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^{21}Ne and ^{3}He ages on quartz and Fe-Ti-oxide minerals from the Atacama Desert, northern Chile

Rita Haeussler (1), Tibor J. Dunai (2), Finlay M. Stuart (1), Gabriel A. González López (3)

(1) Scottish Universities Environmental Research Centre (SUERC), East Kilbride, UK

(2) School of Geosciences, University of Edinburgh, Edinburgh, UK

(3) Dep. de Ciencias Geológicas, Universidad Católica del Norte, Antofagasta, Chile

r.haeussler@suerc.gla.ac.uk

Exposure ages derived from cosmogenic ^{21}Ne measurements in quartz clasts from sediment surfaces in the Atacama Desert, northern Chile, indicate an age of the onset of hyperaridity in the Atacama Desert of $\sim$ 25 Ma [1]. Since then this region has practically been unaffected by erosion. Brief pluvial episodes occasionally interrupted the prevalent hyperaridity [1, 2].

We sampled Fe-oxide pebbles from an uplifted sediment surface in the Central depression east of the Salar Grande in Chile. The Fe-oxide pebbles originate from a gossan in the Precordillera to the east. Modern sedimentation onto the sediment surface is inhibited as it is uplifted above the level of the presently active alluvial fans from the Precordillera.

^{3}He measurements from six different pebbles give a wide spread of apparent exposure ages of $\sim$ 7 Ma up to $\sim$ 65 Ma. Preliminary results of ^{21}Ne measurements on quartz separated from the same pebbles of three of the sampling sites yield exposure ages of 3 to 6 Ma and one very young age of 150 kyr.

The very high 3He ages could be caused by an enhanced production of cosmogenic ^{3}He by

cosmogenic thermal neutrons (CTN) producing ^{3}He via the ^{6}Li(n,α)^{3}H(β)^{3}He reaction [3], however, Li concentrations are 1-3 orders of magnitude too low in order to

explain the observed effect. Alternatively production at high mountain elevations prior to erosion, transport and deposition is potentially a suitable mechanism to explain the high apparent exposure ages. If the latter was be the case the discrepancy between ^{3}He and ^{21}Ne ages would need explanation. This discrepancy might be due to loss of ^{21}Ne from quartz by diffusion. The quartz crystals analyzed were small (125-500 μm) and thus will loose cosmogenic 21Ne in hot desert environments [4]. The low albedo of the Fe-oxide pebbles, in which these small quartz crystals occur, would further enhance this effect.

Ongoing ^{3}He measurements on Fe oxides are aimed at testing the reproducibility of the older ages, and planned ^{53}Mn measurements on Fe-Ti-oxide minerals from the same samples will help to constrain the actual exposure history.

[1] Dunai et al., (2005) Geology 33 (4): 321-324

[2] Evenstar et al., (2007) EGU Abstract, this volume

[3] Dunai et al. Submitted to EPSL

[4] Shuster DL, Farley KA, (2005) Geochimica et Cosmochimica Acta 69 (9): 2349-2359