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Quaternary volcanism in southeastern Tibetan Plateau: A record of stagnant oceanic slab in the mantle transitional zone

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The Tibetan lateral mantle flow bears considerable significance in deciphering the material movement mechanisms within global plate convergence zones. However, the front edge of this mantle flow is unclear. Here we conduct petrological, geochronological, mineralogical, geochemical and Sr-Nd-Pb isotopic investigations on Quaternary intracontinental alkali basalts from the southwestern Yunnan (the south of 27°N), to determine the source characteristics and geodynamic mechanisms of the Quaternary alkali basalts in southeastern Tibetan Plateau and to trace the recent Tibetan mantle flow. Alkali basalts in the region are mainly basanite and trachybasalt with eruptions during the Pleistocene epoch. They possess a highly incompatible elemental and radiogenic Sr-Nd-Pb isotopic composition similar to those of the Ocean Island Basalts, consistent with melts derived from asthenospheric mantle with low-degree partial melting. Calculated magma-water contents of regional alkali basalts range from 1.32 ± 0.48 wt.% to 2.23 ± 0.18 wt.%, corresponding to 269 ppm to 3591 ppm water contents of their mantle source, which are significantly higher than that of the normal upper mantle (i.e., 50–250 ppm). Quantitative trace-element modelling and dramatic variations in oceanic crust-sensitive indicators such as Eu/Eu*, Sr/Sr*, Ce/Pb, $(Nb/Th)_{N\text{-}PM}$ and $(Ta/U)_{N\text{-}PM}$ indicate variable contributions of upper and lower oceanic crust to magma sources. Systematic examinations of petrological, geochemical, and geophysical evidence reveal that the temporary small-volume Quaternary volcanism in southeastern Tibetan Plateau is not related to Tibetan southeastward mantle flow but is primarily attributed to stagnant Neo-Tethyan slab in the mantle transition zone.