Eocene post-collisional magmatism in Himalaya orogenic belt: evidence from petrography, zircon U-Pb age and Sr-Nd-Hf isotope of the Mayum alkaline complex, southern Lhasa subterrane

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Alkaline magmatism is commonly generated in extensional settings, playing an important role in constraining the timing of slab breakoff. Eocene post-collisional magmatism is widely distributed along the Gangdese belt of southern Tibet. However, few Eocene post-collisional alkaline magmatism has been identified. Here, we present a comprehensive study of whole-rock geochemistry, zircon U-Pb ages and Sr-Nd-Hf isotopes of the Mayum alkaline complex from the Southern Lhasa Subterrane, providing an insight into the timing of breakoff of the Neo-Tethyan slab. The alkaline complex is composed of amphibolite syenite, quartz syenite and alkaline granite. The mafic microgranular enclaves are ubiquitous in the syenites. Zircon U-Pb analyses indicates that the alkaline rocks were generated in Early Eocene (ca. 53-50 Ma). These ages suggest that the alkaline rocks emplaced shortly (10-15 Ma) after the continental collision between the Indian and Eurasian plates. The alkaline rocks have high SiO$_2$ (64.32-77.36 wt.%), Na$_2$O + K$_2$O (6.63-9.03 wt.%) contents, low MgO (0.14-2.52 wt.%) contents. These rocks show obvious arc-like geochemical features in trace elements, i.e., enrichment in LILEs (e.g., Rb, K), LREEs, Th and U, and depletion in HFSEs (e.g., Nb, Ta, Ti), HREEs with strongly to moderately negative Eu anomalies ($\delta$Eu=0.28–0.72). These features together with high FeO$^T$/MgO, Ga/Al, Ce/Nb and Y/Nb values, and low Ba, Sr contents, suggesting that the Mayum alkaline rocks belong to an A2-type granitoids. Besides, the alkaline rocks have homogeneous initial $^{87}$Sr/$^{86}$Sr ratios (0.7052-0.7059) and negative $\varepsilon_{Nd}(t)$ values (-2.1 to -0.9) for whole-rock, and positive zircon $\varepsilon_{Hf}(t)$ values (+0.73 to +11.16). Nd-Hf isotope decoupling suggests that the alkaline was likely produced by mixing of mantle- and crust-derived magmas under a post-collisional extensional setting. Combined with previous published results, we propose that the slab breakoff of the subducting Neo-Tethyan oceanic lithosphere at least prior to Early Eocene (ca. 53 Ma). The Eocene Mayum alkaline complex might be related to asthenosphere upwelling trigged by the slab breakoff.