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# REE mineralization age and geodynamic setting of the Jialu deposit in the Southern margin of North China Craton: Constraints from in situ U-Pb dating and Nd isotope

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There are many carbonatite dykes in the Southern margin of North China Craton (S-NCC), which are distinguished from most carbonatites worldwide by they have high contents of HREE. Among them, the Jialu deposit is one of the most representative carbonatite-hosted REE deposits in the S-NCC. However, the age of REE mineralization, origin of REE enrichment, and tectonic setting are still unknown. Here, we conducted detailed mineralogical, geochronological, and geochemical analyses to provide new insights.

Based on mineral assemblages and textures of calcite-related veins, carbonatites/REE ores can be divided into three types. Primary carbonatite is dominated by coarse-grained calcite with a typical cumulate texture and occurs in early magmatic stage. Primary calcite contains the highest HREE (Gd-Lu+Y) contents of 660-1500 ppm, which controls the budget of REE in the bull rock, without any REE minerals. Brecciated ore is mainly composed of calcite and quartz breccia, which can undergo varying degrees of hydrothermal alteration. The principal REE minerals in this sample are REE fluorocarbonates and xenotime. Banded ore mainly occurs in the contact zones between quartz-calcite carbonatites and wall rocks accompanying intense K-(Na) alteration. The dominant REE minerals in this sample are fine-grained scaly aggregates of monazite with minor xenotime. The unaltered parisite, bastnäsite and xenotime U-Pb dating yielded ages of 231.4 ± 7.2 Ma, 234.7 ± 6.5 Ma and 227 ± 1.6 Ma, respectively, corresponding to an extensional environment of the post-collision stage of the Qinling orogeny. Hydrothermal monazite yielded a younger age of 217 ± 5.0 Ma, suggesting the banded ore was formed in the post-magmatic hydrothermal metasomatism. Altered parisite and bastnäsite have lower εNd(t) values ranging from -5.7 to -4.8, while unaltered εNd(t) values ranged from -4.7 to -4.0. This indicates that post-magmatic hydrothermal fluids involved crustal materials. Combined with C-O-Sr-Nd isotopic compositions indicating that carbonatite originated from EMI with additional contribution by partial melting of the lower crust.