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ABSTRACTS

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AMAZONIAN PROTEROZOIC POLES: IMPLICATIONS TO RODINIA PALEOGEOGRAPHY

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Geological and geochronological (and a few paleomagnetic) evidences have been provided for the possible link between the Amazonian Craton and southern Laurentia (Rodinia Supercontinent), although some small variations among the proposed models are quite evident (e.g., Sadowski and Bettencourt, 1996, Bettencourt et al., 1996, D'Agrella-Filho et al., 1998, Dalziel, 1997). This link possibly existed up to late Neoproterozoic/ early Paleozoic, when the ephemeral Pannotia Supercontinent was formed (~580-570 Ma), and the Iapetus Ocean began to open (McCausland and Hodych, 1998). Unfortunately, Meso-Neoproterozoic to early Paleozoic paleomagnetic data for the Amazonian Craton are very sparse, and therefore no paleomagnetic basis can be provided for a test of these models.

Trying to rapidly improve the Amazonian Meso-Neoproterozoic paleomagnetic database, a joint research project of geochronological and paleomagnetic studies has been developed by the Institute of Astronomy, Geophysics and Atmospheric Sciences and the Institute of Geosciences (University of São Paulo, Brazil), with the collaboration of the Depart-ment of Applied Geophysics (Luleå University, Sweden).

The western part of the Amazonian Craton is a multi-orogen region formed between 1.8 and 1.0 Ga where successive magmatism, metamorphism and deformation events regionally affected and reworked previous provinces, producing new complexes, as well as new juvenile continental crust (Fig.1). Three major geochronological and tectonic provinces have been identified in the western part of the craton: the Rio Negro-Juruena Province (1.8-1.55 Ga), the Rondonian-San Ignacio Province, (1.5-1.3 Ga) and the Sunsás Province (1.3-1.0 Ga).

Our main purpose was to collect samples related to the evolution of the Sunsás Province, the youngest tectonic unit of the Amazonian Craton. According to Tassinari et al. (2000), the start of the Sunsás tectonic evolution, which has been chrono-correlated with the Grenville Orogenic Cycle (1.3 to 1.0 Ga) in Laurentia and Baltica, was marked by an important phase of continental distension (rifting). Basaltic magmatism and sedimentary deposition in a continental margin environment (sediments from the Sunsás and Vibosi groups in Bolivia and the Aguapeí group in Brazil) represent this distensive phase. This basin was closed during the development of the Sunsás/Aguapeí Orogenic Belt. During the same orogenic episode the Nova Brasilândia volcano-plutonic sedimentary sequence evolved with syn-tectonic magmatism. The 1.11±0.01 Ga age for a metamorphosed (amphibolite facies) subophitic metagabbro is based on four zircon fractions, and was interpreted as the age of the metamorphism that affected the sequence (Rizzoto, 1999). Samples were collected from 10 levels of the undeformed Fortuna Formation of the Aguapeí Group, and from a basic dyke cutting these sediments, close to the town of Rio Branco (Mato Grosso State). In regions close to Alta Floresta d'Oeste and Colorado d'Oeste, samples from 19 metabasic dykes of the Nova Brasilândia Group were also collected.

Rapakivi rocks in the Brazilian States of Rondônia and Mato Grosso represent the Serra da Providência Intrusive Suite, which comprises the Serra da Providência granite. Gabbros, charnockites and mangerites form parts of the suite. U/Pb geochronological data constrain the age of this batholith to the interval between 1.606±0.024 Ga (the age of the oldest dated granitoid) and 1532±0.024 Ga. Our sampling was concentrated in mafic rocks found in the Serra da Providência area. Samples from 19 sites were collected close to Cacoal, Presidente Médici, Ouro Preto d'Oeste and Ariquemes.

The Sunsás Orogeny affected the northern region of Rondônia (rocks that belong to the Rio Negro-Juruena and Rondonian-San Ignacio Provinces) during the period 1.15-0.97 Ga (Tassinari et al., 2000). This resulted in metamorphic overprinting and deformation at 1.156 to 1.1 Ga and the emplacement of Rapakivi granite intrusives, mafic dykes and granitic plutons from 1.08 to 0.97 Ga. Biotite and amphibole from a charnockite from Ouro Preto (our sampling site RO37) yielded $^{40}Ar/^{39}Ar$ ages of ca. 1.10 Ga, which is an evidence of this metamorphic event. Another geochronological evidence is presented by Bettencourt et al. (1996) from rocks collected close to the town of Ariquemes (sites RO12 and RO13 in their article; site RO12 is very close to our sites RO38, RO39 and RO42). Their rocks (Augen gneisses and granitic gneisses) yielded 40Ar/39Ar ages on hornblendes of 1156±36 Ma (RO12) and 1149±35 Ma (RO13) and on biotites of 1001±33 Ma (RO12) and 912±30 Ma (RO13), respectively. These data suggest a Sunsás orogen related metamorphic overprint.

The best paleomagnetic results are from the samples of the Aguapeí Group and the dyke sampled in the Mato Grosso State, where northern (southern) directions with moderate to steep negative (positive) inclinations were isolated, after alternating field (AF) and thermal demagnetization (Fig. 2a). Magnetization is carried by magnetite in the dyke samples and by both magnetite and hematite in the sediments.

The paleomagnetic results from the Rondônia area are more complicated, probably due to a more complex geological evolution. AF and thermal treatments revealed generally multicomponent behavior. However, basically three groups of magnetic directions could be isolated. The most representative group is formed by northwestern (southeastern) directions with moderate to steep negative (positive) inclinations (Fig. 2b). This component (A) was disclosed for samples from three sites collected close to Ariquemes, two sites close to Presidente Médici, some sites from the Cacoal region and some dykes from the Nova Brasilândia Group (mainly for the less metamorphosed dykes). A northern (southern) component (B) with low inclination appears mainly in the northern area, although it was also found in a few dykes from the Nova Brasilândia Group (Fig. 2c). A third northeastern, moderate positive inclination, direction (component C) was disclosed for dykes from the Nova Brasilândia Group, but it is also present in some samples of the northern area (Fig. 2d).

Figure 3 shows the preliminary paleomagnetic poles calculated from components A, B and C described above, together with the virtual geomagnetic poles (VGPs) obtained from the sediments from the Aguapeí Group (discriminated by AG symbols). Also shown in this figure are some VGPs (TU symbols) obtained for some crystalline basement rocks from the Rio Negro-Juruena Province (Bettencourt et al., 1996), and the paleomagnetic pole (NF) obtained for basalts and gabbros from the Nova Floresta Formation (Tohver et al., 2001). These poles were rotated to the configuration of Rodinia presented in D'Agrella-Filho et al. (1998), and they are compared with the APW path for Laurentia in the time interval: 1.24 Ga - 0.82 Ga. The VGPs from the sediments from the Aguapeí Group fall along an apparent polar wander (APW) path, suggesting that they represent the effect of a very slow cooling of the sampled area. Some of these VGPs fall on (or near to) the 1.1 Ga part of the APW path for Laurentia. Component A yielded poles AS and AN for directions with positive and negative inclinations, respectively. This component was disclosed for several samples from the northern studied area, which was affected by the Sunsás event. Several $^{40}Ar/^{39}Ar$ datings yielded ages around 1.15 Ga (see above), which suggest the possible age for AS and AN poles. These poles are located close to the NF pole obtained for the Nova Floresta Formation, dated at about 1.0 Ga by K-Ar method (Tohver et al., 2001). However, since K-Ar ages are usually affected by Ar excess (or loss), they may not indicate the age of magnetization. Therefore, $^{40}Ar/^{39}Ar$ determinations are needed to better constrain the age of this volcanism. Components B and C yielded poles BS, BN and CN, that fall approximately along the APW path for Laurentia (between 1.1 and 0.82 Ga) apparently suggesting younger ages for these components.

Our paleomagnetic results, although very preliminary, do not deny a possible link between the Amazonian Craton and Laurentia, at about 1.1 Ga (Fig. 3). However, a more trustworthy interpretation awaits new $^{40}Ar/^{39}Ar$ determinations.

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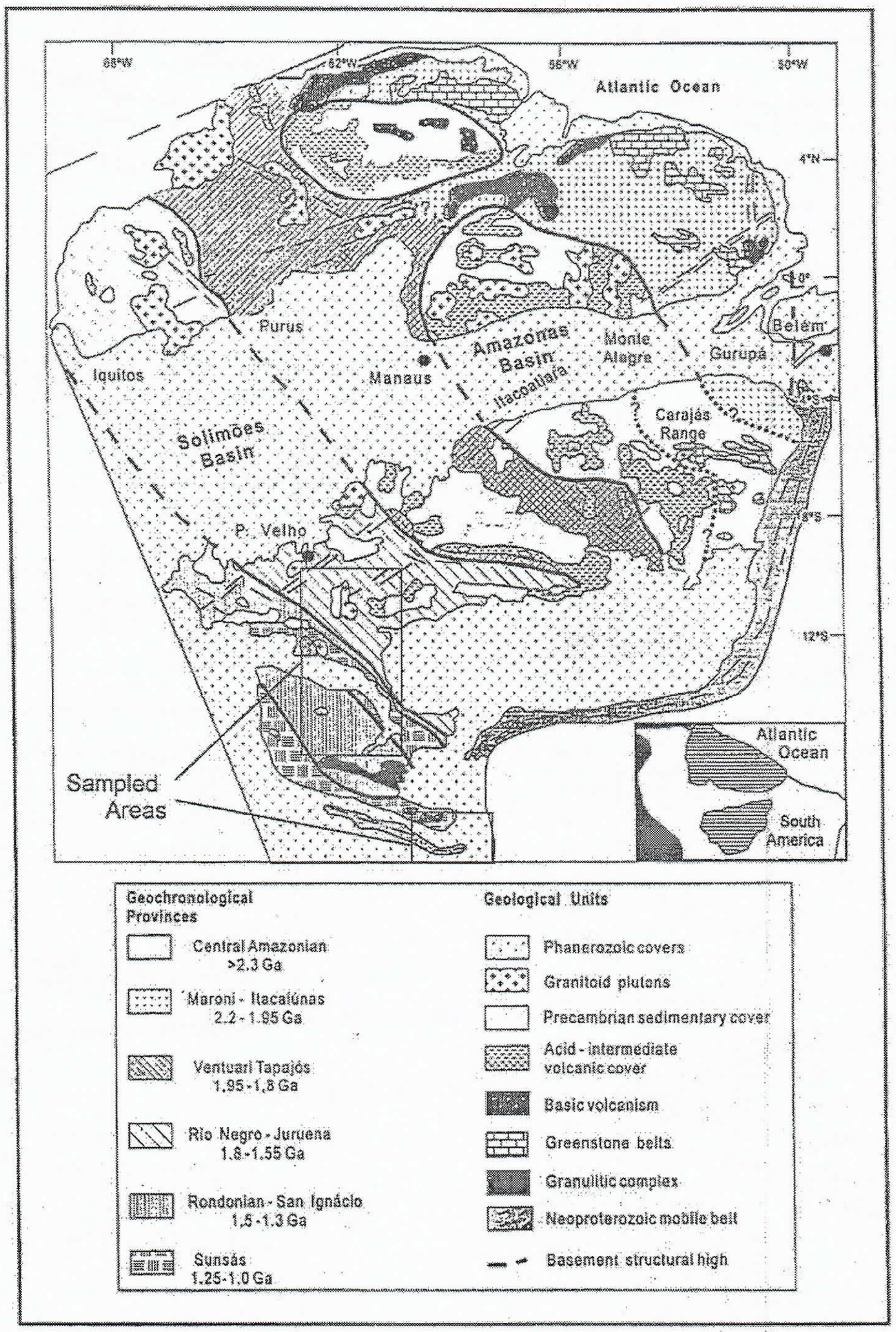

Figure 1. Geological/geotectonic map of the Amazonian Craton (adapted from Tassinari et al., 2000)

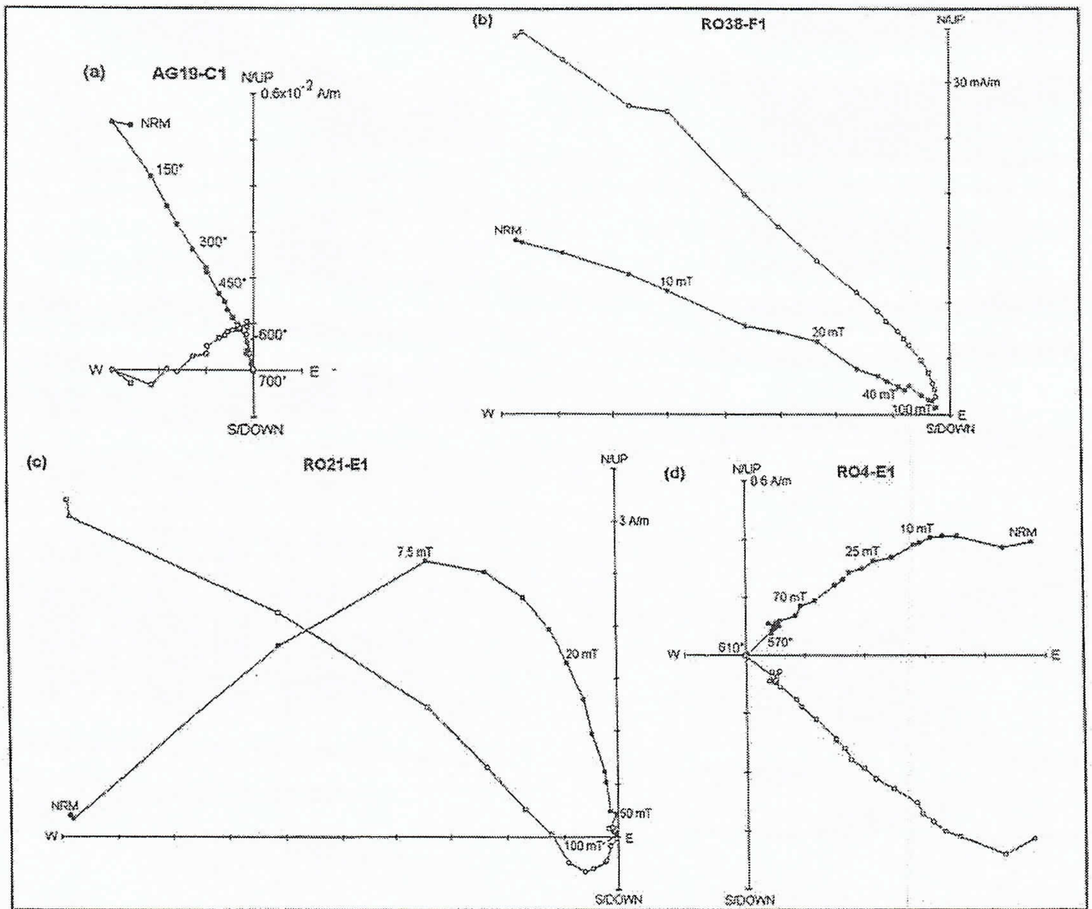

Figure 2. Examples of AF and thermal demagnetizations. Zijderveld projections: full (empty) symbols represent horizontal (vertical) projections (see text for details).

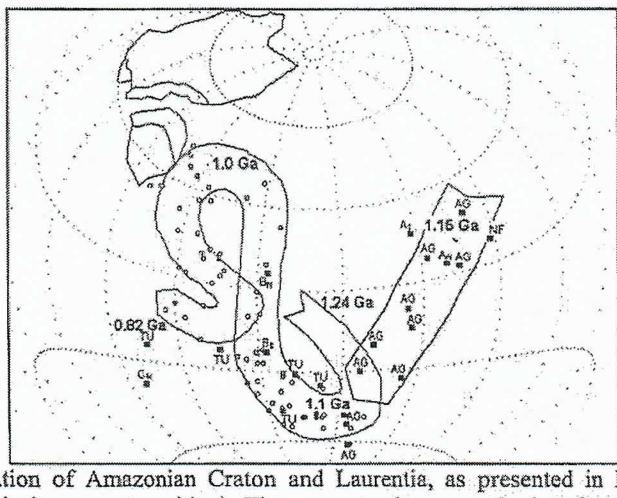

Figure 3. Configuration of Amazonian Craton and Laurentia, as presented in D'Agrella-Filho et al. (1998) (Laurentia is in its present position). The present paleomagnetic data for the Amazonian Craton (full squares) is compared with the APW path for Laurentia (empty circles) in the time interval: 1.24-0.82 Ga. AG: VGPs from the Aguapeí sediments; TU: VGPs from crystalline basement rocks (Rio Negro-Juruena Province); NF: paleomagnetic pole for the Nova Floresta Formation; A_S, A_N, B_S, B_N and C_N: paleomagnetic poles from the Nova Brasilândia Group and the Serra da Providência Intrusive Suite.