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Cenozoic Postcollisional Detachment of Mantle Lithosphere in Southern Tibet: Evidence From Ultrapotassic Magmatism and Mantle Xenoliths

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Detachment of lithospheric slabs via either delamination or slab break-off is a key process in an orogenic belt that is marked by coeval magmatism. Here, we present new data from postcollisional ultrapotassic rocks and mantle xenoliths in southern Tibet, and discuss their origin in the tectonic framework of the subduction of the Indian subcontinent beneath Tibet, and the delamination of the continental mantle lithosphere under southern Tibet. Postcollisional ultrapotassic lavas are widespread in the southern Tibetan Plateau, where they are spatially associated with N-S-trending normal faults. Tibetan ultrapotassic rocks, ranging in age from ∼24 to 8 Ma, consist mainly of trachyte, trachyandesite, basaltic trachyandesite, phonolite, and tephriphonolite. They have high light rare earth element (LREE) and large-ion lithophile element (LILE) concentrations, but are low in high-field strength elements (HFSE). They are characterized by having extremely radiogenic Sr(87Sr/86Sr(initial)=0.710719 to 0.736451) and Pb isotopes (206Pb/204Pb=18.449-19.345, 207Pb/204Pb=15.717-15.803, 208Pb/204Pb=39.443-40.168) with unradiogenic Nd isotopes (EpsilonNd(0)= -7.6 to -15) and old Nd model age (T[Depleted Mantle]=1.3-2.1 Ga), similar in character to the Himalayan crystalline basement. Their isotopic character is believed to reflect subduction of the Indian plate beneath the Lhasa terrane, leading to a highly contaminated mantle source. Delamination of the subducted oceanic/continental material might have played an essential role in the genesis of ultrapotassic rocks in the Lhasa terrane. The available geological, geochemical and geophysical data favor a model in which the Indian plate was subducted under southern Tibet. Samples of mantle xenolith rocks entrained in the Sailipu ultrapotassic lavas reveal the existence of a thin, hot, and metasomatic upper mantle under southern Tibet. The surface uplift of the Tibetan plateau in the latest Cenozoic is interpreted to have been linked to these lithospheric-scale processes.