Journal of South American Earth Sciences 66 (2016) 248–267

Contents lists available at ScienceDirect

Journal of South American Earth Sciences

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

Provenance and paleogeography of the Devonian Durazno Group, southern Parana Basin in Uruguay

N.J. Uriz [a], C.A. Cingolani [a, b, *], M.A.S. Basei [c], G. Blanco [d], P. Abre [d], N.S. Portillo [a], A. Siccardi [a, b]

[a] División Geología Museo de La Plata, Paseo Del Bosque S/n, La Plata, Argentina
[b] Centro de Investigaciones Geológicas (UNLP-CONICET), La Plata, Argentina
[c] CPGeo, Instituto de Geociências, Universidade de São Paulo, Brazil
[d] Polo de Desarrollo Universitario, Geología y Recursos Minerales, Universidad de La República (CURE), Simón Del Pino 1132, Treinta y Tres, Uruguay

ARTICLE INFO

Article history:
Received 25 July 2015
Received in revised form
30 December 2015
Accepted 4 January 2016
Available online 7 January 2016

Keywords:
Detrital zircons
U–Pb ages
Devonian
Provenance
Paleogeography
SW Gondwana

ABSTRACT

A succession of Devonian cover rocks occurs in outcrop and in the subsurface of central-northern Uruguay where they were deposited in an intracratonic basin. This Durazno Group comprises three distinct stratigraphic units, namely the Cerrezuelo, Cordobés and La Paloma formations. The Durazno Group does not exceed 300 m of average thickness and preserves a transgressive-regressive cycle within a shallow-marine siliciclastic shelf platform, and is characterized by an assemblage of invertebrate fossils of Malvinokaffric affinity especially within the Lower Devonian Cordobés shales. The sedimentary provenance of the Durazno Group was determined using petrography, geochemistry, and morphological studies of detrital zircons as well as their U–Pb ages. Sandstone petrography of Cerrezuelo and La Paloma sequences shows that they have a dominantly quartz-feldspathic composition with a minor contribution of other minerals. Whole-rock geochemical data indicate that alteration was strong in each of the three formations studied; chondritic-normalized REE patterns essentially parallel to PAAS, the presence of a negative Eu-anomaly, and Th/Sc and La/Hf ratios point to an average source composition similar to UCC or slightly more felsic. Within the Cerrezuelo Formation, recycling of older volcano-metasedimentary sources is interpreted from Zr/Sc ratios and high Hf, Zr, and REE concentrations. U–Pb detrital zircon age populations of the Cerrezuelo and La Paloma formations indicate that the principal source terranes are of Neoproterozoic age, but include also minor populations derived from Mesoproterozoic and Archean-Paleoproterozoic rocks. A provenance from the Cuchilla Dionisio-Dom Feliciano, Nico Pérez and Piedra Alta terranes of Uruguay and southern Brazil is likely. This study establishes an intracratonic extensional tectonic setting during Durazno time. Considering provenance age sources, regional paleocurrent distributions and the established orogenic history recorded in SW Gondwana, we suggest that the basin fill was derived from paleohighs located in what is currently SE Uruguay.

1. Introduction

The great Paraná basin covered southeastern Brazil and eastern Paraguay from the Silurian through the Devonian, later extending across northeastern Argentina and central-northern Uruguay as the Chaco-Paraná basin (Fig. 1). It is characterized by a thick sedimentary succession deposited in several sub-basins that locally compartmented the epicontinental ocean. The age span of the entire succession is Late Ordovician to Late Cretaceous.

In a general tectono-stratigraphic framework Milani et al. (1998, 2007) and Milani and Zalan (1999), studied several depocenters in the largest Paraná basin, recognizing six unconformity-bounded sedimentary supersequences; namely Río Ivaí (Ordovician-Silurian), Paraná (Devonian), Gondwana I (Carboniferous – Lower Triassic), Gondwana II (Middle to Upper Triassic), Gondwana III (Upper Jurassic to Lower Cretaceous) and Bauru (Upper Cretaceous). The first two of these supersequences are related to transgressive-regressive marine cycles of early-middle Paleozoic age. The Rio Ivaí Supersequence developed mainly in western

* Corresponding author. Centro de Investigaciones Geológicas (UNLP-CONICET), Diag. 113 n. 275, La Plata, Argentina.
E-mail addresses: nuriz@fcnym.unlp.edu.ar (N.J. Uriz), carloscingolani@yahoo.com, ccingola@cig.museo.unlp.edu.ar (C.A. Cingolani).

http://dx.doi.org/10.1016/j.jsames.2016.01.002
0895-9811/

Fig. 1. Gondwana paleogeographic reconstruction showing South American Silurian-Devonian basins (after Torsvik et al. 2012; Torsvik and Cocks, 2013) and the location of the study area.

Paraguay and southeastern Brazil. It is composed of Upper Ordovician conglomerates and arenites which are covered by Hirnantian diamictites, and above this a regional drape of fossil-rich marine pelites. The second sedimentation cycle, the Devonian Paraná Supersequence, occurs in the eastern part of Paraguay, southeastern Brazil and central-northern Uruguay. In southern Brazil, the principal outcrops occur along the so called Ponta Grossa arch trend where the Devonian siliciclastic sequences overlie either Río Ivaí Group or igneous-metamorphic basement rocks.

In central-northern Uruguay, the Paraná Supersequence is recognized both in outcrop and subsurface, forming the rift-related intracratonic Durazno basin (Bossi, 1966). Malvinokaffric invertebrate fossil assemblages suggest an Early Devonian age (Méndez-Alzola, 1934, 1948; Terra Arocena and Méndez-Alzola, 1939; Ferrando and Andreis, 1986; Bossi and Navarro, 1988; Figueiras, 1991; Sprechmann et al., 1993; Gaucher et al., 1996; Bossi et al., 1998; Veroslavsky et al., 2006). The subsidence/uplift pattern of cratonic basins reveals the evolution of the sedimentary environments through time, and the terrigenous grains provide important clues about the composition, age, and tectonic setting of the source areas, in addition to information about the paleoclimatic conditions and sedimentary transport processes (*e.g.*, Dickinson et al., 1983; McLennan et al., 1993). Cratonic basins were often considered to be formed after a continent assembly and controlled