

**PETROLOGY AND GEOCHEMISTRY OF APATITE ± WHITLOCKITE-BEARING  
MANTLE XENOLITHS FROM SOUTHERN LAOS**

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Cenozoic basalts are widespread throughout Southeast Asia and form what is called a “diffuse igneous province (HOANG et al., 2013) mostly consisting of shield-building tholeiites that may be replaced by late-stage and small-volume alkali basalts, the latter often containing mantle xenoliths together with sapphire and/or zircon megacrysts. Here we report the results of a petrological and geochemical study of a suite of spinel-lherzolites and ortho/clino-pyroxenites sampled by nepheline±leucite-bearing alkali basalts of the Bolaven Plateau/southern Laos. Both lherzolites (ol+opx+cpx+sp+FeNi-sulfide) and pyroxenites (opx+cpx+FeNi-sulfide) in part show evidence for cryptic or modal metasomatism characterized by a strong enrichment of Li in cpx and opx with respect to ol (cryptic) and by the appearance of apatite rarely associated with minor phlogopite ± calcic amphibole. Two compositional types of apatite are present: (1) apatite characterized by low P<sub>2</sub>O<sub>5</sub> (37.9-41.0 wt%) and low analytical totals (93.8-97.4 wt%) combined with high Na<sub>2</sub>O (0.9-1.6 wt%) indicative of a significant type-A carbonate-apatite component and (2) apatite with high P<sub>2</sub>O<sub>5</sub> (40.5-42.4 wt%) and high analytical totals (97.7-100.9 wt%) combined with low Na<sub>2</sub>O (0.3-0.7 wt%). In addition low-P<sub>2</sub>O<sub>5</sub> apatites show a much more restricted range in F and Cl (0.2-0.9 wt% F, 0.6-1.6 wt% Cl) compared to high-P<sub>2</sub>O<sub>5</sub> apatites (0.3-3.1 wt% F, 0.3-4.1 wt% Cl). One apatite-bearing sp-lherzolite sample contains trace amounts of whitlockite-merrillite solid solution [Ca<sub>18</sub>Mg<sub>2</sub>(PO<sub>4</sub>)<sub>12</sub>[PO<sub>3</sub>(OH)]<sub>2</sub>-Ca<sub>18</sub>Na<sub>2</sub>Mg<sub>2</sub>(PO<sub>4</sub>)<sub>14</sub>] (HUGHES et al., 2008) in addition to apatite + phlogopite + calcic amphibole. Whitlockite-merrillite is extremely rare in mantle rocks and has been known so far from only one locality in Siberia where its formation was ascribed to a distinct type of ±anhydrous REE-metasomatism (IONOV et al., 2006). In the sample from Laos, whitlockite-merrillite is always intergrown with apatite and was unambiguously identified using EMPA and micro-Raman spectroscopy. It contains 3.5-3.9 wt% MgO and 2.4-3.1 wt% Na<sub>2</sub>O, respectively, which is very similar to values reported by IONOV et al., 2006. Thermometry of the apatite-(whitlockite-merrillite)-sample yields ~900-950°C for a pressure of 1.5 GPa.

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