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Ultrapotassic rocks and xenoliths from south Tibet: Contrasting styles of interaction between lithospheric mantle and asthenosphere during continental collision

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Widespread Miocene (24-8 Ma) mantle-derived ultrapotassic rocks and their entrained xenoliths provide information on the composition, geometry, and thermal state of the sub-continental lithospheric mantle in southern Tibet during the India-Asia continental collision. The geochemical and isotopic characteristics of the ultrapotassic rocks along the Lhasa block delineate two distinct lithospheric source domains that have different histories of depletion and enrichment. The eastern ultrapotassic rocks (89-92°E) reveal a depleted, young and fertile lithospheric mantle (87Sr/86Srt=0.704 to 0.707; εHf(t) = +7.7 to +0.5; Hf TDM =216-499 Ma). The western ultrapotassic rocks (79-89°E) and peridotite xenoliths (81°E) reflect a refractory harzburgitic mantle refertilized by ancient metasomatism (the lavas have: 87Sr/86Srt=0.714-0.734, εHf(t)= +1.1 to -21.2, Hf TDM = 1001-2471 Ma; the peridotites have 87Sr/86Srt= 0.709-0.716).

Our geochemical data, integrated with existing seismic tomography, suggest that upwelling asthenosphere was diverted away from the ancient continental root in the western Lhasa block, but rose to shallower depths beneath a thinner lithospheric mantle in the eastern part. The thermal interaction between the lithospheric mantle and asthenosphere ultimately generated the ultrapotassic rocks in the western and eastern Lhasa blocks. These two different styles of lithosphere-asthenosphere interaction, in turn, determine the oxidation state and the contents of water and other volatiles, ultimately determining the distribution of mineralization in southern Tibet.