Geodynamical and geochemical constraints on continental crust formation since the Archean

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Complex geodynamical and geochemical processes at subduction zones modify the continental crust both by crustal addition by arc volcanism and erosion and recycling of continental material to the Earth's deep interior. It remains difficult to provide a quantitative history of the role of subduction in the evolution of continents since the Archean. Here we provide a combined geodynamical-geochemical study that addresses the long term role of subduction on continental formation and evolution.

The modeling we use is based on Brandenburg et al., 2008, in which a first attempt was made to combine realistic geodynamical models, that satisfy basic constraints from geophysics (heatflow, plate velocities) and geochemistry (^{40}Ar in the atmosphere and spread of HIMU-MORB-EM1 in multiple isotope systems), to understand the continental crust evolution. We found satisfactory agreement with the bulk continental crust composition (Rudnick and Gao, 2003) provided a change in 'dry' to 'wet' subduction was assumed around 2.5 Ga.

Here we provide a discussion of the following improvements on these preliminary models: i) higher resolution dynamical models than previously used; ii) an improved quantification of the subduction zone filter based on Arc-Basalt-Simulator modeling of present-day subduction and that extrapolated to a warmer Earth (Kimura et al., 2009; Syracuse et al., 2010); iii) new tests of the predicted geochemical evolution using recent synchronous Pb-Pb age and Hf isotopes that lead to a better determinations of the Hf evolution of the mantle source; iv) quantification of the role of sediment recycling on the formation of EM2.