Geophysical Research Abstracts,
Vol. 10, EGU2008-A-00939, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-00939
EGU General Assembly 2008

Attempt to combine *in situ* cosmogenic nuclide (^{10}Be) and relative-age Schmidt-hammer dating – first application in the Southern Alps of New Zealand

S. Winkler

Department of Geography, University of Wuerzburg, Am Hubland, D-97074 Wuerzburg, Germany (stefan.winkler@mail.uni-wuerzburg.de)

The investigation of Holocene glacier chronologies in high mountain regions is an important field of research in the context of the use of glaciers as indicators for climate change. Detailed Holocene glacier chronologies offer the opportunity to assess the recent glacier dynamics, and to verify predictions and simulation of the future glacier development. Within the project "MaMoGla" (Holocene and recent dynamics of **ma**ritime **mo**untain **gl**aciers), the Southern Alps of New Zealand have been chosen as southern hemispheric study as part of this more complex comparative study.

One important step of the ongoing project is the improvement of the existing Holocene glacier chronology of the Southern Alps/New Zealand. Previous research has revealed the need for revision due to methodological uncertainties and the focus on an unreliable key locality (i.e. Tasman Glacier). During previous fieldwork, the potential of the Schmidt-hammer as relative-age dating technique has clearly been demonstrated by the successful application on several lateral and latero-frontal moraine sequences in the Mt Cook/*Aoraki* National Park (WINKLER 2005). The relatively homogenous and weathering/erosion-resistant bedrock yielded comparatively small standard errors and, thus, a relatively high time resolution of up to 200 – 300 years could be achieved. This was sufficient to separate between moraine ridges and sequences formed during different Little Ice Age-type events. However, an "absolute" age dating is not possible unless this method is combined with another, absolute dating technique allowing the construction of a dating curve.

This study provides the first attempt to combine *in situ* (terrestrial) cosmogenic nuclide (^{10}Be) surface exposure dating with Schmidt-hammer measurements for the dating of Holocene moraines and the reconstruction of a regional glacier chronology. It represents an alternative approach to radiocarbon (^{14}C) dating of organic material that has, in some cases, previously been used to gain information on absolute ages of moraines, e.g. in combination with measurements of the weathering rind thickness on boulders. In this context, cosmogenic ^{10}Be dating has the important advantage that an absolute age for the exposure of boulder or bedrock surfaces is given, exactly what is tested with the Schmidt-hammer (or weathering rind thickness) as well. Radiocarbon dated organic material is, by contrast, not only difficult or impossible to find at some localities/moraines, the temporal relationship to the processes of moraine formation and the related glacial dynamics is not always free of possible misinterpretations and doubts. There is, however, one disadvantage of cosmogenic nuclide exposure dating: the limited number of boulders sampled due to high costs. This points directly towards a combination with the Schmidt-hammer technique, as the latter could provide measurement of a large number of boulders. Additionally, the Schmidt-hammer can be applied to crosscheck the boulder chosen for cosmogenic nuclide sampling in order to avoid unrepresentative (e.g. rotated) boulder surfaces.

Preliminary results of this combined approach at Strauchon Glacier in Westland/*Tai Poutini* National Park for a large lateral moraine complex with several individual moraine ridges will be presented in order to show the potential of this "multi-proxy approach". Schmidt-hammer measurements have been used to group the moraine ridges into three groups formed during Late-Holocene Little Ice Age-type events prior to the Little Ice Age, whereas a number of samples that have been dated by cosmogenic ^{10}Be gave ages of c. 2,400 a BP, c. 1,700 a BP and c. 1,000/1,100 a BP for these advances. The innermost ridges were dated by a simple dating curve. Even if more subsequent cosmogenic ^{10}Be-dating is necessary to confirm the first preliminary results, the attempt to combine "absolute" cosmogenic surface exposure dating and the relative age-dating technique of the Schmidt-hammer seems to be promising and provides a successful alternative to radiocarbon dating in this special "multi-proxy" approach to improve Holocene glacier chronologies.

Literature:

Winkler, S. 2005: The 'Schmidt hammer' as a relative-age dating technique: potential and limitations of its application on Holocene moraines in Mt Cook National Park, Southern Alps, New Zealand. *New Zealand Journal of Geology and Geophysics* 48, 105 – 116.