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Disrupted subcontinental mantle in an ocean basin: Sal Island, Cape Verde Arcipelago

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Spinel-bearing harzburgites and lherzolites mantle xenoliths occur in two Late Tertiary necks of Sal island (Cape Verde Archipelago). Cpx bi-modal distribution (8-17vol% and 1-3vol%) and major and trace element whole rock and mineral data exclude that compositional variation from lherzolites to harzburgites can be explained by a common progressive depletion process.

Large protogranular clinopyroxenes and orthopyroxene in lherzolites have quite high Cr2O3 content and trace element distribution compatible with a previous origin within the garnet facies. Secondary paragenesis, characterize by clinopyroxene, olivine and spinel + k-feldspar and K-rich glass, is compatible with a metasomatic event related to the percolation of a kimberlite-like melt. In situ Re/Os analyses of intergranular sulfides from lherzolites yield values of 187Os/188Os varying from 0.1013+0.0013 to 0.1268+0.0022. TRD model ages define four groups: 2.7-3.5Ga, 2.0-2.2Ga, 0.95-1.1Ga and 0.5-0.7Ga. These Re-depletion ages mirror the tectonic history of the western margin of the West African Craton and the corresponding continental margin of Brazil, strongly suggesting that at least part of the Cape Verde archipelago is underlain by fragments of subcontinetal lithospheric mantle (SCLM).

On the other hand Cape Verde harzburgites are well comparable to ultradepleted mantle lithologies, which can be sampled by ocean island alkaline basalts. Sulfides are tipically absent from these rocks, thus preventing in situ Re/Os estimation. These samples are characterized by partial melting beyond the cpx-out reaction and are on average significantly more refractory than abyssal peridotites. Thermobarometric estimates exclude that these highly refractory bodies would be the result of plume interaction with an already depleted abyssal peridotites. Some similarities can be observed with recent arc-related peridotites, thus pointing to a recycling mechanism as feasible explanation for their origin. Alternatively they could also represent highly depleted portion of Archean to Proterozoic SCLM which refertilization would have generated the more fertile lherzolitic lithologies.

These data point toward a quite heterogeneous composition of the oceanic lithosphere which can result from the juxtaposition of i) subcontinental lithospheric mantle, ii) residua after MORB extraction and iii) lithospheric mantle material recycled into the upper mantle through subduction.