The Se isotope signature of Mariana arc lavas

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Understanding the elemental behavior and isotope systematics of selenium (Se) in subduction zones provides valuable insights into mechanisms contributing to the distribution of this chalcophile and moderately volatile element between terrestrial reservoirs [1,2]. Subduction constitutes the main process of crust-mantle interaction and thus might account for large Se concentration and isotope differences between Earth's mantle and crust [3,4,5]. In this study, we investigate subduction zone lavas from the Mariana arc system with newly developed analytical techniques for high precision Se isotope analyses of mafic igneous rocks [5,6]. Our results indicate that Se isotopes of submarine lavas are unaffected by sulfide segregation and degassing and thus may preserve their source signature. In contrast, Se concentrations are affected by sulfide segregation but not by degassing. Compared to the estimates for the igneous silicate Earth [3,5], that are based on samples from diverse geodynamical settings but without any subduction-related origin, Mariana lavas show a larger overall range with a clear tendency towards lighter Se isotope compositions. The variable Se isotope signatures of Mariana lavas can be linked to different slab-derived fluid and melt-like components. This provides evidence for a significant role of subduction recycling of altered oceanic crust, hydrothermal sulfides and pelagic sediments with possible implications for the Se isotope evolution of the crust-mantle system throughout geological time.

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