Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.7068

How to avoid the not-so-hidden reservoir of the upper plate

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Understanding and quantifying element cycling through subduction zones has been a focus of geochemical study for decades. Mass transfer between the surface and interior of the planet is critical to understand large scale processes such as the distribution of volatiles, the formation of ore deposits, and the build-up of continental crust.

The vast majority of geochemical work uses arc lavas to peer into the depths of subduction systems and tease out potential slab, mantle, fluid, and sediment contributions. The aim is often to construct elemental recycling efficiencies. Yet even rare and coveted 'primitive' arc lavas have traversed the upper plate to eventually end up in our geochemical laboratories. From there, we work backwards, hoping that our samples are largely unfettered by their journey through the trace-element rich upper plate.

So how might we minimise the influence of the not-so-hidden reservoir of trace elements in the upper plate? To evaluate element recycling, we would ideally like subduction-related lavas to 1) be erupted without significant magmatic evolution and 2) escape navigating a trace element-rich crustal reservoir. Sea floor spreading during subduction initiation can provide such a setting. I will synthesize recent and new results from the ~50Ma subduction initiation magmatic sequence of forearc basalts and boninites recovered by IODP Exp. 352 along the Bonin Ridge [1]. These two contrasting lithologies occur close in space and time, and document the release of elements from the subducting slab without the complication of a substantial upper plate. Major elements, trace elements, radiogenic isotopes [2,3,4], new heavy metal stable isotopes, and geodynamic models [5] showcase rapid element transfer from subduction and can fingerprint changing physical parameters during the first few Ma of subduction.

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