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An integrative study of lacustrine successions of the Sinj Basin (Miocene Dinaride Lake System, SE Croatia) - paleontology, depositional history, cyclostratigraphy and paleomagnetics

O. Mandic (1), M. Harzhauser (1), D. Pavelić (2), A. de Leeuw (3) and W. Krijgsman (3)

(1) Geological-Paleontological Department, Natural History Museum Vienna, Burgring 7, A-1010 Wien, Austria, (2) Faculty of Mining, Geology and Petroleum Exploration, University of Zagreb, Pierottijeva 6, HR-10000 Zagreb, Croatia, (3) Paleomagnetic Laboratory 'Fort Hoofddijk', Faculty of Earth Science, Utrecht University, Budapestlaan 17, 3584 CD Utrecht, The Netherlands (oleg.mandic@nhm-wien.ac.at)

The Sinj basin belongs to the southernmost basins of the Miocene Dinaride Lake System, positioned on the paleogeographical high between the Central Paratethys and the proto-Mediterranean Sea. Its sedimentary infill is composed by more than 300 m thick lacustrine sediments comprising carbonates, marls and vast lignite deposits. The sediments are highly fossiliferous bearing in part very rich mollusk fauna. The taxonomic inventory of the Sinj basin (SE Croatia) represents one of the best known for the whole Dinaride Lake System, with pioneer investigations funded already in the 19th century. Hence from the section Sutina brook near Lučane representing the topmost part of the basin's sedimentary infill several gastropod evolutionary lines became known. The integrative geoscientific study of that succession should reveal the timing of the radiation and speciation events for those lines in the frame of the Austrian FWF Project P18519-B17: Mollusk Evolution of the Neogene Dinaride Lake System.

The studied part of the section is about 140 m thick and comprises two main transgressive-regressive cycles starting with light carbonates and ending with massive lignitic horizons. Based on the sedimentological field research, the deposits are tentatively grouped into six facies. Carbonates strongly predominate, and are divided into calcilutite facies and calcsiltite facies. Biogenic deposits are richly represented by

lignite intercalations and mollusk coquinas, but the occurrence of siliciclastics, like sandstones and silts is very rear. Additionally the pyroclastic facies is represented by at least one intercalation.

The character of the lithological succession resembles strongly the astronomically forced lignite bearing lacustrine successions as described for example from the Pliocene of Ptolomais in southeastern Europe. The spectral analysis of gamma-log data proved the significance of 17 m thick sedimentary cycles which have been correspondingly interpreted as being forced by the 100 kyr. eccentricity periods. Hence the succession could represent the deposition of about 800 k.y. resulting in a mean sedimentation rate of about 0.2 mm/yr.

The represented gastropod phylogenetic lines show around the two main lignite horizons smooth morphologies and low morphologic disparity / taxonomic diversity. The radiation pulse started above the top of the first transgressive-regressive cycle. The diversification enriched the fossil record from 5 to 14 subspecies-level taxa, characterized by prominent sculptural elements. The massive extinction event around the lignite top of the second cycle diminished the species richness to the starting position, although with complete renewed taxonomic content. The observed evolutionary cycle correspond then exactly to one transgressive-regressive cycle and therefore most probably to one single 400 kyr. eccentricity period.

To prove that hypothesis we have additionally conducted a high resolution paleomagnetic investigation with the sample density of 1 sample per 3 meters. Stepwise thermal demagnetization of the samples successfully removed a recent overprint, revealing the primary magnetic signal. We found at least one, potentially two reversals in the section. Hence most of the section is reversed, with in the top-part a normal interval. Since the section can be extended downwards at least as far as 150 m we expect to find more reversals, which should lead thereafter to the conclusive correlation.