Paleomagnetism of Carbonatic Sequences from the Bambui Group-São Francisco Craton

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Introduction

The Neoproterozoic period corresponds to a very important phase in the evolution of the Earth, when the Rodinia supercontinent desagregated to form the Gondwana (e.g. Dalziel, 1997). Although speculative models based on geological grounds can be proposed for the evolution of these supercontinents, paleomagnetism can establish the paleogeography of the envolved cratonic units more precisely.

The São Francisco Craton is covered by extensive carbonatic layers which were deposited during Neoproterozoic. With the purpose of establishing the paleogeography of the Congo/São Francisco Craton in the Rodinia and Gondwana, a paleomagnetic study of these sedimentary covers is being carried out. Results from the carbonatic sequences of the Salitre Formation (Una Group, Bahia State) was already published by D'Agrella-Filho (1995). In this paper we present preliminary paleomagnetic results from the Bambui Group (Minas Gerais State), which is possibly correlated with the Una Group.

The Bambui carbonatic sedimentation occurred after a 1000 Ma glacial episode. However, the age of the carbonates is still debatable since results from the various isotopic dating methodologies led to conflicting interpretations. Babinski at al. (1997) consider 690 Ma as the minimum age for the Bambui carbonatic sedimentation, based on Pb/Pb data, although a 550-500 Ma fluid flow event affecting the Pb/Pb system in a regional scale, was also reported. Kawashita et al. (1997) proposed an age of 595 Ma for the sedimentation from $^{87}Sr/^{86}Sr$ ratios, and a diagenetic to epimetamorphic event at 580±25 Ma based on Sm/Nd, Rb/Sr and K/Ar data.

Paleomagnetic Study

The paleomagnetic study includes the analysis of 282 cylindrical cores collected at five quarries and at an outcrop along a road in the Arcos-Pompéu region (Fig. 1). Six or seven cylinders were extracted from 46 stratigraphic layers (46 sampling sites) of limestones and carbonatic shales from the Bambui Group, using a portable gasoline-powered drill. Whenever possible, sun and magnetic compasses were used for orienting samples. The bedding planes are nearly horizontal.

Both alternating field (AF) and thermal demagnetizations were applied to cylindrical specimens (2.2x2.5 cm) to separate the magnetic components in the rocks. Samples from eight sites displayed magnetization intensities close to the noise level of the 2G-cryogenic magnetometer, and the remanence vectors showed random paths during demagnetization. For the remaining 38 sites, thermal demagnetization was more efficient than AF treatment in separating magnetization components. Two or three magnetic components for each analyzed specimen were identified using the least square fit method. A northeast direction (component A) with high positive inclination could be isolated for most of the sites; the unblocking temperatures of the magnetic carriers were generally between 300°C and 400°C. For eight sites a slightly different component (component B) was identified for higher temperatures, generally between 360°C and 530 °C. Fisher statistics was used to calculate mean directions for these two components as shown in Table 1.

Discussion

The components A and B are similar to that obtained from the Salitre carbonates, suggesting that the acquisition of these characteristic magnetizations was contemporaneous. The corresponding paleomagnetic poles are shown in Figure 2, along with selected Gondwana poles for the time interval 550-500 Ma (Meert et al., 1995), considering that by this time the supercontinent was completely assembled. The paleomagnetic pole for the Piquete metamorphic rocks (D'Agrella-Filho et al., 1986), southern São Francisco Craton, is also shown. K-Ar ages for the Piquete rocks are in the range 531.7±13.5 to 467.6±15.3 Ma, with a peak in the 500-490 Ma interval. All the São Francisco Craton poles (SF, BGA, BGB and PQ, Table 1 and Fig. 2) plot very close to the 510-500 Ma segment of the Gondwana polar wander path. Considering the before

mentioned isotopic evidences, it is suggested that the characteristic magnetizations in the Bambui and Una sequences are of post-depositional origin.

The post-depositional character of the magnetization is strengthened by the following: (i) the petrographic study show that the magnetic mineralogy is typically diagenetic (Nobre-Lopes, 1995); (ii) high paleolatitudes inferred from the paleomagnetic data for the study area would require a different climate pattern during the sedimentation of the wide carbonatic platforms; (iii) magnetization directions with a single polarity were found for hundreds of meters in the sedimentary sequence; (iv) mean magnetization components identified in the Bambuí and Salitre carbonates show lower dispersion (α_{95} between 2.2° and 4.8°, Table 1) than would be expected if the secular variation of the geomagnetic field was fully averaged out.

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Table 1. Neoproterozoic/Lower Paleozoic paleomagnetic poles from the São Francisco Craton.

Unit/component	**Mean direction**					**Paleomagnetic pole**				**Ref.**
	Dm(°)	Im(°)	α_{95}(°)	K	N	Lat.(°N)	Long.(°E)	α_{95}(°)	K	
Bambui/A (BGA)	21.1	67.3	2.2	110	38	16.8	328.4	3.2	52	1
Bambui/B (BGB)	3.9	56.8	4.8	133	8	32.2	318.3	5.5	101	1
Salitre (SF)	3.7	67.1	3.2	126	17	27.5	321.4	4.9	55	2
Piquete (PQ)	60.4	68.0	6.8	57	9	-0.8	346.5	10.2	26	3

N (number of sites); Ref.: 1- this work; 2- D'Agrella-Filho (1995); 3- D'Agrella-Filho et al. (1986).

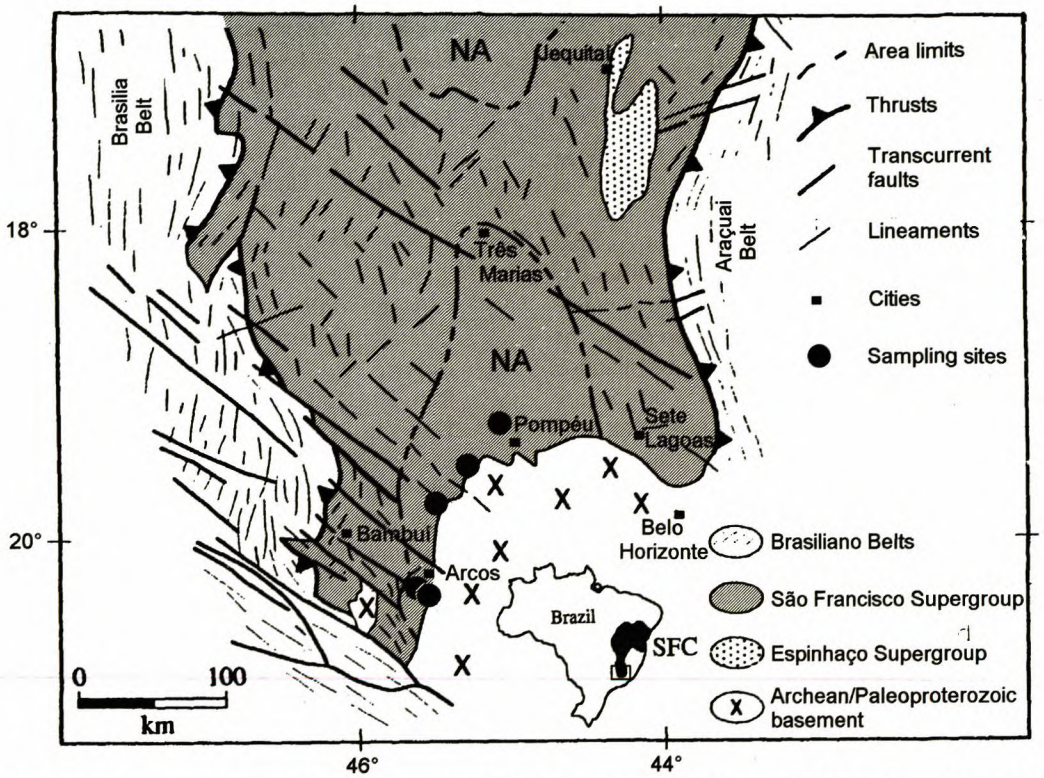

Fig. 1- Southern São Francisco Basin geological map (modified from Chemale Jr. et al., 1993). Sampling sites are indicated by full circles. SFC: São Francisco Craton; NA: areas not affected by the Brasiliano Orogeny.

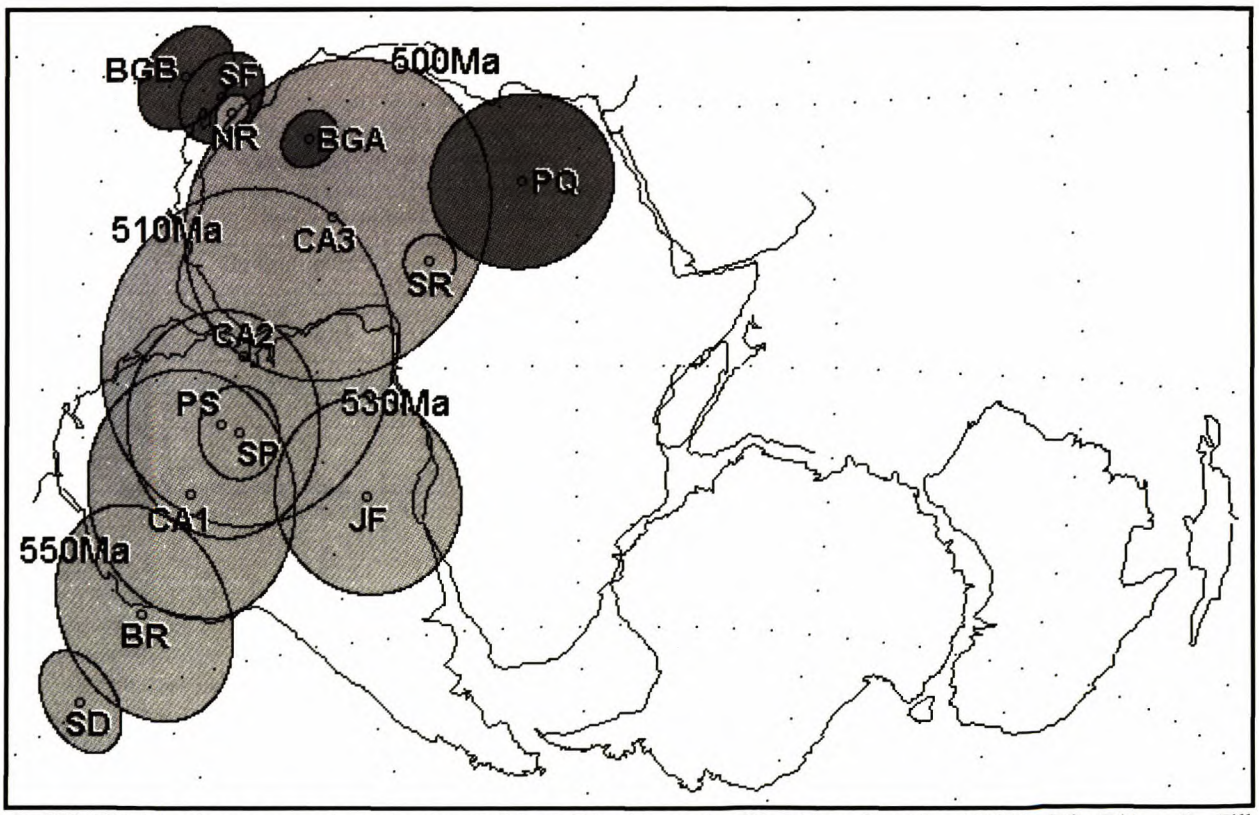

Fig. 2- 550-500 Ma Gondwana selected poles. BGA, BGB: this work; SF: D'Agrella-Filho (1995); PQ: D'Agrella-Filho et al. (1986); Sinyai Dolerite (SD), Ntonya Ring (NR), Bhander & Rewa (BR), Purple Sandstone (PS), Jutana Formation (JF), Salt Pseudomorph's (SP), Sør Rondane Intrusions (SR), Central Australia mean poles (CA1, CA2, CA3): Meert et al. (1995). Equal-area projection.