Petrological features of lithospheric mantle beneath Santo Antao (Cape Verde Archipelago)

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Spinel peridotites in basanites from Sao Antao were studied with the aim of characterising the lithospheric mantle beneath this island, and working towards a better understanding of the nature of the mantle under the Cape Verde archipelago. Most samples examined are four-phase lherzolites with modal clinopyroxenes up to 18% and no evidence of modal metasomatism. A few are characterized by the presence of metasomatic textures such as i) glassy patches with tiny subidiomorphic crystals of secondary olivine and clinopyroxene, and ii) rare spongy pyroxenes. Texturally, clinopyroxene often occurs as clusters of small crystals (<200 microns), whereas olivine and orthopyroxene are larger (up to 1 mm), suggesting a secondary origin for this clinopyroxene. A few samples show clear evidence of host magma infiltration, allowing us to discriminate the chemical effects of this process against processes related to mantle metasomatism, i.e. magma interaction at depth. Olivine, ortho- and clino-pyroxene near basalt or in contact with basaltic veins crossing the samples systematically present lower mg# and Cr2O3, and higher TiO2 and Al2O3 contents. Olivine ranges in composition from mg# 90.1 to 92.0 and NiO from 0.31 to 0.44 wt%, whereas the orthopyroxene has a more restricted mg# range (91.2- 92.2). Clinopyroxene has mg# varying from 91.7 to 93.0, with Al2O3 from 0.98 to 4.43 wt%, without any correlation between the two parameters, which rules out the idea that it results from a simple depletion event. REE clinopyroxene patterns vary from ‘humped’to ‘spoon-shaped’ at Yb at 3-6 x Ch, with strong LREE enrichment (La 7-117 x Ch). Silicate glasses, unrelated to host basalt infiltrations are present just in one sample. They are rather homogeneous in composition with silica contents between 59.6 wt% and 66.0 wt%, and alkali contents up to 15 wt% with Na/K < 1. On the whole they show fractionated trace element profiles with (La/Yb)N varying from 34 to 102. These preliminary petrographic and geochemical data for Sao Antao spinel lherzolites allow a comparison with the data and model proposed for Sal, an island to the east where lherzolites contain a sub-continental mantle component, and Santiago and Fogo to the south where the lherzolite is interpreted as the result of carbonatitic metasomatism and wehrlite is probably cumulate from a large magma chamber system, again involving carbonatitic activity.

Polymetamorphism in the Paleoproterozoic Ubendian Belt, Tanzania

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The Paleoproterozoic (ca. 2.0-1.8 Ga) Ubendian-Usagaran orogens surrounding the SE and SW margins of the Archaean Tanzania craton contain eclogites of MORB-like chemistry which are among the oldest eclogite occurrences exposed in orogenic belts on Earth. Our study of metamorphic events by petrology and U-Pb SHRIMP dating of zircons is aimed to unravel the orogenic history of the Ubendian Belt southwest of the Tanzania Craton.

The Ubendian Belt has been subdivided into eight NW to SE elongated lithotectonic blocks the formation of which is interpreted to be of late Paleoproterozoic or Pan-African age. Lithologically the belt consists, besides minor eclogites, mainly of granitic gneisses, metapelites, some mafic granulites and amphibolites, i.e. rocks attributed to a continental environment. Metapelitic samples from the Wakole, the Ufipa and the Ubende terranes all revealed the same type of clockwise P-T path and thus a crustal thickening event dated with zircons (SHRIMP) at 1900±14, 1901±37, 1949±16 and 1817±26 Ma. Metamorphic mineral assemblages include biotite-muscovite-garnet-staurolite-kyanite and garnet-biotite-K-feldspar-kyanite (partly replaced by sillimanite). Peak metamorphic conditions were calculated for rocks of different parts of the belt and of different blocks. They range from 7kbar / 640°C over 9.4kbar / 670–800°C to 12.4kbar / 800°C, indicating low geothermal gradients during the crustal thickening event that was followed by a strong erosion of the crust.

Locally, metapelites of different parts of the Ubende block experienced a mylonitic overprint within the kyanite stability field. Zircon rims in these mylonites revealed a Kibaran overprint (1086±21 Ma), an age that is also found in metamorphic zircons of some non-mylonitic schists (1166±14 Ma) of that block.

Lenses of eclogites (meter to 100 meter scale) occur widespread in the Ubende and Ufipa blocks (over a distance of ca. 200 km). Some of these eclogites contain metamorphic zircons grown during a Pan-African eclogite-facies metamorphism at 520 to 590 Ma. However, at three localities the eclogite zircons contain inner metamorphic growth zones that revealed a Paleoproterozoic age (1877±20, 1886±16 Ma) in addition to the Pan-African age of the outermost rims (596±41, 548±39 Ma).

Neither the Kibaran mylonitic overprint nor the Pan-African eclogite-facies subduction metamorphism have been described so far. Their discovery demands major revision of the interpretation of the Proterozoic evolution along the southwestern margin of the Tanzania Craton.