



## **Palaeoclimatic interpretation of moraines: Identifying limitations and future tasks (the case study Southern Alps/New Zealand)**

Stefan Winkler (1) and Martin Kirkbride (2)

(1) University of Canterbury, Department of Geological Sciences, Christchurch, New Zealand (stefan.winkler@canterbury.ac.nz, +64 (0)3 364 2769), (2) University of Dundee, Geography, School of the Environment, Dundee, U.K.

During the past 20 years, the widespread deployment of terrestrial cosmogenic nuclide dating (TCND) alongside other substantial geochronological advances in laboratory precision and model calibration have seen an impressive increase in both number and claimed resolution of well-dated geomorphological reconstructions of mountain glacier fluctuations. Correlations at local, regional and hemispheric scales have frequently been performed on basis of those studies that partly include sophisticated probability analyses for reducing the statistical uncertainty of moraine ages, and analyses of glacier sensitivity to temperature and precipitation forcing.

Although these recent advances especially with dating modern dating techniques are acknowledged, some basic conceptual issues still remain. It seems that in certain cases “technical” progress and improved modelling skills have encouraged us to over-reach our interpretive limits and overstate our optimism regarding “reliability” of glacier chronologies and their correlation. Critical evaluation of the interpretative limitations of chronological studies is not always recognised to the necessary extent. Interdisciplinary approaches – indispensable for the complex subject covering Geochronology, Glaciology, Glacial Geomorphology and Palaeoclimatology – are still not necessarily the norm.

Based on a brief theoretical outline of the requirements for “reliable” palaeoclimatic interpretation of moraines (cf. Winkler & Matthews 2010, Kirkbride & Winkler 2012), one of the high-potential key sites for the investigation of Holocene glacier variation, the Southern Alps of New Zealand, are taken as case study to highlight a few of the practical limitations and outline future tasks that need improvement. Those tasks are – among others – identified as: (1) minimise the “geomorphological” uncertainty with the numerical dating of moraines, (2) identify possible non-glacial influence on the formation of moraines and address the potential misleading effect of large-scale mass movements on their subsequent palaeoclimatic interpretation, (3) improve the control on spatial coherence of existing data, and finally (4) include glaciological considerations and critical evaluation of the proposed resolution with any attempts of intra-hemispheric and global correlation.

### References:

Kirkbride, M.P. & Winkler, S. (2012): Correlation of Late Quaternary glacier chronologies: impact of climate variability, glacier response, and chronological resolution. *Quaternary Science Reviews* 46, 1 – 29.

Winkler, S. & Matthews, J.A. (2010): Holocene glacier chronologies: Are ‘high-resolution’ global and inter-hemispheric comparisons possible? *The Holocene* 20, 1137 – 1147.