Surface Deformation Rates of a Deep-Seated Toppling Slope Failure in Lienz (Tyrol, Austria)

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Slow slope deformations often emerge as large-scale slope instabilities affecting entire valley flanks and may move only few millimetres per year. Studying these slope instabilities is critical because their activity status is often unknown and long-term processes switch between periods of activity and inactivity, with the reactivations potentially causing localized catastrophic failures.

In Eastern Tyrol, northwest of Lienz, two examples of deep-seated gravitational slope deformations (DSGSDs) within mica schists and gneiss of the Schober Gruppe ranging between 700 and 2900 m a.s.l. were chosen as study sites for combining differential Interferometric synthetic aperture radar (DInSAR) methods for assessment of movement rates.

The slope between Törl (2507 m a.s.l.) the village of Oberalkus (1284 m a.s.l.) is characterised by a saw-tooth slope profile due to a series of counterscarps as a result of deep-seated toppling. This was enabled by joints and faults steeply dipping into the slope (Reitner & Linner, 2009). The uppermost part reveals a 300 m wide graben structure where now fossil rock glaciers have their root zone.

For the long-term detection of deformation rates and defining the historic baseline to tie reactiviation periods to conditioning factors, we sampled the counterscarps and head scarps for cosmogenic nuclide dating with in total 14 samples. Several samples in stratigraphic order allow for the calculation of slip rates throughout the Holocene.

The last decades and present movement rates are processed with satellite InSAR (Interferometric synthetic aperture radar) acquired from ERS, ENVISAT and Sentinel-1. The combination of movement rates derived from these two methods should enable a better assessment of the current status of slope deformation since their onset as well as its potential future development.

The results are presented as part of the VIGILANS project.

Reference

Reitner, J. M. & Linner, M. (2009): Formation and preservation of large scale toppling related to Alpine tectonic structures—Eastern Alps. – Austrian Journal of Earth Sciences, 102, 69–80.