Pb-isotopic evidence from Isua for two Interacting Hadean-Archaean mantle reservoirs

AUSTIN J. BOYD[1] AND MINIK T. ROSING[2]

[1]Natural History Museum of Copenhagen, Øster Voldgade 5-7, 1350 Copenhagen K, Denmark; Austin.Boyd@snm.ku.dk
[2]Natural History Museum of Copenhagen, Øster Voldgade 5-7, 1350 Copenhagen K, Denmark; Minik@snm.ku.dk

The Isua Supracrustal Belt (ISB) hosts the least radiogenic terrestrial lead signature. This signature is found in galenas from metasomatized tonalite and requires a source with a high time integrated μ ($^{238}U/^{204}Pb$). We performed comprehensive Pb isotope analysis on compiled data from the ISB and its geological surroundings as well as new data from the ultramafic units of the ISB. Many samples have fully or partially equilibrated with regional Pb during various metamorphic events, but a subgroup lies on a model 3.71 Ga isochron pointing past any of the standard curves. This indicates that the rocks were derived from the same high μ reservoir as the galenas. These rocks are all expected to have originally contained a primitive mantle derived Pb isotopic composition. Our study also reveals the existence of an additional reservoir with low time-integrated μ, which is exemplified best by the original composition of the surrounding TTGs. We suggest that many metasomatic phases and rocks within the ISB have original Pb isotopic compositions intermediate between the low and high μ reservoirs indicating mixing between units derived from the two during various metamorphic events. We construct a Pb isotopic evolution model, which is constrained by the ISB data and which takes into account recent $^{142}Nd/^{143}Nd$ ISB evidence for the development of dual interacting mantle reservoirs in the Hadean [1]. In this model, two Pb isotopic reservoirs, low μ and high μ diverge at ~4.47 Ga and gradually remix together. The presence of the two reservoirs in the source region of the igneous rocks of the ISB can explain the breadth of values seen in the ISB region. If conceptually true, the model implies a geodynamic regime for the early Earth in which there was vigorous convection and it thus speaks against a static lid model. This early regime could have been a transient form of plate-tectonic like behavior.

[1] Rizo, H., Boyet, M., Blichert-Toft, J., & Rosing, M. (2011). Combined Nd and Hf isotope evidence for deep-seated source of Isua lavas. *Earth and Planetary Science Letters*, **312(3)**, 267-279.