

Constraining paleo-glacier extent and local erosion using OSL and ¹⁰Be surface exposure dating

Benjamin Lehmann*, Pierre G. Valla **, Georgina E. King **, Susan Ivy-Ochs***, Olivia Kronig *** and Frédéric Herman *

* Institute of Earth Surface Dynamics, Faculty of Geosciences and Environment, University of Lausanne, CH-1012 Lausanne (benjamin.lehmann@unil.ch)

** Institute of Geological Sciences and Oeschger Center for Climate Research, University of Bern, 3012 Bern

*** Laboratory of Ion Beam Physics, ETH Zurich, 8093 Zurich, Switzerland

In this study, we present a new approach to evaluate post-glacial bedrock erosion in mountainous environments by combining ¹⁰Be and optically stimulated luminescence (OSL) surface exposure dating (Haberman et al., 2000; Sohbaty et al., 2011). It relies on the idea that both OSL-signal bleaching and ¹⁰Be concentration within a rock sample depend on the exposure time and the surface erosion rate. We developed an iterative approach that enables us to invert OSL bedrock and ¹⁰Be concentration into exposure time and erosion rate. We then apply our approach to a well-constrained glacial environment: the Mer de Glace glacier (Mont Blanc massif, France). Samples were collected on granitic bedrock surfaces between the LGM ice surface (~2505 m a.s.l., Coutterand et al., 2006) and the present-day glacier (1920 m a.s.l.), covering ~600 m of elevation over which the ice has fluctuated since the LGM. Our results exhibit increasing exposure age with sample elevation, from 0.2 ± 0.1 to 21.0 ± 1.4 ka, and an integrated erosion rate varying from 0.5 to 5 mm.ka⁻¹ since the Last Glacial Maximum. We thus propose that combining OSL and ¹⁰Be surface exposure dating would allow to constrain both paleo-glacier fluctuations and weathering processes during the Lateglacial to Holocene times.

REFERENCES

- Habermann, J., Schilles, T., Kalchgruber R., Wagner, G.A. 2000: Steps towards surface dating using luminescence. *Radiation Measurements* 32(5): 847-851.
- Sohbaty, R., Murray, A.S., Jain, M., Buylaert J-P., Thomsen K.J. 2011: Investigating the resetting of osl signals in rock surfaces. *Geochronometria*, 38(3).
- Coutterand, S. and J.-F. Buoncristiani. 2006: Paléogéographie du dernier maximum glaciaire du Pléistocène récent de la région du massif du Mont Blanc, France. *Quaternaire. Revue de l'Association française pour l'étude du Quaternaire*, 17(1): 35-43.