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Melting of a stagnant slab in the mantle transition zone: Constraints from Cenozoic alkaline basalts in eastern China

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The feasibility of the melting of oceanic igneous crust in stagnant slabs has been proposed by studies on experimental petrology, however, relevant geochemical evidence of melting has not yet been found from igneous rocks. We present evidence that proves that melts from the igneous layer in the stagnant Pacific slab have contributed to the source composition of basalts from eruption in eastern China. Fe-rich (>13 wt%), Si-poor (<43 wt%) basalts only occur above the leading edge of the stagnant Pacific slab in eastern China. Their source has Nd-Hf isotope compositions akin to the igneous layer in the Pacific slab, while they have Sr-Nd-Pb isotope compositions similar to those of mid-oceanic-ridge basalt. The extremely low Rb and Pb (Ce/Pb > 30) contents of these basalts suggest that this source material was modified by a subduction process. Together, these geochemical characteristics help us to conclude that these basalts have received a significant contribution from the melts derived from dehydrated carbonate-bearing oceanic crust, without a long time-integrated ingrowth of Sr-Nd-Hf-Pb isotope systems at the leading edge of the stagnant Pacific slab.

Keywords: Intraplate alkaline basalt, eastern China, Shandong Peninsula, HIMU basalt, stagnant Pacific slab, oceanic crust recycling