

Garnet peridotites in the Dabie-Sulu UHP terrane: A window insight into the upper mantle and plate tectonics

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Abstract

Garnet peridotites occur as block or lens within gneiss or eclogite in the Dabie-Sulu UHP terrane, central-eastern China. Detailed investigations of petrochemical and geochronology on these peridotites have provided important constrains to composition and evolution of the subcontinental lithospheric mantle and the processes related to plate tectonics. The garnet peridotites are either mantle-derived (Type A) or crustal peridotite (Type B) as a resident of continental crust prior to subduction. Type A peridotites show a wide compositional range in major elements and are depleted in CaO, Al₂O₃, TiO₂ and Na₂O, which exhibit pronounced negative correlation with MgO contents indicating that the peridotites have experienced 20-40% partial melting and melt extraction. Presence of hydrous phases (e.g. phlogopite and Ti-clinohumite) and magnesite, and LILE- and LREE- enrichments for the depleted peridotites require multiple metasomatism with various metasomatic agents.

The Dabie-Sulu garnet peridotites were recrystallized at 750-950°C and 4-7 GPa. A few Type A peridotites preserve pre-peak stage minerals, at least >1.5 GPa increase was recognized from initial mantle setting to peak-stage UHP metamorphism in the subduction-zone; the peak P-T estimates of 825-890 °C, 6.8-7.2 for Type B peridotites imply a deep (≥200 km) continental subduction. Exsolution textures are commonly observed, such as pyroxene, rutile and apatite exsolved from garnet inferring presence of a high-P precursor-majoritic garnet. SHRIMP U-Pb analyses of zircon separates from peridotites and associated eclogites yielded metamorphic ages of 220-240 Ma, which are identical (or close) to regional UHP metamorphic ages of the Dabie-Sulu terrane. These data convincingly document that both type peridotites were included in a northward subduction of the Yangtze craton and subjected to Triassic coeval UHP metamorphism with supracrustal rocks prior to the collision with the Sino-Korean craton, and later exhumed to crust level.