Enrichment of fluid-mobile elements in forearc mantle peridotites in the Sulu UHP belt, China

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The Sulu ultrahigh pressure (UHP) belt represents a northern margin of the Yangtze Craton that was subducted below the North China Craton, to a depth greater than 150 km after the collision of the two continents in mid Mesozoic time. The peak metamorphic condition is estimated to be ~ 700 C and > 4.0 GPa (Ernst et al., 2007). The rocks in the Sulu UHP belt are well exposed in the southeastern part of the Shandong Peninsula. They are mostly granitic gneisses and eclogites, but minor volumes of ultramafic rocks are common in the belt. This study examined ultramafic rocks from Yangkou Bay and the Suoluoshu-Hujialin area. Ultramafic rocks form lenticular to rounded bodies within UHP rocks with some in the Hujialin area larger than 5 km in length.

Primary silicate minerals are pervasively hydrated to form serpentinites except for dunite samples in Hujialin. Relict olivine in Hujialin dunite has high Mg (Fo = ~ 92) and NiO contents (0.35-0.4 wt%) and the compositions of olivine and spinel plot in the refractory forearc mantle field in the olivine-spinel mantle array of Arai (1994). The bulk rock compositions show low moderately incompatible elements, such as Ca, Al, V and Ti, and plot in refractory mantle peridotites. Furthermore, high Ir-group PGEs (13 to 22 ppb in total) in bulk rocks and high Cr# (0.66-0.8) in spinel confirm that these ultramafic rocks are residual peridotites after extensive partial melting. High values of Cr# compared to those for abyssal peridotites suggest that they originated from the wedged mantle overlying the subducted Yangtze Craton below the North China Craton. These ultramafic rocks including dunite with relatively low loss on ignition (~ 6.6 wt%) show a prominent enrichment of fluid-mobile elements, such as Sb (20-200 times the primitive mantle value) and Pb (8-100 times the PM value). The enrichment pattern is similar to forearc mantle serpentinites elsewhere reported by Hattori & Guillot (2007). The degrees of the enrichment are comparable to the Himalayan serpentinites, and greater than forearc mantle serpentinites from the Dominican Republic and Marianas. The data suggest that the enrichment of fluid-mobile chalcophile elements is prevalent in mantle wedge peridotites and the degrees of enrichment are greater in continental subduction zones than oceanic subduction zones. This difference likely reflects the compositions of subducted material. Shallow water sediments on the margins of continents are commonly enriched in fluid-mobile elements and readily release them to the overlying mantle.

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