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Melting of subducted slab dictates trace element recycling in global arcs

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Arc magma acquires continental crust-like trace element signatures through selective recycling of incompatible elements from the subducted slab. The long-standing model of element recycling through aqueous fluid from altered oceanic crust (AOC) and sediment melt has been challenged by the resurgence of mélange diapir (a mix of AOC, sediment and serpentinite) and saline aqueous fluid models. Here we present experimental data for near-solidus sediment melts and a framework for calculating trace element concentrations in subduction fluids from metamorphosed sediment and oceanic crust. We observe that variation of element ratios in global primitive arc basalts is comparable with that of sediment and/or oceanic crustal melt, rather than (saline) aqueous fluid or mélange melt. In particular, the systematic correlation of element ratios in arc basalt corresponds to element fractionation in slab melt with temperature, and therefore follows a power function. Our findings suggest that slab melt is primarily responsible for element recycling to the arc[*1*].

Figure caption:

Fig. 1. The negative correlation between Ba/Th and primitive mantle normalized $(La/Sm)_N$, and their correlations with H_2O/Ce in global primitive arc basalts. Data for global arc basalts are from Ruscitto et al. [*2*]. In the three-component mixing model [*3*, *4*], Ba/Th and $(La/Sm)_N$ are used as proxies for the addition of aqueous fluid from AOC and sediment melt respectively (A). However, their correlations with H_2O/Ce may reflect their variation in slab melt with top slab temperatures (B, C). Trendlines are fitted with power functions in (A) and (B), and a linear function in (C).

[1] Li, Hermann & Zhang, (2022), *Sci. Adv.* **8** abh2166.

[2] Ruscitto, Wallace, Cooper & Plank, (2012), *Geochemistry, Geophys. Geosystems*. **13**, Q03025.

[3] Elliott, Plank, Zindler, White & Bourdon, (1997), *J. Geophys. Res. Solid Earth*. **102**, 14991–15019.

[4] Elliott, in *Inside the subduction factory*, J. M. Eiler, Ed. (Geophysical Monograph Series Vol.138, AGU, 2003; pp. 23–45.

Fig. 1