

Carbonate metasomatism of the lithospheric mantle induced by continental subduction in the eastern North China Craton

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The lithospheric mantle beneath the North China Craton (NCC) has suffered from extensive modification and destruction, in which the carbonate melt-induced metasomatism is suggested to play a critical role. Up to now, most studies proposed that the source of such carbonate melt is resulted from the recycling of the subducted Pacific slab. However, it is worth noting that the northward subduction of the South China Block under the NCC in the Triassic can also contribute amounts of crustal materials into the modification of the lithospheric mantle beneath the NCC. Unfortunately, the modified subcontinental lithospheric mantle (SCLM) induced by deep subduction of the South China Block is hard to preserve due to the strong destruction of the NCC in the Mesozoic. Here we report an unusual peridotite xenolith entrained by the Cenozoic Qixia basalts from the southeastern NCC, which is characterized by the presence of apatite and high $(La/Yb)_N$ (9.3-14.4) and Ca/Al (9.4-13.3) and low Ti/Eu (1258-1645) ratios in the clinopyroxenes. All of these petrological and geochemical features are consistent with the results of carbonate metasomatism in the lithospheric mantle. Importantly, the extremely high Sr isotopic ratios of ~ 0.710 in the clinopyroxene implies that the carbonate melt is derived from the subducted South China Block instead of the Pacific slab or asthenosphere mantle. Therefore, the role of deep subduction of the continental crust contributed to lithospheric mantle modification as well as deep carbon cycle is underestimated.