SHALLOW P-WAVE AND S-WAVE SEISMIC IMAGING OF OVERDEEPENED ALPINE STRUCTURES

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The sedimentary infill of overdeepened valleys and basins is objective for a DFG-funded project (grants KR2073/3 -1, GA749/5-1), preparatory to the ICDP proposal DOVE (Drilling Overdeepened Alpine Valleys). Imaging their sediment succession enables us to interpret structures and deposits of different facies environments, which yield to information about, e.g., glacial cycles, geohazards, and groundwater resources. Here, we examine the benefit of combined application of shallow P-wave reflection seismics together with S-wave and multicomponent reflection seismic techniques at two study areas.

The Tannwald Basin, located about 50 km north of Lake Constance at the terminal moraine of the last glacial maximum, represents an overdeepened branch basin of the Rhine glacier in the alpine foreland. Here, we accomplished three reflection seismic campaigns with five high-resolution P-wave profiles, two SH-wave profiles, and one profile using multi-component technique (3-C receivers, SV- and SH-wave sources). In addition, several cross-lines were registered to study 3-D effects and to evaluate a 3-D approach for multi-component reflection seismics.

By P-wave reflection seismics, we reveal the Molasse base of the Tannwald Basin in depth between 80 and 240 m, verified by a nearby research borehole from the 1990s. The sedimentary infill is locally glacio-tectonically disturbed and delineate spatially-spread reflection pattern of different seismic facies, which we interpret as lacustrine, glacial-fluvial, and deltaic sediments. However, SH-waves show only parts of the bedrock reflections and the P-wave reflection inventory, but some SH-wave reflections of the Quarternary deposits can be correlated with P-wave reflections. Possible reasons for different performance of P- and SH-waves may be the response to different elastic parameters, damping, or scattering, which results in a lower maximum penetration depth of SH-waves.

The Lienz Basin constitute an inner alpine basin at the junction of four glaciers in the Pleistocene with a speculated depth of 500 m. In August/September 2016, we will accomplish two seismic reflection campaigns comprising high-resolution P-wave, SH-wave, and multi-component measurements. An open question is if we can distinguish between sediments of different glaciations and can characterize different facies in the Lienz Basin as well.