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The interplay of glacier retreat, tectonic and landslides: Contribution of cosmonuclides (10Be)

Romain Darnault (1), Yann Rolland (1), Guillaume Sanchez (1), Stéphane Bouissou (1), Régis Braucher (2), and Didier Bourlès (2)

(1) Université de Nice - Sophia Antipolis, Geoazur, France (romain.darnault@unice.fr), (2) CEREGE, Université Aix-Marseille, France

The Alpine Range is shaped by the combined effect of glaciers and rivers, which dug valleys along the tectonic fabric. It is noticeable that widespread slope failure occurred across the Alpine arc along some of the main recent to active fault corridors (Le Roux et al., 2008; Sanchez et al., 2010). However, it remains difficult to discriminate such instabilities from the effect of climate change or river incision, and to ascribe a passive or active role to tectonic processes.

To clarify the role of climate change, rivers and tectonics in the triggering of landslides, we dated glacial polished surface in the South Western Alps with 10Be cosmonuclide dating method. The aim of this study is to compare the pre-existing ages in Northern Alps with this new set of data to establish a timing of deglaciation at the Alps scale.

The slopes of the studied South Western Alps Tinée Valley in the Argentera Mercantour Massif bear two planar surfaces (1) the higher slope part with an average slope of 30 $\pm$ 5° and (2) the lower slope part with an average slope of 60 $\pm$ 10°. The ages obtained for these polished glacial surfaces are respectively (1) 14,9 $\pm$ 0,8 ka, which corresponds to the end of the Oldest Dryas period and (2) 11,2 $\pm$ 0,7 ka, which fits with the end of the Younger Dryas. Finally, a narrow corridor zone has been dated at 8,4 $\pm$ 0,9 ka. This younger age is attributed to the northerly exposure and the high elevation of this corridor that may have allowed the preservation of ice cap after the end of Younger Dryas.

These three age ranges can be respectively correlated to three similar age ranges obtained with the same methods in the Northern Alps: 16,0 $\pm$ 0,9 ka, 11,3 $\pm$ 0,9 ka and 9,0 $\pm$ 0,9 ka (Ivy-Ochs et al., 2009). Consequently, it appears that the timing of deglaciation is similar on both sides of the Alps. This observation implies a rapid deglaciation at the Alps scale for these three post LGM glacial periods, related to a fast climate change. Subsequently, large quantities of water were released during this rapid melting event. This large and sudden water influx could play a triggering role in tectonic and landslide pluses. Actually, some studies realised in the Tinée Valley have dated landslides pulses at 11–12 ka and 7-9 ka (Bigot-Cormier et al., 2005) and tectonic pulses at 11,2 ka and 7,7 ka (Sanchez et al., 2010). From these dating results it appears that landslides and tectonics directly follow deglaciation phases.

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