



Deglaciation history of the Aare Valley (Switzerland) revealed by seismic stratigraphy of subaquatic moraine complex

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Due to the scarcity of well-developed moraines that indicate glacial stabilization/readvance, the reconstruction of the deglaciation history of major inner-Alpine valleys remains challenging. Despite significant advances in dating techniques (e.g. surface-exposure dating) allowing for some temporal constraints, little is known about the exact timing and behaviour of retreating glaciers between their recessional phase from the Alpine foreland to the deglaciation of the inner-Alpine ice cap. New seismic stratigraphic data of an inner-Alpine subaquatic moraine complex and its detailed seismic facies architecture contribute to novel insights and a so far unknown tie point to the understanding of the deglaciation process.

Recently acquired high-resolution multibeam bathymetry, in combination with a 2D multichannel reflection seismic campaign on perialpine Lake Thun (Switzerland) reveals new insights into the diverse geometry of the lake basin and a so far unknown subaquatic moraine complex (SMC) with unparalleled clarity.

The overdeepened basin of Lake Thun was formed by a combination of tectonically predefined weak zones and glacial erosion during the last glacial periods. The new data indicate that below the outermost edge of a morphologically distinct platform in the south-eastern part of the lake basin, a ridge structure characterized by strong reflection amplitudes occurs. It is interpreted as a stack of seven subaquatic terminal moraine crests, which were created by a fluctuating, “quasi-stagnant” grounded Aare Glacier during its overall recessional phase. We will present the synthesis of various conceptual models explaining the formation of the SMC, which shows strong similarities to conceptual models for ice-contact submarine fan systems caused by ice-front advance-retreat cycles of temperate glaciers.

The SMC reveals single, seismically well distinguishable packages of overridden moraine crests, which develop into prograding clinoforms with foresets at the ice-distal slope. The succession of subaquatic glacial sequences (foresets and adjacent bottomsets) represent one fifth (> 100 m vertically) of the entire sedimentary thickness in Lake Thun.

Exact time constraints for the deglacial history of the Aare Glacier are sparse. However, previous ¹⁰Be exposure ages from the uppermost Aare Valley and radiocarbon ages from a Late-Glacial lake close to the outlet of Lake Thun indicate that the formation of the subaquatic moraine complex and the associated sedimentary infill must have occurred in less than 1000 years, implying high sedimentation rates (> 10 cm/yr) and rapid disintegration of the glacier.