Investigating Nb & Ta anomalies at Turrialba Volcano, Costa Rica

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Turrialba Volcano, the southeastern-most volcano in the Central American Volcanic Arc, began erupting explosively in 2010 after 144 years of quiescence [1]. Juvenile volcanic glass fragments were collected from tephra layers associated with this new eruptive phase to investigate the origin of the magmas feeding this system. A focus of this research is the origin of the wide variation in La/Nb ratios for Turrialba lavas, which range from those typical of arc lavas to those more akin to ocean island basalt (OIB) [2].

Electron microprobe analyses of these glasses show them to be highly diverse [see also 3]. Mafic magmas are basaltic andesites with a range of TiO_2 concentrations consistent with calcalkaline to OIB-like parental magmas. More differentiated glasses produce significant scatter on major element plots, although most follow a trachyandesite to trachydacite and rhyolite differentiation trend.

The Magma Chamber Simulator [4] was used to better understand magma differentiation at Turrialba. Pure crystal fractionation models reproduce differentiation trends for mafic andesites, but fail to produce trends at higher SiO_2 contents, showing that Turrialba's magmas cannot be produced through fractional crystallization alone. Models involving assimilation of magmatic compositions reproduce a larger swath of data but calculated CaO and Na_2O are higher and K_2O and Al_2O_3 are lower than the measured silicic compositions. We speculate that highly altered rock within the shallow volcanic edifice may be the primary assimilant.

Trace element analyses of glass shards confirm the presence of parental magmas with calcalkaline (low-Nb) to OIB-like (high-Nb) signatures in recent ejecta. Most glasses at all levels of differentiation have low-Nb trace element patterns, whereas high-Nb glasses are relatively rare and unfractionated. Ratios between most incompatible trace elements (e.g. Ba/La) only modestly differ between low- and high-Nb glasses suggesting only a weak input from the subducting slab to generate the low-Nb lavas, and no discernible slab input to generate the high-Nb magmas.

[1] Reagan *et al. (2006) GSA* **412,** 235-257. [2] Reagan & Gill *(1989) JGR* **94**, 4619-4633. [3] Devitre *et al. (2019) JVGR* **381**, 330-346. [4] Bohrson *et al. (2014) J Petrol* **55**, 1685-1717.