7. TRANSMISSION ELECTRON MICROSCOPY OF HUNGARIAN TERTIARY LIGNITES II.

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Abstract

The transmission electronmicroscopical results of three Hungarian lignite samples are presented in this contribution. Two samples of *Sequoioxylon gypsaceum* and one sample of *S. medullare* were the subject of these investigations. Non-experimental and partially dissolved lignite fragments with diethylamine and merkaptoethanol were investigated with transmission electron microscope method. The new results in comparison to the previously described ones indicate that these samples are in a very poor preservation state. Homogenisation of the secondary wall was observed, but sometimes there are important differences in the electron density of the more or less homogeneous substance.

Key words: Xylotomy, fossil, transmission electron microscopy, Tertiary, Hungary.

Introduction

During our previous investigations we established that the transmission electron microscopical method may be useful for the fossil secondary woody remnants (KEDVES and SZEDERKÉNYI, 1985). Moreover the partial dissolution with organic solvents resulted in new data for the alteration of the secondary wood during the fossilization processes (KEDVES, 1997, 1998, KEDVES and PÁRDUTZ, 1998). To continue this research program of our Laboratory in this contribution we present our new data in this respect.

The aim of this contribution was the investigation of the ultrastructure alterations for the same dissolution processes for the differentially preserved lignite samples.

Materials and Methods

The following lignite samples were the subject of our present investigations:

Sequoioxylon gypsaceum (GÖPPERT) GREGUSS 1967

Sample no 3, locality: Mohács, Upper Pannonian, brickyard, lower level. LM results: KEDVES (1999), p. 39,46, plate 4.1., figs. 1-6.
(T-9-7: non-experimental material, T-9-8: dissolution with diethylamine, T-9-9: dissolution with merkaptoethanol).

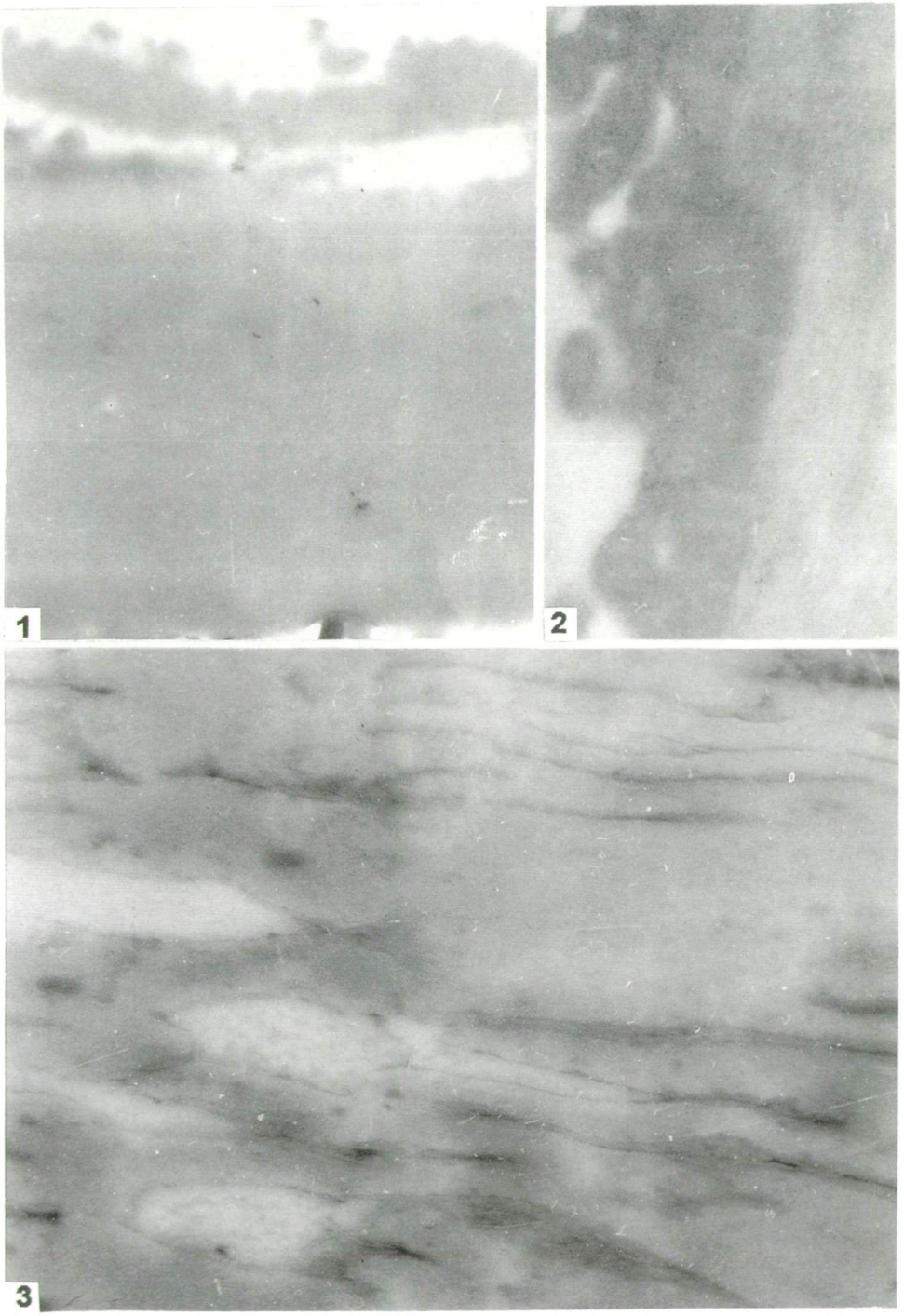

Plate 7.1.

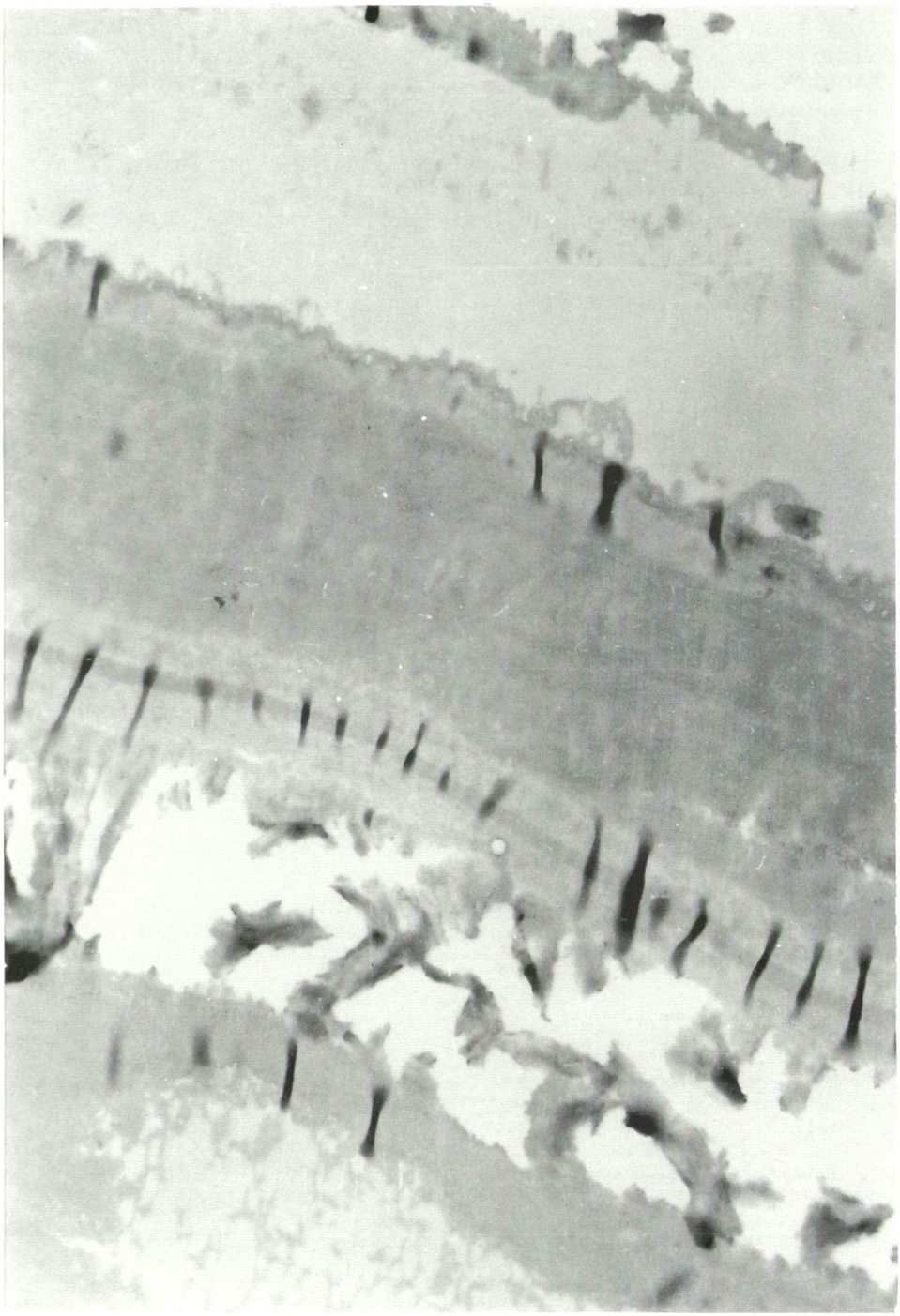

Plate 7.2.

Sample no 10, locality: Bátaszék, Upper Pannonian, layer D-1/B. LM results: KEDVES (1999), p. 46, plate 4.2., figs. 1-3.
(T-9-10: non-experimental material, T-9-11: dissolution with diethylamine, T-9-12: dissolution with merkaptoethanol).

Sample no 7, locality: Bátaszék, well no 7, depth 168.0 m., Upper Pannonian. LM results: KEDVES (1999), p. 46, plate 4.3., figs. 1-4.
(T-9-13: non-experimental material, T-9-14: dissolution with diethylamine, T-9-15: dissolution with merkaptoethanol).

The used experimental method was described in a previous paper (KEDVES 1997).

Results

Sample no: 3 (Plate 7.1., figs. 1-3, plate 7.2)
Sequoioxylon gypsaceum (GÖPPERT) GREGUSS 1967

The ultrastructure of the non-experimental tracheids represents a degraded wall structure (Plate 7.1., figs. 1,2). Based on the electron density an outer and an inner part may be distinguished. The outer is more electron dense, the superficial part is irregular, (Plate 7.1., fig. 2), and some fragments or the outest part detached from the finely lamellar secondary wall (Plate 7.1., fig. 2).

Experiment T-9-8, dissolution with diethylamine during 30 days at 30 °C (Plate 7.2).

After this kind of partial dissolution the different layers of the wall fine structure of the tracheids are relatively well shown. The different layers are in all probability the following: The outest part of the secondary wall (S 3) is two layered based on the electron density. The S 2 layer is also multilamellate by its electron affinity. A relatively thin S 1 layer is probable. The primary wall and the middle lamella was extremely damaged, only some fragments were observed.

Experiment T-9-9 (Plate 7.1., fig. 3). A more or less tangential longitudinal section illustrates the extremely damaged and probably secondarily destroyed wall structure. The dark striae may represents the fossil resinous material. The light holes may be the traces of the medullary rays. No finely lamellar ultrastructure of the wall was observed at this kind of experiment.

Plate 7.1.

Sequoioxylon gypsaceum (GÖPPERT) GREGUSS 1967.
1,2. Ultrastructure of the non-experimental sample (T-9-7).
1. Negative no: 6801, 10.000x.
2. Negative no: 6837, 25.000x.
3. Ultrastructure of the partially dissolved lignite sample with merkaptoethanol (T-9-9). Negative no: 6809, 25.000x.

Plate 7.2.

Sequoioxylon gypsaceum (GÖPPERT) GREGUSS 1967.
Ultrastructure of the partially dissolved lignite sample with diethylamine (T-9-8). Negative no: 6839, 10.000x.

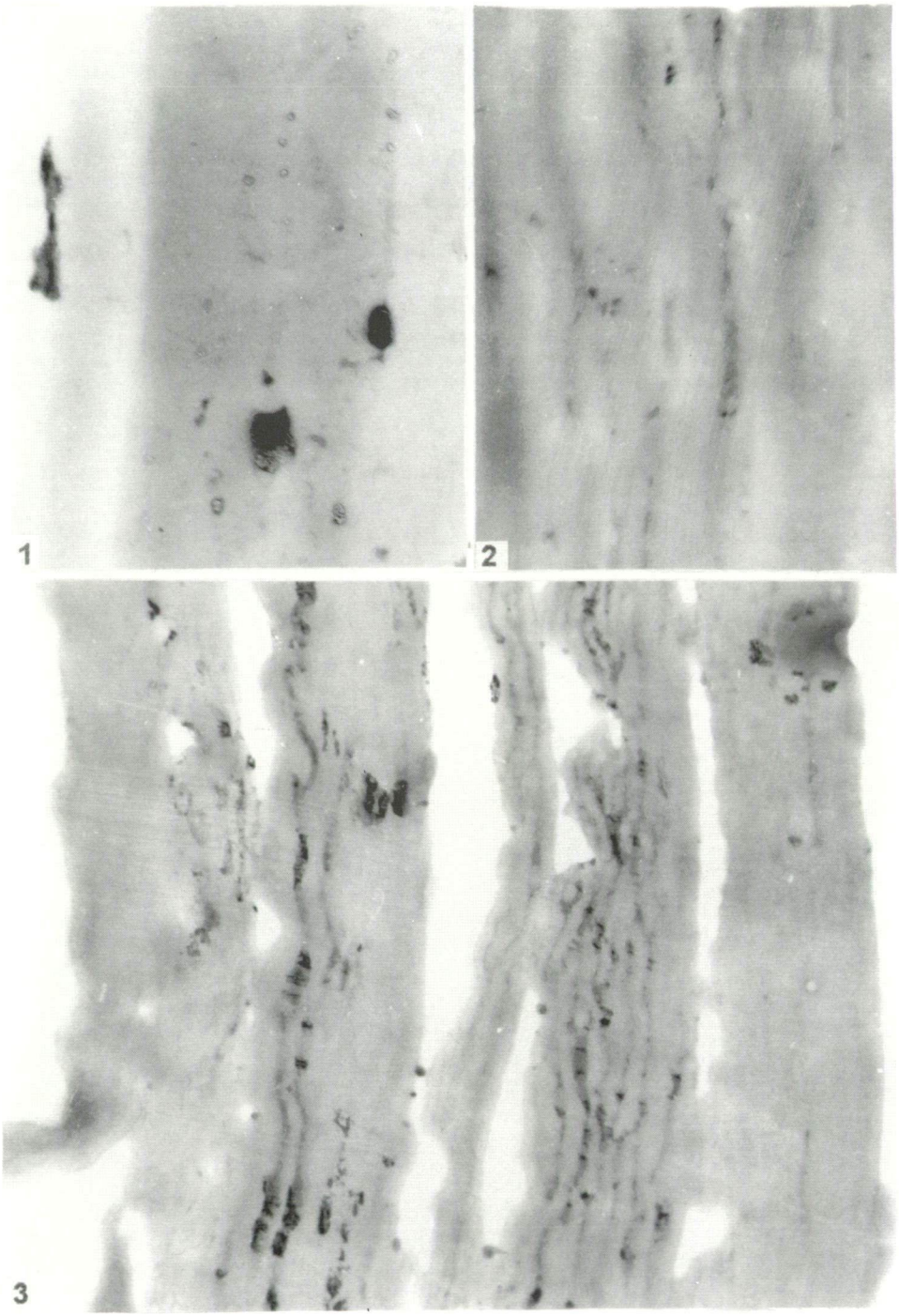

Plate 7.3.

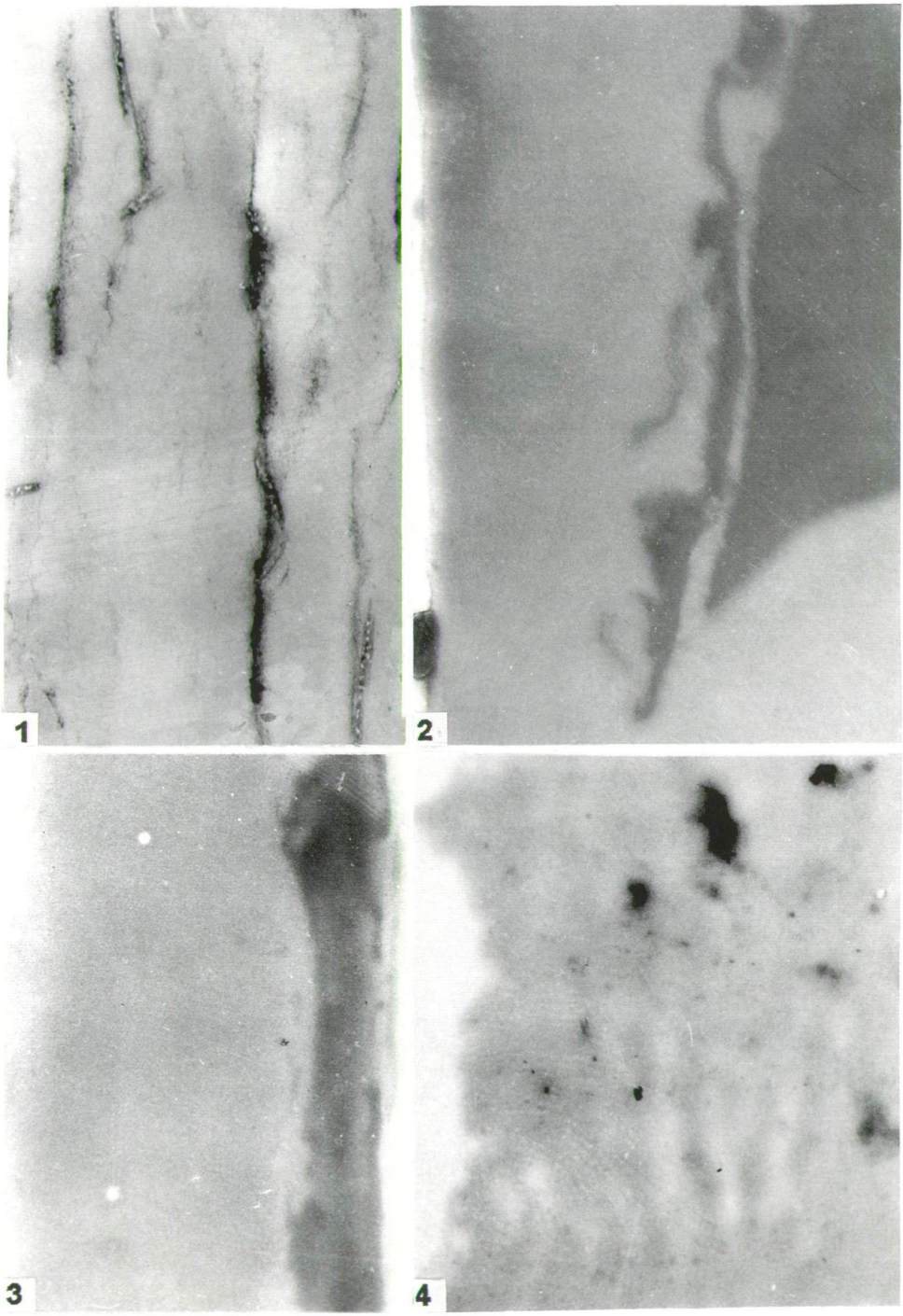

Plate 7.4.

Sample no: 10 (Plate 7.3., figs. 1-3)
Sequoioxylon gypsaceum (GÖPPERT) GREGUSS 1967

As it was illustrated by the LM structure (KEDVES 1999, plate 4.2., figs. 1-3) this sample was extremely damaged and compressed during the fossilization processes, but in contrast to the previous sample the lignite material was not carbonified.

The ultrastructure of the non-experimental material (Plate 7.3., fig. 1) illustrate the extremely damaged wall structure. But within the more or less homogeneous material there are dark small particles in all probability tiny carbonified parts of the secondary wall.

Experiment: T-9-11, dissolution with diethylamine during 30 days at 30 °C (Plate 7.3., fig. 2). This probably tangential longitudinal section represents the extremely altered secondary wall ultrastructure. The darker striae may be remnants of the resinous material within the longitudinal parenchyma, and similarly to the previous by light holes the traces of the medullary rays may be presumed.

Experiment: T-9-12, dissolution with merkaptoethanol during 30 days at 30 °C (Plate 7.3., fig. 3). A longitudinal ultrathin section was investigated. The extremely degraded secondary wall structure is also well shown in this picture. But the dissolution process discovered remnants of the finely lamellar structure. There are dark carbonified particles and remnants of the resinous material within the longitudinal parenchyma in the homogeneous or very finely lamellar secondary wall.

Sample no: 7 (Plate 7.4., figs. 1-3)
Sequoioxylon medullare GREGUSS 1967

The preservation of this lignite sample based on the LM investigations (KEDVES 1999, plate 4.3., figs. 1-4) is quite good. In picture 1 in the paper of KEDVES (1999) it is well shown that in some part of the lignite sample the tracheids are carbonified. On other part of the sample strong degradation may be observed.

The TEM picture of the non-experimental lignite sample (T-9-13, Plate 7.4., fig. 1) illustrates a damaged, homogenised secondary wood fragment, with longitudinal electron dense striae. These dark striae may be the remnants of the resinous material in the longitudinal parenchyma. In some part of the more or less homogeneous lignite remnants fine lamellar structure is also present.

Plate 7.3.

Sequoioxylon gypsaceum (GÖPPERT) GREGUSS 1967.
1. Ultrastructure of the non-experimental lignite sample (T-9-10). Negative no: 6817, 25.000x.
2. TEM picture of the partially dissolved lignite sample with diethylamine (T-9-11). Negative no: 6822, 25.000x.
3. Ultrastructure of the partially dissolved lignite fragment with merkaptoethanol (T-9-12). Negative no: 6833, 10.000x.

Plate 7.4.

Sequoioxylon medullare GREGUSS 1967.
1. Ultrastructure of the non-experimental lignite sample (T-9-13). Negative no: 6904, 25.000x.
2. Ultrastructure of the partially dissolved lignite fragment with diethylamine (T-9-14). Negative no: 6911, 10.000x.

3,4. Ultrastructure of the partially dissolved lignite samples with merkaptoethanol (T-9-15).
3. Negative no: 6917, 10.000x.
4. Negative no: 6919, 10.000x.

Experiment: T-9-14, dissolution with diethylamine during 30 days at 30 °C (Plate 7.4., fig. 2). The secondary wood of the lignite sample was extremely altered. Two kinds of preservation were observed a lighter completely homogeneous part and a dark, electron dense particle embedded in this substance.

Experiment: T-9-15, dissolution with merkaptoethanol during 30 days at 30 °C (Plate 7.4., figs. 3,4). The preservation of the different lignite fragments of this sample is not the same. Fig. 3 in Plate 7.4., illustrates a similar preservations of the ultrastructure as at the previous experiment. But at other part of the lamellar ultrastructure very poor preservations was observed (Plate 7.4., fig. 4). Within the lamellae sometimes there are some electron dense small granular particles.

Discussion and Conclusions

1. The two samples of *Sequoioxylon gypsaceum* are in a poor preservation in comparison to the previously investigated and published sample (KEDVES and PÁRDUTZ, 1999, Plate 5.1., 5.2., 5.3.). The lamellar structure which was observed after the dissolution with merkaptoethanol previously was not present (Plate 7.1., fig. 3) or in a very damaged preservation state (Plate 7.3., fig. 3).

2. The differences in the ultrastructure of *Sequoioxylon medullare* of the previously and presently investigated samples are also very characteristics. Recently superficial alterations of the tracheids were not observed.

Finally, based on the up-to-date knowledge its seems that the alterations in consequence of the fossilization processes the fine structure of the lignite samples may be extremely different. The homogenisation in the fine structure may be advanced, but the substance of the secondary wall may be different. Very coalified fragments may occur in the lighter homogenised substance.

Acknowledgements

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