

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 omphacitite. 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 $P2_1/c$ 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.