

Figure 1. Schematic palaeogeographic map of Paratethys region, comprising Lake Pannon, the Dacian basin (DB), Black Sea and Caspian Sea. The star indicates the position of the Rîmnicu Sarat section in the Dacian basin. DS indicates the location of the Dobrogea sill and MS the position of the Maramara Sea.

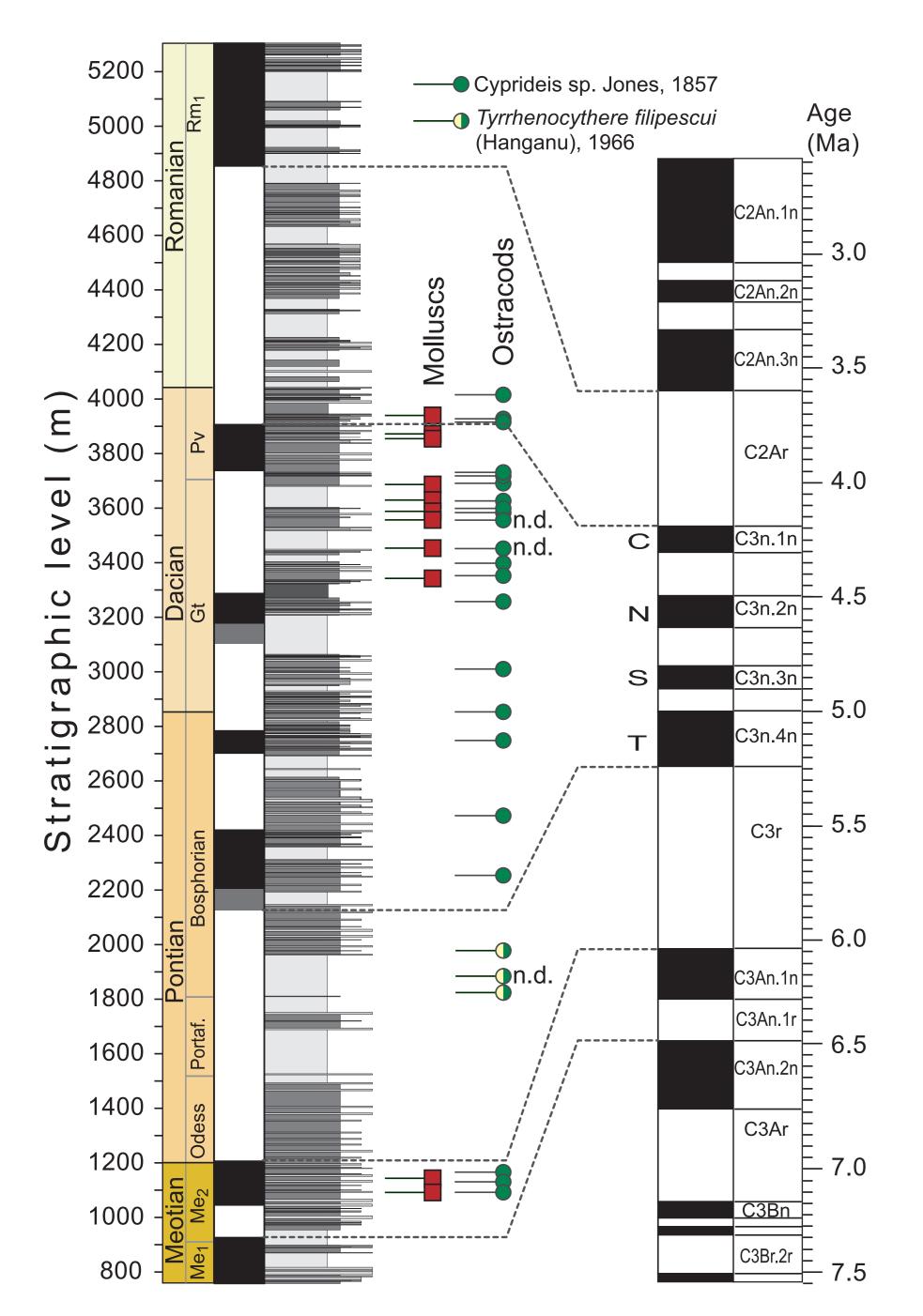


Figure 2. Local stages, polarity zones, schematic lithological column and the position of the mollusc and ostracod samples used for trace elements and Sr isotopes; n.d. indicates the levels where the ⁸⁷Sr/⁸⁶Sr ratios were determined but, because of large Rb amounts found in the sample, were interpreted as diagenetically affected. The dashed lines indicate the correlation of the polarity sequence APTS (Vasiliev et al., 2004) and updated to new paleontological constraints (Stoica et al., 2007; Krijgsman et al., 2010). In the time scale, Me1 and Me2 represent lower and upper Meotian respectively; Odess. (Odessian), Portaf. (Portafferian) and Bosphorian are regional substages of Pontian Stage; Gt (Getian) and Pv (Parscovian) are substages of the Dacian Stage and Rm1 represents the lower Romanian.

Strontium isotope ratios of the Eastern Paratethys during the Mio-Pliocene transition; Implications for interbasinal connectivity

Iuliana Vasiliev ^{1,*}, Gert-Jan Reichart ², Gareth R. Davies ³, Wout Krijgsman ¹ and Marius Stoica ⁴

1. Palaeomagnetic Laboratory 'Fort Hoofddijk', Budapestlaan 17, 3584 CD, Utrecht, The Netherlands; 2.Department of Geochemistry, Faculty of Geosciences, Utrecht University, Budapestlaan 4, 3584 CD, Utrecht, The Netherlands; 3.Department of Petrology, 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, 010041, Romania

* e-mail: vasiliev@geo.uu.nl

Introduction

Paratethys represents the large basin that extended from central Europe to inner Asia, comprising the North Alpine foreland, Pannonian and Dacian basins, the Black Sea and Caspian Sea (Fig. 1). Connectivity between these subbasins and the connectivity of Paratethys with the open ocean varied drastically because of pervasive tectono-climatic processes affecting the region.

Methods

Here, we investigate the biogenically produced carbonates of the Dacian basin for strontium analyses to monitor changes in connectivity, water geochemistry and palaeoenvironment during the Mio-Pliocene transition. We chose the well dated sucession of Rîmnicu Sarat Valley section (Fig. 2). Diagenetic evaluation showed that not all contamination could be removed, but that the strontium content of our samples was not affected by post-depositional processes (Fig. 3).

Results

87Sr/86Sr ratios of ostracods and molluscs are in good agreement and show relatively constant values of 0.70865-0.70885 (Fig. 4). These are much lower than coeval Mio-Pliocene ocean water (0.7089-0.7090), which indicates that no long-standing connection existed to the Mediterranean.

Conclusion

The newly obtained strontium ratios for Paratethys are best explained by a mixture of Danube, Dnieper and Don river water, implying connectivity between Dacian basin and Black Sea during the latest Miocene - earliest Pliocene. We observed no evidence for connectivity to the Caspian Sea during this period. The ⁸⁷Sr/⁸⁶Sr ratios of the Dacian basin are similar to the ones measured in the Mediterranean "Upper Evaporites/Lago Mare" facies (Fig. 4). The major fresh water deluge at the end of the Messinian salinity crisis could thus have been caused by drowning of Eastern Paratethys waters into the Mediterranean.

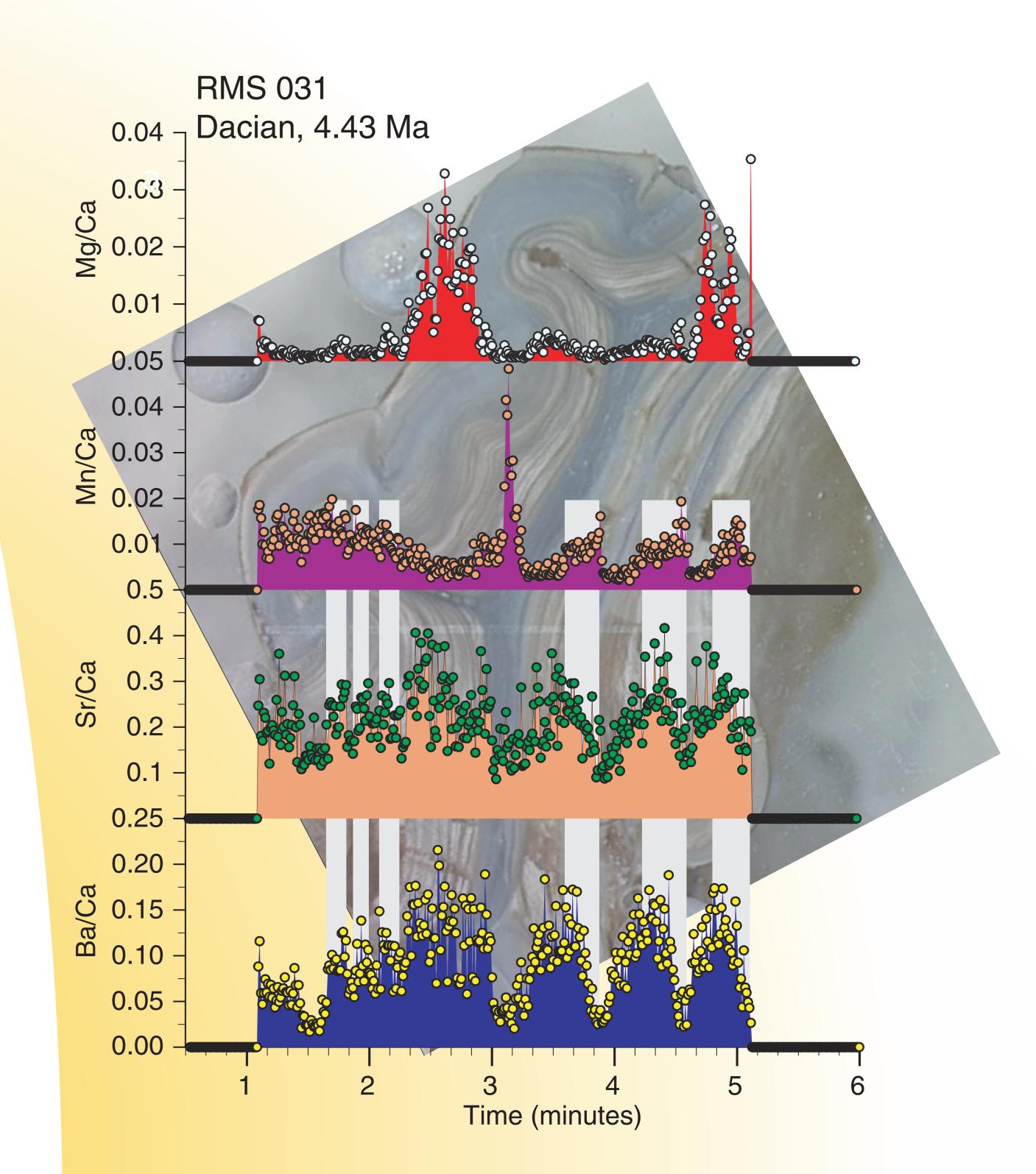


Figure 3. Trace elements ratio from a 5.5 mm profile in the mollusc shells. The profile is located in the lower half of the picture, just above the Mn/Ca record. The well resolved pattern of changes in Ba/Ca, Sr/Ca and Mn/Ca, most probably reflects ancient seasonal changes, from warm to cold season (or vice-versa), indicateing the excellent preservation of the shell.

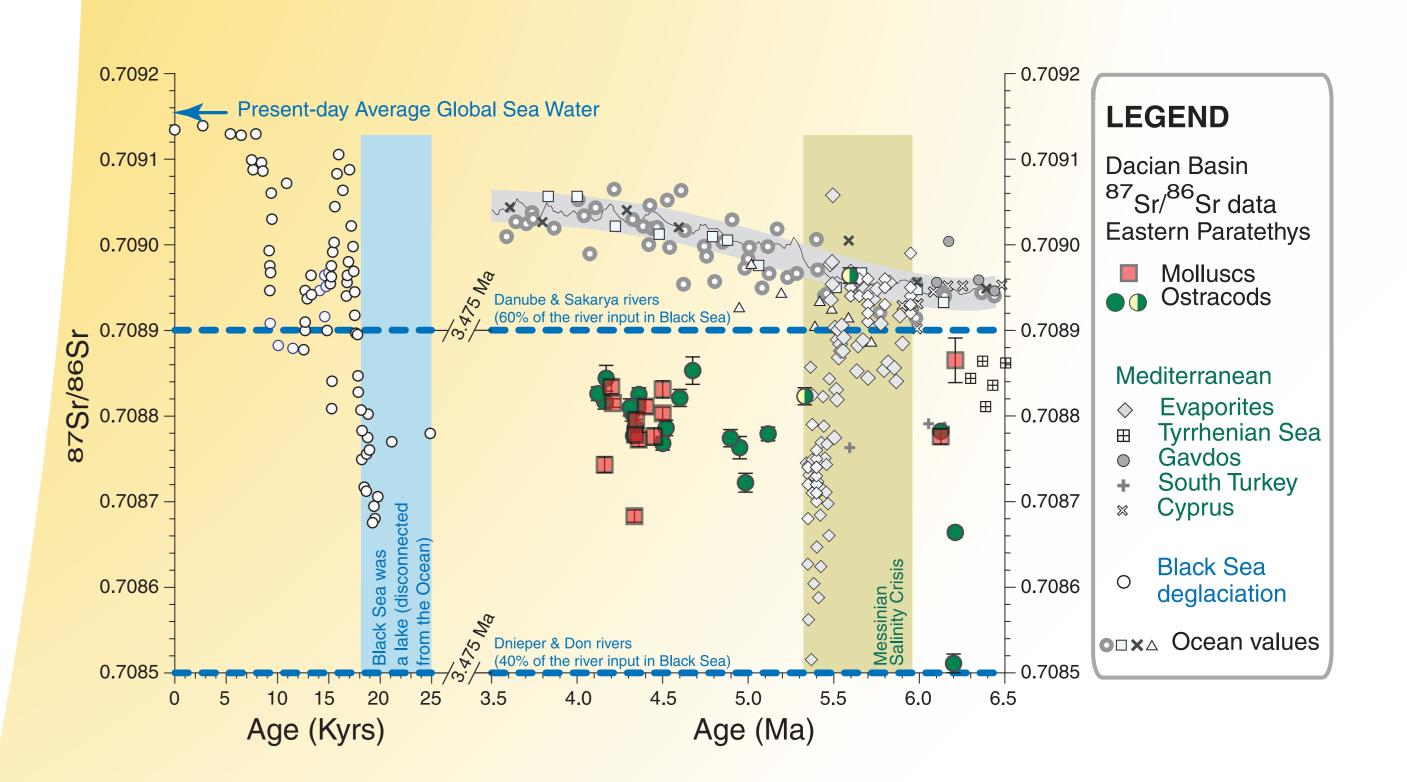


Figure 4. 87 Sr/ 86 Sr ratios for the Miocene-Pliocene samples of Rîmnicu Sarat Valley plotted against the ocean Sr isotope curve in grey between 3.5 and 6.5 Ma (Farrell et al., 1995; McArthur et al., 2001). The open circles, open triangles, open squares and × are individual Sr isotope data used for construction of the Ocean Sr isotope curve. Filled circles (squares) indicate ostracods (molluscs) from this study. The error for individual Romanian samples is plotted. The other values represent all the published data for the 3.5-6.5 Myr time interval from the Mediterranean realm. Blue dashed lines indicate the values from the four major rivers feeding the Black Sea (one of the remnants of the old Paratethys domain). The Caspian Sea (other remnant of the Paratethys) and the values for the main rivers (Volga and Ural) feedinhhhvvg it are much lower (87 Sr/ 86 Sr = 0.7082). In the left hand side data for the last glacial times (Major et al., 2006) are very similar to those obtained for the Mio-Pliocene transition of the Dacian basin. Note the different scale of the time axes.