Geochemical and Sr-Nd isotopic characteristics of the lamprophyre in the Tethyan Himalaya, South Tibet

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A lamprophyre dyke has been found in Ramba area within the Tethyan Himalaya. It intruded into the Late Triassic low-grade metasedimentary rocks (Langjiexue Group) and show typical porphyritic textures, with phlogopite as the dominant phenocrysts. In this study, we performed phlogopite 40Ar/39Ar dating and whole-rock major and trace element as well as Sr and Nd isotope geochemical analyses on the lamprophyre. The $^{40}$Ar/$^{39}$Ar plateau ages (13.1 ± 0.2 Ma and 13.5 ± 0.2 Ma) of the phlogopites from two samples are both in excellent agreement with the inverse isochron ages of 13.1 ±0.3 Ma and 13.6 ± 0.3 Ma, recording the times at which the lamprophyre dyke has cooled below ~300 °C. The lamprophyre has low contents of SiO$_2$ (51.43–55.15 wt%) and Al$_2$O$_3$ (11.10–11.85 wt%), high Fe$_2$O$_3$ (8.57–9.27 wt%) and MgO (9.14–9.49 wt %) contents with Mg$#$ of 66–69, higher content of K$_2$O (3.26–5.57 wt%) relative to Na$_2$O (0.50–1.39 wt%) with K$_2$O/Na$_2$O of 2.3–11.1. Furthermore, the lamprophyre has high abundances of large ion lithophile elements (e.g., Rb, Ba, Sr), shows depletions in high field strength elements (e.g., Nb, Ta, Ti), and displays enrichment in light rare-earth elements over heavy rare earth elements with (La/Yb)$_N$ of 42.3~47.0. Besides, the lamprophyre is characterized by high initial $^{87}$Sr/$^{86}$Sr ratios of 0.7196–0.7204 and negative ε$^{143}$Nd(t) values of -10.7~10.8. Geochemical data suggest that the Ramba lamprophyre was likely generated by partial melting of a metasomatized, phlogopite-bearing harzburgite lithospheric mantle source, followed by crystal fractionation and varying degree of crustal assimilation. The studied lamprophyre provides a window into the composition of the subcontinental lithospheric mantle (SCLM) in the northern margin of the Indian plate. We suggest that the northern Indian plate might be involved in the Andean-type orogeny from the subduction of the Proto-Tethys Ocean during Cambrian to Early Ordovician.