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MOLECULAR STRUCTURES FROM THE ORGANIC REMNANTS OF THE CARBONATE MANGANESE ORE LAYERS OF THE III. SHAFT OF URKÚT, HUNGARY

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Abstract

The results of the transmission electron-microscope studies on the microfossils of *Pleurozonaria concinna* type extracted from the carbonate manganese ore layers of Urkút are the following: The submicroscopical structure of the wall of these microfossils partially degraded, probably during the sedimentation process, and in consequence of this in some places globular biopolymer units may be recognized. On the surface of the spheric microfossils several particules have been adsorbed. 1. Narrow particules, which adhere closely to the surface of the microfossils, their electron affinity is stronger than that of the wall. 2. Irregular masses, at the places of their contacts the surface of the wall is destroyed. 3. Probably polymer units, which are slack, mostly composed from irregular masses between them helical structures were also observed. The helical structures were described first as higher organized biopolymer units of the sporopollenine of the angiosperm pollen grains.
Key words: Jurassic — manganese ore — *Pleurozonaria* — wall molecular structure.

Introduction

The plant microfossils of the manganese ore layers of Urkút were the subject of several previous publications. Using the light-microscope method the description of the basic microflore assemblage and the reconstruction of the vegetation zones of the coastal area (SIMONCSICS and KEDVES 1961, 1969, KEDVES and SIMONCSICS 1964a,b, 1971). The first transmission electron-microscope investigations on the exine of *Spheripollenites scabratus* COUPER 1958 come to an angiosperm type ectexine, in contrast to the earlier establishment of gymnosperm affinity of this species (KEDVES and PÁRDUTZ, 1973). The first SEM data on the plant microfossils of the carbonate manganese ore layers of Urkút were published by KEDVES and RADVÁNSZKI (1975) from *Pleurozonaria concinna* (COOKSON and MANUM 1960) MADLER 1968. Later KEDVES (1976) described his results on the SEM studies of *Classopollis classoides* (PFLUG 1953) POCOCK and JANSONIUS 1961. In spite of the fact that it was a long time ago when the taxonomical elaborations based on the light-microscope method were published, and there were several changes in the nomenclature, but in this respect there is no serious essential change. But till this time we lack detailed taxonomy and modern study, firstly electronmicroscopical

investigations of the planctonic organisms of the manganese ore layers of the III. shaft of Urkút. This paper is a part of these supplementary results, and summarize the first data on the molecular structures of the wall of the planctonic organisms of the manganese ore layers.

Material and Methods

The material of investigations is sample No 7 of the III. shaft of the manganese ore layers of Urkút, green, greenish brown, light green, grey roughly streaked carbonate manganese ore. The preparations for LM investigations were made in 1963, the embedding for TEM studies, in 1973. TEM pictures were taken on Tesla BS-500 electron microscope in the Electron-Microscope Laboratory of the Faculty of Science of the J.A. University. I express my thanks to Dr. I. ROJIK for his kind help.

It is necessary to emphasize that we have a number of publications concerning the destructive effect of the $KMnO_4$ to the ultrastructure of the plant cells.

The subject of investigations were three different types of *Pleurozonaria concinna*, their block No: 85/6, 85/7, 85/8. Before the ultrathin sections, LM pictures were taken from the specimens of investigations. The detailed elaboration and evaluation of the ultrastructure of the whole planctonic organisms of the manganese ore layers of Urkút needs further investigations.

Results

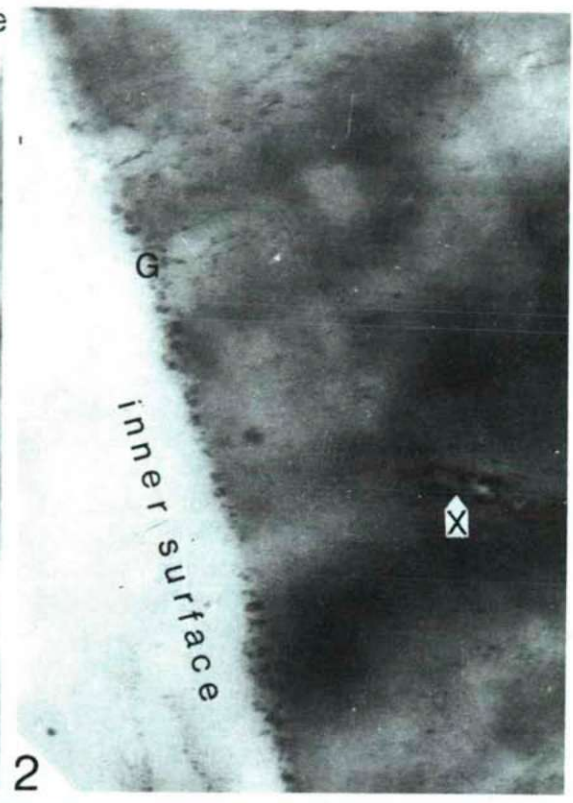
A general view about the ultrastructure of the wall of the planctonic organisms is represented by picture 1, Plate I. Well shown are the hollows oriented in the radial direction of the wall. On the surface there are more or less regularly adsorbed particules. The substance of the wall is originally homogeneous, but in some parts fine granular structures may be recognized. In the right corner of the picture, a part of the inner surface is represented with globular units, which have a relatively strong electron affinity. The same with higher magnification is well shown in fig. 2, of Plate I (G). In all probability the wall of the microplancton organisms was oxidized during the sedimentation. On the inner surface of the hollows of the wall, these globular units are also well shown (X). On the high magnified pictures (Plate I, figs. 3,4) a certain arrangement of these globular polymer units may be established, but our up-to-date knowledge is not enough for the evaluation of this. The diameter of the globular biopolymer units is about 8 Å.

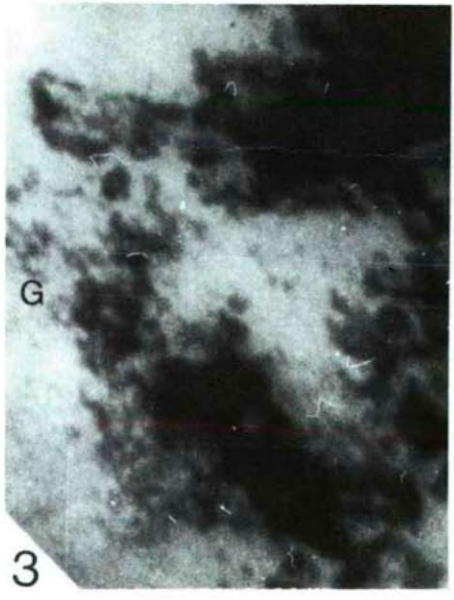
Plate I

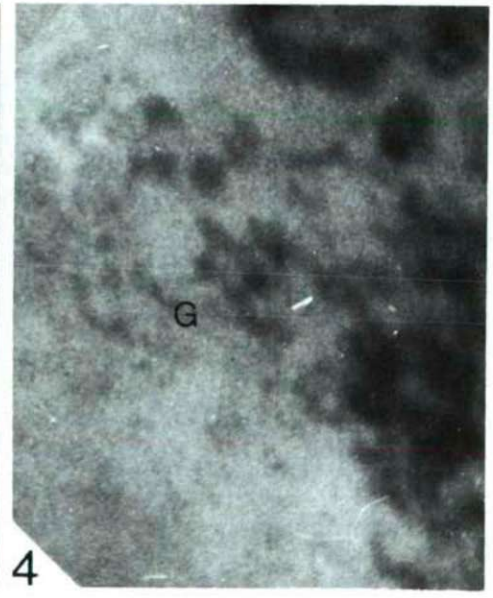
Pleurozonaria concinna (COOKSON et MANUM 1960) MÄDLER 1968

1. Block No: 85/8, cross-section of the wall. x20000
2. Block No: 85/8, the inner surface of the wall. G = globular polymer units on the inner surface, X = polymer units on the surface of the hollow in the wall. x48000
3. Block No: 85/6, globular polymer units of the wall (G). x250000
4. Block No: 85/6, globular polymer units of the wall (G). x500000


outer surface
1


G
inner surface
X
2


G
3


G
4

The origin of the particules adsorbed on the surface of the wall is doubtful, but it seems to be interesting in respect of further investigations. Worth of mentioning are the helical structures (H) on the surface, which occur in a mass. The inner part of the core lack in our helical structures. Moreover there are massulae without structures on the surface of the wall of the planctonic organisms. We have observed the degradation of the wall at the point of contacts with these remains (A). Finally there are narrow particules on the surface, with stronger electron affinity than that the wall of the microplancton organisms.

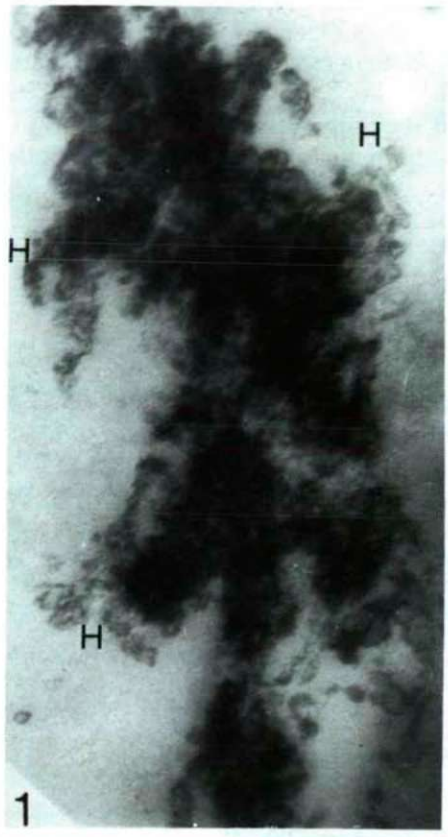
Discussion

1. Our results refer that the molecular structure of the microplancton organisms may be open up partially during the sedimentation process of the manganese ore layers.
2. The observed molecular biopolymer units are globular, and compared with the previous data are relatively small (cf. KEDVES et al.)
3. The exact origin of the particules of three types adsorbed on the surface of the plancton organisms is now in question. These may be refer to microbial, bacterial activity. The helical structures may originate from the organic material of strongly degraded exine of pollen grains. As another opportunity it is possible that these are inorganic remnants of the iron-manganese bacteria.
4. The experimental method, using the oxidation with $KMnO_4$ is necessary for the fossil plant microfossil remnants too. From the literature in connection with the recent pollen grains we stress the importance of the following publications:
ROWLEY, DAHL and ROWLEY (1980); p. 252: "We find the pollen grains exine of *Artemisia vulgaris* to be composed of units 6—100 nm in diameter, consisting of helical subunits about 10 nm in diameter". Methods, p. 252: "Exines of mature pollen grains were oxidized in 2-aminoethanol for 40 sec at 90 °C. Exines were washed free of the organic base in 100nM phosphate buffer at pH 6.5, then kept in freshly prepared 0.01% $KMnO_4$ (phosphate buffered, pH 6.5) for 40 days to oxidize lipids and unmask proteins in glycocalyx elements of exinous subunits. Lipids were extracted in an acetone-epoxy resin series (2) beginning with 20 pts acetone: 1 pt epon-araldite."

Plate II

Pleurozonaria concinna (COOKSON et MANUM 1960) MÄDLER 1968

1. Block No: 85/6, particules adsorbed to the surface with helical units = H. x120000
2. Block No: 85/6, helical units adsorbed to the surface with higher magnification. x250000
3. Block No: 85/7, the outer surface of the wall with different kind of adsorbed particules, A, B. One part of the hollow in the wall well shown. x64000


H
H
H
1


H
2


B
A
3

ROWLEY (1980), p. 358: "Our model of the exinous unit and its subunits (Fig. 1) has a super-coiled binder around one to many core subunits." Reviews about this subject: ROWLEY, DAHL and ROWLEY (1981), ROWLEY, DAHL, SENGUPTA and ROWLEY (1981).

5. Finally, the comparison and evaluation of the molecular structures which were open up under natural and in vitro circumstances is a new opportunity to the knowledge of the conditions of the sedimentation process of the manganese ore layers.

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