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Subduction-induced refertilization of depleted mantle in Sulu continental ultra-high-pressure terrane, eastern China

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The Sulu orogenic belt is world-known as an ultra-high pressure (UHP) terrane formed by continental subduction and collision. Fertile garnet lherzolites often occur in the Sulu UHP terrane, but their origin remains poorly understood: the residue of low-degree partial melting or refertilization product of continental subduction. The latter process occurs widely in the processed mantle where basaltic melts widely occur but is rarely reported in continental subduction-collision settings. Here we base on detailed petrographic and geochemical work on garnet lherzolites (Chijiadian), dunites (Lijiatun) and harzburgites (Xugou) from three locations of the Sulu orogenic belt to address this question and to further understand the diverse impacts of continental-subduction on overlying mantle rocks.

Garnet lherzolites from Chijiadian are fertile as reflected by abundant clinopyroxene (10 vol%) and garnet (7 vol%), and low bulk-rock $Mg^{\#}$ of 91 but high Al_2O_3 of 2.39 to 3.31wt.%. Garnet, clinopyroxene and orthopyroxene include early-stage phases such as olivine and spinel, mainly occur in grain boundary and display secondary poikilitic textures. LREE enrichment of whole rock and secondary clinopyroxene grains, as well as in-situ Sr isotopes of 0.7062-0.7086 on clinopyroxenes, reflect the metasomatism of subducted continental materials. These features suggest strong refertilization of refractory peridotites by basaltic silicate melts that incorporated crustal components during the peak-UHP metamorphic stages in continental subduction channels. Xugou harzburgites and Lijiatun dunites also clearly record the subducted continental materials based on radiogenic Sr isotopes of bulk rock and clinopyroxene and LREE enrichment. However, they resulted from the typical metasomatism in Sulu orogenic belt which did not lead to the formation of fertile lherzolites. Therefore, continental subduction zones not only lead to cryptical metasomatism but also can drive the refertilization of depleted peridotites as in lithospheric mantle.