

Ultra-deep origin of garnet peridotite from the North Qaidam ultrahigh-pressure belt, Northern Tibetan Plateau, NW China

SHUGUANG SONG,¹ LIFEI ZHANG,^{1,*} AND YAOLING NIU²

¹MOE Key Laboratory of Orogenic Belts and Crustal Evolution, School of Earth and Space Sciences, Peking University, Beijing 100871, China

²Department of Geosciences, University of Houston, Houston, Texas 77204, U.S.A.

ABSTRACT

Exsolution textures are observed in garnet and olivine crystals found in an orogenic garnet peridotite massif in the North Qaidam ultrahigh-pressure metamorphic (UHP) belt, northern Tibetan Plateau, NW China. Exsolutions in garnet consist of densely packed rods of rutile, orthopyroxene, and clinopyroxene. Exsolutions in olivine includes needles of ilmenite and Al-chromite. The occurrence of pyroxene exsolution lamellae in garnet crystals suggests that the precursor phase originally must have possessed excess Si, i.e., they were majoritic garnets that are stable only at very high pressures. The exsolution of ilmenite and Al-chromite needles from olivine is also consistent with the peridotite once being equilibrated at depths in excess of 200 km. Geothermobarometric calculations using matrix minerals of the peridotite yield re-equilibrium conditions of $T = 960\text{--}1040\text{ }^{\circ}\text{C}$ and $P = 5.0\text{--}6.5\text{ GPa}$. These observations and inferences, together with other petrological data and field observations, allow us to conclude that the garnet peridotite in the North Qaidam UHP belt may represent mantle materials exhumed from depths of greater than 200 km.