposition of the plants. The bituminous elements are then gathered in the space formed by the stratification of the clayey materials and then gradually solidified and crystallized into a vitreous hard black matter, pure compact bitumen, much like hard coal. Thin sheets of this matter are often observed in the formation of black shales of the Devonian, sometimes appearing like black spots of different forms, generally as thin as paper and adhering to the shale, sometimes like circular groups of sporangia, more rarely as layers of concrete bitumen, and of a thickness of 2 or 3^{mm}, adhering by one side to the shale vertically split by cleavage into cubical pieces more or less distantly separated from each other. This crystallized bitumen is sometimes attached to a flat surface apparently like a piece of bark, traced by thin vertical lines, irregular in distance, but parallel, even sometimes crossed at right angles by a few other straight striæ, probably representing traces of some kind of superficial organization of stems of *Algæ*, but none, as far as I know, distinct or regular enough to offer reliable characters for determination. These flat surfaces, diversely striate, are comparable to the problematic organism figured as *Vexillum* or *Eophyton*, mentioned above.

In cases like this the fossilized bitumen sufficiently proves that these traced surfaces, like the round groups of sporangia, represent marine organisms; but their reference to peculiar groups, genera, even families of *algæ*, remains hypothetical.

HABITAT.—Portage group, in cliffs bordering Lake Erie, near Cleveland, Ohio. Collector, Rev. H. Herzer.

I am unable to discover in the numerous forms traced in relief upon the three forms described below any features or characters in evidence of their vegetable nature.

Nos. 37 and 38.—Large fragments of shale covered upon one face by numerous flexuous linear filaments, mixed and curved in divers ways, varying in diameter from 2 to 5^{mm}, some half cylindrical, others more flattened, traced in the middle by a depression or narrow channel and on the sides by close, more or less regular wrinkles oblique to the axis. Generally the fragments of these linear bodies, some of them 10 to 12^{cm} long, have the same size or equal diameter in their whole length; one of them only seems abruptly narrowed near one of its extremities and there branching at right angles. As the fragments are very numerous, covering the surface in crossing upon each other in many directions, the difference in size, remarked above, may be a mere casual deformation. Their form and distribution correspond to the representation by photography of *Cruziana Bagnolensis* Morière, in Delgado's *Étude sur les Bilobites*, p. 61, pl. XXVIII-XXX. In their generality they represent different forms of *Chrossochorda Scotica* Schp., figured in Saporta and Marion's "Év. Règ. Vég., Cryptogames," p. 81. According to Nathorst they are merely trails of Gasteropods or Annelids, an opinion already admitted by Hall in *Palæontology of New York*, vol. II, pls. XII and XIII, who has figured the same kind of impressions.

No. 39.—Fragments of linear filiform bodies, much smaller than those of specimens 37 and 38, but of the same external form, much longer, flexuous, turning many times around in the same limited space and passing upon each other without abrupt change of direction. Described as species of *Gyrochorta* by some authors, they are, still more evidently than the preceding, mere traces of worms or small marine animals.

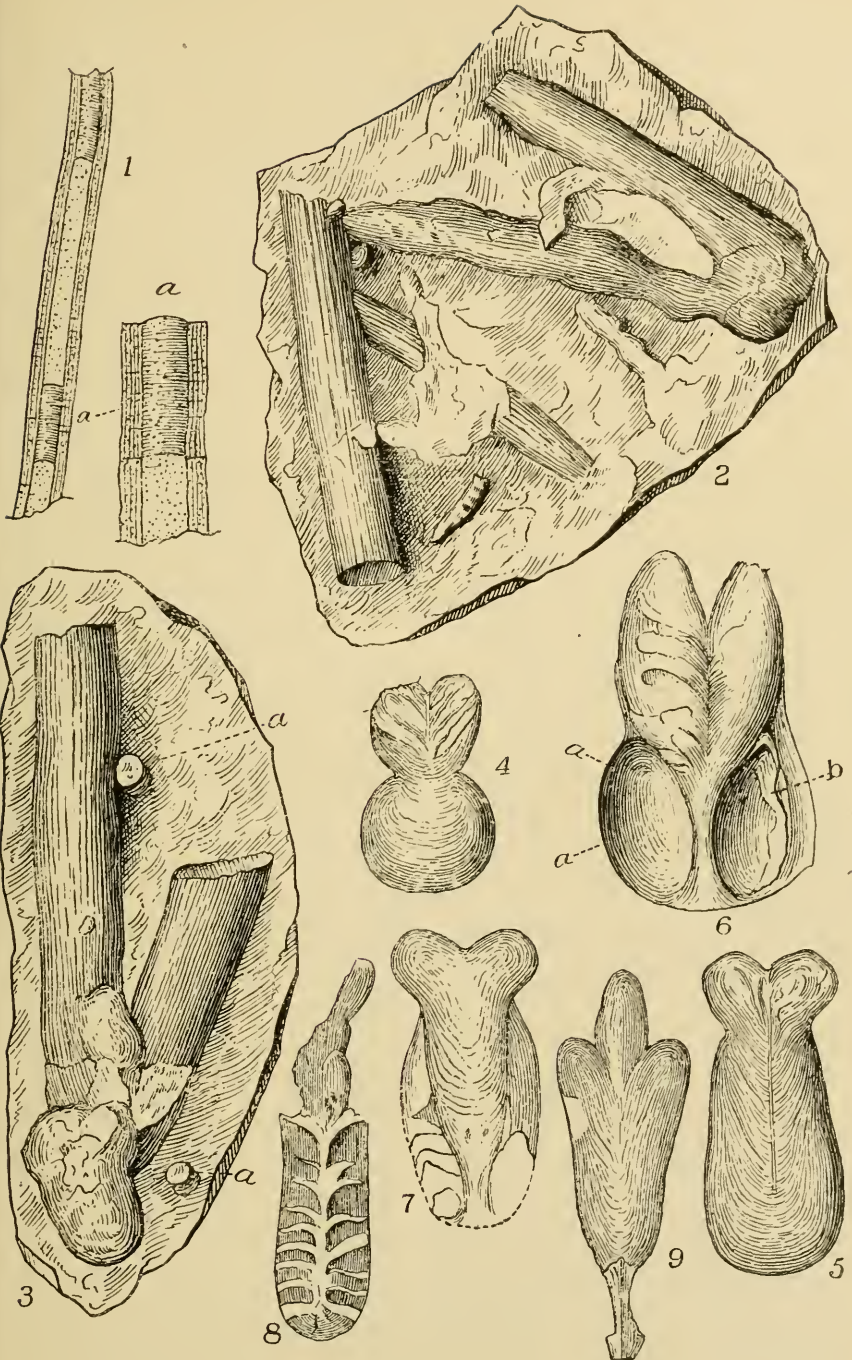
No. 40.—A flat-ribbed or striated fragment like those figured as *Eophyton Morierci* in Saporta et Marion, *Op cit.*, p. 81, fig. B, also figured as *Vexillum Morierci* Sap., "Organ. problém.," pl. XII, fig. 2. It is upon the same slab as No. 39, appearing like a fragment of foreign material of bark of *Calamites*, for example, 2½^{cm} broad, 6^{cm} long, raised about 2^{mm} above the surface of the stone. Its upper face is traced lengthwise by few straight lines or striæ at unequal distances, and by the circular traces of worms or *Gyrochorta* mentioned above.

EXPLANATION OF PLATE.

FIGS. 1, 1a, *Halymenites Herzeri* sp. nov.

FIGS. 2, 3, *Cylindrites striatus* sp. nov.

FIGS. 4-9, *Physophycus bilobatus* sp. nov.



FOSSIL MARINE PLANTS.

