[PS]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*

Razvan-Ionut Bercea[1], Luminita Zaharia[2], Ramona Bălc[2], Andreas Gärtner[3], and Ulf Linnemann[3]

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[1]Black Sea Department, OMV Petrom, Bucharest, Romania (bercearazvanionut@gmail.com)
[2]Babes-Bolyai University, Cluj-Napoca, Romania
[3]Senckenberg Natural History Collections of Dresden, Germany

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 nannoplaknton

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 shalestones (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.

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Pálfy, J., R.R. Parrish, K. David, and A. Vörös, 2003, Mid-Triassic Integrated UPb Geochronology and Ammonoid Biochronology from the Balaton Highland (Hungary): Journal of the Geological Society, London, v. 160/2, p. 271-284. doi:10.1144/0016-764902-029

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

Razvan-Ionut BERCEA[1], Luminita ZAHARIA[2], Ramona BĂLC[2], Andreas Gärtner[3], Ulf Linnemann[3]

[1]Black Sea Department, OMV Petrom, Bucharest, Romania, [2]Babes-Bolyai University, Cluj Napoca, Romania, [3]Senckenberg Natural History Collections of Dresden, Germany (email: razvan_ionut_bercea@yahoo.com)

INTRODUCTION

► Gura Vitioarei section is located in the Carpathian Bend Zone, on Teleajen 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 nannofossil and foraminifera assemblages, as well as U-Pb tuff zircon dating.

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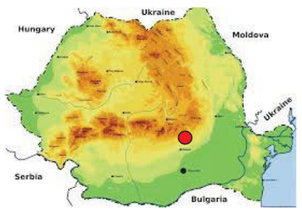
to constrain **the age** and **the depositional environment of the sediments**



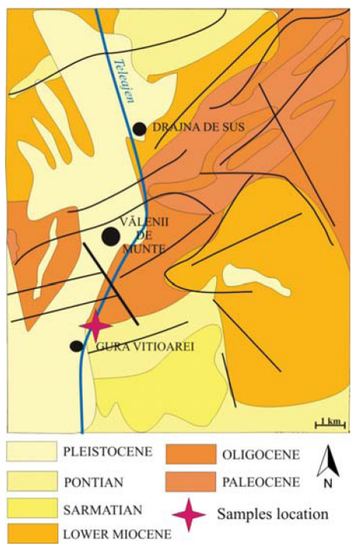


Fig. 1. Location of the studied area in Romania, and geological map of the studied area (after Geological map of Romania, 1:200.000, Ploiesti Sheet)

CONSTRAINING THE AGE OF THE DEPOSITS

Micropaleontological investigations

►The **calcareous nannofossil** assemblages contain 35 species, being dominated by the *Coccolithus pelagicus* (14%-66%), and followed by *Reticulofenestra pseudoumbilica* (10-60%), *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 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 nannofossil assemblages.

► 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.

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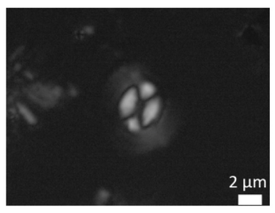
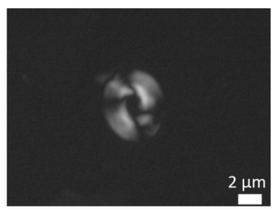
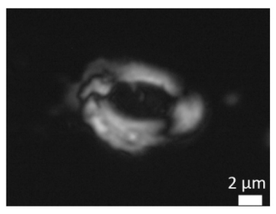
The relative age of the units is **Middle to Upper Burdigalian.**



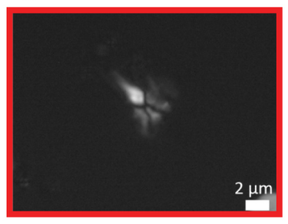
Coccolithus pelagicus



Reticulofenestra pseudoumbilica



Helicosphera ampliaperta



Sphenolithus belemnos

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 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)

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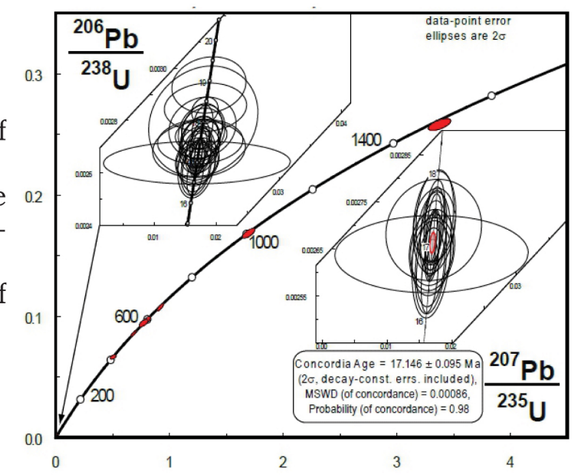
the timing of the magmatic crystallization of the zircons, and as **maximum age of the tuff eruption**.



► 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 ca 17 Ma-old tuff intercalated in the NN3 nannoplankton zone was reported in Hungary (Palfy et al., 2003). Therefore, the data sets (U-Pb and nannofossil 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 siltstones 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/siltstones 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 subtle ripples) appeared (Fig. 3e). The first one was interpreted as F.A1 and the latter as F.B.

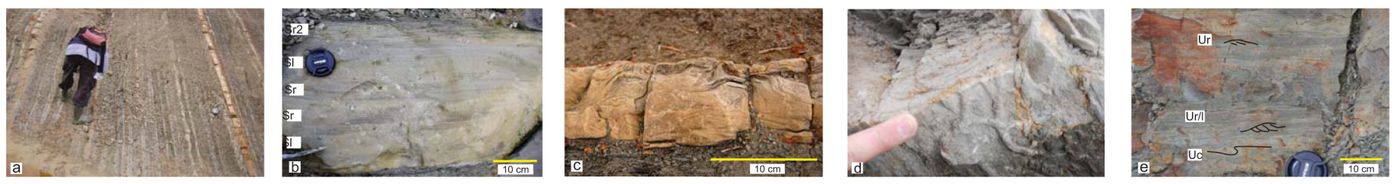


Fig. 3. a. F.A1: grey, red and green calcareous mudstones interbedded with thin sandstones and siltstones beds (distal levees); **b.** Repetitive levels of planar parallel lamination (SI), ripple cross lamination (Sr) and climbing ripples (Sr2) in a dm thick fine sandstones bed. Some muddy drapes were observed on the foresets (?surge-type flow - overbank lobe); **c.** climbing ripple cross lamination to convolute structures in cm thick fine sandstone (distal levees), (F.A1); **d.** Horizontal burrows (?*Thalassinoides* sp.), (F.A1); **e.** Volcanic tuff with traction sedimentary structures (Ur-ripple cross lamination, UI-planar parallel lamination) in the upper tuff bed. Soft sediment deformation were observed (Uc-convolute lamination), (FB).

►The upper part of the outcrop (above thrust fault – Fig. 2) consists of dark gray, greenish mudstones with siltstones and very fine/fine sandstones. Overall, it has the same sedimentary structures as F.A1. It can contain fine sandstones with organic rich shalestones (dysodiles) rip-up clasts (Fig. 4a) beds, quartz rich sandstones with injectites (Fig. 4b) but also mudstones-sandstones couplets slumps (Fig. 4c) beds. This was interpreted as belonging to F.A2 (Fig. 2). Besides this, a 4m thick pebbly (green clasts – Central Dobrogea origin) muddy sandstones (F.C, Fig. 4d), (Fig. 2) bed and organic rich shalestones (dysodiles), (Fig. 4e) with erosional quart rich sandstones (can form injectites) were observed. The latter was interpreted as F.D and has an erosional contact with F.A2 (Fig. 2).

Fig. 4. a. dm thick normal graded fine sandstone to muddy sandstones with organic rich shalestones clasts (possible hybrid flow), ?overbank element (F.A2); **b.** Lateral sandstones injectites from a lenticular dm thick, fine-mediumsandstones bed, overbank channel (F.A2); **c.** m scale ductile deformation related to a slump within the F.A2, slope setting; **d.** Structureless muddy fine sanstones with pebble-size green clasts and cm thick black organic rich shalestones (dysodiles), ?slope related cohesive debrite flow deposit, en masse freezing, (F.C); **e.** m thick erosional Upper Kliwa quarz-rich sandstones (and organic rich shalestones), (F.D) on top of the F.A2 mudstones (no brittle deformation was observed to support a structural contact between F.D and F.A2).

►The depositional environment was interpreted as distal levees with some overbank lobes for the lower unit (F.A1, FB). The thrusted unit in the upper part of the outcrop (F.A2, F.C, F.D) consists of distal levees with overbank channels/lobe beds and thick amalgamated channels storys in a restrictive environment. The presence of slumps could mark a slope setting (?or levee failure).

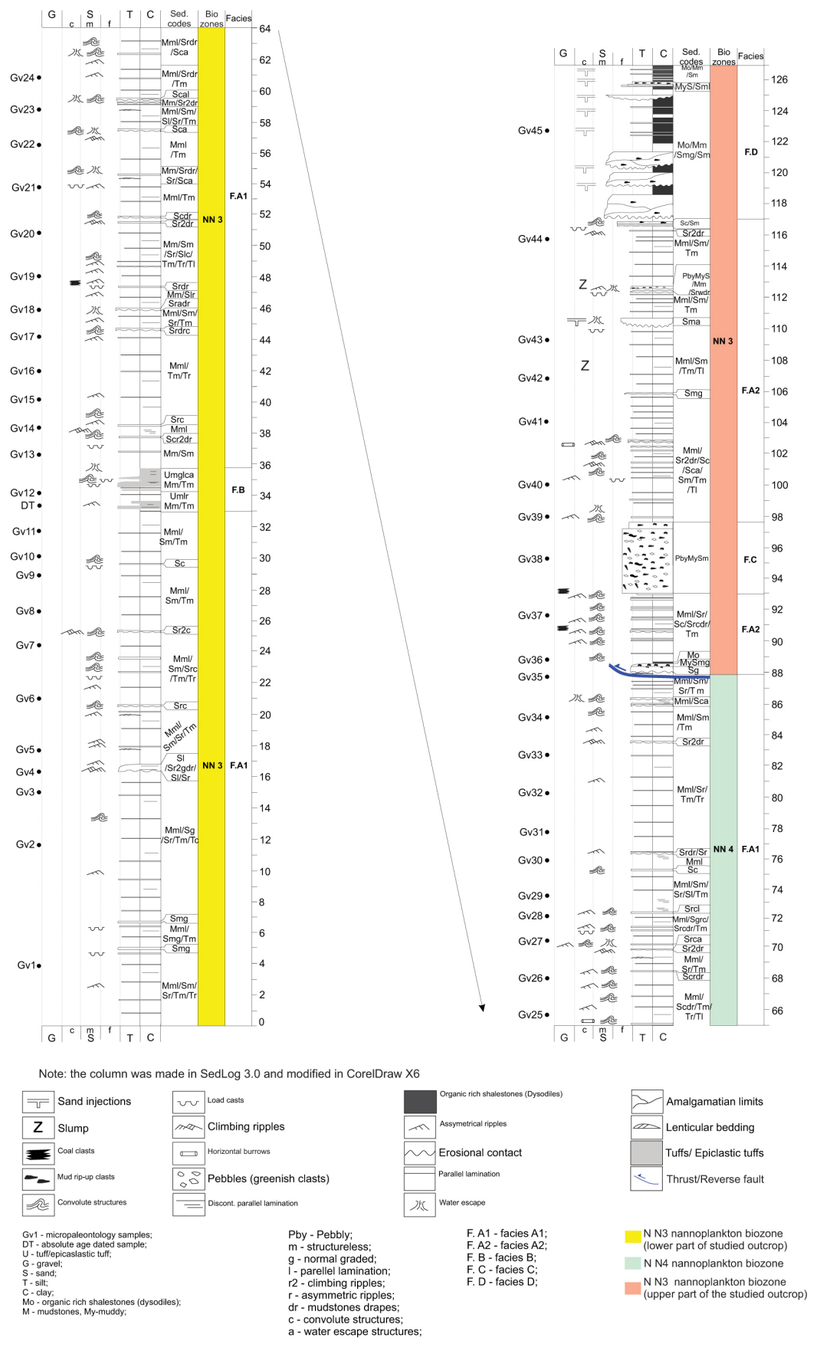


Fig. 2. Sedimentological log of the Gura Vitioarei deposits

► The investigated outcrop is part of some thrusted sheets. The structural style was outlined based on some lithological differences that characterize each thrust unit and on nannoplankton assemblages (NN3 to NN4 and again NN3).

► Based on the facies analysis the studied outcrop consists of deep marine deposits, mostly interpreted as having unconfined distal levees with overbank elements. In addition, the upper thrusted unit was interpreted to also have confined/weekly confined channels deposited on a slope (presence of slumps). The m thick cohesive debrides can be another clue for the slope setting.

References:

PÁLFY, J., PARRISH, R.R., DAVID, K. & VÖRÖS, A. (2003): Journal of the Geological Society, London 160 (2): 271–284.