Complex *in situ* cosmogenic ^{10}Be-^{14}C data suggest Mid-Holocene climate change on the Bolivian Altiplano

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In a recent study on basin-averaged denudation rates on the Bolivian eastern Altiplano, long-lived ^{10}Be and ^{26}Al have been used to provide long-term estimates on sediment production while the short-lived *in situ* ^{14}C allowed to identify interruptions of sediment exposure by episodes of sediment storage [1]. Based on comparatively low *in situ* ^{14}C concentrations sediment storage over at least the past 11- 20 ka has been suggested.

Following this approach, we have chosen to focus on one single catchment on the eastern Altiplano (~350 km^2) to trace the spatial pattern of sediment deposition and quantify individual storage durations. Sediment samples were taken along the main channel and from tributaries as well as from three hilltop sites. Results from the analysis of ^{10}Be and *in situ* ^{14}C are in agreement with previous data [1] showing a high ^{10}Be content and significantly too low *in situ* ^{14}C concentrations for all but one sample, including two of the three hilltop samples. Excluding sediment storage/burial on the hilltop for obvious reasons and excluding soil mixing or slab breakoff from field observations, we propose a change in denudation rate to account for the discrepancy of ^{10}Be and *in situ* ^{14}C on the hilltop. Using a simple model of a rapid, one-step denudation increase, the two samples suggest a minimum 30-40 times increase in denudation rate about 4-6 ka ago.

Assuming that the analyzed fluvial sediments have already an inherited complex ^{10}Be-^{14}C signal from the sediment-producing hilltop areas, the total duration of sediment storage reduces to ~1-5 ka, thus much shorter than previously assumed. Our data further show that sediment storage occurring on the floodplain does not contribute to the complex cosmogenic nuclide signal. In contrast to the channels in the upstream area, that incise a few metres in depth, the material deposited on the floodplain is apparently only rarely reworked.

[1] Hippe *et al* (2012) *Geomorphology* **179**, 59-70.

Mantle structure below the petit-spot

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The petit-spot volcanoes, erupted due to lithospheric bending related to the plate subduction, were found on the subducting plate off Japan and Chile trenches [1, 2]. An old and flexed lithosphere might cause brittle fractures at the upper lithosphere. Incipient melts in the asthenosphere can be squeezed upward by tectonic forces associated with plate flexure [1]. The presence of the tiny submarine volcanoes, petit-spot, is an important indicator of the stress field of the plate [3], in addition to providing information on the geochemical composition of the mantle below the petit-spot [4, 5, 6, 7].

The lavas and entrained xenolithes were newly dated and analyzed in this study. Accordingly, monogenetic petit-spot volcanoes located on the NW Pacific Plate yield ages of 1.8, 3.8, 4.2, 6.0, 6.2, 8.5, and 9.2 Ma by Ar-Ar datings, suggesting the episodic eruption of magma over a large eruption area (over 800 km of plate motion) of the concave part of the plate, but with low volumes of magma production [8]. Most of lavas have the differentiated composition of approximately 50 wt% SiO2 and 60 of Mg number with extremely high contents of carbon dioxide. The petrography and geobarometer of peridotitic xenolithes show that they rapidly ascended through the upper lithosphere. These data implies the magma differentiated at the depth deeper than middle of lithosphere where the carbon dioxide does not exsolve in magmas.

[1] Hirano *et al* (2006) *Science* **313**, 1426-1428. [2] Hirano *et al* (2013) *Geochem. J.* **47**, in press. [3] Valentine & Hirano (2010) *Geology* **38**, 55-58. [4] Machida *et al* (2009) *Geochem. Cosmochim. Acta* **73**, 3028-3037. [5] Hirano (2011) *Geochemi. J.* **45**, 157-167. [6] Yamamoto *et al* (2009) *Chemical Geol.* **268**, 313-323. [7] Machida *et al* (2013) *MinMag*, this volume. [8] Hirano *et al* (2008) *Basin Res.* **20**, 543-553.

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