

Lake Van carbonates: Implications for lacustrine stable isotope analysis

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Carbonate stable isotope ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$) analysis is a commonly applied and powerful proxy in lacustrine palaeoclimatology. In the absence of large quantities of detrital carbonates, the bulk carbonate is assumed to mainly represent inorganic carbonates precipitated in the epilimnion. In well-preserved, geologically young sediments (e.g. varves), post-depositional processes affecting the mineralogy or geochemistry of sedimentary carbonates are difficult to recognise. In case of terminal and alkaline Lake Van, the interpretation of the $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ signals of bulk carbonates is, in comparison to other proxies, far from straightforward when relying on traditional interpretative approaches. Consequently, using a multi-component approach we studied, individually and in detail, various components comprising Lake Van's bulk carbonates.

Samples investigated here cover the last glacial/interglacial period. Inorganic ($< 63 \mu\text{m}$) and biogenic ($> 63 \mu\text{m}$) carbonates were isolated by wet-sieving and analysed by means of XRD, SEM and isotope mass spectrometry. High-resolution mineralogical analysis revealed variable amounts of aragonite and calcite as well as early diagenetic non-stoichiometric (calcian) dolomite. The early diagenetic dolomite appears to be replacing the inorganic aragonite/calcite and occurs within finely-laminated, organic-rich sediments. Isotopically the dolomite differs significantly from the primary carbonates with typically heavier $\delta^{18}\text{O}$ and lighter $\delta^{13}\text{C}$ values. Thus, in the case of bulk sediment isotope analysis the presence of higher amounts of diagenetic dolomite is distorting the isotopic pattern.

Ostracod valves represent biogenic carbonates. However, apart from well-preserved, translucent carapaces we have found coated ones, reoccurring throughout the profile within specific facies types. The coating, comprising mainly of aragonite has a significantly heavier $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ signature compared to coeval inorganic carbonates, precipitated presumably in the surface water. Additionally, the confinement of coated ostracod valves to non-laminated sediments implies oxic bottom-water conditions during the, possibly microbially-mediated, coating process.

Our results, though preliminary have wide implications for palaeolimnological analysis and call for caution when using bulk and/or inorganic carbonates.