ACTA PALAEONTOLOGICA ROMANIAE V. 4 (2004), P. 463-466

PREPANNONIAN MIOCENE SEQUENCES OF THE SW EDGE OF THE TRANSDANUBIAN CENTRAL RANGE. LITHO- AND BIOSTRATIGRAPHY

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Abstract. The study summarises the litho- and biostratigraphic evaluation of Prepannonian Miocene sequences of the western area of the Balaton Highland, Hungary. After a long continental period the first marine sediments were deposited during the Early Badenian. Badenian normal marine sedimentation was followed by Sarmatian brackish water facies.

Keywords: Prepannonian Miocene, Tapolca Basin, lithostratigraphy, biostratigraphy

INTRODUCTION

On the south-western edge of the Transdanubian Central Range (Fig. 1.) Neogene sedimentary basins are to be found. The Prepannonian Miocene sequence consists of three units: continental formations deposited before the Badenian, Badenian marine sediments and Sarmatian brackish water deposits.

The thickness of the Prepannonian Miocene is different from basin to basin. In general it thickens to the NW, towards the Little Hungarian Plain. An extremely thick sequence is to be found in Nagygörbő Ng–1 borehole, where it exceeds 700 meters (Fig. 2.).

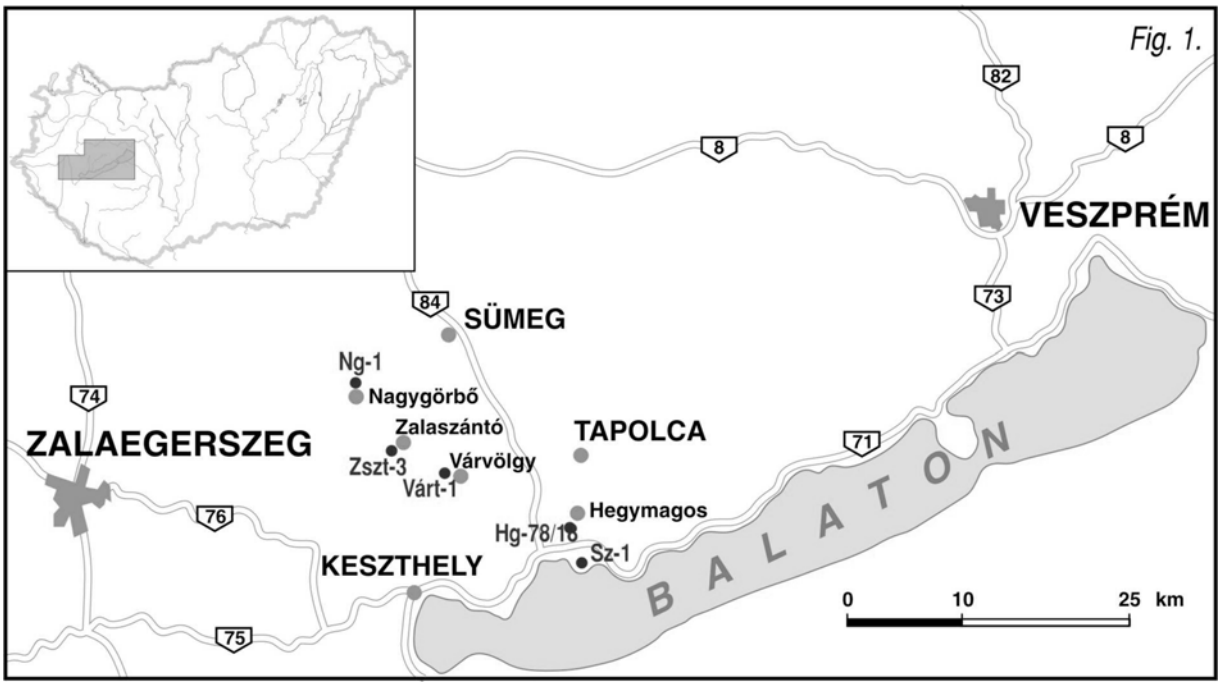

Fig. 1. Geographic position of the area examined

PREBADENIAN CONTINENTAL DEPOSITS

Continental strata can be found in Nagygörbő Ng–1 borehole between 892,0–1067,0 m, known as *Somlóvásárhely Formation* (Selmeczi 1989). In the lower part of this sequence a 1.4 meter-thick bentonitic dacite tuff intercalation is to be found, which can be identified as the "lower rhyolite tuff" horizon: *Gyulakeszi Formation* (Jámbor & Korpás 1974). The continental sequence is present in several boreholes in the western edge of the Transdanubian Range. It is mostly built up of clay, clay marl, variegated clay, carbonaceous clay, bentonitic clay, with subordinate sandy gravel intercalations. Carbonate nodules are characteristic in the pelitic layers. In the upper part of the continental sequence lignite beds are characteristic. Mostly *Bithynia, Theodoxus, Melanopsis sp*. and operculums of *Bithynia* were found in the lignite-bearing sediments.

Somlóvásárhely Formation overlies the Oligocene Csatka Formation, which is also a continental sequence. It is problematical to mark the boundary between the two continental sedimentary cycles.

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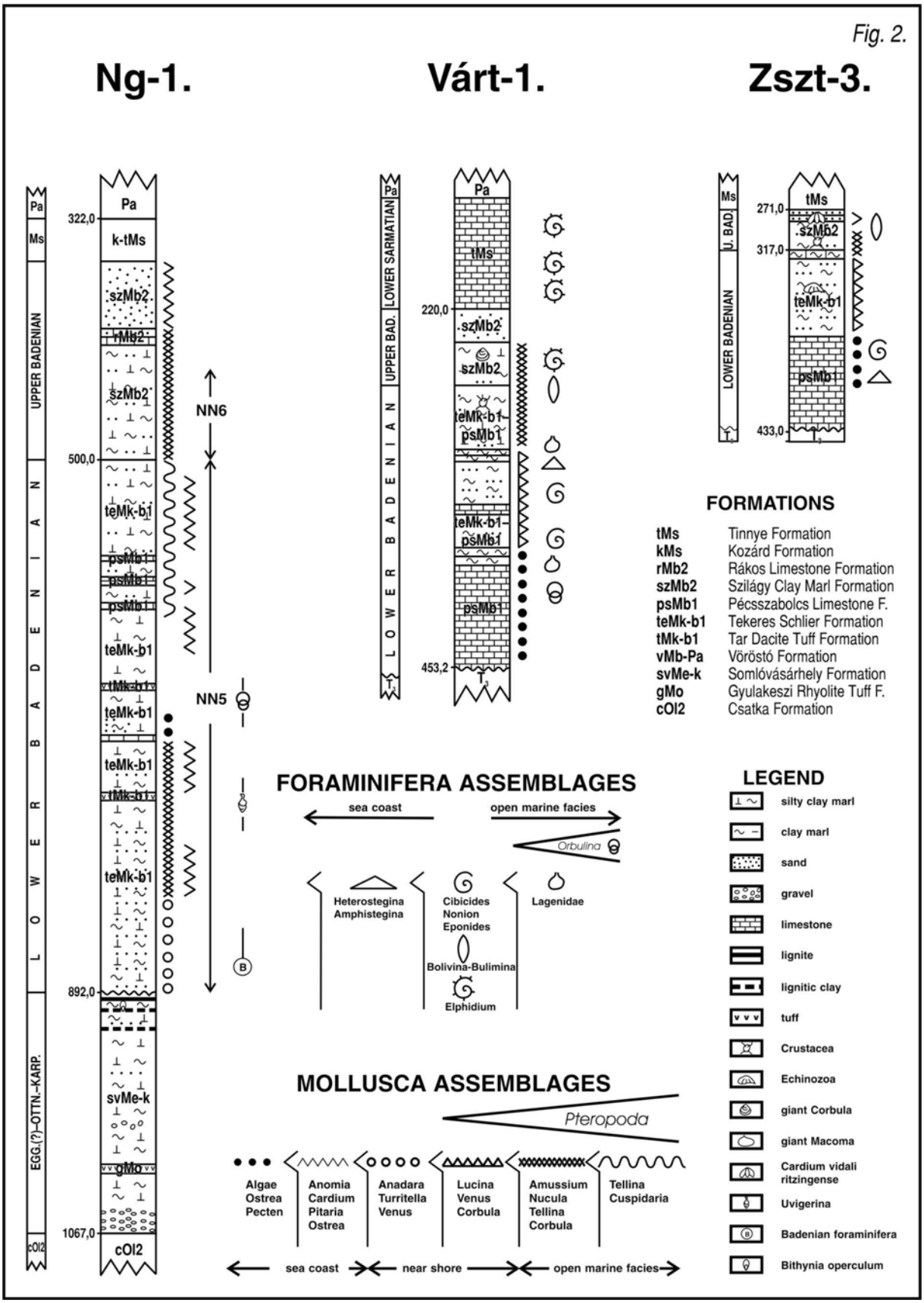

Fig. 2. Stratigraphic columns of the boreholes examined, Mollusca and Foraminifera assemblages of the Prepannonian formations

There are differences in general (colour, material and maturity of gravels), but the only "fixed point" is the appearance of the "lower rhyolite tuff", or bentonite, bentonitic clay derived from the tuff.

The age of *Somlóvásárhely Formation* is problematic, too. For lack of stratigraphic and paleontological evidence we can regard its age as Early Miocene. It is overlain by marine Lower Badenian.

There are two other continental formations in the area examined: the *Cserszegtomaj Kaolin Formation*, which is to be found in deep dolines in the Keszthely Mountains , and the *Vöröstó Formation* at the northern and eastern parts of the Tapolca Basin, which is built up of red clay, redeposited bauxitic clay and bauxite gravels (Bence et al in Budai & Csillag ed. 1999, pp. 202 –203). These two lithostratigraphic units are generally underlain by Upper Triassic and covered by Badenian or younger formations.

BADENIAN MARINE SEDIMENTATION

Marine sedimentation started in the Early Badenian in the area examined. Over large areas of the Tapolca Basin calcareous algae-bearing limestone, calcareous pebbly limestone and calcareous sandstone (*Pécsszabolcs Formation,* "lower leithakalk") transgress and overlie unconformably the Upper Triassic basement: *Amphistegina–Heterostegina*-bearing limestones in Várvölgy Várt–1 and Zalaszántó Zszt–3 boreholes (Fig. 2.). The succession of lagoonal, coastal and nearshore as well as open marine facies (*Pécsszabolcs – Tekeres Schlier Formation*) indicate the dominance of the transgression, and rapid subsidence of the Nagygörbő area. This results in ever increasing open marine connections, which are proved by the foraminifer and mollusc assemblages (Bohnné Havas 1985, Szegő 1984, 1985). The presence of *Orbulina–Lagenidae* assemblages (Várvölgy Várt–1 borehole) is characteristic in the microfauna, and a succession of the mollusc assemblages can be observed from coastal to open marine facies: *Anomia–Cardium–Pitaria–Ostrea* dominance in the coastal region; *Lucina–Venus–Corbula* assemblage in the near shore facies; *Amussium–Nucula–Tellina–Corbula* assemblage in the open marine facies (Várvölgy Várt–1 and Zalaszántó Zszt–3 boreholes). Báldiné Beke (1985) determined NN5 zone from the pelitic layers of Várt–1 borehole. These beds can be correlated with deeper water (shallow bathyal) sediments in Ng–1 borehole, which belong to the *Tekeres Formation* representing NN5 zone (Báldiné Beke 1985) in this area. This unit is characterised by the appearance of *Orbulina universa* D'ORBIGNY, 1839*, Uvigerina macrocarinata* PAPP-TURNOVSKY, 1953 and *U. pygmoides* PAPP-TURNOVSKY, 1953 in the microfauna (Koreczné Laky 1972) and *Vaginella austriaca* KITTL, 1886*, Diacrolinia aurita* (BELLARDI, 1873) and *Clio multicostata* (BELLARDI, 1873) in the macrofauna (Bohn-Havas 1992, 1993). The presence of *Amussium–Nucula–Tellina–Corbula* and *Tellina–Cuspidaria* assemblages is also characteristic here.

In the upper part of the Early Badenian the leithakalk appears even in the formerly deepest areas indicating the elevation of the basins. It is characterized mostly by *algae, Heterostegina* and *Amphistegina* as well as *Pectinidae, Anomia* and *Ostrea* species.

The formations mentioned are overlain by the *Szilágy Formation,* which can be found either in the Tapolca Basin or in the foreland of the Keszthely Mountains. Its grey clay marl, silty clay marl beds represent NN6 zone in Nagygörbő Ng–1 borehole, and contain *Bulimina–Bolivina* assemblages in Várvölgy Várt–1 borehole, and foraminifer assemblages characteristic of the Upper Badenian in Zalaszántó Zszt–3 borehole (Szegő 1984, 1985). According to the data of Kókay (1986) this formation in two other boreholes of the Tapolca Basin (Hegymagas Hg–78/18 and Szigliget Sz–1) contain *Spiroplectammina* and *Bulimina–Bolivina* assemblages. In the macrofauna *Anomia–Cardium–Pitaria–Ostrea* and *Amussium–Nucula–Tellina–Corbula* assemblages can be observed (Nagygörbő Ng–1, Várvölgy Várt–1 and Zalaszántó Zszt–3 boreholes).

Intercalated layers of Upper Badenian limestone called *Rákos Limestone Formation* ("upper leithakalk") are to be found in the pelitic marine sequence in Nagygörbő Ng–1 borehole.

There are mostly thin intercalations of pyroclastic rocks in the Lower Badenian sections. In general two tuff horizons can be defined in Tapolca Tpt–3 borehole, as well as in Nagygörbő Ng–1 borehole. These can be correlated with tuff intercalations in the Lower Badenian sediments of other areas along the western edge of the Transdanubian Range. Bentonitic tuff layers, bentonitic clay intercalations are widespread in this region. It is questionable, whether these tuffs, tuffites can be correlated with the Tar Dacite Tuff Formation ("middle rhyolite tuff"), which is older in age in its type locality.

SARMATIAN BRACKISH WATER FORMATIONS

There are two main formations deposited in the brackish water Sarmatian sea of the region: *Kozárd Formation*, which is mostly built up of clay marl, marl, silty clay marl, and is to be found only in the formerly deepest Nagygörbő area. In Ng–1 borehole these beds show a continuous transition to the biogenic calcarenite, sometimes cavernous, oolitic limestone called *Tinnye Formation*, which is present in Várt–1 and Zszt–3 boreholes, too. Both of the formations

have typical brackish water macro- and microfauna assemblages.

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