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Light MORB-like Mo isotopes in Costa Rican arc lavas: implications for continental crust formation

EKATERINA ROJAS KOLOMIETS[1], CESAR SEQUEIRA[2], VALENTIN CHESNEL[2], MICHAEL BIZIMIS[1] AND ESTEBAN GAZEL[3]

[1]University of South Carolina
[2]Universidad de Costa Rica
[3]Cornell University

Presenting Author: erojaskolomiets@seoe.sc.edu

Continental Crust (CC) is predominantly produced in subduction zones and its current estimated Mo isotope values ($\delta^{98/95}$Mo) are heavier compared to the mantle. However, the magmatic processes by which the CC gain its Mo isotope signatures remain ambiguous. In Costa Rica, subduction and melting of a thick enriched slab associated with the Galapagos hotspot has been proposed as a mechanism to generate juvenile CC (Gazel et al., 2015 – Nature). Here, we evaluate if such a process can produce the heavy Mo-isotope composition of CC by analyzing > 10 Ma old Costa Rican lavas (prior to melting of the Galapagos tracks) and <10 Ma old lavas (after arrival of Galapagos tracks). We report $\delta^{98/95}$Mo and Mo concentrations for basalts to basaltic andesites from Cerro Asunción (14.1 Ma), La Cruz (11.3 Ma), Grifo Alto (4.0–5.1 Ma), La Garita (4.0 Ma) and Paso Real (3.6–4.2 Ma) formations. The data show that the >10 Ma samples have MORB-like $\delta^{98/95}$Mo (–0.22‰ to –0.02‰), low Mo concentrations (0.2-1.1 µg/g) and Mo/Ce ratios (0.02-0.05) that overlap MORB values. In turn, the <10 Ma samples show a wider $\delta^{98/95}$Mo range (–0.88‰ to 0.00‰) and Mo concentrations (0.4-2.2 µg/g) and Mo/Ce ratios (0.01-0.04) that are similar to their older counterparts. The lack of systematic change in Mo isotopes between the two sample groups (older and younger than 10 Ma) and MORB-like or lighter Mo isotopes in all Costa Rican lavas analyzed here, as well as the lack of correlation between Mo isotopes and the tracers of the Galapagos influenced subducted slab (e.g., La/Yb) suggest that melting of a thick enriched oceanic crust does not produce heavy Mo isotopes as observed in the CC. Therefore, additional crust-specific processes (e.g., CC stratification) during CC growth, fluid sources and/or continental recycling may be responsible for the heavy Mo systematics of the CC.