

TECTONIC SETTING OF NEOARCHEAN BASALTS FROM CARAJÁS BASIN: CONSTRAINTS FROM TRACE AND ISOTOPIC SIGNATURES

*Martins, P.L.G.¹; Toledo, C.B.L.¹; Silva, A.M.¹; Toledo, C.B.L.; Chemale Jr., F.²; Santos, J.O.S.³;
Assis, L.M.⁴*

1 University of Brasília; 2 University of Vale do Rio dos Sinos; 3 University of Western Australia; 4 Vale S.A.

ABSTRACT: The Neoproterozoic Carajás Basin is situated in the northern part of the Carajás Mineral Province. The main rock assemblages of this basin consist of volcano-sedimentary sequences composed predominantly of mafic volcanic rocks, and banded iron formations. The Grão-Pará Group is the dominant sequence in the basin. The basalts of Grão-Pará Group (Parauapebas Formation) occur in extensive succession of massive or amygdaloidal lava flows at least 369 m in thickness. The basalts are grayish green amygdaloidal, porphyritic, aphanitic or fine-grained, and hypocrystalline. The primary mineral assemblages consist predominantly of clinopyroxene and plagioclase. On the other hand, albite, chlorite (brunsvigite), Fe-epidote, quartz and calcite are the main secondary minerals, being interpreted as product of seafloor hydrothermal alteration and/or sub-greenschist metamorphism. The basaltic rocks of Parauapebas Formation have high SiO₂ contents ranging from 51.12 to 55.26 wt%, low TiO₂ (0.69–0.92 wt%), and FeO = 7.02%–12.35 wt%. The total alkali contents (Na₂O+K₂O) range from 3.93 to 6.17 wt% and transitional metals (Cr and Ni) reach an average of 90.89 ppm and 47.40 ppm, respectively. The MgO is low from 4.38 to 7.38 wt%. Moreover, the rocks are sub-alkaline, plot in the transitional and calc-alkaline fields, and show either arc-like trace element patterns or similar to those of the upper continental crust. These features include LILE (e.g., Ba/La* \cong 6.34) and LREE (La/Yb_{CN} = 4.00–7.58; La/Sm_{CN} = 2.83–4.09) enrichment and Nb and Ti depletion. SHRIMP zircon U–Pb dating constrains the crystallization ages at 2749 \pm 6.5 and 2745 \pm 5 Ma (Early Neoproterozoic) regarding volcanic mafic rocks. WDS zircon results demonstrate crystallization of zircon from a mantle-derived magma emplaced into continental crust. Given the high ⁸⁷Sr/⁸⁶Sr ratios (0.704198 to 0.709571), the relatively wide range of ϵ Nd(t) (-1.53 to -4.11) and Nd model ages higher than crystallization age (3.02 to 3.36 Ga), we consider that the primary magma experienced significant contamination by upper crustal rocks with low Nd isotopic values. This is further supported by the predominant negative ϵ Hf(t) values (-2.75 to -0.79), with Hf crustal model ages (TDM^C) ranging from 3224 to 3345 Ma. Our data suggest that the Carajás Basin was likely formed in an extensional regime related to a rift setting at ca. 2750 Ma. We propose that this rift basin is related to post-orogenic setting in the passage from the Mesoproterozoic to the Neoproterozoic. The rifting process could be associated to a slab breakoff and subsequent asthenosphere upwelling that provided heat for partial melting of the lithospheric mantle.

KEYWORDS: CARAJÁS MINERAL PROVINCE; CARAJÁS BASIN; CONTAMINATED
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