

Discovery of clinoenstatite in garnet pyroxenites from the Dabie-Sulu ultrahigh-pressure terrane, east-central China

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ABSTRACT

Transmission electron microscopy (TEM) reveals that some enstatites from garnet-pyroxenites in the Chinese Dabie-Sulu ultrahigh-pressure (UHP) terrane consist of intimate intergrowths of orthoenstatite (OREN) and clinoenstatite (CLEN), and some grains of pyroxene (MgFe)₂Si₂O₆ exhibit inclined extinction. These garnet pyroxenites are enclosed in coesite-bearing eclogite or interlayered with harzburgite and omphacite. They contain garnet (Prp54 to Prp73), “enstatite” (En85 to En92), magnesite, and titanomagnetite (Sulu sample) or clinohumite (Dabie sample), and recrystallized at about 4.0–6.5 ± 0.2 GPa, ~750 ± 50 °C. All clinoenstatite lamellae in the host orthoenstatite have even numbers of 9 Å (100) fringes without twins, and are oriented parallel to (100) of the host. The lamellae and host phases have nearly identical (MgFe)₂Si₂O₆ compositions. The thickest observed CLEN lamellae are ~0.4 μm. Clinoenstatites from Sulu have cell parameters: $a = 9.67(7)$ Å, $b = 8.88(6)$ Å, $c = 5.22(3)$ Å, $\beta = 107.7(2)^\circ$, and $V = 427(8)$ Å³, and those from Dabie: $a = 9.53(6)$ Å, $b = 8.88(6)$ Å, $c = 5.24(3)$ Å, $\beta = 107.0(2)^\circ$, and $V = 424(8)$ Å³. The TEM electron-diffraction patterns indicate that both clinoenstatites possess *P21/c* structures and are the low-*P* polymorph of clinoenstatite. The host orthoenstatites have cell dimension: $a = 18.32(12)$ Å, $b = 8.88(6)$ Å, $c = 5.20(3)$ Å for the Sulu sample, and $a = 18.24(12)$ Å, $b = 8.88(6)$ Å, $c = 5.18(3)$ Å for the Dabie sample. Clinoenstatites in garnet pyroxenites from the Dabie-Sulu UHP terrane may have formed either by inversion from OREN, or by the displacive transformation from high-*P* clinoenstatite during decompression.