



Mantle Xenoliths from Central and South Vietnam: Petrology and Geochemistry

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Mantle xenoliths, spinel lherzolites and subordinate amounts of spinel harzburgites and pyroxenites, are commonly found in alkali basalts from south-central Vietnam. The basalts are part of widespread Neogene volcanism found in southern China and Indochina regions. Samples from different localities between the cities of Ban Me Thuot and Saigon were recovered. In addition one xenolith sample from an off-shore volcano SE of Ho Chi Minh City in the South China Sea was investigated. The mineral assemblage in most samples consists of the simple lherzolititic mineral assemblage Ol–Opx–Cpx–Sp. The Ol, Cpx and Opx crystals are equigranular while Sp occurs usually as smaller sized intersertal phase or as partly oriented inclusions in Cpx. Cpx II occurs in some samples as recrystallized “spongy rim” around Cpx I. Cpx I has a very uniform composition between different samples with a typical XMg ($=\text{Mg}/(\text{Mg}+\text{Fe}^{2+})$) of 0.92 to 0.98, a XNa ($=\text{Na}/(\text{Na}+\text{Ca})$) of 0.10 to 0.16, a Cr₂O₃ content of 0.6–0.9 wt. % and Al₂O₃ values of c. 6 to 8 wt.%. Cpx II has a lower XNa and Al content as well as higher XMg and Cr content compared to Cpx I. Orthopyroxene typically has a XMg of c. 0.90 to 0.93. The XMg values for Ol differ slightly between different samples but are within 0.84 to 0.94. Spinel grains have a variable composition with XMg from 0.65 to 0.92 and XCr ($\text{Cr}/(\text{Cr}+\text{Al}+\text{Fe}^{3+})$) of 0.08 to 0.25. The use of the Cpx–Opx thermometer (BREY & KOEHLER, 1990) and the Al and Cr in Ol thermometer (DE HOOG et al., 2010) allowed to constrain the temperature with 800 to 1100 °C.

Trace and rare earth element composition of Cpx was determined by LA-ICPMS. While most Cpx compositions are slightly depleted in LREE, typical for average depleted mantle compositions, some samples are strongly enriched in LREE indicating mantle metasomatic processes. The sample displaying the highest level of LREE enrichment in Cpx has the lowest calculated temperature ($T = \text{c. } 800^\circ\text{C}$) and the highest Ni content in olivine (3000 ppm). The variation in LREE as well as LIL element concentration in Cpx from different xenoliths is evidence for the heterogeneous nature of the mantle beneath Indochina.

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