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Tracking hydrothermal events using zircon REE geochemistry from the Carajás Mineral Province, Brazil

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ABSTRACT

Zircon geochemistry and geochronology are powerful tools in the study of multistage cratonic settings, yielding information on ages and distinguishing terranes. The Carajás Mineral Province (CMP) SE of the Amazonian Craton is renowned for its complex tectonic evolution and notable mineral deposits endowment, such as the giant iron-oxide-copper-gold (IOCG)-type Sossego and Salobo. Tectonic, magmatic, metamorphic, and hydrothermal event sequences imprint their records regionally and deposit scales that, in most cases, are difficult to identify. Basement and wall-rock samples from the southern portion of the CMP's, Sossego area were selected and analyzed using sensitive high-resolution ion microprobe (SHRIMP). Cathodoluminescence images guided the morphological and textural characterization and spot location. U-Pb and rare earth elements (REE) analyses using SHRIMP provided ages and trace element contents leading to classification of zircon type as magmatic, hydrothermally altered magmatic, or hydrothermal zircon. Hydrothermal zircon is characterized by anomalous morphology and REE and U contents, and these features have prompted the identification of an Archean hydrothermal event in the province. These zircon classifications indicate a circa 2.54 Ga hydrothermal event in the southern region of Carajás, likely associated with main shear zone movements (Carajás Fault). The 2.54 Ga event is well constrained to the Carajás northern zone and has not been indicated in the southern region. The magmatic and hydrothermally altered zircons indicate ages around 2.95 Ga and 2.74 Ga, coinciding with the zone's known ages, with better resolution achieved using SHRIMP. The use of zircon type classification in cratonic terranes to track hydrothermal events offers original possibilities and represents new frontiers in mineral exploration.