Effects of continental subduction-related metasomatism on Fe isotopic compositions in mantle wedge beneath the Dabie UHP belt, eastern China

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Orogenic mantle-derived peridotites, fragments of the subcontinental lithospheric mantle (SCLM) wedge, could offer a unique window to investigate crust-mantle interaction in subduction zones. Here we report Fe stable isotope data for a series of well-characterized orogenic peridotites with orthopyroxenite veins collected from Maowu, the Dabie ultrahigh-pressure (UHP) metamorphic belt, eastern China to evaluate the effects of deep crustal metasomatism on mantle Fe systematics. Our results show that the Maowu garnet dunites produced by high degrees of melt extraction, display consistent Fe isotopic compositions ($\delta^{57/54}$Fe = 0.05 to 0.12‰ with an average of 0.09 ± 0.05‰ (2SD, n=4)) within the range of normal upper mantle. In contrast, the Maowu garnet orthopyroxenite veins, products of metasomatism between slab-derived silica-rich hydrous melt and dunites, show vaiable $\delta^{57/54}$Fe ranging from -0.57 to -0.06‰ in garnet-rich orthopyroxenite veins and from 0.12 to 1.25 ‰ in garnet-poor orthopyroxenite veins. The light Fe isotopic signature of garnet-rich orthopyroxenite veins could be caused by infiltration of the earlier crust-derived sulfur-saturated silicate melts with low $\delta^{57/54}$Fe as evidenced by the bulk-rock Fe, Ti, Al, Ca, S enrichment. The heavy Fe isotopic signature in the garnet-poor orthopyroxenite veins most likely reflect kinetic isotope fractionation during the later crust-derived sulfur-depleted silicate melts percolation into the wall dunites combined with relatively high Mg# but extremely low S contents. Taken together, these findings imply that the isotope effects of crustal metasomatism largely depend on the nature and extent of metasomatic processes in the lithospheric mantle. Therefore, deep crust-mantle interactions in continental subduction zones could induce high degrees of Fe isotopic heterogeneity in the SCLM wedge.