Deep-Seated Gravitational Slope Deformations in the Austrian and Italian Alps: Characteristics and Dating

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Deep-seated gravitational slope deformations (DSGSDs) are large to extremely large, slow moving mass movements generally affecting the entire length of high-relief valley flanks, extending up to several hundred meters in depth, which can frequently spread beyond the slope ridge and they have been recognized to affect different lithologies at many sites worldwide. Large parts of a DSGSD can accelerate and result in catastrophic rock-slope failures and secondary landslides are common in the lower part of these slopes.

One of the most pending questions concerning DSGSDs are their long-term evolution as their dynamics on centennial to millennial time scales is difficult to capture. Because DSGSDs last for ≥102 to 105 years and are characterized by complex and temporally variable displacement behaviour (two basic long-term movement patterns, i.e. slow continuous creep and discrete episodic movements), constraining the timing of such movements is of paramount importance. Although there are several geochronological and stratigraphical methods, which have been used to constrain the chronology of DSGSDs, dating of DSGSDs is still in its infancy.

We present some examples from the Austrian and Italian Alps, where the (joint) application of different dating methods (cosmogenic nuclide exposure dating, U-series disequilibrium dating, radiocarbon dating) achieved reliable results on the long-term evolution of DSGSDs. This data is fundamental in the view of engineering geological modelling and extents the time-frame of DSGSD displacement measurements (D-GPS, DInSAR, precise levelling …) from a few decades to several thousand years.