American Mineralogist, Volume 89, pages 1396–1404, 2004

Metasomatic formation of kosmochlor-bearing diopside in peridotite xenoliths from North Island, New Zealand

KEI IKEHATA* AND SHOJI ARAI

Department of Earth Sciences, Kanazawa University, Kakuma, Kanazawa 920-1192, Japan

ABSTRACT

Pale green Cr- and Na-rich diopside (kosmochlor-bearing diopside) was observed in anhydrous Group I mantle xenoliths hosted by Pliocene-Quaternary hawaiite from the Ngatutura volcanic field of the North Island, New Zealand. The diopside is characterized by high Cr_2O_3 (up to 5.87 wt%) and Na_2O (up to 3.31 wt%) and low Al_2O_3 (1.09 wt%, on average), and contains the highest kosmochlor component (up to 18 mol%) known for diopsides in spinel peridotite xenoliths. It also contains high REE concentrations and is slightly enriched in LREE relative to HREE. The kosmochlor-bearing diopside commonly forms rims around chromian spinel and replaces secondary Al-poor (<0.57 wt% Al_2O_3) and Si-rich (~58.1 wt% SiO_2) orthopyroxene crystallized from slab-derived fluid/melt at the expense of olivine. The kosmochlor-bearing diopside may have been formed through metasomatism by an Na-bearing carbonatite melt, which selectively reacted with orthopyroxene and can carry a large amount of rare-earth elements. Cr-rich spinel in refractory peridotites that had been formed in an arc setting is a prerequisite for genesis of this kind of kosmochlor-bearing diopside upon carbonatite metasomatism. The carbonatite melt from the deeper part penetrated the mantle wedge, which had been at a supra-subduction zone setting until 15 Ma, due to the absence of slab cover at an intraplate setting (~10 Ma) in the North Island.