



# Granites of the intracontinental termination of a magmatic arc: an example from the Ediacaran Araçuaí orogen, southeastern Brazil



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## ARTICLE INFO

### Article history:

Received 28 January 2015

Received in revised form 7 July 2015

Accepted 29 July 2015

Available online 29 August 2015

Handling Editor: A.S. Collins

### Keywords:

Granites

Magmatic arc termination

Ediacaran

Rio Doce arc

Araçuaí orogen

## ABSTRACT

The Araçuaí orogen of southeastern Brazil together with the West Congo belt of central West Africa form the Araçuaí–West Congo orogen generated during closure of a terminal segment of the Neoproterozoic Adamastor Ocean. Corresponding to an embayment in the São Francisco–Congo Craton, this portion of the Adamastor was only partially floored by oceanic crust. The convergence of its margins led to the development of the Rio Doce magmatic arc between 630 Ma and 580 Ma. The Rio Doce magmatic arc terminates in the northern portion of the Araçuaí orogen. Granitic plutons exposed in the northern extremity of the arc provide a rare opportunity to study magmatism at arc terminations, and to understand the interplay between calc-alkaline magma production and crustal recycling. The plutons forming the terminus of the arc consist of granodiorites, tonalites and monzogranites similar to a magnesian, slightly peraluminous, calcic- (68%) to calc-alkaline (24%), with minor alkali-calcic (8%) facies, medium- to high-K magmatic series. Although marked by negative Nb–Ta, Sr and Ti anomalies, typically associated with subduction-related magmas, the combined Sr, Nd and Hf isotopic data characterize a crustal signature related to anatexis of metamorphosed igneous and sedimentary rocks, rather than fractional crystallization of mantle-derived magmas. Zircon U–Pb ages characterizes two groups of granitoids. The older group, crystallized between 630 and 590 Ma, experienced a migmatization event at ca. 585 Ma. The younger granitoids, emplaced between 570 and 590 Ma, do not show any evidence for migmatization. Most of the investigated samples show good correlation with the experimental compositional field of amphibolite dehydration-melting, with some samples plotting into the field of greywacke dehydration-melting. The studied rocks are not typical I-type or S-type granites, being particularly similar to transitional I/S-type granitoids described in the Ordovician Famatinian arc (NW Argentina). We suggest a hybrid model involving dehydration-melting of meta-igneous (amphibolites) and metasedimentary (greywackes) rocks for magma production in the northern termination of the Rio Doce arc. The real contribution of each end-member is, however, a challenging work still to be done.

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## 1. Introduction

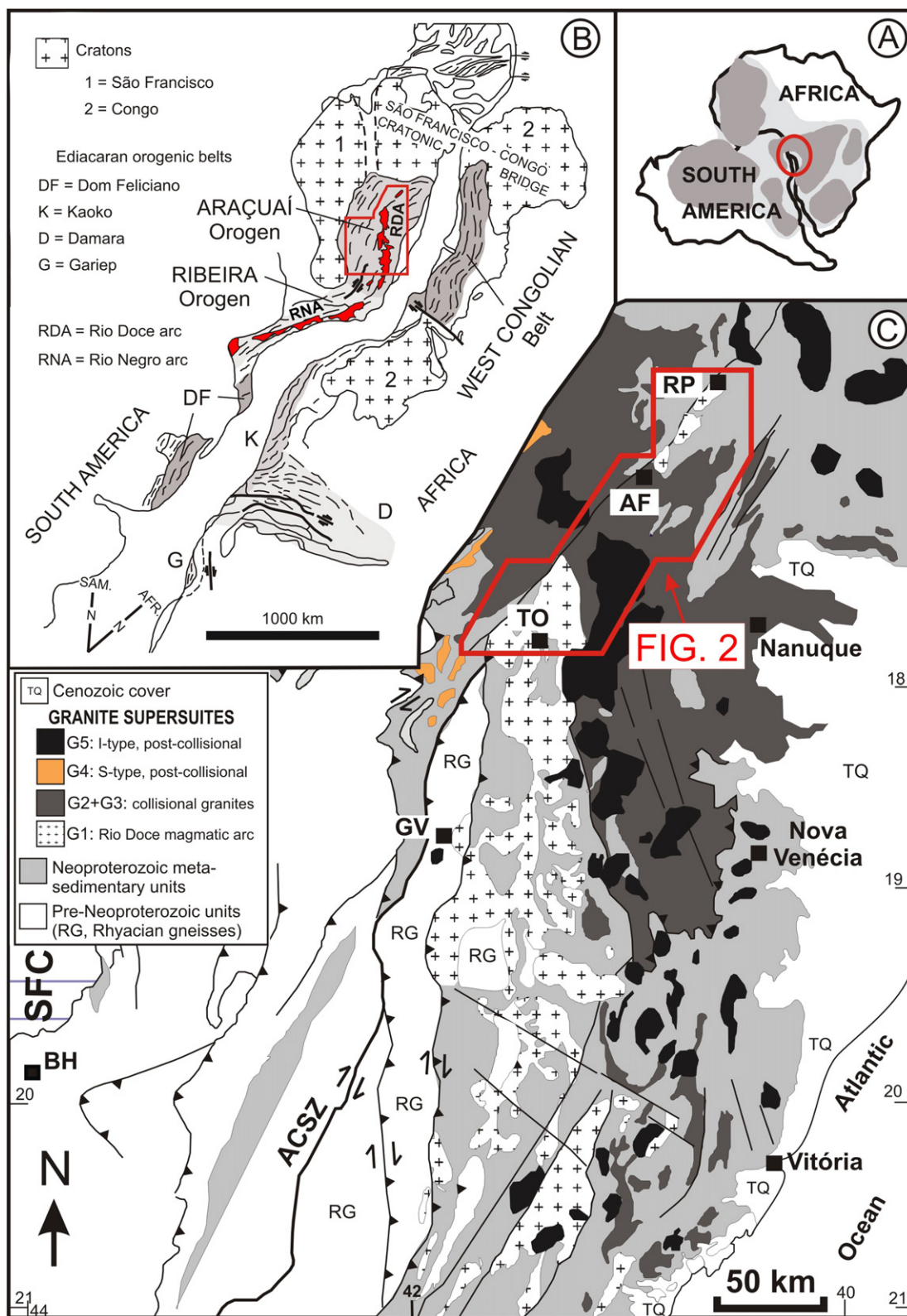
Major and trace element data, together with Lu–Hf in zircon, whole-rock Sm–Nd and Rb–Sr isotopes provide sensitive discriminators of tectonic and/or magmatic processes operating above subduction zones and within collisional orogens (Rudnick, 1995; Kemp and Hawkesworth, 2003; Kemp et al., 2006; Liu et al., 2013; Niu et al., 2013). These chemistry and isotope datasets can also be used to discriminate between a range of

geological processes involved in the pre-collisional to collisional stages of an orogenic belt evolution, such as crustal reworking, crust–mantle interactions, and production of juvenile magmas from the mantle.

The Araçuaí orogen of southeastern Brazil and the West Congo belt of southwestern Africa once lie in the central portion of West Gondwana (Alkmim et al., 2001). Together, they form the Araçuaí–West Congo orogen (AWCO), generated during closure of a terminal branch of the Neoproterozoic Adamastor Ocean (Pedrosa-Soares et al., 1992, 2001; Brito Neves et al., 1999; Cordani et al., 2003; Alkmim et al., 2006). Emplacement of ophiolite slivers, development of intra-oceanic and continental-margin magmatic arcs, and collision of the plates represented by the São Francisco–Congo, Paranapanema, Rio de la Plata and Kalahari cratons record the Adamastor Ocean closure from the Cryogenian to Ediacaran periods (e.g., Pedrosa-Soares et al., 1998, 2011; Campos-Neto, 2000; Alkmim et al., 2001, 2006; Basei et al.,

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**Fig. 1.** A) The Araçuaí–West Congo orogen and related cratons in the context of West Gondwana (after Alkmim et al., 2006; Noce et al., 2007). Dark gray = cratons; light gray = orogenic belts. B) Relative positions of the Neoproterozoic orogenic belts (in gray) presently exposed along the South American and African margins of the Atlantic (modified from Porada, 1989). Red polygon and regions indicate, respectively, the approximate location of Fig. 1C and plutons forming the Rio Doce and Rio Negro arcs. C) Simplified geological map of the Araçuaí orogen, with a box indicating the studied region (modified from Pedrosa-Soares et al., 2008). ACSZ = Abre Campo Shear Zone; SFC = São Francisco Craton. Cities: BH = Belo Horizonte; GV = Governador Valadares; TO = Teófilo Otoni; AF = Águas Formosas; RP = Rio do Prado.

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