

## **Reconstruction of the rock fall/avalanche frequency in the Mont Blanc massif since the Last Glacial Maximum. New results using $^{10}\text{Be}$ cosmogenic dating and reflectance spectroscopy**

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Rockfalls and rock avalanches are active processes in the Mont Blanc massif, with infrastructure and alpinists at risk. Thanks to a network of observers (hut keepers, mountain guides, alpinists) set up in 2007 present rockfalls are well surveyed and documented. Rockfall frequency over the past 150 years has been studied by comparison of historical photographs, showing that it strongly increased during the three last decades, especially during hot periods like the summer of 2003 and 2015, due to permafrost degradation driven by the climate change. In order to decipher the possible relationship between rockfall occurrence and the warmest periods of the Lateglacial and the Holocene, we start to study the morphodynamics of some selected high-elevated (>3000 m a.s.l.) rockwalls of the massif on a long timescale.

Contrary to low altitude, deglaciated sites where study of large rockfall deposits allows to quantify frequency and magnitude of the process, rockfalls that detached from high-elevated rockwalls are no more noticeable as debris were absorbed and evacuated by the glaciers. Therefore, our study focuses on the rockfall scars. Their  $^{10}\text{Be}$  dating gives us the rock surface exposure age from present to far beyond the Last Glacial Maximum, interpreted as the rockfall ages. TCN dating of rockfalls has been carried out at the Aiguille du Midi in 2007 (Boehlert et al., 2008), and three other sites in the Mont Blanc massif in 2011 (Gallach et al., submitted). Here we present a new data set of rockfall dating carried out in 2015 that improves the 2007 and 2011 data.

Furthermore, a relationship between the colour of the Mont Blanc granite and its exposure age has been shown: fresh rock surface is light grey (e.g. in recent rockfall scars) whereas weathered rock surface is in the range grey to orange/red: the redder a rock surface, the older its age. Here, reflectance spectroscopy is used to quantify the granite surface colour.

Böhlert, R., Gruber, S., Egli, M., Maisch, M., Brandová, D., Haeberli, W., Ivy-Ochs, S., Christl, M., Kubik, P.W., Deline, P. (2008). Comparison of exposure ages and spectral properties of rock surfaces in steep, high alpine rock walls of Aiguille du Midi, France. Proceedings of the 9th International Conference on Permafrost, 143–148.

Gallach, X. et al. (submitted). Timing of rockfalls in the Mont Blanc massif (western Alps). Evidences from surface exposure dating with cosmogenic  $^{10}\text{Be}$ . Landslides.