Strontium isotopes in Samoan basaltic melt inclusions

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We measured $^{87}Sr/^{86}Sr$ ratios on 41 olivine-hosted melt inclusions from nine Samoan basalts (taken from 5 Samoan volcanoes) using laser ablation multi-collector (LA-MC) ICPMS. $^{87}Sr/^{86}Sr$ ratios are corrected for mass bias after eliminating major isobaric interferences from Rb and Kr. The external precision averages ±320 ppm (2σ) for the $^{87}Sr/^{86}Sr$ ratios on natural Samoan basalt glass standards of a similar composition to the melt inclusions.

Surprisingly, all of the Sr-isotope ratios measured by LA-MC-ICPMS on Samoan melt inclusions fall within the range recorded in whole-rocks using conventional methods. However, melt inclusions (grey diamonds and open squares) from two Samoan basalt bulk rock samples are extremely heterogeneous in $^{87}Sr/^{86}Sr$ (0.70459-0.70926). Melt inclusions from a third high $^{3}He/^{4}He$ Samoan basalt (open circles) are isotopically homogeneous, exhibit $^{87}Sr/^{86}Sr$ values from 0.70434 - 0.70469, and mark the unradiogenic extreme in the Samoan array. The isotopic variability (or lack thereof) is mirrored in Rb/Sr from the same inclusions.

Several melt inclusions yield $^{87}Sr/^{86}Sr$ ratios higher than their host rock, indicating that assimilation of oceanic crust and lithosphere is not the likely mechanism contributing to the isotopic variability in these melt inclusions. Additionally, none of the 41 melt inclusions analyzed exhibit $^{87}Sr/^{86}Sr$ ratios lower than the least radiogenic basalts in Samoa ($^{87}Sr/^{86}Sr = 0.7044$), providing an additional argument against assimilation of oceanic crust and lithosphere as the source of the isotopic diversity in the melt inclusions. Instead, the source sampled by the high $^{3}He/^{4}He$ Samoan basalt may be a more appropriate, common unradiogenic endmember that is the source of much of the isotopic heterogeneity in melt inclusions observed in other Samoan basalts.

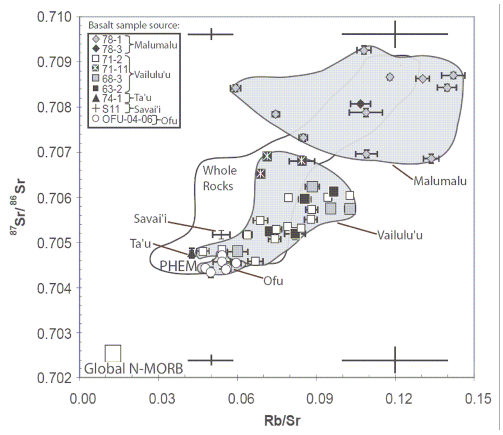

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Fig. 1 Sr-isotope and Rb/Sr ratios in Samoan basalts (light field) and melt inclusions (dark fields, representing melt inclusions from 9 basalt samples). Internal (error bars on data points) and external (bars on periphery) precision are 2σ.