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Tracing the influence of different subducted materials with Mo isotopes in arc lavas

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Redox-sensitive molybdenum (Mo) isotopes have emerged as powerful tracers of metal recycling in subduction zones, particularly in tracking the involvement of oxidized sab-derived fluid transfer. However, the contribution of different subducted lithologies, such as oceanic crust and marine sediment, to the Mo isotope signature of arc magmas remains debated [1]. Furthermore, the specific influence of distinct sediment lithologies and, in turn, the redox conditions of sab-derived fluid transfer are poorly understood [1].

In this research, we aim to investigate the Mo isotope systematics of the Central American Volcanic Arc (CAVA). We focus on how along-arc proportional changes in relative subducted lithologies – pelagic sediments, carbonate-rich sediments, and altered oceanic crust – affect the Mo isotope composition of arc magmas. The CAVA is one of the largest active subduction zones globally [2] and is particularly suitable for this study due to its pronounced SE-NW increase in carbon-rich sediment input, which influences subarc geochemistry.

Our research will expand on existing studies that highlight the geochemical variation along the arc, such as changes in trace element compositions and isotopic ratios (e.g., LILE/HFSE, $^{87/86}$Sr, and $^{208/204}$Pb;[3]). By incorporating Mo isotopes, we aim to better understand how different subducted materials shape the redox conditions of the mantle wedge and influence the fluid-driven metasomatism affecting arc magma compositions. Ultimately, this study will clarify the role of Mo isotopes in tracking metal recycling and oxidized fluid transfer in subduction zones, providing a deeper understanding of the complex interactions between subducted materials, fluids, and magmatic processes.

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