Meteoric ^{10}Be in soils of loessic origin- a case study of Luvisols from Northern France

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Meteoric ^{10}Be, due to its high affinity with soil and sediment particles, is a popular tracer in geomorphologic and environmental studies attempting to evaluate the soil production/denudation rates or soil age up to 10^7 years. However, the evolution of the ^{10}Be distribution as a function of depth is poorly known in soils, as has been shown by recent reviews [1, 2]. In this study, we have measured ^{10}Be concentrations of bulk samples and in 0-2 μm (lutum) granulometric fractions in Luvisols profiles developed on loess in Northern France. The three sites differ significantly in ^{10}Be absolute concentrations in bulk samples reflecting probably the past ^{10}Be accumulation in loess parent material. In all profiles, ^{10}Be concentrations in bulk samples show a significant correlation with the lutum content with the maximum ^{10}Be concentrations in the Bt-horizon. This result was surprising, as we expected the maximum concentration of ^{10}Be to appear at the soil surface, since ^{10}Be input occurs at the soil-atmosphere interface. Dominant adsorption of ^{10}Be to the lutum has been corroborated by measurements of ^{10}Be concentrations in lutum fraction and mass balance equation. Nevertheless, an anti-correlation has been observed between ^{10}Be concentrations in lutum and lutum content of the soils, thus outlining the dilution effect of lutum on ^{10}Be concentrations in this fraction. Contrary to the bulk samples, ^{10}Be concentrations in lutum show several maxima coinciding with the shifts in loess grain size distribution (coarse silt/fine silt), probably due to different episodes of pedogenesis occurrence. Finally, in order to quantify ^{10}Be transfers in these soils, a mass balance and numerical modelling approach of diffusion-convection equation has been used.

[1] Graly *et al*. (2010) *GCA* **74**, 6814-6829. [2] Willenbring & von Blanckenburg (2010) *ES-Reviews* **98**, 105-122.

Were ancient granitoid compositions influenced by contemporaneous atmospheric and hydrosphere oxidation states?

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A fundamental shift in the nature of granitoids occurs at approximately the Archean-Proterozoic boundary. Archean crust is dominated Na-rich tonalite-trondhjemite-granodiorites (TTGs), whereas post-Archean granitoids are characterized by K-rich granodiorite-granite (GG). Due to the HREE depletion commonly found in TTGs indicating the presence of residual garnet, many researchers have proposed that the difference in Na/K is related to the deeper melting depth of the TTG parental liquids.

Here I present a compilation of the relevant experimental data, documenting that no correlation exists between the Na/K of derivative felsic liquids and the pressure of partial melting/fractional crystallization. Instead, the Na/K ratio of the felsic liquid best correlates with the Na/K ratio of the source. This implies that in Archean time the source material of TTG rocks must have been Na/K enriched relative to the modern. Modern granitoids are dominantly formed in a supra subduction zone environment, where a feedback loop exists between subducted materials (oceanic crust and sediments) and arc magmatism. Sea-floor weathering and the Na/K of the altered oceanic crust strongly depends on f(O2) conditions during alteration, which likely changed with earth history. During alteration under oxidized condition K2O is fixated due to the formation of celadonite (K-Mica), wheres during anoxic condition saponite (Na-Smectite) is the stable alteration mineral. I propose that the rise of oxygen at 2600–2400 Ma triggered associated changes in f(O2) seafloor alteration conditions (Jagoutz 2012). The change in the dominant seafloor alteration mineral from reduced to oxidized causes a change in the nature of the arc magma source and provides a possible explanation for the observed transition from TTG-rocks in the Archean to the GG-granitoids in post-Archean times.

[1] Jagoutz, O. (2012) Terra Nova, **25**, pp 95-101

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