Using trace element proxies for crustal thickness of magmatic arcs: La/Yb

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It has been hypothesized that the ratios of La/Yb in arc intermediate magmas reflect fractionation processes within the crust, potentially making them proxies for crustal thickness [1]. Higher ratios indicate equilibration of arc magmas with garnet and amphiboles, typical for deeper levels of thick crust, whereas lower values are indicative of plagioclase being a major fractionating phase, perhaps indicating a thinner arc crust.

Here we use global compilations of geochemical data and crustal thickness grouped by arc segments. We show that for intermediate and felsic compositions, La/Yb presents a positive correlation to crustal thickness (Fig.1). We compare this trend with La/Yb from a suite of individual volcanic fields from the Southern Andean Volcanic Zone, which reflect the crustal thickness gradient in that region [2].

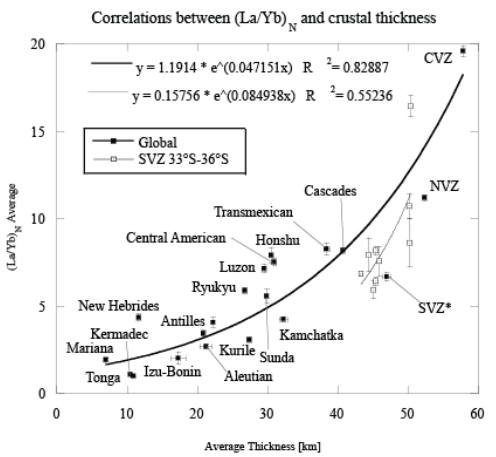

Figure 1: Average chondrite-normalized La/Yb for Quaternary extrusive rocks with SiO_2 55-70 wt % plotted against arc mean crustal thickness.

We suggest that this correlation can be used to infer crustal thickness in extinct arcs, by averaging La/Yb over discrete time-space intervals (e.g. 10 Ma and at least 30 km diameter), either for whole rocks or from zircons, using zircon/melt partition coefficients.

[1] Kay & Mpodozis (2001) *GSAToday*, **11**, no. 3, 4-9. [2] Hildreth & Moorbath (1988) *Contrib Mineral Petrol*, **98**, 455-489.