



The Paleoproterozoic Campinorte Arc: Tectonic evolution of a Central Brazil pre-Columbia orogeny



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ABSTRACT

The Campinorte Arc is a poorly exposed 2.19–2.07 Ga Paleoproterozoic terrane in contact with the Neoproterozoic Goiás Magmatic Arc by the Rio dos Bois Fault in the northern Brasília Belt, Central Brazil. The Campinorte Arc is divided into Pau de Mel Suite metatonalites to metamonzogranites and the Campinorte volcano-sedimentary Sequence. Pau de Mel Suite whole rock geochemistry indicates at least three separate coeval parental magmas compatible with arc signatures. U–Pb geochronology data of paragneiss and mafic granulite exposed in the region as part of the Campinorte Arc provide additional information on this Paleoproterozoic orogenic cycle. The formation and preservation of these granulites was due to tectonic switching of the back arc basin and consequent lithospheric thinning from 2.14 to 2.09 Ga with metamorphic peak from 2.11 to 2.08 Ga. A Pau de Mel Suite granodiorite sample dated at ca. 2.08 Ga indicates post-peak magmatism. The arc was thereafter rapidly contracted preserving Paleoproterozoic high metamorphic grade mineral assemblages. Additionally, the Campinorte Arc and the neighboring Crixás/Guarinos/Faina greenstone belts may have shared the same source of sediments as attested by geographic proximity, coeval maximum sedimentation, felsic volcanism and the occurrence of similar rock types. Gravimetric and seismic data also support a common basin hypothesis. The formation of the Campinorte Arc is contemporaneous to other northern Brasília Belt basement terranes and, along with similar arcs within and at the São Francisco Craton edges, indicate a continental crust formation event that eventually led to the assemblage of Columbia.

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1. Introduction

The link between orogenic events and granulites has been well documented in belts formed during four main periods in Earth's history (Brown, 2007): Archean–Paleoproterozoic (2.7–2.45 Ga), mid-Paleoproterozoic (2.0–1.8 Ga), Late Mesoproterozoic to early Neoproterozoic (1.4–1.0 Ga) and Late Proterozoic–Cambrian (630–510 Ga). These periods coincide with continental agglutination and formation of supercontinents (Kenorland, Nuna/Columbia, Rodinia and Gondwana, respectively) and suggest a link between high-temperature granulite metamorphism and supercontinent amalgamation events.

The Central Brazil northern Brasília Belt basement encompasses evidence of arc-related granulite formation that still

lack correlation with supercontinent assemblage/breakup events. Geochronological evidence of a Paleoproterozoic accretionary event is preserved in the Goiás Massif Campinorte Sequence containing ~2.17–2.05 Ga magmatic arc rocks and correlated sedimentary sequences (Kuyumjian et al., 2004; Giustina et al., 2009a), in spite of pervasive regional Neoproterozoic metamorphic and structural overprint. The occurrence of high temperature granulites within the northern Brasília Belt basement is in tandem with coeval arcs in neighboring São Francisco and Amazonian cratons (Rosa-Costa et al., 2006; Oliveira et al., 2011). Metamorphic ages in both cratons fall within the 2.1–2.0 Ga range. Contemporaneous metamorphism is also described in the Ribeira Belt (Heilbron et al., 2010), Araguaia Belt basement (Gorayeb et al., 2000) and São Luis Craton (Klein and Moura, 2008), in Brazil; the Dahomeyide Belt in Africa (Agbassoumoundé et al., 2007); and the Dabie orogeny in China (Wu et al., 2008). These coeval São Francisco Craton orogens point to a widespread arc formation and amalgamation cycle formerly described in Central Brazil as the Trans-Amazonian Cycle (Brito Neves, 2011). These metamorphic events coincide

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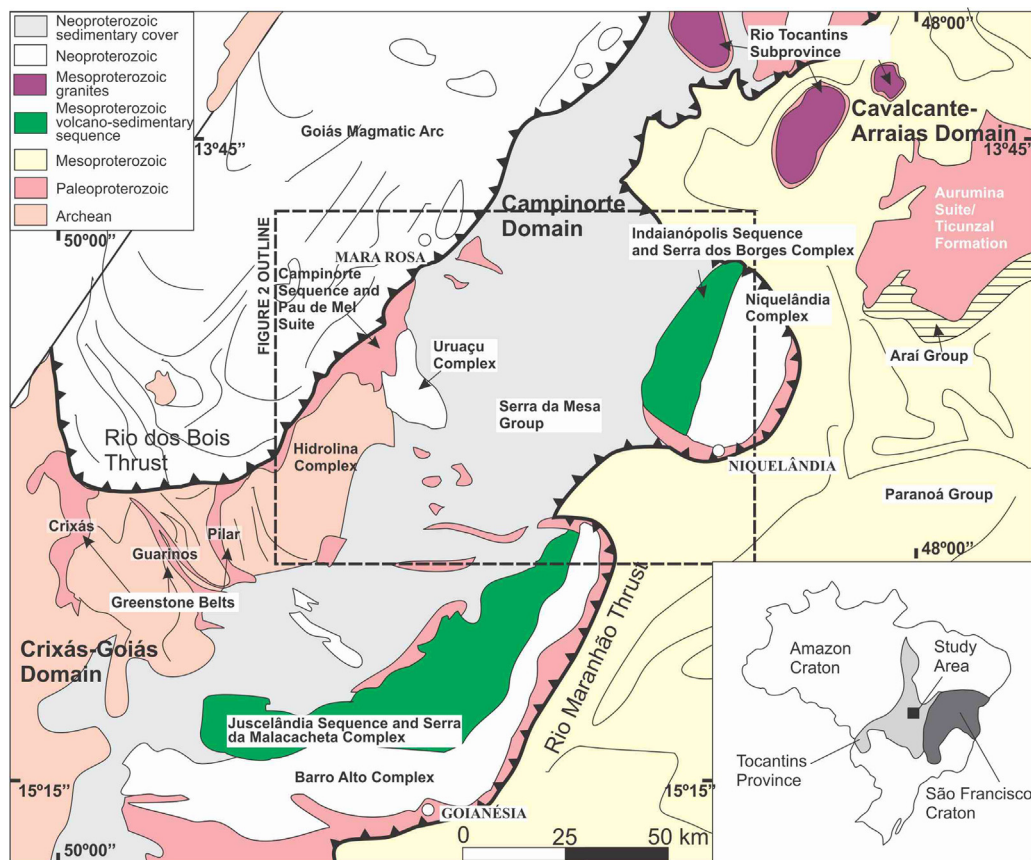


Fig. 1. Geological sketch of the terrane between the Crixás-Goiás Block and the Barro Alto and Niquelândia complexes (Fuck, 1994; Delgado et al., 2003; Giustina et al., 2009a; Ferreira Filho et al., 2010; Jost et al., 2010).

with the amalgamation stage of Columbia and the detailing of the Campinorte Sequence and related rocks would add to this supercontinent tectonic evolution.

In this paper we present whole-rock geochemistry results of several Pau de Mel Suite rocks, including tonalite, granodiorite and monzogranite and new in situ zircon U–Pb LA-ICP-MS geochronology of a granodiorite and a monzogranite in order to refine the studied area tectonic and geological setting. We also provide U–Pb LA-ICP-MS ages for Campinorte Domain para- and orthogranulite to better constrain the timing of Paleoproterozoic metamorphism in the Goiás Massif and propose links with neighboring terranes. Our main goal is to suggest a Paleoproterozoic tectonic evolution model that can be used as backbone for revised northern Brasília Belt geological framework.

2. Geological setting

The Northern Brasília Belt basement forms a 600 km long and 150 km wide NE trending area between the Amazonian and São Francisco cratons and the Paranapanema Block (Pimentel et al., 2000). The belt is in contact to the west with the Neoproterozoic Goiás Magmatic Arc by the Rio dos Bois Thrust. To the east, toward the São Francisco Craton, the Goiás Massif is covered by the Bambuí Group; to the south by Paranoá Group metasedimentary rocks and to the north by the Paleozoic Parnaíba basin. Northern Brasília Belt basement terranes have been grouped under several different names in the past, such as Median Goiás Massif (Almeida, 1976), Granite-gneiss Complex (Cordani and Hasui, 1975), Goiano Basal Complex (Marini et al., 1978) and Goiás Massif (Pimentel et al., 2000). In this paper we favor the latter term (Goiás Massif) referring to the northern Brasília Belt terrane formed by exposed Archean

to Mesoproterozoic crystalline rocks east of the Neoproterozoic Goiás Magmatic Arc. According to the non-descriptive nomenclature proposed by Cordeiro (2014), the Goiás Massif in the studied area is divided from southwest to northeast into the Crixás-Goiás, Campinorte and Cavalcante-Araias Domains:

- (1) *Crixás-Goiás Domain*: 2.8–2.6 Ga Archean TTG complexes wrapped by greenstone belts (Queiroz et al., 2008) with Archean komatiite sequences covered by gold-bearing ~2.17 Ga Paleoproterozoic metasedimentary rocks (Jost et al., 2010, 2012).
- (2) *Campinorte Domain*: 2.19–2.07 Ga Campinorte Sequence metavolcano-sedimentary rocks and Pau de Mel Suite meta-granites depicted in Fig. 1 and detailed by Kuyumjian et al. (2004), Oliveira et al. (2006) and Giustina et al. (2009a). These rocks are well exposed at the contact with the Rio dos Bois Thrust whereas restricted structural windows also occur within the Neo-Mesoproterozoic Serra da Mesa Group to the east. Paleoproterozoic granite-gneiss, felsic migmatites and ultramylonites southeast of the Barro Alto mafic-ultramafic complex (Fuck et al., 1981; Correia et al., 1997) are grouped under this domain.
- (3) *Cavalcante-Araias Domain*: ~2.17–2.12 Ga syn- to post-collisional Aurumina Suite peraluminous metagranites intrusive in Ticunzal Formation metasedimentary graphite-bearing schists to paragneisses (Botelho et al., 2006; Alvarenga et al., 2007). Para-derived gneisses and graphite-rich nodules (restites) are common at the Aurumina Suite intrusive contacts. Other evidence of the Ticunzal Formation as an important source for this voluminous Paleoproterozoic syn-collisional

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