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Elemental and isotopic constraints on the nature of mantle metasomatism at Santiago Island (Cape Verde)

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Santiago Island magmatism covers a time span of at least 10 Ma producing a lithological spectrum from basanites to melilitites. Geochemical analysis of primitive lavas (Ni $>$ 150 ppm; Mg# $>$ 59) indicates mantle source compositions that were dominated by HIMU plus a heterogeneous EM type component, consistent with previous studies on southern Cape Verde islands. Younger ($<$ 3 Ma) primitive lavas have strong K negative anomalies, high Ba/Rb and inferred high D_K/D_{Rb}values during partial melting, implying magma interaction with residual K-bearing mineral assemblages (amphibole $\pm$ phlogopite). Considering the relatively low temperature stability limit of the dominant amphibole K-bearing phase, such residual mantle parageneses should reflect previous metassomatic events within the lithosphere. Lavas displaying K negative anomalies also have sub-chondritic Ti/Eu ratios (down to 3300) which correlates with low $a(SiO_2)^{melt}$, Al_2O_3/CaO, Ga/Sr and high Sr/Sm ratios requiring magma generation from a CO_2-rich mantle peridotite assemblage. New Sr, Nd and Hf isotope results indicate significant variations ($^{87}Sr/^{86}Sr$ = 0.703177 to 0.703907, ε_{Nd}= -0.4 to 4.5 and ε_{Hf} = 2.5 to 7.2) that correlate with $a(SiO_2)^{melt}$ and several trace element ratios (e.g. Ti/Eu, La/Yb, Th/U), clearly showing that the observed elemental heterogeneities cannot be exclusively explained by variations on the degree of mantle partial melting. Indeed, both incompatible trace element ratios and isotope variations imply complex interaction of different components in Santiago magma sources. Comparative inspection of $^{143}Nd/^{144}Nd$ – $^{87}Sr/^{86}Sr$ and $^{176}Hf/^{177}Hf$ - $^{143}Nd/^{144}Nd$ isotopes spaces indicates relative $^{143}Nd/^{144}Nd$ depletion, requiring a long-term LREE-enriched component in the Santiago magma sources. However, the very low Ti/Eu and Ga/Sr val-

ues, as well as their correlations with isotopic ratios strongly suggest the presence of an additional carbonatitic metasomatic agent, consistent with both the occurrence of abundant (outcropping) carbonatites and petrological evidence for carbonated metasomatism in Santiago lherzolite xenoliths. Mixing modeling, including a predominant HIMU+EMI type mantle component and lamproite + carbonatite metasomatic agents are consistent with the observed geochemical variations; model results indicate that the inclusion of only a minor ($< 1\%$) carbonated metasomatic contribution is capable to cause significant chemical changes.

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