Intraplate high-Mg andesites as melting products of recycled crust from the deep mantle

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Isotopic variations of global oceanic island basalts (OIBs) are mainly attributed to recycled crustal materials in mantle plumes. The oceanic crust and sediments transform into eclogites during subduction, but when recycled eclogites melt during OIB production, such melts tend to react with peridotite during ascent, and this can obscure the nature of the recycled material. Here we report Cenozoic intraplate high-Mg# andesites (HMAs) from NE China, which share isotopic and trace element characteristics with potassic, EM1-type basalts in the region. They display a continuous progression from andesites, formed by direct, high-degree eclogite melting with minimal interaction with peridotite, to enriched, potassic, low-SiO2, alkali basalts, which have suffered progressive melt-peridotite interaction.

The HMAs are distributed along the surface expression of the stagnant Pacific slab's front in the mantle transition zone. These intraplate HMAs are comparable to arc HMAs in major elements, and they show a strong 'garnet effect', (e.g high Gd/Yb and low Sc), suggesting an eclogite source in the mantle. Moreover, light Mg isotopic compositions ($\delta^{26}Mg$ = -0.63‰ to -0.30‰) and EM1-like isotopic compositions ($^{206}Pb/^{204}Pb$ <17.2), suggest that they are derived from recycled ancient sediments. The spatial relationship between the stagnant slab and the intraplate HMAs and widespread occurrence of OIB-type Cenozoic basalts in eastern China suggest that all this volcanism might be driven by a hidden mantle plume beneath the stagnant slab. Plume material can ascend into the upper mantle only through gaps or in front of the stagnant slab.