

Petrogenesis of the Yangkou layered garnet-peridotite complex, Sulu UHP terrane, China

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ABSTRACT

The Yangkou garnet-peridotite complex in the Sulu UHP terrane, eastern China, consists of several blocks, tens of meters across, enclosed within gneiss. The blocks consist mainly of garnet lherzolite and garnet clinopyroxenite with small amounts of eclogite. The complex displays a finely layered structure from outcrop to thin-section scales. Lherzolitic garnet is generally homogenous in composition ($\text{Prp}_{64-67}\text{Alm}_{23-24}\text{Grs}_{10-12}\text{Sps}_1$). Garnet (Prp_{51-63}) from clinopyroxenite contains more pyrope component than eclogitic garnets (Prp_{29-35}). Porphyroblastic garnet from clinopyroxenite and eclogite contains abundant exsolved rods of rutile and apatite ($\pm\text{Cpx}$). Lherzolitic garnet exhibits an unusual sinusoidal REE pattern characterized by a decrease in abundance from La to Pr and an increase from Nd to the HREE, and shows Ba and Pb enrichment and negative Nb and Ni anomalies in primitive mantle-normalized trace-element plots. In contrast, diopside shows a normal REE pattern with decreasing abundances from La to Lu, a peak at Ba and Pb, and depletion in Co and Ni. Garnet from eclogite has a REE pattern with increasing abundances from La to Lu, or a maximum at Eu. Eclogitic clinopyroxene shows humped REE patterns with a peak at Nd. Except for slightly lower $\delta^{18}\text{O}_{\text{VSMOW}}$ of +4.40‰ for olivine, O-isotopic compositions (+5.03 to +5.53‰) of analyzed garnets and clinopyroxenes from all three rock types lie in the range of mantle $\delta^{18}\text{O}$ values of +5.1 to +6.6‰. Small O-isotope fractionations ($\Delta\text{Grt-Cpx}$: -0.16 to -0.35) in eclogite suggest isotopic equilibrium. On the basis of petrochemical and isotopic data, this garnet-peridotite complex was initially a mantle peridotite cut by mafic veins. These rocks experienced metasomatism and subduction-zone UHP metamorphism at 750 ± 50 °C and 40 to 45 kbar with a low thermal gradient. The fine-scale layering probably formed as a result of strong shear deformation during exhumation.