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MIOCENE FORAMINIFERA BIOZONATION BY BIOGRAPH (ZALA BASIN, SW HUNGARY)

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Abstract. Authors deal with the Prepannonian sediments of the Zala Basin, SW Hungary, and summarise micropalaeontological data available from documents of hydrocarbon core drillings. The computerized method BioGraph based on graph theory was used in establishing the Foraminifera zone boundaries.

Keywords: Pre-Pannonian Miocene, Zala Basin, BioGraph v. 2.02, Foraminifera biozones

INTRODUCTION

Since 1998 É. Szegő has been summarising micropalaeontological data available from documents of hydrocarbon core drillings deepened in the Zala Basin, SW Hungary (Fig. 1.), foraminifers in the samples of which were determined by Kőváry, Dubay, Nyírő and others. The aim of this study was to characterise the foraminiferal assemblages and set provisional zones.

STUDIED AREA AND GEOLOGICAL SETTING

There is a few hundred-metre-thick Prepannonian Miocene sequence known in the Zala Basin (Fig. 1.), under the thick Pannonian s.l. deposits. It overlies unconformably Mesozoic or Eocene formations, generally with basal conglomerate.

Fig. 1. Geographic position of the area examined

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Karpatian sedimentation is characterised by predominantly clastic sediments: monotonous grey, dark grey silty sand and silty clay marl, clayey silt (*Tekeres Formation*), which are poor either in macro- or in microfauna. There are breccia and conglomerate as well, derived from Mezozoic rocks and found in certain boreholes (e.g. Budafapuszta and Csesztreg), the age of which can with all probability be considered Karpatian (*Budafa Formation*). These deposits are missing in other sequences. From the northern – north-eastern part of the Nagylengyel area continental variegated clay and conglomerate is known of a thickness of 0–250 m (*Szászvár (?) or Somlóvásárhely (?) Formation*).

The **Badenian** sequence is built up mostly of fine-grained clastic sediments: clay marl, marl, silt, silty clay marl and silty sand. In certain boreholes (e.g. Nagylengyel) sand, sandstone and glauconitic sandstone are characteristic, too. These deposits often form very monotonous sequences. Beside these siliciclastits, in the vicinity of horsts, also algae-bearing limestone (leithakalk) appears in the sections. Intercalations of acidic pyroclastits ("middle rhyolite tuff" horizon?) are characteristic as well.

Badenian sequence consists of the following lithostratigraphic units: *Tekeres Formation, Pécsszabolcs Formation* ("lower leithakalk"), *Szilágy Formation*, *Rákos Formation* ("upper leithakalk"). Pyroclastic rocks (*Tar Formation*) intercalate younger units than it is known in the type locality.

The some 10 meter-thick **Sarmatian** sequences develop gradually from the Badenian strata. Lithologically it is similar to the Badenian. Sarmatian depressions are mostly filled by homogenous grey marl, clay marl, sandy-silty clay marl, sandstone, laminated marl (*Kozárd Formation*), while in the uplifted areas biogenic calcarenite, oolitic limestone as well as pebbly limestone (conglomerate) are characteristic (*Tinnye Formation*). In the Sarmatian sequence dispersed volcanic material (acidic tuff) can be found in the form of thin intercalations ("upper rhyolite tuff" horizon). The shallow marine sediments are rich in molluscs of brackish facies Strata deposited in open basins relatively far from the shore contain few molluscs, and are characterised by foraminifera assemblages consisting of few taxa. With the absence of fossils the boundary between Sarmatian and the lithologically similar Pannonian is difficult to draw.

MATERIAL AND METHOD

The work has been based upon J Guex's Biochronological Correlations (Guex 1991, Savary – Guex 1991) and a computer software linked to it. It's name is **BioGraph v. 2.02**. The computerized method based on graph theory was used in establishing the Foraminifera zone boundaries. The software identified so-called unique assemblages represented by fossils that we used for defining Foraminifera biozones similar to the Oppel-zone system.

1. Data Acquisition

Litho- and chronostratigraphic as well as micropalaeontological data of Prepannonian Miocene sections of **450** mostly hydrocarbon core drillings have been collected from the archives. Foraminifera identifications were done previously by R. Nyírő (1960), L. Dubay (1962) and J. Kőváry (1968). Requirements of the selection of data were the following:

a) Micropalaeontological data are required to be available from at least 3 samples that follow each other within the log;

b) The necessity of filtering the taxa that have not been identified to species level (only to sp. or cf.), because these would make the evaluation inaccurate;

c) Taxonomic review of the taxa.

After selecting the micropalaeontological data from 450 boreholes evaluated only **60** fulfilled the requirements of this work. Due to the limits of cartographic presentation the results of only 50 boreholes were put on the thematic map presented (Fig. 6.).

2. Making a list of species

A list consisting a total of **311 species** has been made and revised Taxa with a long range in time and taxa providing insignificant information were filtered because taking them into consideration would have made the evaluation inaccurate.

Taxa filtered:

–those which occur only in 1 borehole section or in 1 sample;

–those which are indifferent from the point of view of dating;

–those which are redeposited.

Taxa used in the evaluation:

– index fossils

– taxa which are not index fossils but characteristic of the particular assemblage.

After the above mentioned selection the number of the species subjected to the evaluation was 269.

3. Representing the processed data by the program BioGraph in tables

Plankton/benthos ratios in the provisional Foraminifera zones are represented in Fig. 2. Frequency distribution of the planktonic and of some benthic genera in the provisional Foraminifera zones can be seen in Fig. 3 and Fig. 4. The change of the ratio of appearing and disappearing taxa is shown in Fig. 5.

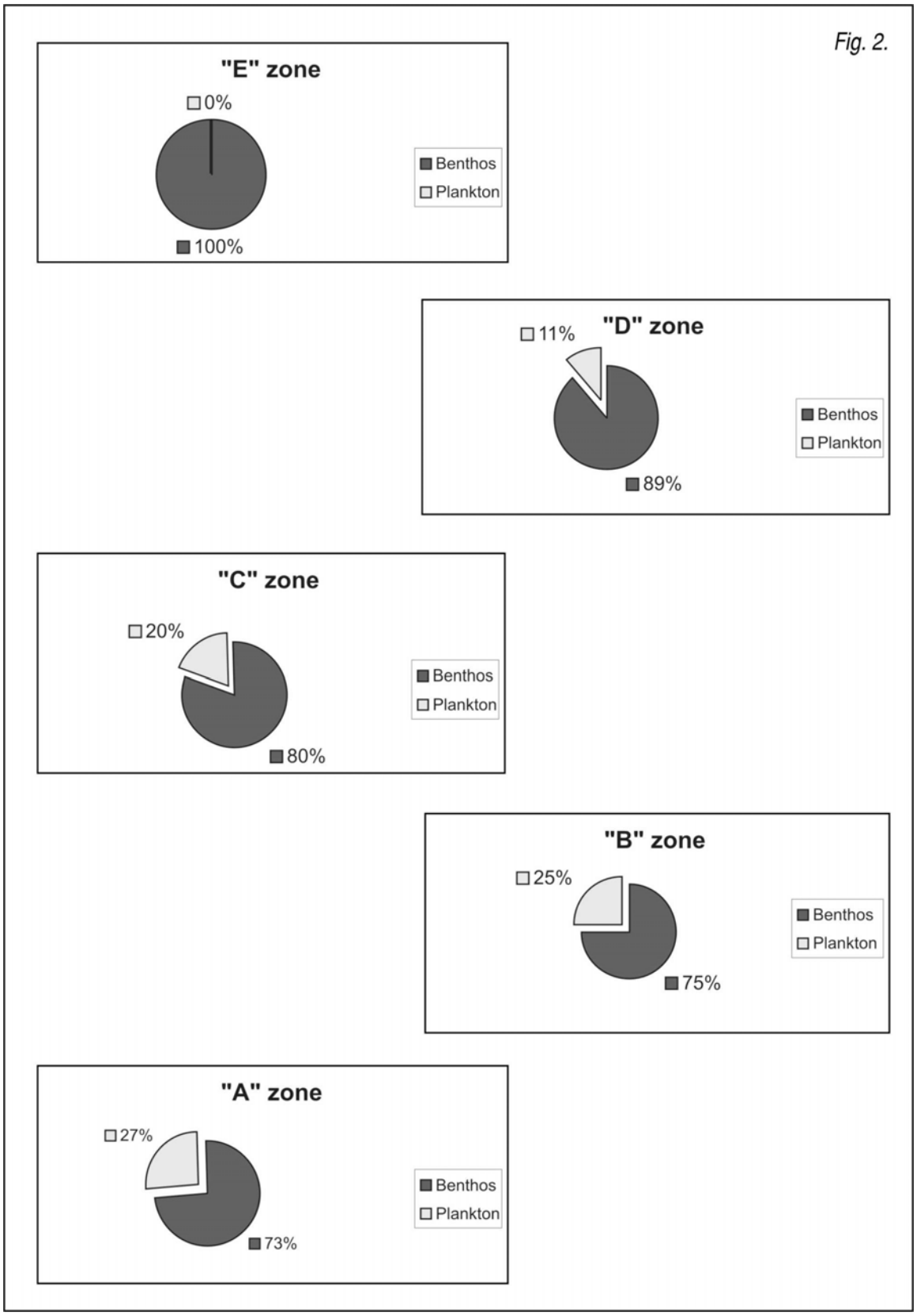

Fig. 2. Plankton/benthos ratio in the provisional Foraminifera zones

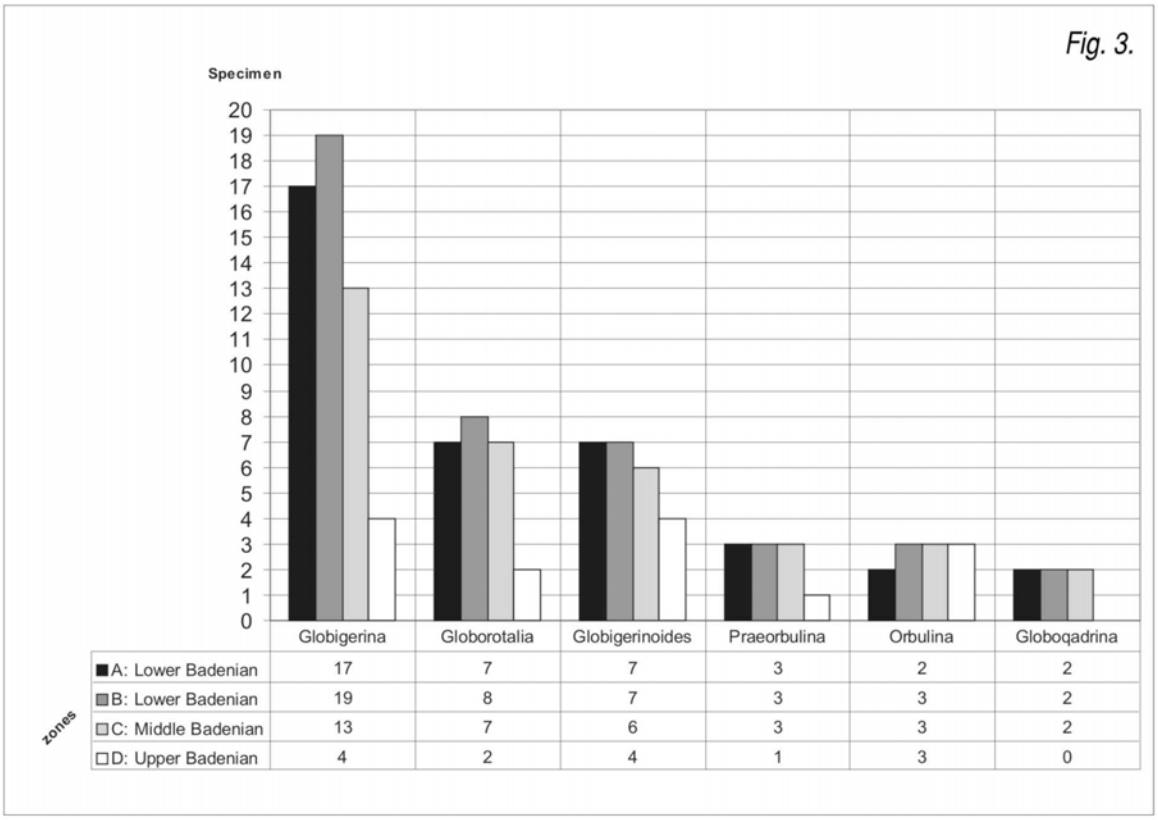

Fig. 3. Frequency distribution of the planktonic genera in the provisional Foraminifera zones in the Zala Basin

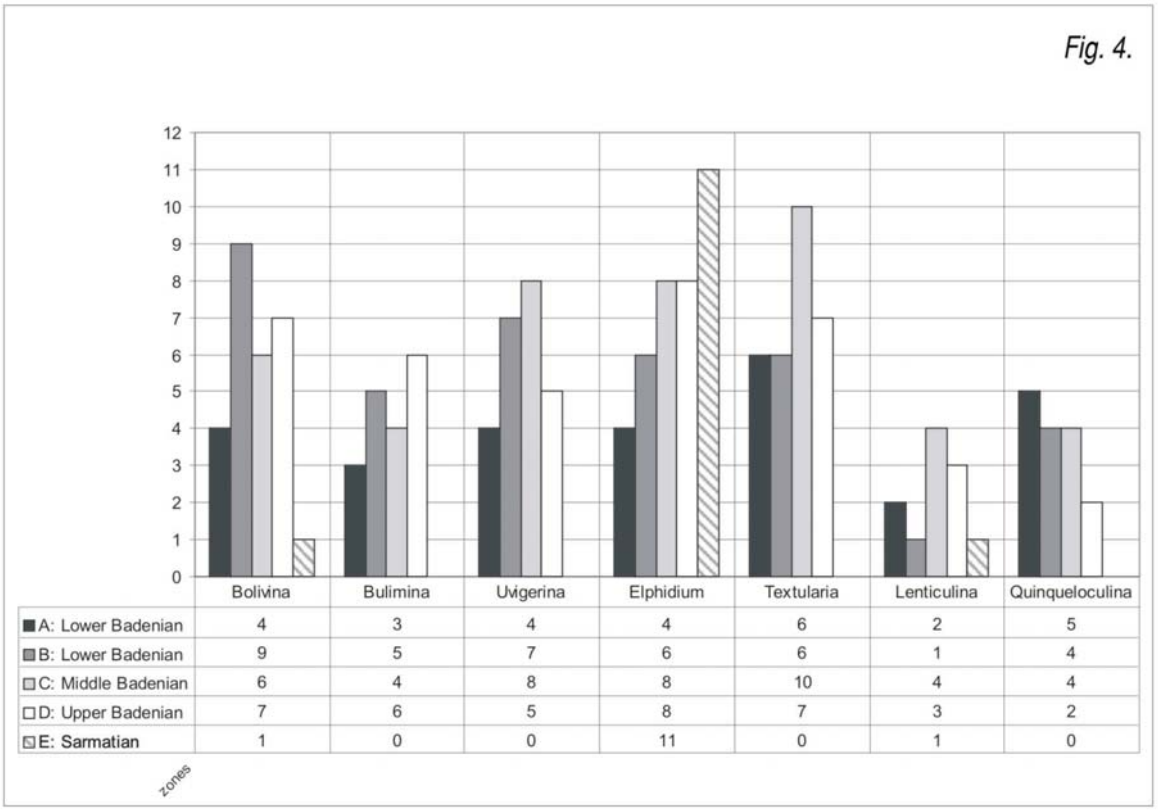

Fig. 4. Frequency distribution of some benthic Foraminifera genera with stratigraphic importance in the provisional zones in the Zala Basin

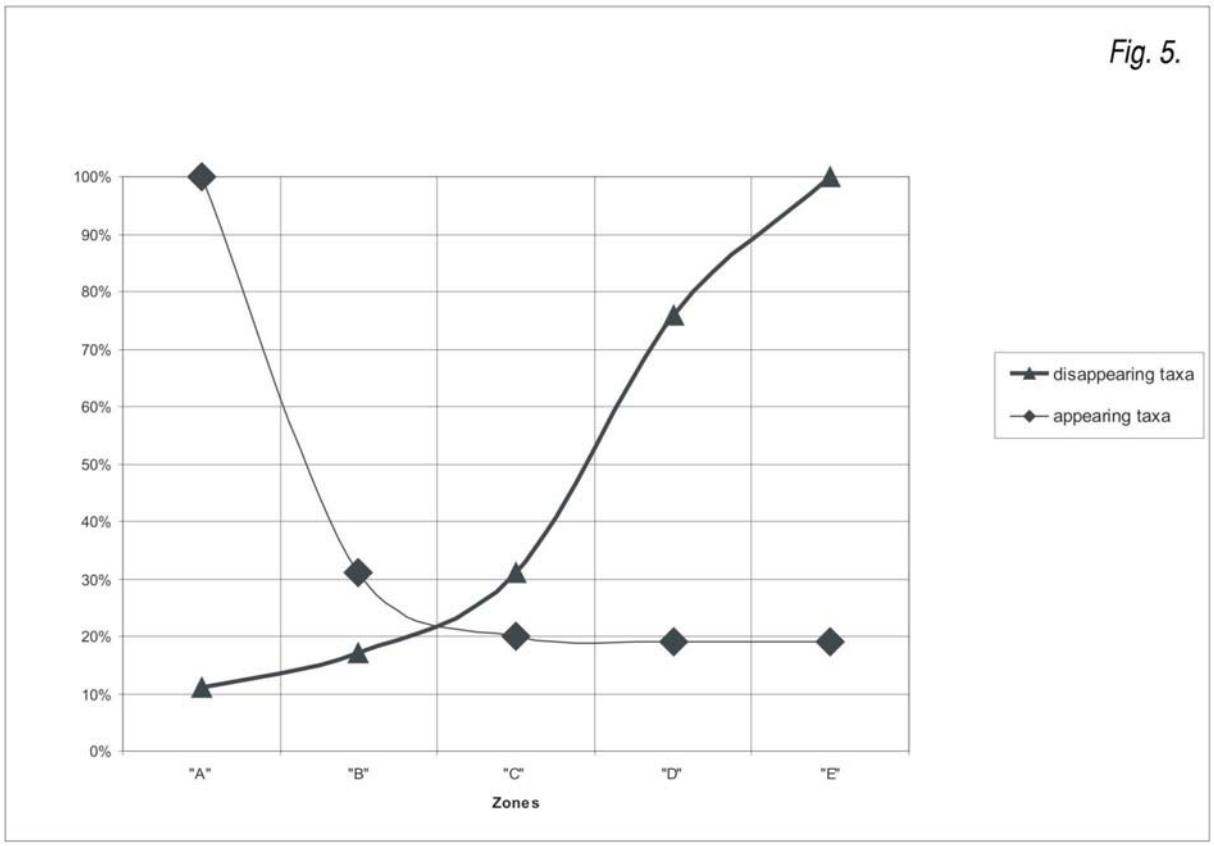

Fig. 5. Change in the ratio of appearing and disappearing taxa

CONCLUSIONS

According to the results of the investigation **5 provisional zones (A–B–C–D–E)** can be registered in the area (Fig. 6.). These zones indicate ages from Early-Badenian up to Sarmatian. In many sequences of the region the microfauna gives no proof of the age of the pelagic sediments previously considered Karpatian. **Zone A–B** represents Lower–Badenian, **Zone C** shows a transition towards **Zone D** which represents Upper–Badenian. **Zone E** is equivalent with Sarmatian (Table I.).

Representation of the provisional Foraminifera zones in the map shows that the joint appearance of **Zones A** and **B** in the Zala Basin is generally characteristic. The exceptions are Ortaháza–20, Hahót Ny–I. and Pusztamagyaród–11 boreholes, in which only **Zone C** indicating the uppermost part of the Lower Badenian and a transition toward the Upper Badenian can be shown. This transitional zone can not be found at all in the Csesztreg and Pusztaapáti area.

The lack of **Zone D** representing the Upper Badenian substage is characteristic of the Nagylengyel area. The easternmost occurrence of Foraminifera assemblages indicating the Upper Badenian is Csesztreg–1 borehole, the westernmost is Nagybakónak–1 borehole.

Foraminifera assemblages showing the presence of Sarmatian sediments can be traced in boreholes Lovászi and Budafapuszta towards the South from the Botfa area.

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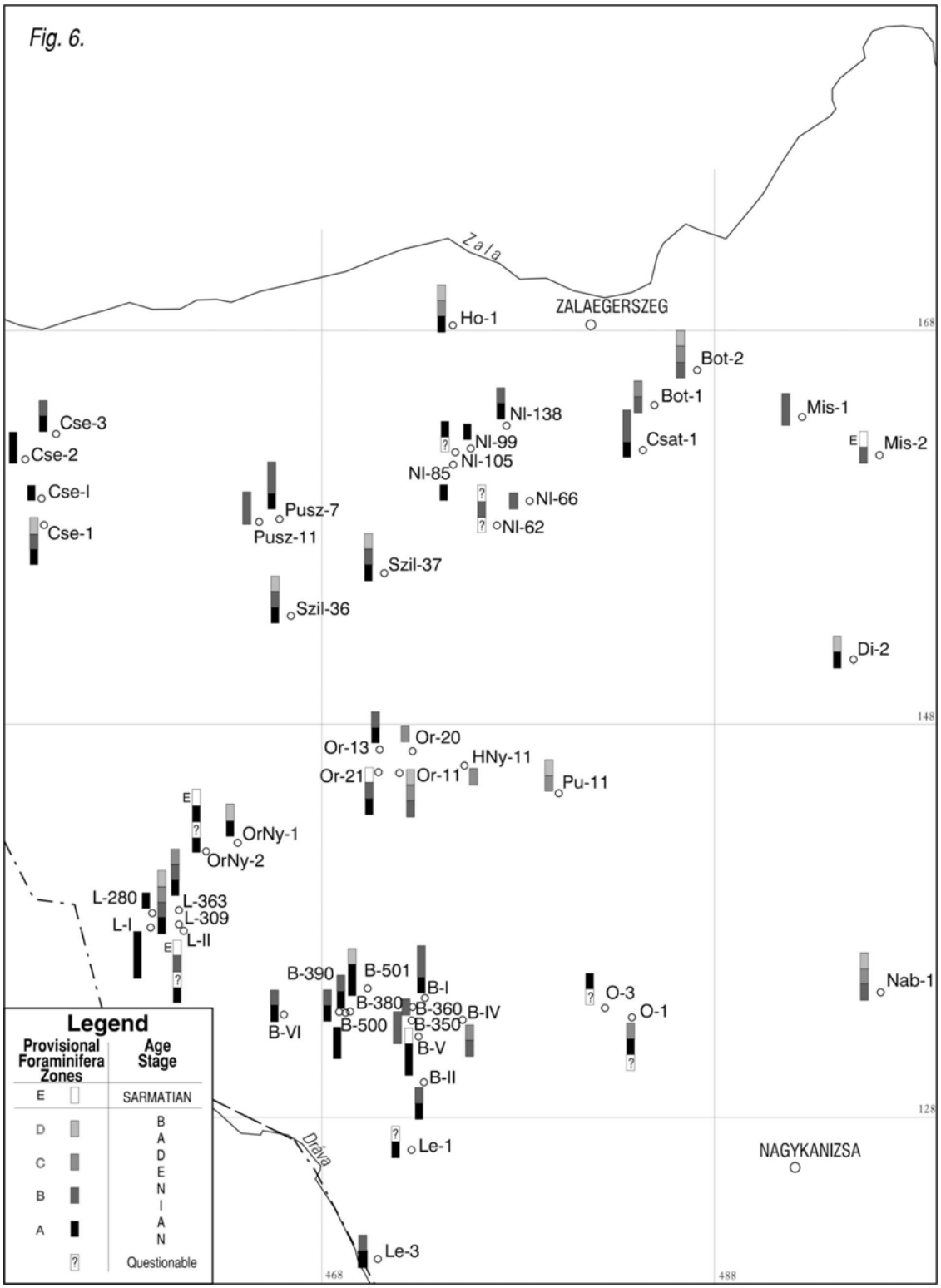

Fig. 6. Foraminifera Biozones in the Miocene sequences of the Zala Basin (Compiled by É. Szegő, Gy. Don, L. Ó Kovács, G. Turczi 1999)

SARMATIAN		**ZONE 'E'**	Significant changes at the Badenian/Sarmatian boundary Sudden decrease of the number of species, Foraminifera fauna of only 42 species 8 new species appear No planktonic forms Benthos: 1 dominant genus: Elphidium (11 species) other genera: Bolivina and Quinqueloculina ('–' species)
BADENIAN	**UPPER**	**ZONE 'D'**	Number of Foraminifera species: 144 Planktonic forms: 16 species (11%) Great number of disappearing species: 110 (=76%) Number of appearing species: 28 – none of them is planktonic Characteristic genera of planktonic forms: *Globigerina* and *Globigerinoides* (4–4 species); *Orbulina* (3 species) Characteristic genera of benthic forms: *Elphidium* (8 species); *Bolivina* and *Textularia* (7–7 species); *Bulimina* (6 species)
	MIDDLE	**ZONE 'C'**	Greatest diversity: 183 species! Plankton/benthos ratio decreases (planktonic taxa = 19,5%) Increasing number of disappearing taxa (=56 species: 17 planktonic, 39 benthos) Number of disappearing species:= 31% of total species number Number of appearing species = 20% of total
	LOWER	**ZONE 'A'+'B'**	**Zone 'B'** 179 species, 44 planktonic species (=24,5% of the total species number) Number of appearing species: 56 (9 planktonic) Number of disappearing species: 31 (10 planktonic) Most frequent planktonic genera: *Globigerina* (19 species), *Globorotalia* (8 species), *Globigerinoides* (7 species) Among the 5 zones the species number of *Globigerina* genus is the highest here. Most frequent benthic genera: *Bolivina* (9 species), *Uvigerina* (7 species), *Elphidium* and *Textularia* (6–6 species) **Zone 'A'** 140 species, 38 planktonic species (=27% of the total species number) Characteristic genera: Globigerina (17 species), Globorotalia (7 species), Globigerinoides (7 species) Number of appearing taxa is the greatest in this zone

Table I.

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