

Oxygen-barometry of the upper mantle beneath the Azores sector of the Mid-Atlantic Ridge

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Relict textures and mineralogy of serpentized upper mantle exposures on Rainbow area (36°14'N; Azores sector, Mid-Atlantic Ridge) indicate that their protoliths were (dominantly) refractory spinel-harzburgites and dunites, whereas samples collected from Saldanha seamount (36°34'N) also include strongly tectonized garnuloblastic harzburgites that display veins and irregular areas filled with Ti-rich hornblende. The refractory characteristics of the studied ultramafics ($X_{Fe}(\text{olivine}) = 0.91 - 0.92$, Cr# (spinel) = 0.46 - 0.52) and modal amphibole metasomatism are consistent with a significant extent of upper mantle partial melting and metasomatic activity on approaching the Azores hotspot, as suggested by previous studies in the area. Spinel-olivine thermometry indicates temperatures of about 650°C to 840°C, reflecting Fe-Mg re-equilibrium at low T. However, calculations using a N-MORB from the regional MAR sector indicate olivine-saturation temperatures of 1200 - 1300°C; thus, assuming that these temperatures are representative of mantle-melt segregation, allows us to estimate that the studied harzburgites should lie at mantle depths of about 39 - 45 km (12 - 14 kb). Oxygen barometry was performed under those P-T values, indicating highly to mildly reducing conditions ($\Delta QFM = -4.13$ to -1.65) in harzburgites from Rainbow area and higher oxidation ($\Delta QFM = +1.13$) for the amphibole bearing harzburgite from Saldanha seamount. Data from Rainbow area conform to the dominant reducing conditions of the upper oceanic mantle, whereas the higher ΔQFM value for amphibole-bearing peridotites from the SE slope of the Saldanha massif indicate that local mantle metasomatism took place under significantly oxidizing conditions.

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