



## New geochronological constraints on the geological evolution of Espinhaço basin within the São Francisco Craton—Brazil

André Danderfer<sup>a,\*</sup>, Bert De Waele<sup>b</sup>, Augusto J. Pedreira<sup>c,1</sup>, Herminio A. Nalini<sup>a,2</sup>

<sup>a</sup> *Geology Department, Federal University of Ouro Preto, Morro do Cruzeiro, Ouro Preto, MG, Brazil*

<sup>b</sup> *Tectonics Special Research Centre, School of Earth and Geographical Sciences, The University of Western Australia, 35 Stirling Highway, Crawley WA6009, WA, Australia*

<sup>c</sup> *CPRM—Geological Survey of Brazil, Ulysses Guimarães 2862, Salvador, BA, Brazil*

### ARTICLE INFO

#### Article history:

Received 25 April 2008

Received in revised form 7 October 2008

Accepted 8 January 2009

#### Keywords:

São Francisco Craton  
Espinhaço  
Basin analysis  
Rodinia supercontinent  
Tectonics  
Geochronology

### ABSTRACT

The São Francisco Craton, in the central-eastern region of Brazil, is a cratonic fragment stabilized after the Rhyacian tectono-metamorphic event (2.25–2.05 Ga). Volcanic and sedimentary rocks of the Espinhaço (Paleo- to Mesoproterozoic) and São Francisco (Neoproterozoic) basins crop out on this craton. In the northern sector of the craton, the Espinhaço basin crops out in two domains: the Northern Espinhaço Range and the Chapada Diamantina, that are separated by the Paramirim Corridor, a Brasiliano/Pan African (650–500 Ma) deformation zone, which crosses the craton in NNW–SSE direction. The stratigraphic framework of the Northern Espinhaço is characterized by eight synthemms that comprise units bound by unconformities, or stratigraphic discontinuities with regional extent over the Espinhaço basin. These synthemms are: Algodão, São Simão, Sapiranga, Pajeú and Bom Retiro (lower interval), São Marcos and Sítio Novo (intermediate interval) and Santo Onofre (upper interval). For each interval the sedimentary processes, the depositional systems, the filling style of the basin and the tectonic settings were evaluated, based mainly on the facies association characteristics and their lateral/vertical changes. Zircon U–Pb SHRIMP and basin analysis studies carried out along the eastern border of the Northern Espinhaço Range provide a few new or improved anchors upon which the tectonic evolution of the Espinhaço basin can be pinned. We identified Statherian rifting in the São Simão Synthem, by dating volcanic rocks at 1.73 Ga. This is followed by a previously unknown, minor intracratonic rift phase within the São Francisco Craton, dated at circa 1.57 Ga through a volcanic unit within the Pajeú Synthem. The entire lower interval is cut by mafic intrusive dykes of which we dated one at 850 Ma, which we correlate with a Tonian rifting phase affecting the eastern part of the São Francisco craton, and related to the break-up of the Rodinia Supercontinent. Our data show that the development of the Northern Espinhaço Range spans a large time interval, and comprises a discontinuous series of tectonic events that gave rise to the formation of the various synthemms and are punctuated by the extrusion of minor volcanic units and emplacement of dykes within the eastern part of the São Francisco Craton.

© 2009 Elsevier B.V. All rights reserved.

### 1. Introduction

The Espinhaço basin occurs in the northern portion of the São Francisco Craton, occupying two physiographic domains: the Chapada Diamantina and the Northern Espinhaço Range (Fig. 1), as well as the western margin of the Araçuáí orogen at the eastern border of the craton. The basin records a polycyclic depositional history, with alternating episodes of distinct tectonic regimes over time. The

rocks related to these various episodes have been ascribed to the Espinhaço Supergroup, which has a geological evolution spanning the Paleo- and Mesoproterozoic eras. The Espinhaço Supergroup underwent metamorphism and deformation during the Neoproterozoic Brasiliano Event, between 650 and 550 Ma (Schobbenhaus, 1996; Danderfer, 2000), providing a minimum age of deposition.

In the Northern Espinhaço Range, several stratigraphic models have been proposed, based on the characterization and interpretation of the various lithostratigraphic units (Schobbenhaus, 1972; Portela et al., 1976; Moutinho da Costa and Silva, 1980; Fernandes et al., 1982; Inda and Barbosa, 1978; Mascarenhas et al., 1984; Inda et al., 1984; Mascarenhas, 1990; Barbosa and Domingues, 1996; Schobbenhaus, 1993, 1996). Based on the recognition of regional unconformities or stratigraphic discontinuities, eight unconformity-bounded units (the synthemms sensu Salvador, 1994) were recognized (Danderfer, 2000; Danderfer and Dardenne,

\* Corresponding author. Tel.: +55 313559 1601; fax: +55 313559 1601.

E-mail addresses: [andre@degeo.ufop.br](mailto:andre@degeo.ufop.br) (A. Danderfer), [bdewaele@srk.com.au](mailto:bdewaele@srk.com.au) (B. De Waele), [apedreira@sa.cprm.gov.br](mailto:apedreira@sa.cprm.gov.br) (A.J. Pedreira), [nalini@degeo.ufop.br](mailto:nalini@degeo.ufop.br) (H.A. Nalini).

<sup>1</sup> Fax: +55 713371 4005.

<sup>2</sup> Fax: +55 313559 1601.