Geophysical Research Abstracts
Vol. 14, EGU2012-3792-2, 2012
EGU General Assembly 2012

EAG Eminent Speaker: Two types of Archean continental crust: plume and plate tectonics on early Earth

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Over 4.5 billion years, Earth has evolved from a molten ball to a cooler planet with large continental plates, but how and when continents grew and plate tectonics started remain poorly understood. In this paper, I review the evidence that 3.5-3.2 Ga continental nuclei of the Pilbara (Australia) and Kaapvaal (southern Africa) cratons formed as thick volcanic plateaux over hot, upwelling mantle and survived due to contemporaneous development of highly depleted, buoyant, unsubductable mantle roots. This type of crust is distinct from, but complimentary to, high-grade gneiss terranes, as exemplified by the North Atlantic Craton of West Greenland, which formed through subduction-accretion tectonics on what is envisaged as a vigorously convecting early Earth with small plates. Thus, it is proposed that two types of crust formed on early Earth, in much the same way as in modern Earth, but with distinct differences resulting from a hotter Archean mantle. Volcanic plateaux provided a variety of stable habitats for early life, including chemical nutrient rich, shallow-water hydrothermal systems and shallow marine carbonate platforms.