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# Evolution of alkaline lakes – Lake Van case study

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Lake Van in Eastern Anatolia (Turkey) is the largest terminal soda lake on Earth. The lake sedimentary profile covers ca. 600 ka (Stockhecke et al. 2014) Based on lithological changes, the presence of freshwater microfossils and close-to-freshwater pH value in the pore water, members of ICDP PALEOVAN concluded that Lake Van might have started as an open lake. Here we show paleontological and geochemical evidence in favour of this idea and constrain the time, when Lake Van likely transformed into a closed lake. Additionally we provide the first conceptual model of how this closure may have happened.
Our archives of choice are inorganic and biogenic carbonates, separated by wet sieving. We identified microfossil assemblages (fraction > 125 $\mu$m) and performed high-resolution oxygen isotope (delta18O) and elemental (Mg/Ca, Sr/Ca) analyses of the fraction < 63 $\mu$m assuming that it represents only carbonates precipitating in the water column.
Microfossil assemblage consists of three different species of ostracods (Candona spp, Loxoconcha sp, Amnicythere spp.), diatoms, gastropods and bivalves. Brakish-water ostracods, Loxoconcha sp and Amnicythere sp occur more often after 530 ka. Additionaly, Loxoconcha sp is a shallow-water species relaying on plants growing in the photic zone as food supply. These two aspects point to an increasing salinity in a shallowing lake. The delta18O values of inorganic carbonates are relatively low during the initial phase of Lake Van and increase abruptly (ca. 7‰ after 530 ka BP. At approximately the same time combination of Sr/Ca and Mg/Ca data suggest first occurrence of aragonite. Again, these findings suggest geochemical changes of the lake water concurrent with transition documented by microfossils.
Comparison between Lake Van and Lake Ohrid (Lacey et al. 2016) delta18O data, precludes regional climate change (e.g.: increased evaporation) as the main driver of observed changes. With no evidence for increased volcanic or tectonic activity (e.g.: tephra layers, deformation structures, slumping) in the Lake Van sedimentary profile around 530 ka, it seems unlikely that a pyroclastic flow blocked the outflow of the lake. Alternatively, a portion of inflow has been diverged which might have caused a change in the hydrological balance and lake level falling below its outlet. However, as no geomorphological data confirming this scenario yet exist, it is only a tentative explanation.

Lacey et al. 2016. Northern Mediterranean climate since the Middle Pleistocene: a 637 ka stable isotope record
from Lake Ohrid (Albania/Macedonia). Biogeosciences 13
Stockhecke et al. 2014. Sedimentary evolution and environmental history of Lake Van (Turkey) over the past 600 000 years. Sedimentology