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Late Quaternary palaeoenvironmental reconstruction from Lake Ohrid using stable isotopes

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Lake Ohrid is a large, deep lake located on the Balkan Peninsula at the border between Macedonia and Albania, and is considered the oldest extant lake in Europe. An International Continental scientific Drilling Program (ICDP) deep drilling campaign was carried out in 2013 as part of the interdisciplinary Scientific Collaboration On Past Speciation Conditions in Lake Ohrid (SCOPSCO) project. Over 1500 m of sediment were recovered from six coring locations at the main target site in the central basin, where the maximum drill depth reached 569 m below the lake floor. Initial results indicate continuous lacustrine conditions over the past >1.2 Ma (Wagner et al., 2014). Here, we present oxygen and carbon isotope data (δ18O and δ13C) from carbonate from the upper 248 m of the SCOPSCO succession, which covers the last 640 ka, spanning marine isotope stages 15-1, according to an age model based on tephra and orbital tuning (Francke et al., 2015).

Modern monitoring data show Lake Ohrid to be an evaporative system, where variations in δ18O of endogenic carbonate are primarily a function of changes in water balance, and δ13C largely reflects fluctuations in the amount of soil-derived CO_2 and organic matter recycling. Our results indicate a trend from wetter to drier conditions through the Holocene, which is consistent with regional and hemispheric processes related to changes in insolation and progressive aridification. Over the last 640 ka, relatively stable climate conditions are inferred before ca. 450 ka, a transition to a wetter climate between ca. 400-250 ka, and a trend to drier climate after ca. 250 ka. Higher frequency, multi-millennial-scale oscillations observed during warm stages are most likely associated with regional climate change as a function of orbital forcing. This record is one of the most extensive and highly-resolved continental isotope records available, and emphasises the potential of Lake Ohrid as a valuable archive of long-term palaeoclimate and palaeoenvironmental change in the northern Mediterranean region.

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