THE MICROFAUNA OF THE CARBONIFEROUS LIMESTONE AT SZABADBATTYÁN (TRANSDANUBIA, HUNGARY)

PART II.

by

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Introduction

The writer, on the authority of the Geological Survey of Hungary studied the microfauna of the Carboniferous limestone of Szabadbattyán in 1971. This present paper contains the second part of the paleontological descriptions and the stratigraphical and faciological evaluation of the fauna.

Descriptions (Continuation)

Family ENDOTHYRIDAE BRADY 1884
Genus *Endothyra* PHILLIPS 1846

Endothyra cf. *bradyi* MIKHAILOV 1939

Pl. I., Figs. 1 – 2.

Description: Diameter: 0.45 – 0.60 mm
Number of whorls: 2.5
Number of chambers in the last whorl: 7 to 8.

The coiling have a planispiral tendency — apart from the initial chambers. The whorls rise gradually. The chambers are slightly convex, the sutures are pronounced only in some places. The septa are relatively weakly developed, with occasional proversity or convexity. The secondary deposit forms more or less developed knobs, with thin connecting wall-cover. The wall is dark and fine-grained.

Remarks: The specimen figured on Pl. I. Fig. 1. agrees well with the var. *alta* of CONIL and LYS 1964, Fig. 474.

For lack of sufficient comparative material it cannot be decided whether the *Endothyra bowmani* and *E. bradyi* species are synonyms. The forms figured here undoubtedly resemble the *E. bowmani* PHILLIPS specimen figured on Pl. V. Fig. 4. of BRADY (1876), the *E. bowmani* PHILLIPS in BROWN emend. BRADY specimen of MAMET (1970. Pl, VI, fig. 3.) and the specimen figured by LOEBLICH and TAPPAN (1964) as neotype. On the other hand, these differ completely from the neotype figured by ZELLER (1963).

Occurence at Szabadbattyán: Borehole Szabadbattyán – 9, from 285.1 m, Borehole Szabadbattyán – 10, from 339.3 m, and from the samples of the exploration shaft.

Endothyra cf. *omphalota* RAUSER – CHERNOUSSOVA et REITLINGER 1936

Pl. II., Fig. 3.

Diameter: 0.67 mm

Remarks: Only one section, without the possibility of more precise determination.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 9, from 302.7 m.

Endothyra cf. *prisca* RAUSER-CHERNOUSSOVA et REITLINGER 1936

Pl. II., Fig. 4.

Description: Diameter: 0.37 mm
Number of whorls: 3.5
Number of chambers of the last whorl: 9.

The coiling is nearly regular, the chambers are convex, with pronounced sutures on the last whorl. The septa are slightly convex. Secondary deposit cannot be visible. The wall is relatively thin, dark and fine-grained.

Remarks: The single suitably oriented section shows a strong resemblance to the var. *undata* of CONIL and LYS (1964). It also resembles the *Endostaffella parva* (MOELLER), figured by ROZOVSKAJA (1963, Pl. XI., Fig. 12).

Occurence at Szabadbattyán: From the single sample of the Borehole Szabadbattyán – 6.

Endothyra cf. *similis* RAUSER-CHERNOUSSOVA et REITLINGER 1936

Pl. I., Figs. 3 – 7., Pl. II., Figs. 1 – 2.

Description: Diameter: 0.33 – 0.64 mm
Number of whorls: 3
Number of chambers in the last whorl: 6 to 9.

The coiling is asymmetrical, the included angle of the last and the penultimate whorls is nearly 90°. The last whorl rises quickly. The sutures are usually weak, but some pronounced sutures can occasionally occur between the last chambers. The septa are straight, rarely slightly convex, they are perpendicular to the spire, or curve in the direction of the coiling. The secondary deposits appear as distinct tubercules and inner wall-covering, but sometimes – owing to the poor preservation – these are hardly visible. The wall is fine-grained, granular, dark.

Remarks: The specimen figured here on Pl. I. Fig. 3. and Figs. 5–7. shows a good resemblance to that figured by CONIL and LYS (1964, Figs. 733–736) as var. *elegia* MALAKHOVA, but the specimen figured on Pl. I. Fig. 4. is close to the var. *crustata* designated in their work.

The originals of the Pl. II., Figs. 1–2. show the specific characters of this species, but the dimensions are greater than those given for this form so far. Because of the limited specimen-number it is impossible to decide whether there is wide variability, or subspecific-specific difference in the case of these forms.

Occurence at Szabatbattyán: Borehole Szabadbattyán–9, from 285.1, 302.7 and 306.8 m, Borehole Szabadbattyán–10, from samples between 338.5–340.1 m depth, and from samples of the exploration shaft.

Family OZAWAINELLIDAE THOMPSON et FOSTER 1937
Genus *Eostaffella* RAUSER-CHERNOUSSOVA 1948

Eostaffella cf. *ikensis* VISSARIONOVA 1948

Pl. IV., Figs. 5–7.

Description: Diameter: 0.7–0.82 mm
Width: 0.35–0.37 mm
Number of whorls: 4.

Compressed, lenticular form, with flat, or slightly depressed umbilicus. The inner whorls are rounded, the two outer whorls are narrowly rounded, sharp, or occasionally keeled. The last whorl increases more strongly. The last half whorl appears occasionally to be more rounded. Because of the poor preservation the character of the secondary deposit is hardly visible, but seems to be of variable strength. The wall is undifferentiated.

Remarks: The studied specimens appear to be slightly flattened in comparison to those assigned into this species in the literature, and the measurements are also greater. Special feature is the pronounced roundness of the last half whorl.

Occurence at Szabadbattyán: Borehole Szabadbattyán–10, from 342.6 m depth, and from samples from the exploration shaft.

Eostaffella cf. *parastruvei* RAUSER-CHERNOUSSOVA 1948

Pl. IV., Fig. 1.

Description: Diameter: 0.43 mm
Width: 0.215 mm
Number of whorls: 4.

It is a compressed, lenticular form, with slightly depressed umbilicus. The outer half whorl is narrowly rounded, sharp. The plane of coiling of the first whorl is different. The secondary deposits are hardly visible, and seem to be variable. The wall is dark, undifferentiated.

Remarks: The visible features of the available specimen are well comparable with those of the specimens figured by CONIL and LYS (1964).

Occurence at Szabadbattyán: Borehole Szabadbattyán – 10, between 338.5 – 340.1 m depth.

Eostaffella cf. *prisca settella* GANELINA 1951

Pl. IV., Figs. 3 – 4.

Description: Diameter: 0.20 – 0.24 mm
Width: 0.11 – 0.135 mm
Number of whorls: 3.

It is a lenticular form, with narrowly rounded edges. Because of the bad state of preservation the secondary deposits are hardly visible, but seem to be rather weak and irregular.

Remarks: On the basis of the visible features this form can be assigned into this subspecies.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 9, from 309.1 m, and from samples of the exploration shaft.

Eostaffella cf. *vasta* ROZOVSKAJA 1963

Pl. III., Fig. 5.

Description: Diameter: 0.60 mm
Width: 0.25 mm
Number of whorls: 4.5.

It is a strongly compressed form, with narrowly rounded, sharpening edge. The secondary deposit is somewhat variable. The wall is dark and undifferentiated.

Remarks: The majority of the available specimens is fragmented and the sectional orientation of the single entire specimen is unconvenient. The character of the coiling, the shape and the width/diameter ratio as well, resemble to those of this species. The measurements are as the upper limits of the species.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 10, samples between 338.5 – 340.1 m depth.

Eostaffella sp.

Pl. III., Fig. 6.

Description: Diameter: 0.65 mm
Width: 0.34 mm
Number of whorls: 3.5.

It is a compressed, lenticular form, with shallow umbilicus. The last 1.5 whorl is narrowly rounded. The secondary deposits developed unevenly and are hardly visible. The wall is dark, undifferentiated

Remarks: The figured form resembles the species *E. mosquensis* VISSARIONOVA, but its measurements are greater than the maximal dimensions mentioned in the literature so far.

Occurence at Szabadbattyán: From samples of the exploration shaft.

Eostaffella? sp.

Pl. IV., Fig. 2.

Description: Diameter: 0.35 mm
Width: 0.23 mm

The edges are rather narrowly rounded, with strong secondary deposits.

Remarks: A closer determination – owing to the poor preservation – is impossible, but the form resembles also the *Eoparastaffella* forms described by VDOVENKO (1964), therefore the generic state is uncertain.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 10, from samples between 338.2 – 339.8 m depth.

Genus *Mediocris* ROZOVSKAJA 1961

Mediocris mediocris (VISSARIONOVA 1948)

Pl. II., Figs. 5 – 7.

1948. Eostaffella mediocris sp. nov. – VISSARIONOVA pp. 222 – 223., Pl. XIV., Figs. 7 – 9.

1954. Eostaffella mediocris VISSARIONOVA var. mediocris VISSARIONOVA – GROZDILOVA and LEBEDEVA, p. 120., Pl., Figs. 9 – 10.

1959. Eostaffella mediocris VISSARIONOVA – DURKINA, p. 193., Pl. XIX., Fig. 17.; Pl. XX., Figs. 1 – 3.

1960. Eostaffella mediocris VISSARIONOVA – GROZDILOVA and LEBEDEVA p. 109., Pl. XIII., Fig. 13.

1962. Mediocris mediocris (VISSARIONOVA) – BOGUSH and JUFEREV, P. 158., Pl. VI., Fig. 5.

1963. Mediocris mediocris (VISSARIONOVA) – ROZOVSKAJA, pp. 103 – 104., Pl. XVII., Figs. 26 – 33.

1964. Eostaffella mediocris VISSARIONOVA – CONIL and PIRLET, Pl. III., Fig. 42.

1964. Mediocris mediocris (VISSARIONOVA) – CONIL and LYS, p. 239., Pl. XL., Fig. 843., Pl. XLI., Figs. 844–846.

1965. Mediocris mediocris (VISSARIONOVA) – POJARKOV, pp. 96–98., Pl., Figs. 8–10.

1966. Mediocris mediocris (VISSARIONOVA) – BOGUSH and JUFEREV, pp. 154–155., Pl. X., Figs. 12–13.

1967. Mediocris mediocris (VISSARIONOVA) – PELHATE-PERON, p. 54., Pl. IV., Fig. 58.

Description: Diameter: 0.43 mm
Width: 0.21 mm
Number of whorls: 3.

It is a compressed, lenticular form, with broad'y rounded edges. Owing to the strongly increasing last half whorl, the periphery is slightly divergent. The whorls are planispiral. The secondary deposits form pronounced lateral infillings. The umbilical part is slightly depressed. The diameter of the proloculus is 0.035 mm. The wall-thickness on the last whorl is 0.01 mm. The wall is dark, fine-grained.

Remarks: The given measurements refer to the figured entire specimen.

Geographical distribution: Belgium, Germany, France, USSR.

Age: Viséan – Namurian.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 9, from 296.3 m, Borehole Szabadbattyán – 10, from samples between 338.5 – 340.1 m depth, and from samples of the exploration shaft.

Mediocris cupellaeformis (GANELINA 1951)

Pl. II., Fig. 7.

1951. *Eostaffella mediocris* VISSARIONOVA var. *cupellaeformis* n. var. – GANELINA, pp. 196–197., Pl. II., Figs. 16–18.

1963. *Mediocris ovalis cupellaeformis* (GANELINA) – ROZOVSKAJA, pp. 105–106., Pl. XIX., Figs. 5–7.

1965. *Mediocris cupellaeformis* (GANELINA) – POJARKOV, p. 95., Pl., Figs. 5–6.

Description: Diameter: 0.23 mm
Width: 0.14 mm
Number of whorls: 3.

The cross-section is oval, slightly inflated at the umbilical part, the edge is narrowly rounded. The spire is involute, tightly coiled, planispiral. The secondary lateral deposit is well developed. The diameter of the proloculus is 0.035 mm. The wall is dark, fine-grained.

Geographical distribution: USSR.

Age: Middle to Upper Viséan (Tulaian – Venevian horizons)

Occurence at Szabadbattyán: Borehole Szabadbattyán – 9, from 285.1 m.

Mediocris sp. 1.

Pl. II., Fig. 8.

Description: Diameter: 0.34 mm
Width: 0.13 mm
Number of whorls: 4.

It is a strongly compressed form, with rounded edges and nearly parallel sides. The coiling plane of the initial whorls is somewhat unstable. The secondary deposit is a developed lateral infilling. The wall-thickness at the last whorl is 0.010 mm. The wall is dark, fine-grained.

Remarks: The width/diameter ratio of the available specimens resembles to that of the species *M. breviscula* (GANELINA), but on the basis of the number of whorls and the size it compares to the *M. mediocris*.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 10, from samples between 335.9 – 338.2 m depth.

Mediocris sp. 2.

In the material there are rather poorly preserved *Mediocris* sections of 0.17 – 0.20 mm diameter. The number of whorls is 2 to 3. These seem to be allies of the species *Mediocris breviscula* (GANELINA).

Genus *Pseudoendothyra* MIKHAILOV 1939

Pseudoendothyra cf. *struvii supressa* (SCHLYKOVA 1951)

Pl. III., Figs. 1 – 2.

Description: Diameter: 0.73 – 0.78 mm
Width: 0 30 – 0.32 mm
Number of whorls: 4.

It is a strongly compressed form, with a rather depressed umbilicus. The outer 1.5 whorl is narrowly rounded. Because of the poor preservation, the secondary deposits cannot be studied sufficiently, but the presence of slight chomatas is presumable. The diafanotheca is developed.

Remarks: All of the visible features of the studied specimens indicate this subspecies, the measurements are near to the upper limits mentioned in the literature.

Occurence at Szabadbattyán: Borehole Szabadbattyán – 9, from 285.1 m depth.

Pseudoendothyra sp.

Pl. III., Figs. 3–4.

Two badly preserved, strongly fragmented form, which are related to the *Pseudoendothyra struvii* (MOELLER) group.

Occurence at Szabadbattyán: Borehole Szabadbattyán–9, from 285.1 m depth.

Stratigraphical evaluation

1. The poor preservation, as well as the low specimen number of the fauna encumbers the stratigraphical interpretation. The data of the recent evaluation of the Carboniferous Foraminifera of Szabadbattyán (SIDÓ 1971), which suggest an agreement with the Upper Carboniferous of the Bükk Mountains, are not supported with the figured specimens. The *Plectofusulina* sp. figured on Pl. III., Fig. 2. in that work is not a well developed fusulinid, but presumably an *Eostaffella* section, which is undeterminable by the reason of unorientation. Similarly an unoriented section of an *Endothyra* is the *Codonofusiella* sp., figured on Pl. III., Fig. 3. (On the other hand it is unlikely the occurence of this Permian guide-fossil *Codonofusiella* in the Carboniferous!) The *Ozawainella* cf. *angulata* COLANI of Pl. III., Fig. 4. is presumably a form from the *Eostaffella ikensis* group. This latter is also an unconveniently oriented section, which unables closer determination.

The Szabadbattyán fauna is indisputably of Carboniferous. The available fauna furnishes a basis for preclusion the presence of the stages younger than Namurian: i.e. in the Foraminifera fauna the developed fusulinids are completely absent, which common in the Moskovian-Uralian limestones of the Bükk Mountains of similar facies (for detailed studies see ROZOVSKAJA 1963).

On the basis of the faunal composition, older rocks than Viséan can also not be proved. Consequently the studied sequence should be placed into the Viséan – Namurian stages.

2. With the stratigraphical arrangement the following difficulties arise:

A. The Foraminifera faunas studied from the European Namurian so far, are poor and less characteristic. Some basis for the separation of the Viséan and Namurian by foraminifers are the studies of MAMET, CHOUBERT and HÖTTINGER in Marocco (1966). The most important, however, are the quantitative data, and the material of Szabadbattyán of small specimen number cannot be evaluated in this way. In this material forms of the characteristic Namurian *Asteroarchaediscus baschkiricus* group, and the genus *Loeblichia* are not represented.

B. The overlying rocks of the Viséan yield more richer Foraminifera fauna in the USSR, but the correlation of these strata with the W European Namurian is hitherto much debated question.

The recent studies on the ammonite faunas (RHUZENZEV and BOGOSLAVSKAYA 1971) made the parallelization of the W European Namurian and the corresponding sequences of the USSR possible. In these studies they used instead of the Baschkirian, suggested as an overlapping stage between the Namurian and Moscovian, the more precisely definiable Kayalian stage. Other workers (IVANOVA and ROZOVSKAJA 1970) correlate with the W European Namurian the strata between the Viséan and Baschkirian.

A third group of authors (POPOVA, EINOR, ALEXANDER, REITLINGER 1970, EINOR 1970) continues to debate the usefulness of the Namurian. The source of the controversies is the asynchronous rate of evolution of the different animal and plant groups. OSIPOVA, HECKER and BELSKAYA (1971) pointed out, that at the base of the Namurian just a few new element appears. In the time of significant evolutionary changes in several macrofaunal groups, the Foraminifera show a reduced evolution.

In the case the of Szabadbattyán fauna the controversies regarding the upper boundary of the Namurian are of insignificant. In all of the Soviet works mentioned above the upper boundary of the Viséan (i.e. the Viséan/Nanurian boundary) coincides with the base of the Serpuhov Superhorizon. In the parallelization of the Viséan – Namurian boundary of the USSR and W Europe the only problematic element is that RUZHENZEV and BOGOSLAVSKAYA (1971) regards the uppermost Viséan ($V3c^s$) strata of Belgium to be of lowermost Namurian.

The *Bradyina* sp., which is an ally of the *Bradyina cribostomata* RAUSER et REITLINGER is the single form previously unknown in the Viséan. All of the forms of the *Bradyina rotula* (EICHWALD) group in the USSR, as well as in Belgium and France are known from the Upper Viséan. The *Mediocris cupellaeformis* (GANELINA) is unknown from post-Viséan strata. In spite of the difficulties of the determination, it is recognizable, that the Szabadbattyán foraminifers show relation to species which appear within the Viséan in the USSR and in the Dinantian stratotype as well (CONIL, LIPINA and REITLINGER 1970). The differences can be due to facial causes (e.g. the genus *Mediocris* appears within the Middle Viséan in Belgium). These above mentioned arguments all suggest, that the Carboniferous limestone of Szabadbattyán is a sequence of not older than Middle Viséan and not younger than Lower Namurian in age. The Foraminifera fauna as a whole shows a closest resemblance to the Upper Viséan associations.

Because of the scarcity of the fauna a further subdivisioning of the Carboniferous sequence in boreholes is unrealizable, and the parallelization of the two section is difficult too. Some differences appear in the faunas of the two boreholes: e.g. the representatives of the genus *Bradyina* occur repeatedly in Borehole Szabadbattyán – 10, but are completely absent from the Borehole – 9 (Fig. 1.1 – 2). These disagree-

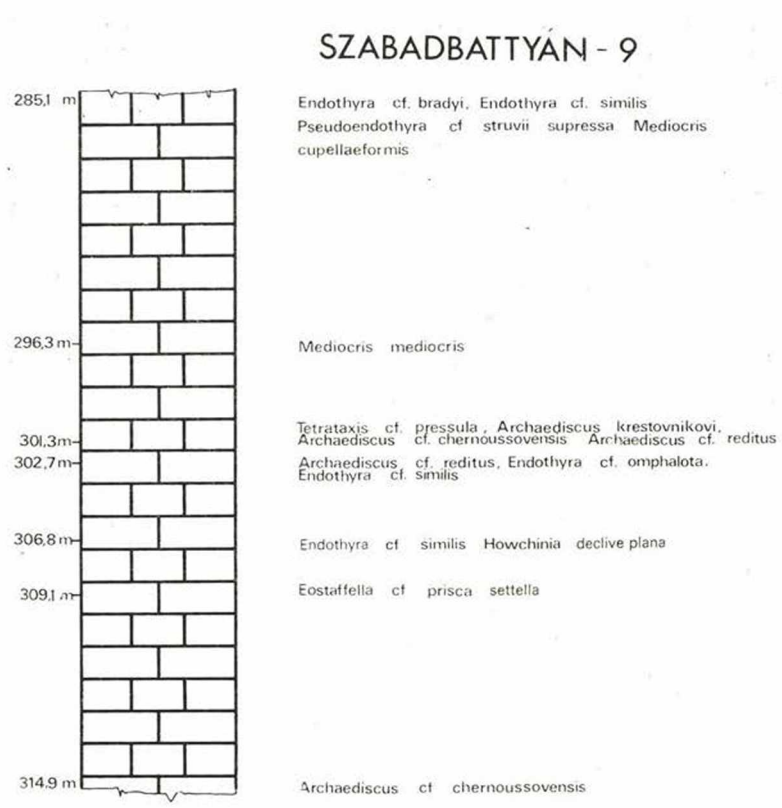

Fig. 1. Occurence of certain Foraminifera in Borehole Szabadbattyán – 9.

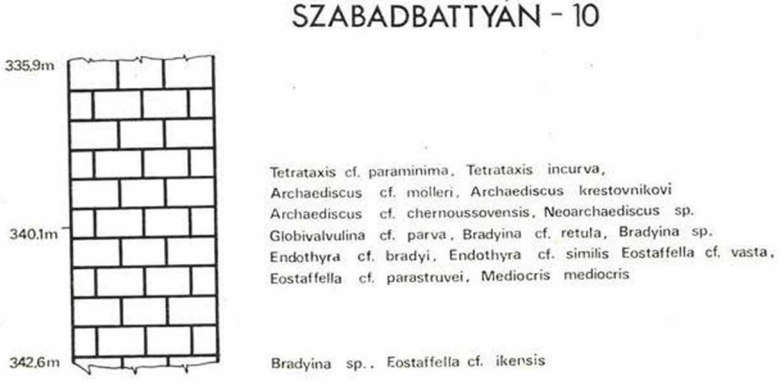

Fig. 2. Occurence of certain Foraminifera in Borehole Szabadbattyán – 10.

ments also can be due to facial differences. [The considerable temporal and areal facies-variablity is shown also by the fact, that the faunal spectrum and the foraminifer-content of the certain beds within the two boreholes are of remarkably different (Figs. 1.3 – 4).]

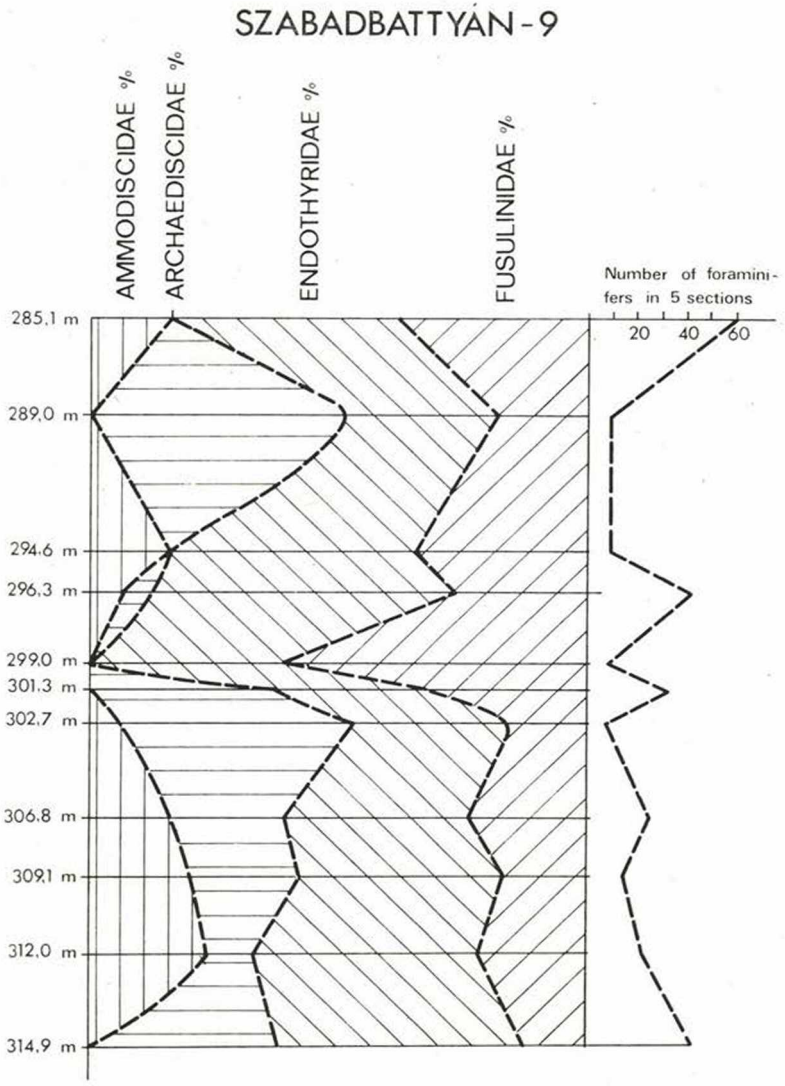

Fig. 3. Quantitative distribution of the Foraminifera in Borehole Szabadbattyán – 9.

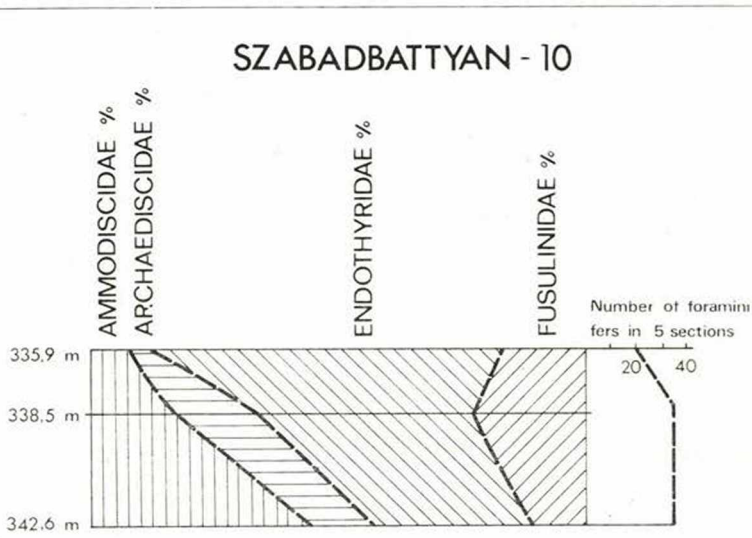

Fig. 4. Quantitative distribution of the Foraminifera in Borehole Szabadbattyán – 10.

Facies evaluation

1. Brachiopods, echinoderms, and corals frequently occur all along in the Carboniferous limestone sequence. These suggest marine environment of normal salinity.

2. The common blue-green algae *(Girvanella)* show shallow water.

3. The coarser organo-detrital beds can be due to occasionally more agitated water.

4. The main biogenic elements are not the foraminifers; this limestone rather can be regarded as brachiopodal-crinoidal limestone.

5. The study of the relative abundance, as well as the change of the specimen number of the four most important Foraminifera group suggest a considerable spatial and temporal variability of the biotic conditions within this shallow-water environment.

6. On the basis of the poor foraminifer fauna a detailed ecologic reconstruction cannot be outlined. However, according to MAMET (1968), the abundance of the primitive fusulinids is common in the vicinity of the biogenic accumulations ("bioherms"). From similar place KALASNIKOV (1967) recorded the abundance of attached foraminifers (Tuberitinidae). The abundance of the *„Calcisphaera" (=Pachysphaerina)* – according to MAMET (1970) – is characteristic in the back-reef lagunes. On the other hand KALASNIKOV (1967) regarded the primitive fusulinids as eurybionts, and he considered their abundance as the indication of the unfavourable life conditions.

Conclusively, the Carboniferous limestone of Szabadbattyán deposited in shallow marine water of normal salinity, partially in form of

biogenic accumulation. The life conditions, which changed significantly in space and time within this shallow-water environment were unfavourable for the Foraminifera.

Conclusions

In the point of view of stratigraphy the study of the foraminifer fauna of Szabadbattyán permitted to reinforce the Viséan age of this limestone, which age was previously suggested by FÖLDVÁRI (1952), on the basis of corals and brachiopods. The importance of the Viséan Foraminifera fauna of Szabadbattyán is the fact that the knowledge, as well as the localities of connecting foraminifer faunas between Eastern and Western Europe are very limited.

Besides of stratigraphical conclusions the fauna enabled some facies evaluations. It is suggested a normal marine, shallow-water environment, with repeated local changes in the life conditions and with resulted various faunal composition.

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PLATE I.

Fig. 1 – 2. Endothyra cf. *bradyi* Mikhailov. From sample of the exploration shaft. X 100

Fig. 3 – 7. Endothyra cf. *similis* Rauser-Chernoussova et Reitlinger.

Fig. 3 – 4. Borehole Szabadbattyán-9., 306,8 m. X 100

Fig. 5 – 6. From sample of the exploration shaft. X 100

Fig. 7. Borehole Szabadbattyán-9., 285,1 m. X 100

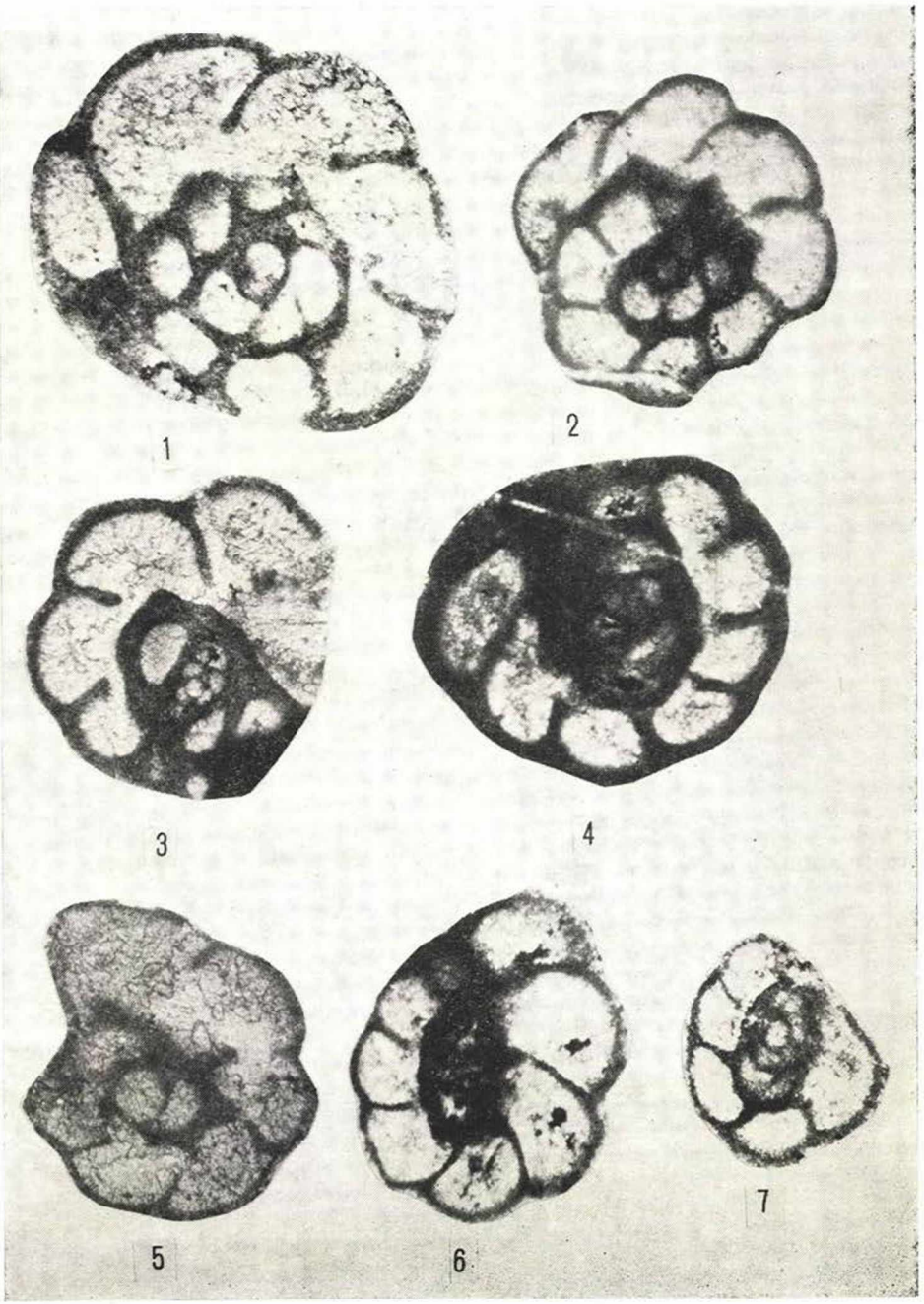
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PLATE II.

Fig. 1–2. Endothyra cf. *similis* Rauser-Chernoussova et Reitlinger

Fig. 1. From sample of the exploration shaft. X 100

Fig. 2. Borehole Szabadbattyán-10., between 338,5–340,1 m. X 100

Fig. 3. Endothyra cf. *omphalota* Rauser-Chernoussova et Reitlinger. Borehole Szabadbattyán-9., 302,7 m. X 100

Fig. 4. Endothyra cf. *prisca* Rauser-Chernoussova et Reitlinger. From sample of the exploration shaft. X 100

Fig. 5–6. Mediocris mediocris (Vissarionova)

Fig. 5. Borehole Szabadbattyán-9., 296,3 m. X 100

Fig. 6. Borehole Szabadbattyán-10., between 338,5–340,1 m. X 100

Fig. 7. Mediocris cupellaeformis (Ganelina). Borehole Szabadbattyán-9., 285,1 m. X 100

Fig. 8. Mediocris sp. Borehole Szabadbattyán-10., between 335,9–338,2 m. X 100

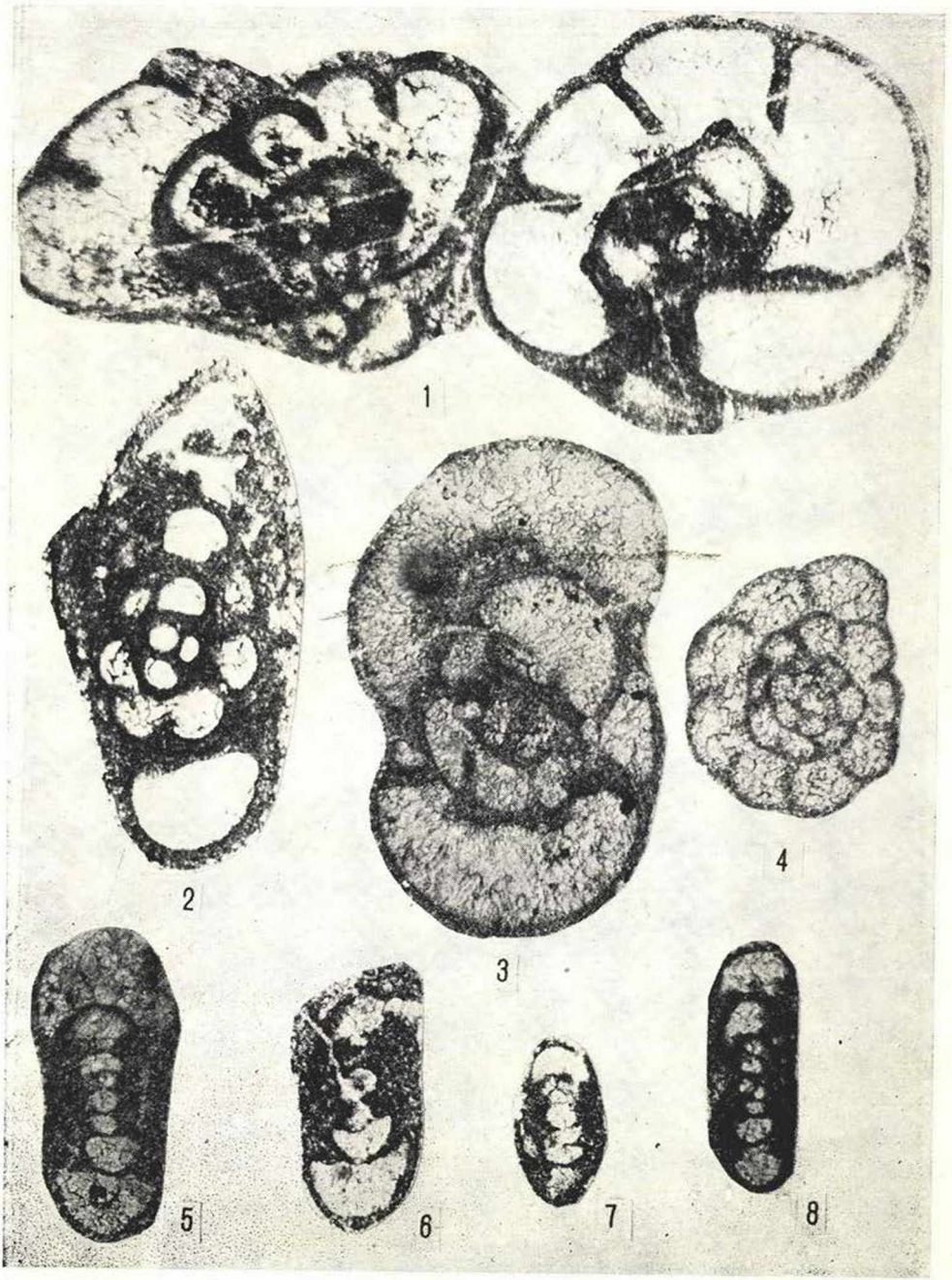
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PLATE III.

Fig. 1–2. Pseudoendothyra cf. *struvii supressa* (S c h l i k h o v a). Borehole Szabadbattyán-9., 285,1 m. X 100

Fig. 3–4. Pseudoendothyra sp. Borehole Szabadbattyán-9., 285,1 m. X 100

Fig. 5. Eostaffella cf. *vasta* R o s o v s k a j a. Borehole Szabadbattyán-10., between 338,5–340,1 m. X 100

Fig. 6. Eostaffella sp. From sample of the exploration shaft. X 100

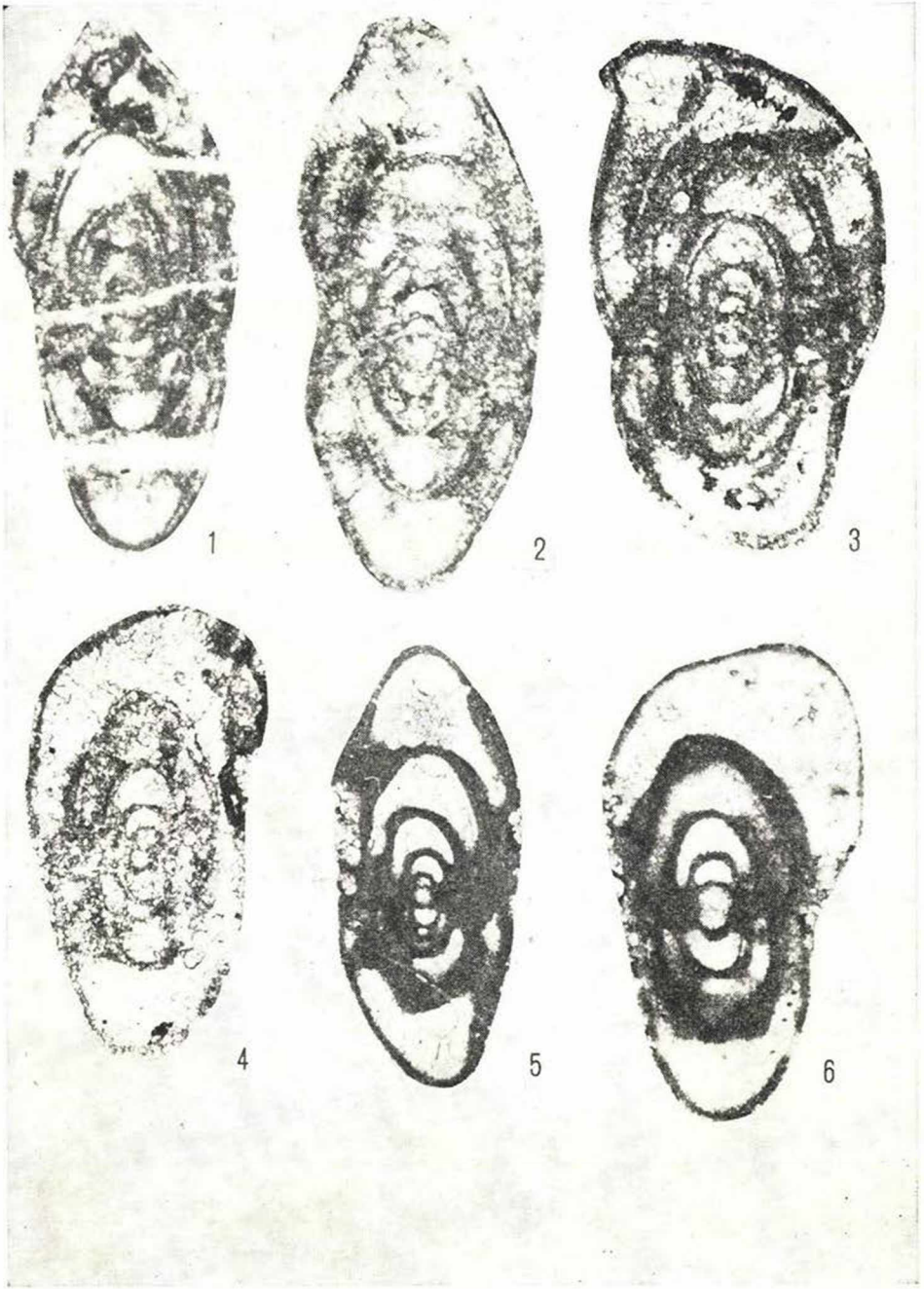
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PLATE IV.

Fig. 1. Eostaffella cf. *parastruvei* Rauser-Chernoussova et Reitlinger Borehole Szabadbattyán-10., between 338,5 – 340,1 m. X 100

Fig. 2. Eostaffella? sp. Borehole Szabadbattyán-10., between 338,2 – 339,8 m. X 100

Fig. 3 – 4. Eostaffella cf. *prisca settella* Ganelina

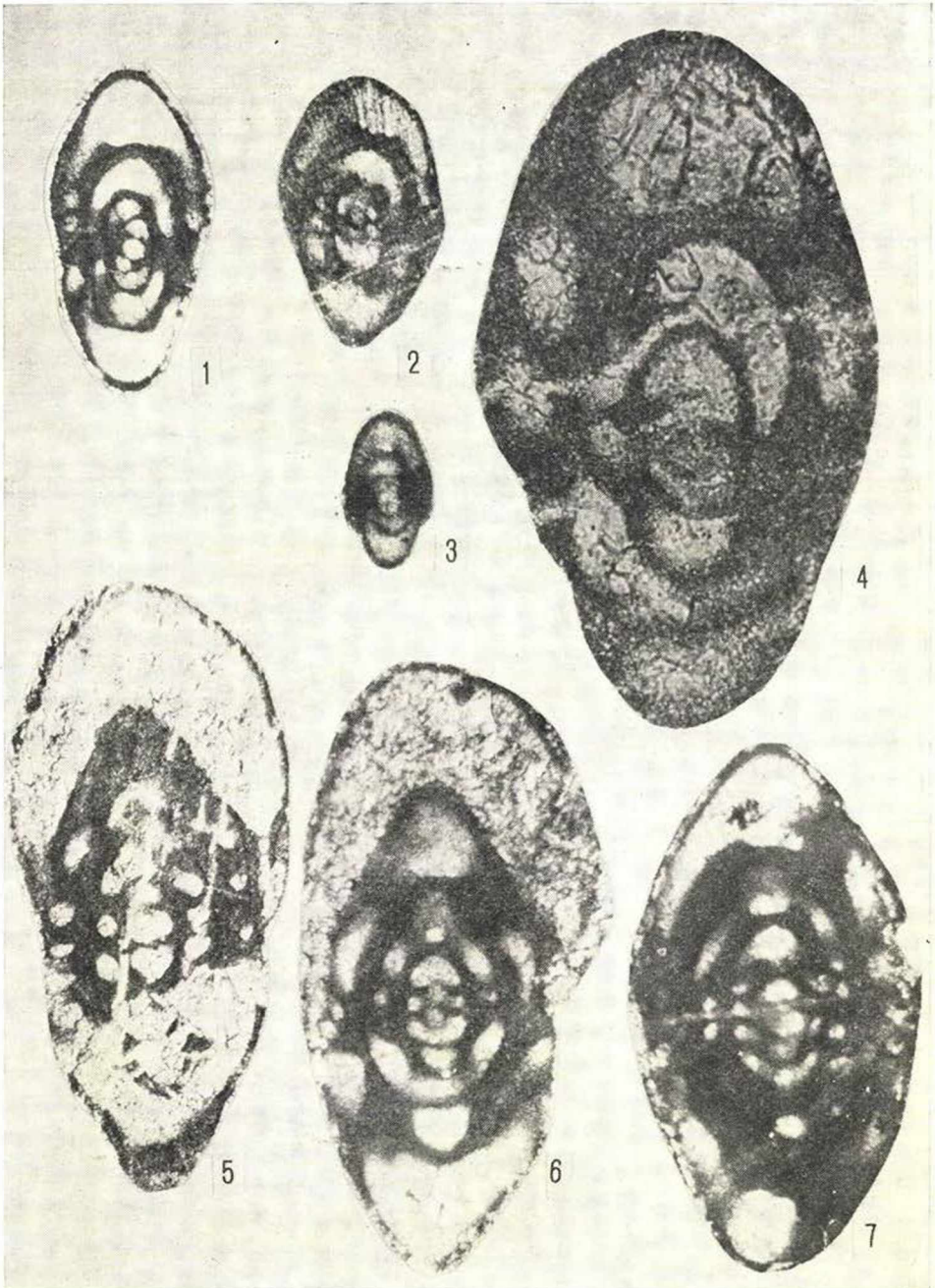
Fig. 3. From sample of the exploration shaft. X 100

Fig. 4. Borehole Szabadbattyán-9., 309,1 m. X 100

Fig. 5 – 7. Eostaffella cf. *ikensis* (Vissarionova)

Fig. 5. Borehole Szabadbattyán-10., 342,6 m X 400

Fig. 6 – 7. From sample of the exploration shaft. X 100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