Lithospheric evolution at the Early Andean convergent margin, Chile.

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Classic models of tectonic evolution of the SW Gondwana margin suggest that in between two orogenic cycles, the Gondwanian (Late Paleozoic) and the Andean (Jurassic to Recent), continental subduction ceased during much of the Triassic period. In order to test this hypothesis, 50 new geochemical and isotopic data from igneous samples, mostly of Triassic units cropping out in northern Chile (24°30'-30°S), were studied and compared to avalaible data of ~500 Late Paleozoic to Late Jurassic igneous rocks from north-central Chile/Argentina. The geochemistry suggest that the magma generation was invariably controlled by fluid induced melting of a depleted asthenospheric mantle source in a subduction setting. However, our data show systematic shifts in specific geochemical parameters that are linked to the extent of lithosphere in the magma sources as well as to crustal thickness. The εNd decreases with time from Carboniferous (-8 to -2, >95%) to Jurassic (0 to +6, >95%), a variation that is coupled to Sr and Pb isotope data, although these system are more prone to post-magmatic homogenization due to hydrothermal alteration processes which are common in the Andean rocks. The previous observations are supported by the La_N/Yb_N ratios that decrease from 4.0 at ca. 300 Ma to 1.5 at ca. 200 Ma. This shift suggests that the crust beneath the magmatic arc may have thinned from the Carboniferous to the Early Jurassic, involving loss of the lithosphere at some time during the Triassic. Either delamination of the arc roots or stretching of the lithosphere are likely scenarios. The Cordilleran geology (28°-29° S) indicates major tectonic changes during the Early Triassic, with evidences of extensional tectonics onset of extensional basins and large scale exhumation of basement and Early-Middle Triassic plutons, both covered by Late Triassic sequences. This large amount of uplift and exhumation processes relates to changes of buoyancy of the lithosphere triggered by partial delamination of lithosphere rather than crustal stretching.