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Integrated perspectives on geological and biological dynamics in ancient Lake Ohrid

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Lake Ohrid on the Balkan Peninsula is one of the very few lakes in the world that provides a continuous and high-resolution record of environmental change of >1.2 Ma. The outstanding number of endemic taxa (>300 endemic taxa) in Lake Ohrid in combination with its long existence makes Lake Ohrid a unique target to study the drivers of speciation and endemism. For this purpose, a 569 m long sediment sequence was recovered from the central part of the lake in spring 2013 within the scope of the International Continental Scientific Drilling Program (ICDP) and the Scientific Collaboration on Past Speciation Conditions in Lake Ohrid (SCOPSCO) project.

In January 2016, the lowermost core sections of the 569 m long sediment sequence were opened. Ongoing work comprises core correlation to a composite sequence and various geological and biological analyses on the sediment material. Here, we present the results of analyses of the upper 248 m of this sequence, which covers the last ca. 640 ka according to an age model based on tephrostratigraphy as well as tuning of in situ physical and biogeochemical proxy data to orbital parameters and supported by paleomagnetic studies. The sedimentological, physical, and geochemical data from the sediment sequence indicate changes in primary productivity, water column stratification, and water depth of the lake, and in weathering and erosion processes in the catchment. These changes can be clearly correlated with orbitally driven environmental change, such as the intensity of glacial and interglacial periods as well as stadials and interstadials. These long-term changes are interspersed by short-term events, such as the deposition of tephra horizons. More than 30 tephra layers were found in the upper 248 m. The comparison of long-term and short-term environmental changes with paleontological and molecular clock analyses indicates that catastrophic extinction events in the endemic species community did not occur over the last 640 ka in Lake Ohrid. The lack of such catastrophic extinction events is probably due to the buffering capacity of the deep lake, possibly enhanced by the continuous existence of subaquatic karst springs with relatively stable habitats in the surroundings. This would enable the survival of species over time. The stability of Lake Ohrid over time thus could be one of the main drivers for the high endemism in the lake.