

METALLOGENETIC PROCESSES ASSOCIATED WITH BRAZILIAN CARBONATITE COMPLEXES

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Although Brazilian carbonatites are known for their economic significance as relevant sources of niobium and phosphate – and potential for titanium, nickel, rare earth elements (REEs), etc. –, their metallogenic processes have not been sufficiently clarified. Brazilian carbonatite-related deposits often exhibit unique ore formation processes that are either uncommon or lacking in better-understood international counterparts. Most alkaline-carbonatite Brazilian provinces had their petrogenetic and textural features detailed, providing an appropriate petrologic framework from which to detail ore formation processes associated with them. Compiling and comparing this data in a review work from more than 30 Brazilian carbonatite occurrences will improve our understanding of the mineralization processes within these systems. As an example of a province that has been well investigated, the Alto Paranaíba Igneous Province (APIP), in southeastern Brazil, can be used to demonstrate the uniqueness of some of these metallogenic features. The APIP, which comprehends the Araxá, Catalão I, Catalão II, Salitre, Serra Negra, and Tapira alkaline complexes, is one of the various provinces that occur surrounding the Paleozoic Paraná sedimentary basin and hosts the largest known niobium deposits in the world, along with important phosphate deposits. Unlike barren alkaline-carbonatite provinces, the APIP is genetically linked to ultramafic and ultrapotassic rocks, such as kamafugites and kimberlites. These rocks were likely formed during a regional mantle melting event related to the impact of a mantle plume. The role of mantle plumes and the association with ultrapotassic rocks is also observed in other carbonatite-related phosphate deposits in Brazil, such as Angico dos Dias and Jacupiranga, northeastern and southeastern Brazil, respectively. Finally, some questions remain regarding supergene ore formation processes that affected non-economic, hypogene carbonatites and enriched them to ore grades. These questions encompass from timing of the supergene enrichment to the mineralogical complexity of ores that directly impact milling and concentration. Therefore, a detailed metallogenic review of Brazilian carbonatite-related deposits and their ore formation processes would not only benefit existing mines, resources being currently developed and future exploration efforts, but in the long term, influence the Brazilian economic panorama, considering the country's agroindustrial-based economics and its need to import commodities like phosphate to produce farming fertilizers.

KEYWORDS: BRAZILIAN CARBONATITES, METALLOGENIC PROCESSES, ALTO PARNAÍBA IGNEOUS PROVINCE