Geophysical Research Abstracts
Vol. 18, EGU2016-9675, 2016
EGU General Assembly 2016

Reconstruction of glacier fluctuations in the Western Alps since the LGM using OSL surface exposure dating

Benjamin Lehmann (1), Georgina King (2), Pierre Valla (1), and Frederic Herman (1)

(1) Institute of Earth Surface Dynamics, Faculty of Geosciences and Environment, University of Lausanne, CH-1012 Lausanne , (2) Institute of Geography, University of Cologne, D-50923 Cologne, Germany

Providing tight spatial/temporal constraints on late-Pleistocene glacier fluctuations remains an important challenge for understanding glacier response to climate change. In most mountainous settings, paleo-glacier reconstructions are limited because they lack precise temporal constraint, which would enable their use as a paleoclimate proxy. OSL-surface exposure dating has been recently proposed [Sohbati et al., 2011] and offers the potential to improve paleo-glacier reconstruction. Because the OSL signal is sensitive to light, OSL-signal bleaching within a rock sample depends on its exposure time and environmental conditions, and can therefore be used to date the exposure time of glacially-polished bedrock or erratic boulders. However, successful application of this technique first requires calibration and validation.

Here, we focus on the Mer de Glace glacier (Mont Blanc massif, France) where the post-LGM glacier dynamics remain poorly constrained with numerous short glacier re-advances occuring during the mid-Pleistocene and Holocene [LeRoy et al., 2015]. First, the different parameters involved in OSL surface exposure dating were calibrated. Vertical transect of polished bedrock surfaces with known exposure ages (from 10 to 165 years) from the Montenvers train station (1913 m a.sl.) to the present-day position of the Mer de Glace (1600 m a.s.l.) was sampled.
Secondly, we sampled the Trelaporte transect where exposed bedrock surfaces are of uniform lithology. Here, we will apply similar approach on a much longer timescale, from the Last Glacial Maximum (LGM, ∼24 ka, Coutterand et al., 2006) to the present day.
OSL data from rock slices show increasing exposure age with elevation which is consitent with glacier thinning since the Little Ice Age. Moreover, our results confirmed the possibility to first calibrate the model parameters on known-age surface and use it to constrain the exposure time for nearby bedrock surfaces. In summary, OSL-surface exposure dating applied to periglacial environments appears to be a promising method to high-resolution reconstruction (both spatial and temporal) of ice-extent fluctuations over the LGM.

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