Journal of South American Earth Sciences 86 (2018) 38–53

Contents lists available at ScienceDirect

Journal of South American Earth Sciences

journal homepage: www.elsevier.com/locate/jsames

Insights on the evolution of the Arroio Grande Ophiolite (Dom Feliciano Belt, Brazil) from Rb-Sr and SHRIMP U-Pb isotopic geochemistry

Ramos Rodrigo Chaves[a,*], Koester Edinei[b], Vieira Daniel Triboli[a], Porcher Carla Cristine[b], Gezatt Julia Neri[c], Silveira Renato Luiz[a]

[a] Programa de Pós-Graduação Em Geociências, Instituto de Geociências, Universidade Federal Do Rio Grande Do Sul, PO Box 15001, 91501-970, Porto Alegre, RS, Brazil
[b] Departamento de Geologia, Universidade Federal Do Rio Grande Do Sul, Bento Gonçalves Avenue, 9500, 91540-000, Porto Alegre, RS, Brazil
[c] Department of Geology and Petroleum Geology, University of Aberdeen, AB243UE, Aberdeen, Scotland, United Kingdom

ARTICLE INFO

Keywords:
Geochronology
Geochemistry
Punta del Este Terrane
Ophiolite

ABSTRACT

This paper presents the first Rb-Sr isotopic geochemistry study and SHRIMP zircon U-Pb dating in the Arroio Grande Ophiolite (southeasternmost Dom Feliciano Belt in Brazil), an extension of the Uruguayan Punta del Este Terrane. The metamafic units of the ophiolite show $^{87}Sr/^{86}Sr$ ratios ranging from 0.7036 to 0.7070 (recalculated at 630 Ma), which suggest a MORB magmatic source for the amphibolite protoliths and a volcanic magmatic arc source (with possible crustal contamination) for the metagabbro protoliths. Together, these features suggest a supra-subduction zone origin for these rocks, corroborating previous studies based on bulk-rock chemistry. In the metaultramafics, the $^{87}Sr/^{86}Sr_{630}$ ratio of the chloritite sample (0.7152) is comparable to that of the Três Figueiras granite (0.7139), a syn-kinematic peraluminous granite related to the Ayrosa Galvão-Arroio Grande Shear Zone (which also affected the southern portion of the ophiolite, where the studied samples are located). The emplacement of the latter granite could be responsible for the metasomatism of the former serpentinites, generating talc- and chlorite-rich reaction zones. The SHRIMP U-Pb analysis of twelve chloritite zircons strengthens that assumption, as zircons with ca. 610-585 Ma (the age of the granite) were found in association with metasomatic microtextures. Zircon ages ranging from ca. 2000 to 660 Ma were also found in the chloritite. These latter ages are analogous to those found in the metasiliciclastic rocks that envelop the metaultramafic rocks of the ophiolite, so that the chloritite probably represents a blackwall reaction zone between (i) a former serpentinite, (ii) the Três Figueiras granite, and (iii) metasiliciclastic rocks. Additionally, we perform a SHRIMP U-Pb dating in a quartz-syenite melt, which are related to a tonalitic intrusion within the metasedimentary unit (the Matarazzo Marbles) of the ophiolite. The obtained concordia age of 640 Ma constrains the minimum age of ophiolitic mélange emplacement, as the tonalitic intrusion is related to continental arc magmatism (Pinheiro Machado Intrusive Suite).

1. Introduction

Radiogenic isotopes are meaningful tools to understand the processes related to the evolution of mantle and crustal rocks (isotope geochemistry) as well as to determine their ages (geochronology). In all the isotopic systems used in petrological studies, the elements respond in specific ways to particular geological processes in the deep Earth, thus acting as petrogenetic indicators (Rollinson, 1993; Faure and Mensing, 2005; Gill, 2010).

Since the late 1970's (e.g. Jacobsen and Wasserburg, 1979; Richard and Allègre, 1980; McCulloch et al., 1980; Noiret et al., 1981; Cohen and O'Nions, 1982), studies involving radiogenic isotopes have become essential to understand the petrogenesis of the mantle and crustal section of relic oceanic lithospheres: the ophiolites. These associations represent obducted fragments of paleo-oceanic basins and are mainly constituted by upper mantle serpentinized harzburgites, crustal ultramafic cumulates, (meta) gabbros, (meta) basalts and pelagic (meta) sedimentary rocks (Dilek and Furnes, 2011).

The ophiolites mark the closure of paleo-oceans and thus represent key elements to understand and reconstruct the geodynamic evolution of orogenic belts. They become even more important in ancient orogenic terranes (e.g. Neoproterozoic Brasiliano/Pan-african belts in South America and western Africa – Basei et al., 2018, Schmitt et al., 2018; Arabian-Nubian Shield – Johnson and Woldehaimanot, 2003,

* Corresponding author.
E-mail addresses: rodrigo.chaves@ufrgs.br (R. Rodrigo Chaves), koester@ufrgs.br (K. Edinei), danieltriboli@hotmail.com (V. Daniel Triboli), carla.porcher@ufrgs.br (P. Carla Cristine), gezattjn@gmail.com (G. Julia Neri), renato.geofisica@gmail.com (S. Renato Luiz).

https://doi.org/10.1016/j.jsames.2018.06.004
Received 23 January 2018; Received in revised form 5 June 2018; Accepted 9 June 2018
0895-9811/

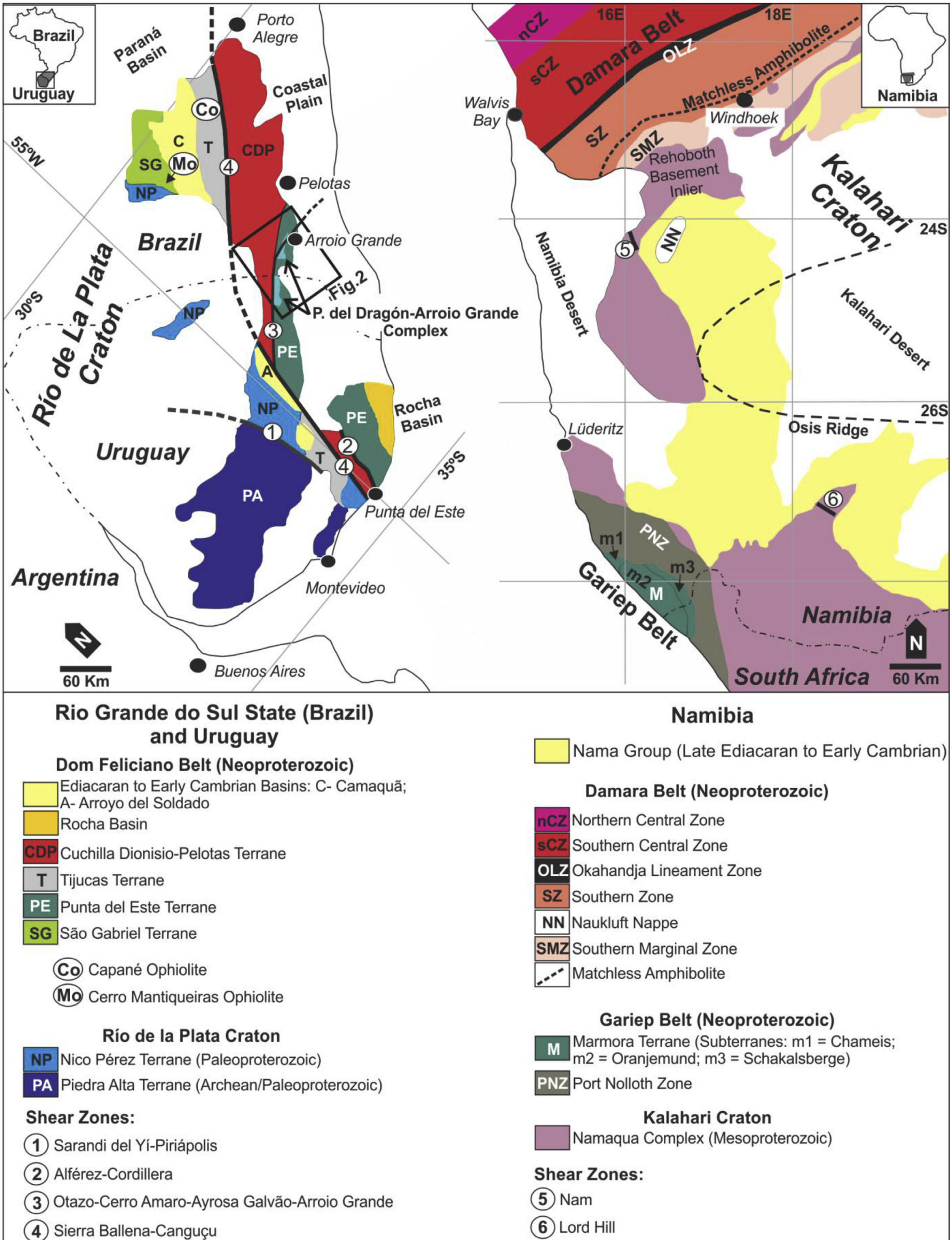

Fig. 1. Simplified geotectonic map of SW Gondwana (modified from Ramos et al., 2017a) – Location of the eastern Dom Feliciano Belt and related Pan-African belts and Ediacaran-Early Cambrian sedimentary basins (modified from Blanco et al., 2011).