Reworked Hadean crust in the ca. 3780 Ma Nuvvuagittuq supracrustal belt

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Variably deformed amphibolites and granitoid gneisses of the Nuvvuagittuq supracrustal belt (NSB) preserve lower $^{142}Nd/^{144}Nd$ ratios than the terrestrial standard. Expressed as negative $\varepsilon^{142}Nd$ values, the amphibolites also show a slight positive correlation in Sm/Nd. Combined ^{142}Nd and ^{147}Sm-^{143}Nd data were used [1] to produce a ca. 4280 Ma isochron; this could make the NSB amphibolites the oldest preserved terrestrial rocks by about 300 Myr. Alternatively, the $^{142}Nd/^{144}Nd$ signal may be inherited from crustal recycling of remnant ancient mafic lithosphere and hence it would have no bearing on the crystallization ages of the amphibolites.

Here we report U-Pb ages for detrital igneous zircons with rhythmically zoned rounded cores and later metamorphic overgrowths, extracted from NSB fuchsitic quartzites. We show that they are statistically indistinguishable from other ~ 3800 Ma zircon ages obtained for transecting felsic gneisses [2, 3]. The zircon-bearing fuchsitic quartzites show: i) Elevated whole-rock Cr (>150 ppm) contents, and rounded chromites with mantling Cr-muscovite, inconsitent with orthogneiss compositions; ii) Enriched $LREE_{CN}$ and mantle-normalized multi-element compositions inconsistent with NSB chemical sediments (BIFs), but nearly identical to quartz-biotite schists (metaconglomerates) which also host mass-independently fractionated sulfur isotopes; iii) Major and trace elements, including elevated REE, Nb and Ti contents that are neither compatible with a silicification origin of NSB amphibolites, nor with hydrothermal quartz veinings; and iv) Oxygen isotopes consonant with a sedimentary origin.

It is thus improbable that amphibolites of the NSB represent relict genuine Hadean mafic crust captured in a supracrustal belt that can be no older than 3780 Myr. Comparison of detrital and igneous zircon ages from multiple lithologies in the NSB show that its initial development took place in under 20 Myr in the Eoarchean. However, our results do underscore the notion that recycling of volumetrically significant relict Hadean mafic crust continued to play a role in Eoarchean crustal processes, in accord with data in [1].

[1] O'Neil *et al*. (2008) *Science* **321**, 1828-1831. [2] Cates & Mojzsis (2007) *EPSL* **255** 9-21. [3] Cates & Mojzsis (2009) *Chem. Geol*. **261** 98-113.

Colloidal control on the distribution of major and trace elements in a small mountain stream (Malaval catchment, Massif Central, France)

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Organic and/or inorganic colloids play a major role in the mobilization and speciation of trace elements in river waters. Environmental physicochemical parameters (pH, Eh, T, ionic strength…) are the controlling factors of colloidal mobilization. Ultrafiltration experiments using small ultracentrifugal filter devices were performed at different pore size cut-offs (30 kDa, 10 kDa and 3 kDa) to study the colloidal control on partitioning of major and trace elements in stream water [1]. Six sites were sampled in the Malaval stream catchment from upstream to downstream (Massif Central, France [2]) during two sampling campaigns (September 2009 and June 2010) and analyzed for major and trace elements, and organic carbon. In addition to evolution with distance, the modification of the colloidal pool by water mixing at two confluences of the Malaval stream with tributaries was also studied.

The main results of the present study are the following: most elements behave coherently through time and their speciation evolves with distance from source. Based on principal component analysis and hierarchical ascendant classification performed on the whole ultrafiltration dataset, three groups of elements with a specific chemical behavior can be distinguished: (i) a dissolved group (Na, Mg, Si, K, Ca, Rb, Sr), (ii) a reactive group (Al, Fe, Y, Pb, Cu, Ni, As, U, Zr) and (iii) an intermediate group (Co). In addition to this statistical approach one trace element of each group (Sr, Co and Nd) has been studied in more detail on ultrafiltrated sample fractions (0.2 μg/L, 30 kDa, 10 kDa and 3 kDa). The results suggest that (i) the alkalines and alkaline earths are present as dissolved species, whereas (ii) rare earth elements and some metallic elements are bound to colloidal material. However, (iii) a few elements, like cobalt, have an ambivalent behavior: in some samples they behave like the first group and in others like the second group.

[1] Pourret *et al*. (2007) *App. Geochem*. **22**, 1568-1582 [2] Steinmann & Stille (2008) *Chem. Geol*. **254**, 1-18.