Crustal growth along a 1.1 Ga non-collisional cratonic margin: U-Pb and Lu-Hf evidence from the Peruvian Eastern Cordillera

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The results of a coupled laser ablation (MC) ICPMS U-Pb and Lu-Hf isotopic survey of zircons from the Eastern Cordilleran intrusives of Peru reveal 1.15 Ga of magmatic activity along the western Amazonian margin largely dominated by mid-Phanerozoic (i.e. Gondwanide) plutonism related to the assembly and break up of Pangea. Hitherto unknown occurrences of the late Mesoproterozoic and Neoproterozoic granitoids from the south central cordilleran segment define magmatic events at 691 ± 13 Ma, 751 ± 8 Ma, 985 ± 14 Ma and 1071 to 1123 ± 23 Ma, broadly coeval with the Braziliano and Sunsás-Grenville orogenies. The Hf isotope systematics of magmatic zircons from the Eastern Cordillera batholiths are invariably characterised by a range in the initial $^{176}Hf/^{177}Hf$ compositions for a given intrusive event suggesting mixing of material derived from the Paleoproterozoic crustal substrate and variable Neoproterozoic to recent juvenile sources. The periods of well documented compressive tectonics correspond to negative mean εHf_i values of -6.73, -2.43, -1.57 for the Ordovician Puna-Famatinian, Carboniferous-Permian and late Triassic respectively, suggesting the minimum crustal contribution between 74% and 44% by mass. The average initial Hf systematics from granitoids associated with intervals of regional extension such as the middle Neoproterozoic, Permian-Triassic and Cenozoic Andean back arc plutonism are consistently shifted toward the positive values (mean εHf_i = -0.7 to + 8.0) indicating systematically larger inputs of juvenile magma (22% to 49% by mass). In the absence of the collisional tectonics, the time integrated Hf record from the proto-Andean margin of western Amazonia suggests crustal recycling as the dominant process during episodes of arc magmatism and implies that most of continental growth took place vertically via crustal underplating of isotopically juvenile, mantle derived magma during intervals of crustal attenuation.

Bentonite colloid generation from a deep geological repository in granite: An *in situ* study

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The role of bentonite colloids on radionuclide transport in crystalline rocks still presents large uncertainties. The present study includes first *in situ* analyses on bentonite colloid generation carried out at the Grimsel Test Site (Switzerland), where the FEBEX experiment, reproducing at a real scale a high-level waste repository in granite, was installed 10 years ago.

To analyze the formation of bentonite colloids, in realistic conditions, two hydro-geochemical boreholes (FUN1 and FUN2) were drilled quasi-parallel to the tunnel and at a distance of approximately 30 and 60 cm from the bentonite surface. Other 19 boreholes in radial position in respect to the tunnel already existed. Water sampling was performed both in the new and old boreholes.

The water in the FEBEX tunnel is slightly alkaline (pH 7-8) and with low (~100-200 μS/cm) electrical conductivity. In these conditions, bentonite colloids are expected to be stable. Several techniques were used for detection and characterisation of colloids in these waters (PCS, LIBD, SEM, FESEM, EDX). ICP-MS analyses of the water before and after ultra-centrifuging were carried out to know which trace elements are present in colloidal form.

Clay colloids were detected in some interval of the FUN 1 borehole and compared to those obtained in the laboratory studies of bentonite colloid generation. The similarity in both microstructure and composition was shown.

The quantification of bentonite colloids is still a difficult issue even so it's clear that at approximately 30 cm from the bentonite, the quantity of bentonite colloids cannot be higher than 1 ppm. Higher colloid concentration was measured by PCS, showing that artifacts, possibly introduced during the excavation of the new boreholes, exist. The analysis of these artifacts for a better quantification of the "source term" it's a very important issue at moment.

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