Exploring the hidden Rodinia: crustal xenoliths of Vestfjella, Dronning Maud Land, Antarctica

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Lamproite-hosted crustal xenoliths from Vestfjella, Dronning Maud Land, Antarctica, provide unique insights into the Mesoproterozoic crustal evolution of a poorly exposed region at the former juncture of Antarctica, southern Africa, and the Falkland plateau. The lithologically diverse suite of xenoliths is dominated by high-grade metamorphic rock types (Romu et al., 2008). On the basis of mineralogy and geochemistry, the metagabbroids and metapelites represent granulite-facies samples from lower to middle crustal levels (6-19 kbar), whereas the metagranitoids were probably derived from the upper crust. Thermobarometric studies record consistently high temperatures of 650-1100 °C for metagabbroids, 800 °C for metapelites, and 750-800 °C for metagranitoids. Our U-Pb (SHRIMP, SIMS) zircon ages indicate emplacement of syn- to post-orogenic silicic magmas in a rapid succession at ca. 1.0–1.1 Ga during Rodinia assembly. The oldest ages of ca. 1.3 Ga from zircon cores likely correspond to formation of juvenile crust in a volcanic arc setting. Sm-Nd isotopic data on the metagabbroids are compatible with generation of mafic magmas during this period. A heterogeneous zircon population from a quartz-diorite yielded ca. 0.5-1.3 Ga concordant ages. We interpret these ages as crystallisation ages of xenocrystic detrital grains originally derived from diverse magmatic rock types associated with Rodinia breakup and amalgamation of Pangea. Importantly, Hf isotopic data on zircons representing different xenolith types invariably indicate ca. 1.3–1.4 Ga juvenile sources which suggests that crust formation during the 1.0–1.1 Ga orogeny and subsequent magmatic events in the Vestfjella sector of Rodinia was insignificant.

References:

Romu I., Kurhila M., and Luttinen A., 2008. Precambrian metaigneous xenoliths of Vestfjella: Implications for lithospheric architecture in western Dronning Maud Land, Antarctica. Geochimica et Cosmochimica Acta 72, A772-A816.