The Late Glacial and Holocene Sedimentary Infill of Lake Mondsee (Eastern Alps, Austria) and Historical Rockfall Activity revealed by Reflection Seismics and Sediment-Core Analysis

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Glacigenic perialpine lakes can constitute continuous geological archives allowing for reconstruction of lake-internal sedimentological processes and of paleoenvironments since the last glacial maximum (LGM). Lake Mondsee is one of many perialpine lakes in the Salzkammergut, Upper Austria and has previously been studied based on sediment cores for paleoclimate, paleolimnology and (paleo-) ecology. However, the full extent and environment of Late-Glacial to Holocene sediment deposition remained unknown due to the lack of reflection seismic data imaging the 3D sediment accumulation patterns.

In this study, the sedimentary infill of Lake Mondsee was examined by 57 km of high-resolution seismic reflection data (3.5 kHz pinger source) correlated to a new 13.76 m long sediment core. In the northern basin, seismic penetration is strongly limited in most areas because of abundant shallow gas (acoustic blanking). In the deeper areas, the acoustic signal reaches depths of up to 80 ms TWT (two-way travel time), representing a postglacial sedimentary sequence of at least 60 m thickness. The Holocene deposits constitute only the uppermost 11.5 m of the sedimentary succession. Postglacial seismic stratigraphy of Lake Mondsee closely resembles those of well-studied French and Swiss perialpine lakes. Our data show that most of Lake Mondsee's sedimentary basin infill was deposited within a short time period (between 19,000 and 14,500 years ago) after the Traun Glacier retreat from the Mondsee area, revealing an average sedimentation rate of about 1.4 cm/yr.

Compared to other perialpine lakes, the seismic data of Lake Mondsee revealed little indications of mass movement activities during the Holocene. An exception, however, are rockfalls originating from a steep cliff situated on the southern shore of Lake Mondsee, the Kienbergwand. Here, the seismic profiles show mass transport deposits (MTDs), which extend approximately 450 m into the lake and are mappable in an area of about 45300 m2. Sediment cores targeting the MTDs show two separate rockfall events. The older event consists of clast-supported angular dolomitic gravels and sands, showing high amounts of fine fraction. The younger event exhibits dolomitic clasts of up to 1.5 cm in diameter, mixed within a lacustrine muddy matrix. Radiocarbon dating and correlations to varve-dated sediment cores hint at ages of AD 1484 ± 7 for Event 1 and AD 1639 ± 5 for Event 2. Our data show no evidence of a large-scale mass movement affecting Lake Mondsee and its surroundings, but we infer that the present-day morphology of the Kienbergwand is the result of infrequent medium-scale rockfalls.