Geophysical Research Abstracts
Vol. 16, EGU2014-15871, 2014
EGU General Assembly 2014

Calibration of cosmogenic ^{3}He and ^{10}Be production rates in the High Tropics

Pierre-Henri Blard (1), Léo Martin (1), Jérôme Lavé (1), Julien Charreau (1), Thomas Condom (2), Maarten Lupker (3), Régis Braucher (4), and Didier Bourlès (4)

(1) CRPG-CNRS, Université de Lorraine, Vandoeuvre-lès-Nancy, France (blard@crpg.cnrs-nancy.fr), (2) LTHE-LGGE-CNRS-IRD, Grenoble, France, (3) ETH, Zurich, CH, (4) CEREGE-CNRS, Aix-Marseille Université, Aix-en-Provence, France

It is critical to refine both the accuracy and the precision of the in situ cosmogenic dating tool, especially for establishing reliable glacial chronologies that can be compared to other paleoclimatic records. Recent cross-calibrations of cosmogenic ^{3}He in pyroxene and ^{10}Be in quartz [1, 2] showed that, both at low (1300 m) and high elevation (4850 m), the ^{3}He/^{10}Be production ratio was probably $\sim$40% higher than the value of $\sim$23 initially defined in the 90's. This recent update is consistent with the last independent determinations of the sea level high latitude production rates of ^{10}Be and ^{3}He, that are about 4 and 125 at.g^{-1}.yr^{-1}, respectively [e.g. 3, 4]. However, major questions remain about these production rates at high elevation, notably because existing calibration sites for both ^{3}He and ^{10}Be are scarce above 2000 m. It is thus crucial to produce new high precision calibration data at high elevation.

Here we report cosmogenic ^{10}Be data from boulders sampled on a glacial fan located at 3800 m in the Central Altiplano (Bolivia), whose age is independently constrained by stratigraphic correlations and radiocarbon dating at ca. 16 ka. These data can be used to calibrate the production rate of ^{10}Be at high elevation, in the Tropics. After scaling to sea level and high latitude, these data yield a sea level high latitude P_{10} ranging from 3.8 to 4.2 at.g^{-1}.yr^{-1}, depending on the used scaling scheme.

These new calibration data are in good agreement with recent absolute and cross-calibration of ^{3}He in pyroxenes and ^{10}Be in quartz, from dacitic moraines located at 4850 m in the Southern Altiplano (22°S, Tropical Andes) [2,5]. The so-obtained ^{3}He/^{10}Be production ratio of 33.3$\pm$0.9 (1σ) combined with an absolute ^{3}He production rate locally calibrated in the Central Altiplano, at 3800 m, indeed yielded a sea level high latitude P_{10} ranging from 3.7$\pm$0.2 to 4.1$\pm$0.2 at.g^{-1}.yr^{-1}, depending on the scaling scheme [2,5]. These values are also consistent with the ^{10}Be production rate recently calibrated in Southern Peru, 1000 km north from the bolivian sites [6].

These new refinements of the cosmogenic dating tool significantly improve both the accuracy and the precision of paleoglaciers chronologies in the Tropical Andes. It is now theoretically possible to reach precisions better than 5% (at 1σ) for dating glacial landforms deposited during the last 20 ka.

[1] Amidon et al. (2009) Earth Planet. Sci. Lett. 280, 194-204.

[2] Blard et al., (2013) Earth Planet. Sci. Lett. 382, 140-149.

[3] Putnam et al. (2010) Quat. Geochron. 5, 392-409.

[4] Goehring et al. (2010) Quat. Geochron. 5, 410-418.

[5] Blard et al., (2013) Earth Planet. Sci. Lett. 377-378, 260-275.

[6] Kelly et al. (in press) Quat. Geochron.