



## Application of Schmidt-hammer exposure-age dating (SHD) to improve numerical age dating of Holocene moraines

Stefan Winkler

University of Canterbury, Department of Geological Sciences, Christchurch, New Zealand (stefan.winkler@canterbury.ac.nz, +64 (0)3 364 2769),

Schmidt-hammer exposure-age dating (SHD) has proven its reliability as relative-age dating technique on Holocene moraines in different region over the past 2 decades, e.g. in Norway or the Southern Alps of New Zealand. One of its main advantages is the ability of destruction-free and in situ testing of high numbers of moraine boulders. Especially in tectonically active regions providing a significant potential of post-depositional movement, the latter mentioned characteristic is extremely important.

Additionally, SHD is an effective method to improve the reliability of numerical age dating attempts with terrestrial cosmogenic nuclide dating (TCND). As the potential number of samples taken for this numerical age dating technique is usually small, the choice of representative boulders on Holocene moraines is crucial. Most studies, however, solely use "visual" attempts without any form of independent testing. Therefore, the Schmidt-hammer needs to be considered as strongly recommended when choosing boulders for TCND-sampling as it provides a non-subjective and non-visual form of control for the boulder sampled. It constitutes an efficient and reliable tool to reduce the geomorphological uncertainties with such dating attempts. Some examples of its potential will be addressed.

During the past few years, SHD has also been used in combination with TCND in a "multi-proxy approach". These two techniques are logically combined to enable mutual testing and to construct age-calibration curves. Results from various glaciers in the Southern Alps using a "multi-proxy approach" of Schmidt-hammer exposure-age dating (SHD) combined with terrestrial cosmogenic-nuclide dating (TCND) will be presented. It will be argued that much of the controversy between existing studies on the New Zealand glacier chronology emerges from the regionally specific geomorphological environment and the related uncertainties with the application of different dating techniques.

### References:

Winkler, S. (2009): First attempt to combine terrestrial cosmogenic nuclide ( $^{10}\text{Be}$ ) and Schmidt hammer relative-age dating: Strauchon Glacier, Southern Alps, New Zealand. Central European Journal of Geosciences 1, 274 – 290.

Winkler, S. & Matthews, J.A. (2010): Holocene glacier chronologies: Are 'high-resolution' global and inter-hemispheric comparisons possible? The Holocene 20, 11347 - 1147.