

Mantle transition zone source of Cenozoic water-rich intraplate magmatism in eastern China

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The genesis of intraplate magmatism is still one of the open questions in geoscience being especially the case for the widespread but small-volume continental basalts. Recently, based on the geochemical signal of oceanic crust discovered in the mantle source of intraplate basalts, a recycled oceanic slab in the mantle transition zone (MTZ) has increasingly been suggested as the source of these basalts. However, no direct observation has been proposed to support this hypothesis. Different levels of the mantle (upper mantle, MTZ, and lower mantle) have distinct water content, and therefore the water content in the source of basalts can potentially be used to infer the mantle depth from where they originated. Here, we calculated the minimum water content in the mantle source of Cenozoic alkali basalts from eastern China using the water content of the parental magmas and the estimated minimum degree of partial melting. The elevated water content in the source (45 ppm to 3710 ppm H₂O by weight, mostly >500 ppm H₂O), combined with results of seismic tomography revealing a stagnant slab in the MTZ beneath eastern Asia, provides convincing evidence for a hydrous MTZ source for the eastern China basalts. In addition, the distribution of water content in the mantle source (decreasing from east to west) and the temporal heterogeneity of the source components indicate effects of the ongoing westward subduction of the Pacific slab on the mantle evolution and the generation of sustained and extensive Cenozoic intraplate magmatism in eastern China (even the whole eastern Asia).