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Lamproites and lamprophyres in the Salitre alkaline intrusion (APIP, Brazil): a mineralogical, petrological, and isotopic investigation

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The Upper Cretaceous Salitre intrusion (~86-82 Ma) is part of the Alto Paranaíba Igneous Province (APIP), which crops out in SE Brazil. It is characterized by volcanic rocks with variable alkali enrichment, such as kimberlites, kamafugites, lamprophyres, and carbonatites. Within the Salitre intrusion, we report the presence of lamproites for the first time, in association with ultramafic lamprophyres trending towards a kamafugitic affinity. These lamproites contain phlogopite and clinopyroxene phenocrysts, set in a groundmass of alkali feldspar, clinopyroxene, apatite, carbonate, and ilmenite. Zircon, baddeleyite, and wadeite are accessory minerals. The only investigated lamprophyre contains olivine and phlogopite phenocrysts in a fine-grained matrix made of clinopyroxene, apatite, phlogopite, magnetite, chromite, perovskite, rare titanite, and schorlomite.

We integrate mineralogical and whole-rock geochemical data to constrain the origin and evolution of these rare, and poorly understood magmas. Both rock types have low SiO_2 (28.5-39.0 wt% for the lamproites and 35.6 wt% for the single lamprophyre), are ultrapotassic (K_2O/Na_2O = 3-14 and 5; K_2O = 4.4-6.1 wt% and 4.4 wt%) and peralkaline (PI = 1.1-1.9 and 1.3). They also have variable MgO content (6.3-10.1 wt% and 13.9 wt%), and variable REE content (∑REE = 500-1500 ppm and 1300 ppm) and other incompatible trace elements (Nb, Ta, Zr, Hf, Sr, Ba). The initial Sr-Nd-Pb isotopic compositions at 84 Ma ($^{87}Sr/^{86}Sr_i$ = 0.70490-0.70547 in lamproites and 0.70497 in lamprophyre; $^{143}Nd/^{144}Nd_i$ = 0.51220-0.51228 in lamproites and 0.51224 in lamprophyre; $^{206}Pb/^{204}Pb_i$ = 17.45-17.89 in lamproites and 17.87 in lamprophyre) fall within the compositional range of APIP alkaline rocks reported in the literature.

These findings are compatible with the derivation of the APIP magmatism originated from an ancient, metasomatized, carbonated, phlogopite-bearing domain within the continental lithospheric mantle, with limited evidence of an asthenospheric (OIB-type) mantle contribution.

By integrating mineralogical, petrographic, and geochemical evidence, this study significantly advances the petrogenetic model of the Salitre alkaline intrusion and reveals new insights into the petrological diversity of the entire APIP.