Mantle recycling of sedimentary carbonate along the northern margin of the North China Craton

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Sedimentary carbonate rocks, which exist extensively in the oceanic realm, are subducted to differing degrees during the closure of oceanic basins. However, very few observational data exist to provide details on the mechanisms of transport of carbonate materials from the surface to mantle depths and back to the Earth's surface. Here we presented a series of diamond-bearing carbonatite xenoliths, carbonatite intrusions and carbonatite veins along the northern margin of the North China Craton (NCC). These carbonatites show geochemical features of recycled limestone (similar trace element patterns and high $^{87}Sr/^{86}Sr$ ratios of 0.705-0.709), indicating that they had a sedimentary limestone precursor. However, the presence of diamond, reduced minerals (e.g., moissanite), mantle-derived silicate minerals (eg., Cpx and Opx), and high Ni content and $^{143}Nd/^{144}Nd$ ratio indicate their staying for a time in the mantle. Combining with the zircon age spectrums of the carbonatite xenoliths and intrusions and the extensive high-$^{87}Sr/^{86}Sr$ (up to 0.708) carbonatite metasomatism in the lithospheric mantle along the northern margin of NCC, we suggest that the limestone precursor could have been derived from the Paleo-Asian Ocean, and these carbonatites mark the subduction of a carbonate platform of the Paleo-Asian Oceanic slab to mantle depths beneath the NCC. Extensive mantle recycling of sedimentary carbonate could have contributed to the modification of the lithospheric mantle along the northern margin of the North China Craton.