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Molybdenum Isotope Systematics of the Kamchatka Subduction Zone System

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Molybdenum isotopes in magmatic rocks are a promising tool in high-temperature isotope geochemistry. Particularly, basalts from subduction zones that are geochemically controlled by mass transfer through slab-fluid addition have systematically higher δ^{98}Mo values (i.e. measured ^{98}Mo/^{95}Mo ratio in a sample relative to a standard) than the depleted mantle. In these rocks, elevated δ^{98}Mo values are linked to typical fluid tracers and can be reconciled by addition of isotopically heavy Mo via a slab fluid component [1,2]. So far, these systematics are best expressed in basalts from the Mariana and Izu subduction zones that also form coherent mixing trends between fluid-enriched mantle domains in δ^{98}Mo versus ^{143}Nd/^{144}Nd and ^{176}Hf/^{177}Hf space [1, 2].

The Kamchatka arc system represents the northernmost expression of the W-Pacific convergent margin. Volcanic front lavas and volcanic rocks in the central Kamchatka Depression are dominated by slab-to-mantle mass transfer through fluid transport, whereas subduction of the Emperor seamount ridge gives rise to back-arc basalts with a lower fluid signal and geochemical and isotopic affinity to within-plate basaltic rocks [3].

Here, we report δ^{98}Mo data for basalts from an E-W transect across the Kamchatka peninsula that have previously been analysed for their major, trace element, radiogenic and stable isotope data. The δ^{98}Mo data extent the trend defined by samples from the Izu arc starting from moderately high δ^{98}Mo and Pb/Ce values towards sub-depleted mantle δ^{98}Mo and mantle-like Pb/Ce ratios that indicate the presence of a source component formed by partial melts of a geochemically enriched source component [4].

The common geochemical and isotopic trends formed by the combined Izu – Kamchatka datasets suggest a surprisingly uniform Mo isotope composition and a common fluid endmember component for more than 5000 km along-strike of the Circum-Pacific subduction zone system. Our data also confirm the presence of an enriched source component in the Kamchatka mantle wedge, possibly originating from the subducted Emperor seamount chain.

[1] Freymuth, H., et al., *EPSL* 432, 176-186 (2015). [2] Villalobos-Orchard, J., *et al.,* GCA 288, 68-82 (2020). [3] Churikova, T., et al. JPet 42, 1567-1593 (2001). [4] Chen, S., *et al.*, Nat. Comm. 10, 4773 (2019).