



Seismic velocity problems in glacial overdeepened alpine valleys

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The age, formation, depth and infill of “overdeepened” Alpine valleys trending parallel to the strike of the mountain belt remains one of the great and unresolved mysteries in the topographic evolution of the Eastern Alps. Such valleys are overdeepened with respect to the actual river level with bedrock surfaces as deep as several hundred or thousand meters below the present valley floor and very thick Quaternary fluvio-glacial sediment fills.

Generally overdeepened valleys are formed in areas where the ice discharge was high. Most of these follow major seismic active tectonic faults.

Seismic investigations give information about valley geometries, depth, and facies of Quaternary sediments. Higher amounts of overdeepening derived from seismic surveys were reported from the Inn Valley (up to 1000 m) as well as from the Zillertal (up to 900 m). –

Particularly for the Inn Valley reflection seismic results in a relative uniform model for the region between Landeck and Kufstein; it is characterized by two units:

upper unit with good reflection characteristics indicating internal sedimentary structures

deeper unit with weak reflection characteristics; in this case no clear structural analysis is possible. Questionable reflections are caused by only low contrasts in the seismic

impedance.

For any seismic analysis the knowledge of the velocities is the key problem. In this case a preliminary model shows for the two units

the upper unit (travel time 350 ... 450 ms) with velocities between 1700 and 2500 m/s represents the quarternary sediments,

the deeper unit (travel time 400 ... 1000 ms) with extremely high velocities between 3300 and 4000 m/s; this unit represents overcompacted quarternary sediments.

A 900 m deep well was drilled in the valley of the Inn (Wattens); the well did not reach the bedrock and supports this suggestion. Acoustic log measurements confirm the two units and their strong velocity difference. Other logs (density, resistivity, nuclear) confirm the boundary between the two different sedimentary units and their completely different petrophysical characteristic.

Considering the velocity model with the high seismic velocities of the deep horizons as well as the sonic velocities measured in the borehole, the depth of the pre-Quaternary basement in the Inn Valley and the history of sedimentary processes are still under discussion.