



Deep drilling of ancient Lake Ohrid (Balkan region) to capture over 1 million years of evolution and global climate cycling

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Ancient lakes, with sediment records spanning >1 million years, are very rare. The UNESCO World Heritage site of Lake Ohrid in the Balkan region is thought to be the oldest lake in continuous existence in Europe and, with 212 endemic species described to date, is a hotspot of evolution. An international group of scientists working on a project entitled ‘Scientific Collaboration on Past Speciation Conditions in Lake Ohrid (SCOPSCO)’ realized a deep drilling campaign of Lake Ohrid in spring 2013. Based on several coring seismic campaigns between 2004 and 2011, Lake Ohrid became the target of an ICDP deep drilling campaign, with specific research aims: (i) obtain precise information about the age and origin of the lake, (ii) unravel the lake’s seismotectonic history, (iii) obtain a continuous record of Quaternary volcanic activity and climate change, and (iv) investigate the influence of major geological/environmental events on evolution and the generation of extraordinary endemic biodiversity.

Drilling began in April 2013 using the Deep Lake Drilling System (DLDS) of DOSECC (USA). The campaign, completed by late May, was deemed one of the most successful ICDP lake drilling projects, with a total of ~2100 m of sediment recovered from four different sites. At the central “DEEP” site, hydro-acoustic data indicated a maximum sediment fill of ca. 700 m, of which the uppermost 568 m was recovered. Coarse gravel and pebbles underlying clay and shallow water facies hampered deeper penetration. A total of 1526 m of sediment cores was collected from six boreholes, with a composite field recovery (‘master core’) of 544 m (95%). Three additional sites were drilled in order to analyze lake-level fluctuations, catchment dynamics, biodiversity and evolution processes (“Cerava”, deepest drilled depth: 90 m), to investigate active tectonics and spring dynamics (“Gradiste”, deepest drilled depth: 123 m), and to try to understand the geological origins of the Ohrid Basin (“Pestani”, deepest drilled depth: 194 m). Composite field recovery at each site was >90%.

The cores are now stored at the University of Cologne, Germany, where they are currently opened, described, and the first analyses are taking place, such as Multi-Sensor Core Logging (MSCL) and X-ray fluorescence (XRF) scanning. Subsampling will be carried out at consistent intervals.

To date, seismic, borehole logging, geochemical and susceptibility data show fluctuations which are in excellent accord with current understanding of global Quaternary glacial-interglacial cycles, indicating that the record is probably >1.2 Ma old. ‘Instant diatom screening’ on smear slides also indicates marked fluctuation and clear evidence for Quaternary evolution. Stable isotope analysis is under way. The broad spectrum of multi-proxy analyses, including palynological and biomarker analyses, will set the framework to establish the Lake Ohrid record as a master record of environmental change and short-term events in the northern Mediterranean. The combination of long continuous existence of the lake, high temporal resolution, sensitivity to environmental change, and the high degree of endemism today is unique worldwide and demonstrates Ohrid’s status as a site of global importance for palaeoenvironmental and evolutionary research.