



## **Surface exposure dating of moraines in Bolivia: unrecognized uncertainties and paleoclimatic implications**

**R. Zech** (1), Ch. Kull (2), P.W. Kubik (3) and H. Veit (1)

(1) Institute of Geography, University of Bern, Switzerland, (2) PAGES IPO, Bern, Switzerland, (3) Institute of Particle Physics, ETH Zurich, Switzerland  
(roland.zech@giub.unib.ch / Fax: +41 31 631 8511 / Phone: +41 31 631 8019)

Surface Exposure Dating provides a new tool to directly date moraines and to establish glacial chronologies. We dated 28 boulders in three valleys in the Cordillera Real and the Cordillera Cochabamba, Bolivia, in order to contribute to the reconstruction of the Late Quaternary glacial and climate history in the Central Andes. Our exposure ages indicate that glacial advances occurred  $\sim 20$  ka ago. Significant re-advances are dated to  $\sim 12$  ka. We tentatively infer that low temperatures during the global LGM (Last Glacial Maximum:  $\sim 20$  ka), as well as during the Late Glacial ( $\sim 12$  ka) were mainly responsible to trigger the observed glacial advances. Precipitation – related to the tropical monsoonal circulation – was thus not a major limiting factor at least for parts of the Cordillera Occidental.

Our results seem to be in disagreement with recently published exposure age chronologies from the tropical Central Andes in Bolivia and Peru. It has been suggested that the local LGM occurred earlier during the last glacial cycle ( $\sim 30$  ka), with re-advances  $\sim 17$  ka. However, the apparent disagreement can be attributed to different exposure age calculations only. This highlights the hitherto unrecognised systematic uncertainties of surface exposure dating, which is mainly due to large differences in the applied scaling systems (latitude and altitude dependence of the cosmogenic radiation) and due to differences in the reference production rate used. Without further studies solving these controversial issues, for example local calibrations based on independent age controls, paleoclimate interpretations of exposure ages should be very tentative.