Re-evaluation of ^{10}Be production by muons

BRAUCHER R.[1], BOURLÈS D.L.[1], BROWN E.T.[1,2], COLIN F.[1]

[1] CEREGE, Plateau de l' Arbois BP80, 13545 Aix-en-Provence, France. E-mail: braucher@cerege.fr, bourles@cerege.fr.

[2] Large Lake Observatory, University of Minnesota, 2205 East 5th Street Duluth, MN 55812, USA

Among other applications to the study of the Earth surface evolution, *in situ*-produced ^{10}Be has been used to characterize and quantify processes leading to the emplacement of lateritic soils. Here we present a ^{10}Be concentration profile measured along a quartz vein embedded within saprolite. In order to quantify erosion and exposure time using the depth variability of a cosmogenic nuclide, it is crucial to constrain the particle attenuation lengths involved in its production.

The present work focuses on the Mato Grosso region of Brazil, a semi-arid savanna with gently rolling hills, where earlier work indicates mean erosion rates of about 2.5 m/My (Braucher et al., EPSL,163, 1998). A quartz vein located in the Itaipu Mine (15°S, 53°W; Brazil) was sampled from the surface to a depth of 15 meters. Field observations suggest that 4 m of soil was removed from the surface during excavation of the mine.

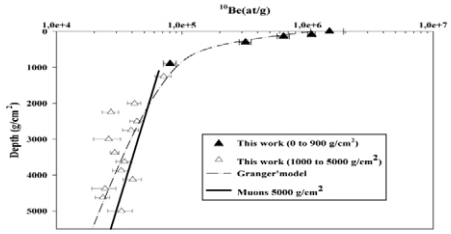

Fig. 1 : Depth evolution of ^{10}Be concentrations for the Itaipu Mine quartz vein (Open triangles). Depths have been adjusted for soil loss during mining operations; for comparison we include surface data (black triangles) from an unperturbed quartz vein located near the mine site. The solid line represents theoretical ^{10}Be concentrations obtained using an apparent muon attenuation length of (5000±500) g/cm^2. The dash-dot line represents the ^{10}Be concentrations using the model of Granger and Smith (Nucl. Instr. Meth.B 172, 2000), based on ^{36}Cl production profiles of Stone et al. (GCA 62-3, 1998), which corresponds to a muon attenuation length of ~3000 g/cm^2. At depths greater than 1000 g/cm^2, deep enough for neutron-induced reactions to be insignificant, there is only a slight decrease in ^{10}Be concentration with increasing depth. Low U/Th contents (<5 ppb), indicate that radiogenic ^{10}Be production is likely to be negligible, and can not be invoked as the cause. Our results are consistent with deep production of ^{10}Be by a mechanism, presumably induced by muons, with an attenuation length of 5000±300 g/cm^2. This is somewhat greater than the value of ~3000 g/cm^2 derived from depth variability of ^{36}Cl, suggesting that reactions leading to ^{10}Be production may be induced by a higher energy component of reactive muons.

Re/Os-Studies of the German Kupferschiefer

MICHAEL BRAUNS AND UDO HAACK

michael.brauns@geolo.uni-giessen.de, udo.haack@geolo.uni-giessen.de

Abstract

Although the Kupferschiefer ore districts in Germany have been mined for more than 800 years and despite a long research history the controversies about the mechanism of metal accumulation are not yet settled. In this respect informations about the age of mineralization might help to decide between competing hypotheses or incite new ideas. However, the ores and the wall rocks do not lend themselves readily to the classical U/Pb-, K/Ar-or Rb/Sr-methods of geochronology and no precise radiometric age exists as yet. In this situation the new Re/Os-technique looked promising and was applied to four ore profiles: to the unmineralized Kupferschiefer samples from two drill holes near Dortmund in Western Germany, to an ore profile from Sangerhausen and to an ore profile from Lengefeld both situated in the southern foreland of the Harz mountains in the former German Democratic Republic. Trace element analysis however, allow us to draw conclusions on the genesis of the Kupferschiefer formation. We tried to obtain an isochron and thereby the isotopic composition of Os in the Kupferschiefer sea. At the same time the study is a contribution to a better knowledge of the geochemistry of Re and Os.