Self-consistent generation of continental crust in global mantle convection models

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We present preliminary results of our mantle convection code in which the continental crust is generated self-consistently. The silica-rich continental crust appears to have been formed by fractional melting and crystallisation in episodes of relatively rapid growth from late Archaean to late Proterozoic eras (3-1 Ga) [1] which has also been linked to the onset of plate tectonics around 3 Ga [2]. It takes several stages of differentiation to generate continental crust. First, the basaltic magma is extracted from the pyrolitic mantle. Second, it goes through eclogitic transformation and then partially melts to form Na-rich Tonalite-Trondhjemite-Granodiorite (TTG) which rise to form proto-continents [3, 4]. TTGs dominate the grey gneiss complexes which make up most of the continental crust. Based on the melting conditions proposed by Moyen [5], we parameterize TTG formation and its subsequent melting to generate continental crust. Numerical modeling commonly shows that mantle convection and continents have strong feedbacks on each other, but the continents are always inserted a priori while basaltic (oceanic) crust is generated self-consistently in such models. We aim to implement self-consistent generation of continental crust in global models of mantle convection using StagYY [6]. Continental crust can also be destroyed by subduction or delamination. We will investigate continental growth and destruction history in the models spanning the age of the Earth.

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