The age of the Sarmatian-Pannonian transition in the Transylvanian Basin (Central Paratethys)

Iuliana Vasilev1,*, Arjan de Leeuw1, Sorin Filipescu2, Wout Krijgsman1, Klaudia Kuiper3, Marius Stoica4, Andrei Bricap5

1 Paleomagnetic Laboratory ‘FORT Hoofddijk’, Budapestlaan 17, 3584 CD, Utrecht, The Netherlands; 2 Department of Geology, Babes-Bolyai University, Kogalniceanu St., 1, 400084 Cluj-Napoca, Romania; 3 Department of Isotope Geochemistry, Faculty of Earth and Life Sciences, Vrije University, De Boelelaan 1085, 1081 HV, Amsterdam, The Netherlands; 4 Department of Palaeontology, Faculty of Geology and Geophysics, University of Bucharest, Balcescu Bd. 1, Bucharest, 010041, Romania; 5 National Institute of Marine Geology and Geocology, GeoEcoMar, Dimitrie Onciul Street 23-25, Bucharest, 70318, Romania 010041, Romania

A marked paleoenvironmental change took place during the middle Miocene in the Central Paratethys (Fig. 1), with dominantly marine Sarmatian successions grading rapidly into mainly brackish Pannonian deposits. A long and excellently exposed section comprising the Sarmatian-Pannonian transition has been investigated at Oarba de Mures in the Transylvanian basin (Romania). In this research, we focus on both radiometric and magnetostratigraphic dating (Fig. 2) to provide a numerical age for the Sarmatian-Pannonian transition in Transylvania. Two volcanioclastic layers, located approximately 40 m below the Sarmatian-Pannonian transition, yield excellent 40Ar/39Ar ages. The weighted mean plateau age for biotite and sanidine separates provides isotopic ages of 11.6±0.02 Ma and 11.6±0.13 Ma (Fig. 3). This implies deposition during the magnetic chron C3r2r, which is in agreement with the magnetostratigraphic results of the Oarba de Mures composite section (Fig. 4). Rock magnetic analyses indicate greigite as main magnetic carrier, with characteristics very similar to the magnetosomal greigite found in the Carpathian foredeep. The newly obtained chronology at Oarba de Mures limits the age of the Sarmatian-Pannonian transition in the Transylvanian basin to 11.3±0.1 Ma, slightly younger than the 11.61 Ma postulated in the Styrian and Vienna Basins (Fig. 4).

Figure 1. (a) The extent of the Central Paratethys basin during the Miocene on the present-day land configuration. (b) Outcrop A with the position of the sampled and analysed volcanioclastic layers indicated with arrows.

Figure 2. Representative thermal demagnetization diagrams (after IRM correction) with the directions of the different temperature components: T1 red solid lines, T2 orange solid lines, T3 blue dashed lines, T4 green dashed lines. Judd-impact circles denote projection on the horizontal/vertical plane and the attached numbers indicate temperatures in °C. The sample codes (in capital letters) is located in the right-hand corner: stratigraphic levels in metres in bold/italic characters are indicated in the left-hand corner.

Figure 3. Figure 4. Cumulative probability distributions for 40Ar/39Ar ages derived from biotite and sanidine separated from Oarba de Mures samples (a) T1A with the probability distributions for 40Ar/39Ar ages derived from biotite. (b) OM.C with the probability distributions for 40Ar/39Ar ages derived from sanidine. (c) OMAD with the probability distributions for 40Ar/39Ar ages derived from forsterite.

Figure 4. Correlation of the polarity sequence of Oarba de Mures section in the APTS (Lienert et al. 2002). The solid line between the section record and APTS record is approximate, as the abrupt polarity boundary. The names of the substages are in the columns attached to the APTS. The global deep-sea record of Zachos et al. (2001) is provided for comparison. The grey band marks the uncertainty in the age of the Sarmatian-Pannonian transition. Main trends in eustatic sea level are generalized from Hardenbol et al. 1998.