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Paleoproterozoic bimodal post-collisional magmatism in the southwestern Amazonian Craton, Mato Grosso, Brazil: Geochemistry and isotopic evidence

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ABSTRACT

This paper discusses geological and geochemical aspects of a Paleoproterozoic volcano-plutonic association that crops out in southwestern Amazonian Craton, Mato Grosso, Brazil. The study area was divided into undeformed and deformed domains, based on structural and geochronology studies. The undeformed domain is composed mainly of felsic explosive and effusive flows. Inter-layered mafic flows of basalts and sedimentary rocks are also present. The deformed domain is mainly composed of titanite and hornblende-bearing monzogranite to syenogranite and biotite monzogranite, while granodiorite is less common. U–Pb single zircon analyses yielded ages of 1.8–1.75 Ga in granites and felsic volcanic rocks for both domains. Basalts from the undeformed domain are phaneritic, fine-grained, and are often hydrothermally altered. They show tholeiitic affinity and are LREE enriched. Their trace element composition resembles those of within-plate associations. The ε_{Nd} (t = 1.75 Ga) for all these rocks are positive, ranging from 0.12 to 1.49, which reflect a juvenile source. The felsic volcanism comprises subalkaline rocks with high K contents and is divided into two groups: crystal enriched ignimbrites and effusive rhyolites. REE patterns of effusive rocks show negative-Eu anomalies and are smooth in the ignimbrites. Trace element patterns similar to those of the effusive rocks and ignimbrites are found in magmatic rocks derived from sources affected by subduction-related metasomatism. Hornblende and biotite granites occur in the deformed felsic plutonic domain. These rocks show evidence of low-temperature metamorphism and deformation, and in some places, of hydrothermal alteration. The LREE/Nb (or Ta) ratios of these rocks are consistent with those observed in granites of post-collisional settings. The ε_{Nd} (t = 1.75 Ga) values are slightly negative on average, with few positive values (−1.41 to +2.96). These data are interpreted as indicative of a magmatism produced during a post-collisional event from mixed sources: a metasomatised mantle and a Paleoproterozoic continental crust. An intracontinental shearing with age of 1.7–1.66 Ga created the Teles Pires–Juruena lineament which partially controlled this magmatism.

1. Introduction

The Amazonian Craton was formed by the accretion and amalgamation of micro-continents during the Archean and Proterozoic eons. It is divided into six different geochronological provinces: Central Amazonian (>2.3 Ga), Maroni-Itacaiúnas (2.2–1.9 Ga), Ventuari-Tapajos (1.95–1.80 Ga), Rio Negro-Juruena (1.8–1.55 Ga), Rondonian-San Ignacio (1.55–1.3 Ga), and Sunsas-Aguapeí (1.3–1.0 Ga) (Tassinari and Macambira, 1999). The study area is located in the southwest part of the Ventuari-Tapajos Province – Rio-Negro-Juruena Province border region (Fig. 1B). The southern portion of the Ventuari-Tapajos Province comprises mostly granite-gneiss, metamorphosed under amphibolite facies (Tassinari and Macambira, 1999). These units show Rb–Sr and U–Pb zircon ages ranging from 2.0 to 1.85 Ga, and are covered by volcano-plutonic rocks of the Iriri and Teles Pires formations and by Gorotire and Beneficente sedimentary groups. Selected rocks from Ventuari-Tapajos Province show ε_{Nd} (t = 2.0 Ga) values in the range +2.0 to −1.6 (Sato and Tassinari, 1997), which were considered by the authors as mixing of subordinate crustal component with predominantly Paleoproterozoic mantle-derived magma. Recently, Lamarão et al. (2005) presented Nd data from Paleoproterozoic volcanic rocks of Vila Riozinho and Jamanxim (Tapajos Gold Province) located in the Ventuari-Tapajos Province. The $\varepsilon_{Nd}(T)$ values and $\varepsilon_{Nd}T_{DM}$ model age of the magmatic rock associations exposed in the Vila Riozinho are fairly uniform, ranging from −0.7 to −5.2 and 2.50 to 2.23 Ga, respectively. The Sm–Nd data are similar in all the studied rocks, independently of age or geochemical composition. These data indicate that the original magmas were not produced exclusively by

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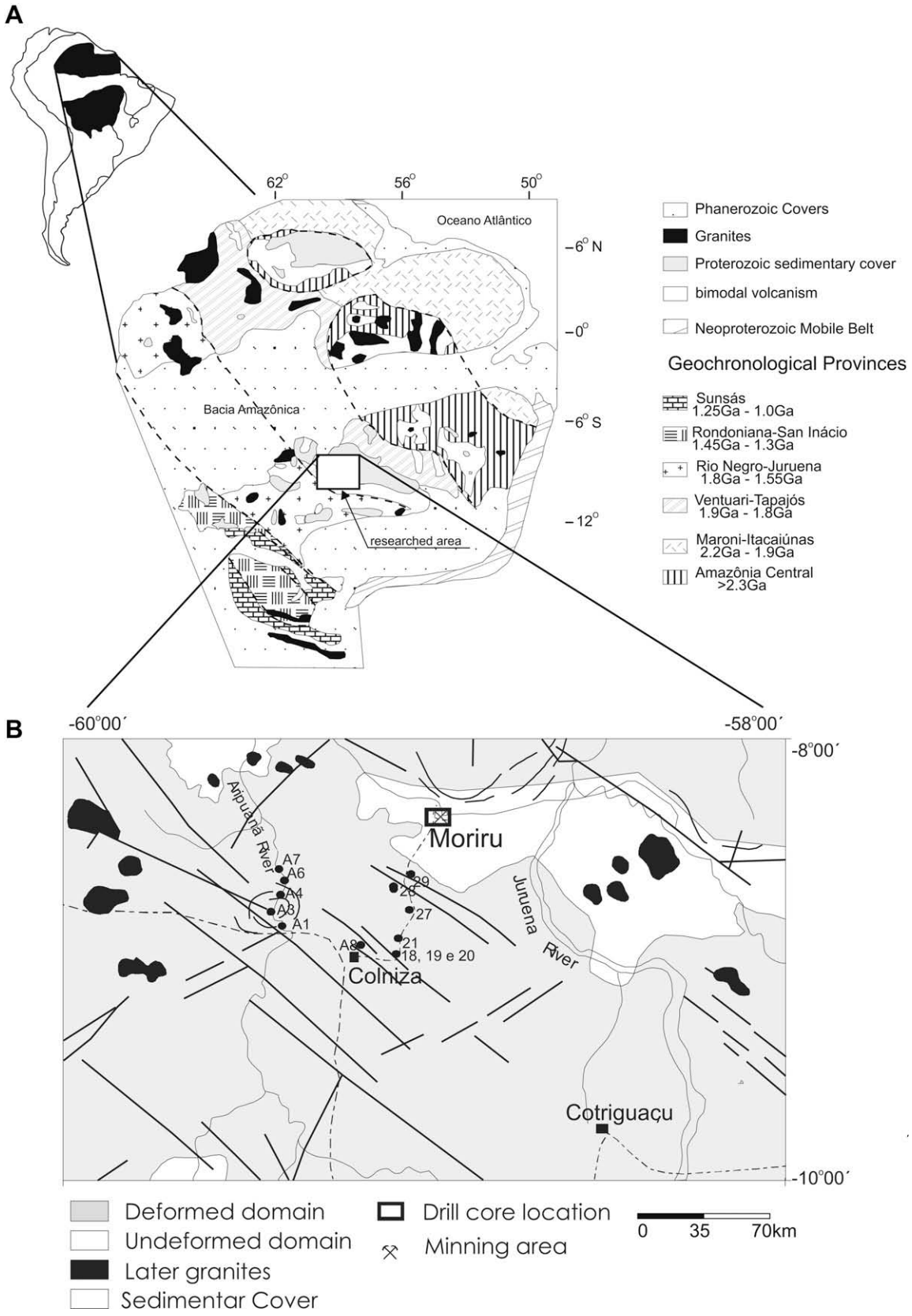

Fig. 1. (A) South America map with the Amazon craton as dotted area (B). Map of the Amazon Craton showing the geochronological provinces defined by Tassinari and Macambira (1999). (C) Geologic map of the study area (after Barros, 1982 and Pinho et al., 2003).

reworking or remelting of Archean sialic crust but from mixed Paleoproterozoic crustal and mantle sources. The negative $\varepsilon_{Nd}(T)$ values also preclude derivation from only primitive mantle sources (Lamarão et al., 2005).