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Quantification of glacial erosion in the Alps using OSL-thermochronology

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The impact of glaciations on the topography of the Alps is still unclear: Long-term denudation rate determined by low-T thermochronology are in the range of 0.2 to 1 mm/yr, and increased during the Plio-Quaternary by $\tilde{3}$ fold (Vernon et al., 2008). Such an increase is also documented by peri-alpine sediment budget (Kuhleman, 2000), with a two to three fold increase in sediment yields since 5-3 Ma. This increase was considered as evidence of a climatically-driven surface process change, a large component of which was attributed to increased precipitation (Cederbom et al., 2004) and erosion by glacial processes (Champagnac et al., 2007). The transition from full fluvial to glaciated landscape must have involved major changes in topography and erosion rates, in particular given the changes in sediment yield (Kuhlemann, 2000; Mutoni et al 2003). However, the timing of the onset of intense glacial erosion as well as its rates are still ambiguous. The glacial erosion seems to have accelerated around 0.9 Ma as suggested by the ten fold increase of incision rates of a valley in the Central Alps (Häuselmann et al., 2007), and by information about vegetation and sedimentologic changes (Muttoni et al., 2003; Scardia et al., 2006). There is however no direct quantification of topographic change during the Plio-Quaternary.

We present here how we use OSL-thermochronology, a new thermochronometer of exceptionally low closure temperature (about 30-400 C) (Herman et al subm.) and a glacial erosion model (Herman and Braun 2008) to estimate topographic changes in the Alps in response to glaciations. Because of its low closure temperature, OSL-thermochronology enables quantification of events of less than 1 Ma at very small wavelength of the topography. We collected two vertical profiles, one in the Zermatt Valley (Valais) and one in Maurienne Valley (Savoy). We infer from these results changes in topography, date and quantify relief creation under glacial - interglacial cycles.

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