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Magmatic srilankite (Ti_2ZrO_6) in gabbroic vein cutting oceanic peridotites: An unusual product of peridotite-melt interactions beneath slow-spreading ridges

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ABSTRACT

We report srilankite in a gabbroic vein cutting a serpentinized peridotite collected from the Atlantis II Fracture Zone, the slow-spreading Southwest Indian Ridge, using submersible SHINKAI 6500 of the Japanese Marine Science Technology Center. Srilankite occurs in small patches, <30 μm across, always coexisting with ilmenite and rutile. Zircon, apatite, and phlogopite also occur as accessory minerals in the vein. The Zr/Ti ratio of the srilankite is close to the stoichiometric value of one-half ($Ti_{2.00}Zr_{0.98}Hf_{0.01}Fe_{0.01}O_6$). Based on petrography, the srilankite appears to have co-crystallized with ilmenite and rutile from melts rather than through metamorphic recrystallization. Mineral assemblages and mineral compositions in the vein indicate that melts that produced the vein have high concentrations of compatible elements (MgO and Cr_2O_3) as well as incompatible elements (high-field strength elements, K_2O, and H_2O). On the other hand, TiO_2-enrichment of minerals in the peridotite host on the periphery of the gabbroic vein may have resulted from interaction with the melts. Geochemical interactions between peridotite and melt in the upper mantle may effectively concentrate incompatible elements in a modified melt, which may precipitate srilankite directly. Physical conditions under slow-spreading ridges, characterized by a highly attenuated magma supply and high rock/melt ratio, favor peridotite-melt interactions.