



Paleomagnetism and rock magnetism of the Neoproterozoic Itajaí Basin of the Rio de la Plata craton (Brazil): Cambrian to Cretaceous widespread remagnetizations of South America

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ARTICLE INFO

Article history:

Received 8 July 2010

Received in revised form 27 April 2011

Accepted 28 April 2011

Available online 6 May 2011

Handling Editor: E. Tohver

Keywords:

Remagnetization

Paleomagnetism

Rock magnetism

West Gondwana

Rio de la Plata

Neoproterozoic

ABSTRACT

A detailed rock magnetic and paleomagnetic study was performed on samples from the Neoproterozoic Itajaí Basin in the state of Santa Catarina, Brazil, in order to better constrain the paleogeographic evolution of the Rio de la Plata craton between 600 and 550 Ma. However, rock magnetic properties typical of remagnetized rocks and negative response in the fold test indicated that these rocks carried a secondary chemical remanent magnetization. After detailed AF and thermal cleaning, almost all samples showed a normal polarity characteristic remanent magnetization component close to the present geomagnetic field. The main magnetic carriers are magnetite and hematite, probably of authigenic origin. The mean paleomagnetic pole of the Itajaí Basin is located at $\text{Plat} = -84^\circ$, $\text{Plong} = 97.5^\circ$ ($A95 = 2^\circ$) and overlaps the lower Cretaceous segment of the apparent polar wander path of South America, suggesting a cause and effect with the opening of the South Atlantic Ocean. A compilation of remagnetized paleomagnetic poles from South America is presented that highlights the superposition of several large-scale remagnetization events between the Cambrian and the Cretaceous. It is suggested that some paleomagnetic poles used to calibrate the APWP of Gondwana at Precambrian times need to be revised; the indication of remagnetized areas in southern South America may offer some help in the selection of sites for future paleomagnetic investigations in Precambrian rocks.

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1. Introduction

The timing and kinematic models of the Gondwana supercontinent assemblage at the end of the Neoproterozoic is still a matter of debate (e.g., Yoshida, 1995; Torsvik et al., 2001; Stern, 2002; Meert, 2003; Veevers, 2004; Collins and Pisarevsky, 2005; Squire et al., 2006; Trindade et al., 2006; Yoshida and Upreti, 2006; Paulsen et al., 2007; Yoshida, 2007; Meert and Lieberman, 2008; Vaughan and Pankhurst, 2008; Cordani et al., 2009; Santosh et al., 2009). Several models are proposed in the literature but they still deserve more high-quality paleomagnetic poles to be tested, particularly for South America cratons. A principal limitation resides in the superposition of successive large-scale deformational events (from Cambrian to Cretaceous) that affected the area causing overprints of secondary magnetization, or the complete resetting of primary magnetic

components (e.g. Trindade et al., 2004; Rapalini and Sánchez Bettucci, 2008; Tohver et al., 2010, 2011).

The APWP of Gondwana is well documented from 550 to 500 Ma (see review in Trindade et al., 2006), the latter representing the time of the final assemblage of the supercontinent. However, the 600–550 Ma interval is still poorly constrained (Tohver et al., 2006). Recently, a high quality but secondary origin paleomagnetic pole has been obtained from the Nola dolerite, Central Africa (Moloto-A-Kengumba et al., 2008) satisfying six of the seven criteria of the Q index of Van der Voo (1990). The remagnetization is associated to metamorphism and dated by $^{40}\text{Ar}/^{39}\text{Ar}$ on amphibole to 571 ± 6 Ma. This pole gives clues to Gondwana APWP, however only two poles from the South American plate (Fig. 9), namely the Sierra de las Animas (SA1, Sánchez-Bettucci and Rapalini, 2002) and Sierra de los Barrientos (LB, Rapalini, 2006) contribute to the curve. In this way, additional efforts are needed to better constrain the APWP of Gondwana at 600–550 Ma. In this way, in this paper we investigated the Neoproterozoic rocks from the Itajaí basin (Santa Catarina) recently dated at 563 ± 3 Ma and 549 ± 4 Ma (U–Pb dating, Guadagnin et al., 2010). However, as will be discussed, rock magnetic properties typical of remagnetized rocks and negative response in the fold test indicated that these rocks carried a post-folding remanent

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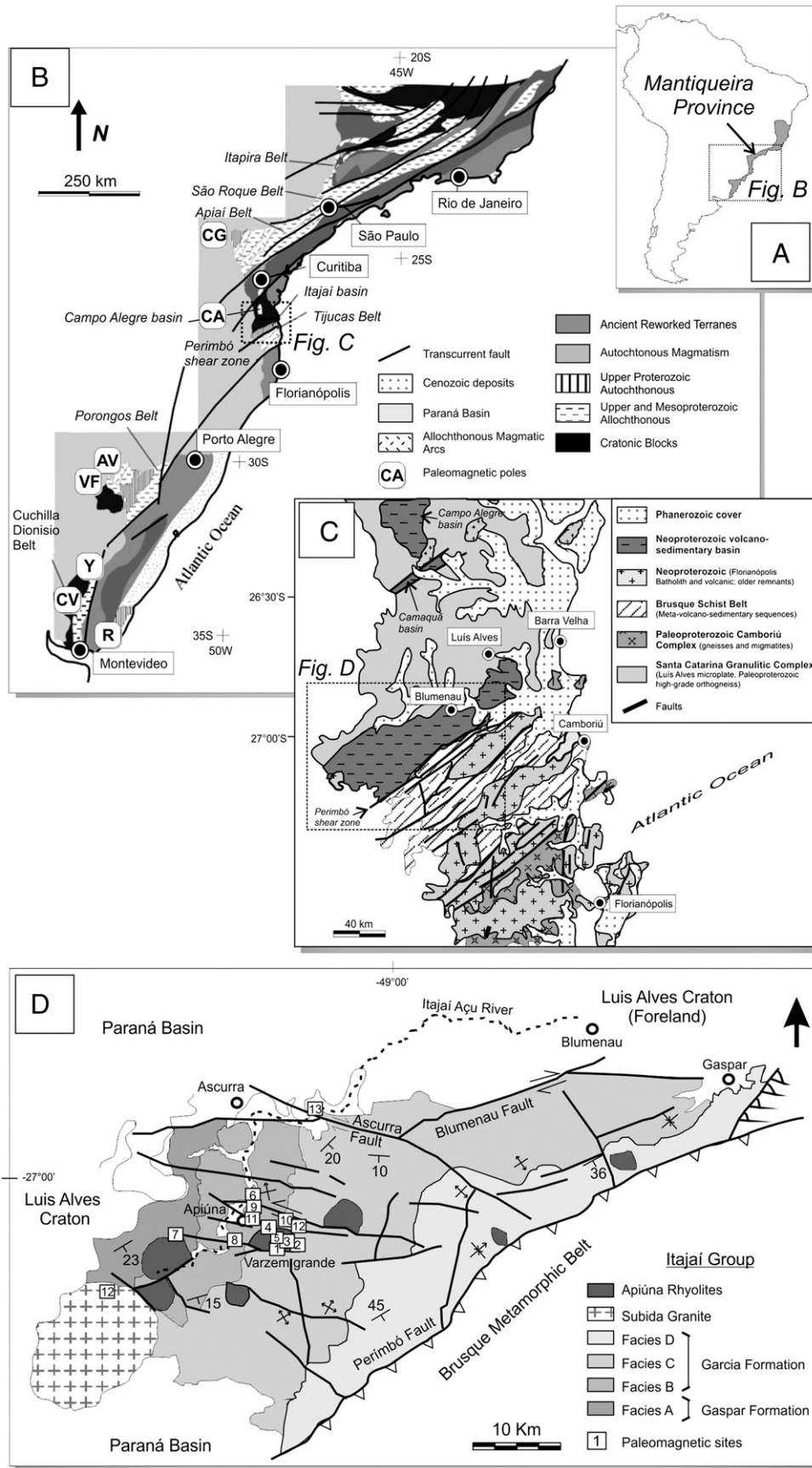


Fig. 1. A) Map of South America and location of the Mantiqueira Province; Geological and structural maps of B) main tectonic terranes in southern Brazil and northeastern Uruguay (modified from Rostirolla et al., 1999); C) eastern Santa Catarina and southernmost Paraná with emphasis on the Itajaí, Camaquã and Campo Alegre basins (modified from Hartmann et al., 2003); D) the Itajaí basin (modified from Rostirolla et al., 1999).

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