Thermal history and origin of the Tanzanian Craton from Pb isotope thermochronology of feldspars from lower crustal xenoliths

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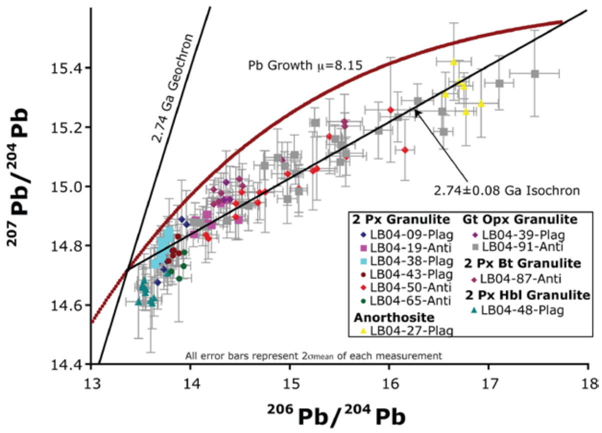
In order to further understand the formation and cooling histories of cratons; common and radiogenic Pb isotopic compositions of individual anti-perthite and plagioclase feldspars have been measured via laser ablation MC-ICP-MS from granulite-facies xenoliths from the Labait volcano on the margin of the Tanzanian Craton. A lack of radiogenic Pb in coexisting apatites and rutiles from the same samples shows that they derive from the present-day lower crust [1]. The Pb isotopic composition of these feldspars and a single stage Pb evolution model indicate that the lower crust of the Tanzanian Craton was extracted from the mantle at 2.74±0.08 Ga with a μ ($^{238}U/^{204}Pb$) of 8.15±0.25 and a *K* ($^{232}Th/^{238}U$) of 4.3±0.1. Single anti-perthitic crystals with heterogeneous Pb isotopic compositions yield ~2.6 Ga ages, identitical to U-Pb zircon ages from the same sample suite. Given the closure temperature of Pb in feldspar, these Pb isotopic heterogeneities require lower crustal temperatures to be kept at <600°C from ca. 2.6 Ga to the present. In concert with the chemistry of surface samples, mantle xenoliths, and lower crustal xenoliths, our data imply that the Tanzanian cratonic lithosphere formed in a convergent margin setting ca. ~2.7 Ga; the cratonic lower crust cooled to <600°C and has not re-equilibrated or undergone any fractionation with respect to U, Th, or Pb since that time.



[1] Blondes *et al*. (2010) *GCA* **74**, Suppl. (this volume).

Iron shear modulus in the Earth's inner core

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Shear modulus in the Earth's Inner Core (IC) is unusually low. We demonstrated [1], by means of molecular dynamics (MD) using embedded-atom model [2], that when a significant number of defects is introduced, the shear of body-centered cubic (bcc)iron [3, 4] under IC conditions is close to the one derived from seismic observations. Here, we were careful to not introduce any defects except those that appear due to equilibrium solidification. We placed in the box filled with 16 millions atoms in the liquid phase a solid sample and crystallized the sample by 2-phase method [5] very slowly by controlling the degree of undercooling. After obtaining solid sample, it was deformed by applying shear. The evolution of stress was then recorded for the constant shear. The stress relaxation exhibits clearly viscoelastic behavior. The shear modulus can be obtained as the value that would be observed during the time required for the sound velocity to pass through the sample. In both cases (with 1 million [1] and 16 millions atoms samples) the shear modulus in the Earth IC is close to 190 GPa. Since the potential we use is highly realistic, as was recently independently confirmed [6], the results can be considered as reliable. The size and time duration of simulations are the largest performed so far for the iron under IC conditions.

[1] Belonoshko *et al*. (2007) *Science* **316**, 1603–1605. [2] Belonoshko, Ahuja, & Johansson (2000) *Phys. Rev. Lett.* **84**, 3638–3641. [3] Belonoshko, Ahuja, & Johansson (2003) *Nature* **424**, 1032–1034. [4] Belonoshko *et al*. (2008) *Science* **319**, 797–800. [5] Belonoshko (1996) *GCA* **58**, 4039–4047. [6] Sola & Alfé (2009) *Phys. Rev. Lett.* **103**, 078501.