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Terminal Miocene Events in the Pannonian Basin

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The Late Miocene Messinian age has witnessed profound palaeogeographic re-arrangements both in the Mediterranean and in the Paratethyan realms (POPOV et al. 2006). These included the Messinian salinity crisis, commonly interpreted as a complete desiccation of the Mediterranean Basin (HSÜ et al. 1977), and at least a significant base-level drop, if not total desiccation, of the Black Sea and Dacian Basins (HSÜ & GIOVANOLI 1979; CLAUZON et al. 2005; GILLET et al. 2006). Another common feature shared by the two realms is the sudden appearance of a characteristic brackish water fauna in the post-salinity crisis "lagomare" of the Mediterranean (ESU 2007) and at the beginning of the Pontian age in the Eastern Paratethys (NEVESSKAJA et al. 1987).

How did these events affect the Central Paratethyan Pannonian Basin? Many authors argued that the Pannonian Basin became part of a united Paratethys at the beginning of the Pontian, and that Eastern Paratethyan Pontian fauna, first of all cardiid bivalves, entered and conquered the basin at that time (NEVESSKAJA et al. 2001). Study of seismic reflection profiles led some authors to argue that the Pannonian Basin experienced a large-scale (several hundred metre) base-level drop at about the time of the Messinian salinity crisis (CSATÓ 1993). According to this view, the Pannonian Basin shared the history of the Eastern Paratethys: it received a new mollusc fauna immigrating from an adjacent basin at the beginning of the Pontian, and experienced significant lowering of water level during the late Messinian salinity crisis.

Several lines of evidence, however, indicate that this might not be the correct interpretation of the palaeontological and seismic record. In fact, all early Pontian cardiid genera of the Black Sea Basin, with the single exception of *Eupatorina*, have a long stratigraphic record well back into the Tortonian within the Pannonian Basin. The first representatives of *Euxinicardium*, *Pseudocatillus*, and *Paradacna* appear before 9.5 Ma in the deposits of Lake Pannon. *Prosodacnomya* originated from the "*Lymnocardium*" *decorum* group around 8 million years ago (MÜLLER & MAGYAR 1992). The first known representative of *Pontalmyra*, *P. budmani*, is also at least as old as 8 Ma. "*Euxinicardium*" *subodessae* of the Black Sea Basin corresponds to "*Euxinicardium*" *ochetophorum* of the Pannonian Basin, the latter originating from "*Lymnocardium*" *vicinum* sometime between 8 and 7 Ma. During most of the Tortonian age, Lake Pannon was the only waterbody inhabited by endemic brackish lacustrine cardiids (subfamily Lymnocardiinae).

Thus it seems very probable that the "alien" bivalve fauna that appeared at the beginning of the Pontian in the Euxinian Basin came from Lake Pannon. The stratigraphic data seem to support the following migration routes for Lymnocardiinae: Lake Pannon (Tortonian) > Euxinian Basin (Early Pontian) > Aegean Basin (Late Messinian) > Mediterranean (latest Messinian, "lagomare").

Our regional seismic studies, including 3D volumes, in the north-eastern shelf of Lake Pannon revealed that seismic onlaps on the shelf-margin clinoforms, interpreted earlier as representing a significant sequence boundary, were in fact caused by strike variability of the sediment supply. Reconstruction of the post- and partly synsedimentary deformation history of the basin fill indicated that the apparent difference in water depth below and above the boundary is only virtual, thus the onlaps do not necessarily justify regional lake-level drops. The only regionally extended unconformity within the late Miocene to Pliocene succession of the Pannonian Basin, however, can be traced along the entire length of the northern shelf of the basin. This unconformity always separates deltaic sediments of Lake Pannon, sometimes with obviously eroded surface, from onlapping fluvial to paludal deposits with characteristic Pliocene fossils. Towards the basin proper the unconformity becomes a conformable surface, whereas in the margins it is usually strongly tilted basinwards, arguing for tectonic origin. Where dated, it is older than 4.6 Ma and younger than 6.8 Ma (Pogácsás et al. 1994).

These features indicate that Lake Pannon remained isolated throughout the Messinian. Although its water level was not directly influenced by the drawdown of the Mediterranean and the Eastern Paratethys, this lake was the source of the Pontian and, partly and indirectly, of the lagomare fauna. The major unconformity in the basin is a consequence of a tectonic inversion (Horváth & Cloetingh 1996; Sacchi et al. 1999) that began sometime in the latest Miocene or earliest Pliocene.

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