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Recycling of subducted Indian continental crust and its significance on post-collisional ultrapotassic magmatism in southwestern Tibet

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Continental lithospheres are usually lighter and thicker than oceanic lithospheres, and are not prone to subduction and fusion. Hence, the subduction and transformation mechanisms of the subducted continental lithosphere are still mysterious. Here we show that a few Eocene (43–42 Ma) Nb-rich granitoids in the Kohistan-Ladakh island arc are characterized by high Nb (24.0–44.1 ppm), Ta (1.39–3.39 ppm), and high Sr (445–933 ppm) and low Y (8.6–18.5 ppm) contents with high Sr/Y (41–77) and $(La/Yb)_N$ (16–37) ratios. They show similar geochemistry and comparable Sr–Nd–Hf isotopic compositions with the coeval (42–40 Ma) amphibolites in the Nanga Parbat massif, implying that they were derived from partial melting of subducted Indian continental plate rather than the Kohistan-Ladakh basement. High Mg# (up to 61) and Cr_2O_3 (2.27–2.36 wt.%) and low TiO_2 (0–3.21 wt.%) biotites and high SiO_2 (48.33–51.74 wt.%) phengites with calculated pressure of 1.6–0.6 GPa were present in these granitoids, indicating significant melt-mantle interaction during magma ascending. We propose that partial melting of the subducted Indian continental crust occurred when it underthrusted into the Kohistan-Ladakh asthenosphere mantle and the resultant melts upward migrated and significantly modified the overlying lithosphere and the residual Indian continental crust sank into deep mantle. Both the metasomatized lithospheric mantle and the residual Indian continental crust played a critical role for formation of the Miocene ultrapotassic rocks in southwestern Tibet.