# 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 volume of melting unlikely other mantle-derived magmas as OIB and CFB. Sr and Nd isotopes have been thoroughly used to constrain mantle processes, while $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ ratios and $T_{DM}$ (Sm-Nd) model ages comprise quite useful tools to characterize and date these processes, specially the lithospheric growth (continental crust plus depleted mantle). The subduction zones are special tectonic settings to modifications in the bulk, major, trace, REE and isotopic composition of the lithospheric mantle through processes like lithospheric growth (mantle depletion), asthenospheric upwelling, subducted-slab fluid percolations and interactions between host magma and mantle xenoliths. The Andean cordillera has a complex Phanerozoic history of terrane accretion and subduction processes. Two oceanic plates (Antarctic and Nasca) with different velocities, dipping angles and ages have been subducting beneath the continental South American Plate, which was made up by several and distinct crustal terrane ages. This active margin system presents four active volcanic zones (northern-NVZ, central-CVZ, southern-SVZ and austral-AVZ), separated by flat-slab or seismic ridge subduction segments, with samples of the lithospheric mantle hosted in alkaline basalts, except in the CVZ due to thickness and expressive crustal contamination. The well-marked 800-600 Ma peak in the $T_{DM}$ model ages (based on literature and new data on mantle xenoliths and mantle-derived rocks) in all volcanic zones probably indicates the main period of crustal growth at the Andes. Sr and Nd isotopic ratios in spinel and/or garnet-bearing mantle xenoliths exhibit strong variations along the Andean cordillera ($^{87}Sr/^{86}Sr$ - NVZ: 0.7030-0.7053, SVZ: 0.7035-0.7045, AVZ: 0.7026-0.7052 and $^{143}Nd/^{144}Nd$ - NVZ: 0.5128-0.5135, SVZ: 0.5129-0.5134, AVZ: 0.5128-0.5131), apparently as a result of metasomatic process with chromatographic characteristics. In addition, interactions between mantle xenoliths and host lavas in crustal reservoirs tend to equalize chemical and isotopic ratios, masking the pristine signatures of the mantle.

# 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 coninuous, 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 steep NS axial plane. Map relations reveal that Fe-rich quartzites are part of the stratigraphy, not later veins or intrusions. Contrasting whole-rock $\delta^{18}O$ values of quartzite (13‰) and adjacent metaigneous units (8‰), and silica contrasts also preclude a metasomatic 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

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