Timing and Sedimentation of Foredeep Deposits from Gura Vitioarei Section, Carpathian Bend Zone, Romania – Implications for the Stratigraphy of Lower Miocene in the Paratethys Domain*

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Abstract

Located in the Carpathian Bend Zone, on Telejean Valley, Gura Vitioarei section displays alternating mudstones and sandstones gravitational flow - related deposits, with two tuff beds in the lower part of the sedimentary interval. To constrain the age and the depositional environment of the sediments, the section was the subject of an integrated study, including sedimentological analysis, investigation of calcareous nannofossil, and foraminifera assemblages, as well as U-Pb tuff zircon dating.

The calcareous nannofossils assemblages contain 35 species, being dominated by the Coccolithus pelagicus (14%-66%) and followed by Reticulofenestra pseudoumbilica (10-66%), R. minuta (1-37%) and Helicosphaera ampliaperta (1-24%). Based on the last occurrence of Sphenolithus belemnos and first occurrence of S. heteromorphus, the lower-middle part of the studied section falls into the NN3-CN2 – NN4/CN3 biozones. In the upper part of the section, due to a reverse fault, the deposits belonging to the NN3 Biozone are again present, as indicated by the presence of the Spenolithus belemnos, an important species in the calcareous nannofossils assemblages. The foraminifera assemblages are scarce, as most of the identified small planktonic foraminifera have large ranges. Thus, the relative age of the units is Middle to Upper Burdigalian.

Sixty-four zircons extracted from the stratigraphically lower tuff were investigated by LA-ICPMS, seventy U-Pb ages being obtained. Of them, four U-Pb ages are 90-110% concordant, while 33 are within an extremely narrow range of 17-19 Ma. The rest show Paleozoic or older ages. The youngest 21 ages form a tight cluster, with a Concordia age of 17.146 ± 0.095 Ma (MSWD = 0.00086), interpreted as the timing of the magmatic crystallization of the zircons, and as maximum age of the tuff eruption. The U-Pb dated tuff seems to be correlative with the NN3/CN2 Biozone. However, the NN3/NN4 boundary, marked by the last occurrence of Sphenolithus belemnos, was astronomically calibrated at 17.94 Ma, thus being inconsistent with the isotopic age of the tuff. A similar 17 Ma – old tuff intercalated in the NN3 nannoplankton
Biozone was reported in Hungary. Therefore, the date sets (U-Pb and nannofossil ages) from different geographical localities from Central Paratethys support the calibration of the regional stratigraphic scale.

The lower – middle part of the studied outcrop is dominated by dark gray, reddish, greenish mudstones with siltstones and very fine sandstones intercalations. In the thrusted, upper part of the studied outcrop, pebbly muddy sandstones, quartz rich sandstones, dark gray – greenish mudstones, and organic rich shales (dysodiles) were identified. The depositional environment was interpreted as being represented by distal levees with overbank lobes for the lower unit, while for the upper, thrusted unit, by distal levees with overbank channel beds and amalgamated channels stories, deposited in a slope setting.

Reference Cited

INTRODUCTION

Gura Vitioarei section is located in the Carpathian Bend Zone, on Telegajen Valley. It displays alternating clay and sandstone turbidity flow-related deposits, with two tuff beds in the lower part of the sedimentary interval.

The section was the subject of an integrated study, including sedimentological analysis, investigation of calcareous nanofossil and foraminifera assemblages, as well as U-Pb tuff zircon dating.

CONSTRaining THE age of the deposits

**Micropaleontological investigations**

- The calcareous nanofossil assemblages contain 35 species, being dominated by the Coccolithus pelagicus (14%-66%) and followed by Reticulofenestra pseudoumbilicalis (10%-60%), R. minuta (1%-37%) and Helicosphaera amphiaperta (1%-24%).
- Based on the last occurrence of Sphenolithus belemnos and first occurrence of S. heteromorphus, the lower-middle part of the studied section falls into NN3/CN2 – NN4/CN3 Biozones. In the upper part of the section, due to a reverse fault, the deposits belonging to NN3 Biozone are again present, as indicated by the presence of Sphenolithus belemnos, an important species in the calcareous nanofossil assemblage.
- The foraminifera assemblages are scarce and, from biostratigraphical point of view, no clear taxa were found within the samples, as most of the identified small planktonic foraminifera have large ranges.

The relative age of the units is Middle to Upper Burdigalan.

**U-Pb tuff zircon dating**

- Sixty-four zircons extracted from the stratigraphically lower tuff layer were investigated by LA-ICPMS.
- Seventy U-Pb ages were obtained, of which forty U-Pb ages are 90-110% concordant, 33 are within an extremely narrow range of 17-19 Ma. The rest shows Palaeozoic or older ages.
- The youngest 21 ages form a tight cluster, with a concordia age of 17.146 ± 0.0095 Ma (MSWD = 0.00086).
- The timing of the magmatic crystallization of the zircons, and as maximum age of the tuff eruption.

A similar ca 17 Ma old tuff intercalated in the NN3 nanoplankton zone was reported in Hungary (Paify et al., 2003). Therefore, the data sets (U-Pb and nanofossil ages) from different geographical localities from Paratethys support the calibration of the regional stratigraphic scale.

CONSTRaining THE DEPOSITIONAL ENVIRONMENTS

- Four facies types have been interpreted based on lithology-grain size and associated sedimentary structures. (Note: facies A was subdivided into two sub-groups (F.A1, F.A2) based on some particular sedimentological features).
- The lower-middle part of the outcrop (below the thrust fault—see Fig. 2) is dominated by dark gray, reddish, greenish mudstones with silstones and cm thick, very fine sandstones intercalations (Fig. 3a). One dm thick very fine sandstones bed was observed (Fig. 3b). Common sedimentary structures in the sandstones/silstones beds are: convolute lamination (Fig. 3b,c), climbing ripples (Fig. 3c), water escape structures and rare horizontal burrows (Fig. 3d). Also volcanic tuffs with traction related structures (convolute, parallel lamination and subite ripples) appeared (Fig. 3e). The first one was interpreted as F.A1 and the latter as F.B.
- The upper part of the outcrop (above thrust fault – Fig. 2) consists of dark gray, greenish mudstones with silstones and very fine/fine sandstones. Overall, it has the same sedimentary structures as F.A1. It can contain fine sandstones with organic rich shales (dysolids) rip-up clasts (Fig. 4a) beds, quartz rich sandstones with organic rich shales (dysolids) rip-up clasts (Fig. 4b) beds, quartz rich sandstones with organic shales (dysolids) rip-up clasts (Fig. 4c) beds. Besides this, a 4m thick pebbly (green clasts - Central Dobrogea origin) muddy sandstones (F.C, F.D), (Fig. 4d) bed and organic rich shales (dysolids), (Fig. 4e) with erosional quartz sandstones (can form injections) were observed. The latter was interpreted as F.D and has an erosional contact with F.A2 (Fig. 2).

References: