Andean subduction-related lithospheric mantle: Growth and isotopic evidence of chemical exchange in mantle and crustal reservoirs

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The Earth’s sub-continental lithospheric mantle has a long-term evolution that records depletion and enrichment events and seems to have a close isotopic relationship to the continental crust formation. The heterogeneity of the mantle is well-constrained by chemical and isotopic data. Therefore, homogeneous compositions in MORB are related to large well-constrained by chemical and isotopic data. Therefore, homogeneous compositions in MORB are related to large

Geology, age, and origin of Akilia supracrustal rocks, Greenland

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It has been proposed that supracrustal rocks on Akilia Island, Greenland, contain both the oldest marine sediments (Nutman et al., 1997), and the oldest evidence for active biological processes (Mojzsis et al., 1996). The interpretations rely on three strongly contested observations: the nature of crosscutting relations; the sedimentary origin of some lithologies; and interpretation of zircon ages (Myers and Crowley, 2000; Fedo and Whitehouse, 2002). Despite heated debate, the exposure has never been mapped at a scale appropriate to address the contested issues. New mapping (1:250) supports a >3.8 Ga sedimentary origin for components of the supracrustals.

Supracrustal lithologies comprise compositionally distinct, laterally continuous, mappable units of mafic amphibolite, ultramafic rocks, and two Fe-rich quartzites which contain C-isotope evidence for early life. The earliest structures are foliations parallel to lithologic contacts, with locally preserved upright fold hinges. Early foliations are isoclinally folded about a steep axial surface and refolded about a deep NS axial plane. Map relations reveal that Fe-rich quartzites are part of the stratigraphy, not later veins or intrusions. Contrasting whole-rock δ18O values of quartzite (13%) and adjacent metaigneous units (8‰), and silica contrasts also preclude a metamorphic origin for the quartzite, while S-isotope data are consistent with a sedimentary origin (Mojzsis et al., 2003).

The age of Akilia supracrustals hinges on the nature of contacts with tonalitic gneisses. We identified two previously unrecognized crosscutting tonalites. U-Pb ion microprobe measurements of 21 zircons yielded ages of 3.6 to 3.83 Ga. 8 zircons are >3.8 Ga with tight age clustering at 3.83±0.01 Ga. The oldest grains have higher Th/U and are interpreted to be the original magmatic population.

Thus our mapping, geochemistry and geochronology provide strong evidence for a sedimentary component to, and a >3.83 Ga age of the Akilia supracrustals.

References