# THE FOUR ARCHEAN CRUSTAL SEGMENTS OF THE SÃO FRANCISCO CRATON, BAHIA, BRAZIL AND THEIR PALEOPROTEROZOIC COLLISION

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**Keywords:** Archean, Paleoproterozoic, collision, São Francisco Craton, Bahia, Brazil

## THE ARCHEAN BLOCKS

Each aforementioned segment is well discriminated by Sm-Nd model ages as well as the distribution in the $\varepsilon_{Nd}$ x $\varepsilon_{Sr}$ diagram, supporting their distinct origin, evolution and metallogenetic characteristics.

In the Gavião Block two groups of TTG rocks constituted the early continental crust into the amphibolite facies. The first with age varying between 3.4-3.2 Ga has been considered, as originated from the melting of tholeiitic basalts. The second with age of 3.2-3.1 Ga, had similar origin but with some crustal contamination (Martin et al., 1991; Santos Pinto, 1996; Cunha et al., 1996; Bastos Leal, 1998). The greenstone belts in the greenschist facies (Contendas Mirante, Umburanas, Mundo Novo) (Marinho, 1991; Mascarenhas and Silva, 1994; Cunha et al., 1996), have been formed in intracratonic basins of the early TTG crust, with basal komatiites, pyroclastic rocks, chemical exhalative sediments and tholeiitic basalts with pillow-lava (3.1 Ga). The 2.8-2.7 Ga granitic-granodioritic-migmatitic crust, metamorphosed under amphibolite facies conditions is interpreted as products of partial melting of the TTG (Santos Pinto, 1996) during the closing of these basins. Calc-alkaline volcanics (2.6 Ga), granite intrusions (2.5 Ga) and mafic-ultramafic intrusions (2.4 Ga), besides phyllites and grawackes occur associated with the Archean greenstone belts (Marinho, 1991).

The Itabuna-Salvador-Curaçá Belt is composed by at least three tonalite/trondhjemites groups with 2.7-2.6 Ga (Silva et al., 1997). These rocks are interpreted, by the REE geochemistry, as result of the tholeiitic oceanic crust melting. Reequilibrated in the granulite facies, also include charnockite bodies, stripes of intercalated metasediments (quartzites with garnet, Al-Mg gneisses with sapphirine, graphitites and manganesiferous formations) and ocean-floor/back-arc gabbros and basalts. These latter ones are originated from mantle sources (Teixeira, 1997). 2.4 Ga old, shoshonitic monzonites occur in this belt as important intrusive bodies (Ledru et al., 1994). The island-arcs, back-arc basins and subduction zones were the dominant environments during the construction of this belt (Barbosa, 1990, 1997).

The Jequié Block is characterized by migmatites with supracrustal bodies (the oldest component, with 3.0-2.8 Ga) and granodiorític–granitic intrusions (the youngest component, with 2.8-2.7 Ga). The oldest component is mainly constituted of granitic rocks that form the basement of the rift-type intracratonic basins, where basalts and andesitic basalts, cherts, banded iron formation, graphitites and kinzigites were accumulated. The youngest component is constituted of multiple intrusions of granodiorites and granites of high to low Ti that eventually contain megaenclaves of the oldest component.

In the NE, occurs the Serrinha Block with c.a. 2.9 Ga old orthogneisses and migmatites, which represent the basement of the Paleoproterozoic greenstone belts. This orthogneisses and migmatites are granitic to granodioritic composition, with gabbroic enclaves, metamorphosed under amphibolite facies conditions.

## THE PALEOPROTEROZOIC COLLISION

During the Paleoproterozoic (c.a. 2.3-2.0 Ga) (Barbosa & Dominguez, 1996), these four crustal segments collided resulting in the formation of an important mountain belt. The evidences of this collision are found not only through the structural elements, but also in the pre- and syn-tectonic Paleoproterozoic rocks that are present in the above mentioned crustal segments.

In the Gavião Block it was identified: (i) the Jacobina Group (foreland basin) formed by schists, banded iron formations, manganesiferous formations, quartzites and metaconglomerates with intrusions of mafic-ultramafic rocks (Mascarenhas et al., 1992), where the siliciclastic metassediments contain detrital zircons with ages 2.1 Ga and (ii) the Areião Formation constituted of arkoses and sands containing also detrital zircons dated 2.1-2.2 Ga.

In the Itabuna-Salvador-Curaçá Belt, the most important paleoproterozoic lithologies are: (i) tonalites and trondhjemites, with zircons dated approximately 2.1 Ga (Sabaté et al., 1994, Silva et al., 1997); (ii) Caraiba norites and Medrado gabbros, both with ages slightly older than 2.0 Ga (Oliveira and Lafon, 1995); and (iii) syntectonic granites dated about 2.1 Ga (Sabaté et al., 1990).

In the Serrinha Block occurs the Greenstone Belts Rio Itapicuru and Capim, formed from back-arc basins (Silva, 1992; Winge, 1984) where: (i) the lower unit of basaltic lava (2.2 Ga) is constituted by tholeiitic basalts and maffic tuffs, associated with banded iron formation, cherts, and graphitic phyllites; (ii) the intermediate unit is formed mainly by felsic rocks (2.1 Ga), with its composition varying from andesites to calcalkaline dacites; and (iii) the upper unit is composed by thick packages of psefites, psamites and pelites. These paleoproterozoic greenstone belts are essentially different from the Archean greenstone belts of the Gavião Block mainly because they lack significant proportion of komatiitic volcanic rocks.

The Paleoproterozoic collision occurred with the movement of the four blocks in the NW-SE sense, identified by the presence of large thrusts and transcurrence zones, in general sinistral, as the kinematics of the late ductile shear zones demonstrate (Figs. 1, 2).

The Paleoproterozoic high grade metamorphism has average pressures of 7 kbar and temperatures of about 850 °C, with its peak occuring at about 2.0 Ga (Barbosa, 1990, 1997). It is interpreted as originated from the crust thickening related to the tectonic superposition of blocks during the collision. Along the Itabuna-Salvador-Curaçá Belt, this metamorphism reached the granulite grade and the obduction of the Itabuna-Salvador-Curaçá Belt over the Jequié Block transformed the Jequié rocks, from amphibolite to granulite facies. The presence of coronitic reactions with destruction of garnet-quartz or garnet-cordierite, producing simplectites of orthopyroxene-plagioclase, are observed in the high degree gneisses, both in the SSE, SSW, and NE. They have been interpreted as suggestion of pressure release. This fact reinforces the presence of these collision processes and of great thrusts, that brought blocks of rocks from deep zones to the more surficial parts of the crust. PTt diagrams elaborated for these metamorphites show a trajectory of the metamorphism of the clockwise type, confirming the collision context (Barbosa, 1990, 1997).

It is also worth while to observe the late charnockitic and granitic intrusions that crossed the segment of rocks stacked by the tectonic. Charnockitic bodies with ages of about 2.1 Ga intruded the northern part of the Jequié Block, in all the other blocks, granitic bodies, in general with peraluminose characteristics (Sabaté et al., 1990). With a major concentration in the NE of Bahia, these granites exhibit, in general, ages of about 2.0 Ga and can be assumed to have origin from the melt of hydrated rocks of the amphibolite facies, tectonically placed under rocks of the granulite facies as aforementioned.

Late deformations have formed retrograde shear zones in the Archean blocks under consideration. It is assumed that alkaline syenitic bodies, with minimum ages of 1.9 Ga, have been emplaced in these shear zones (Conceição, 1993). The syenites intruded the granulites after these rocks reached the amphibolite facies crustal environment.

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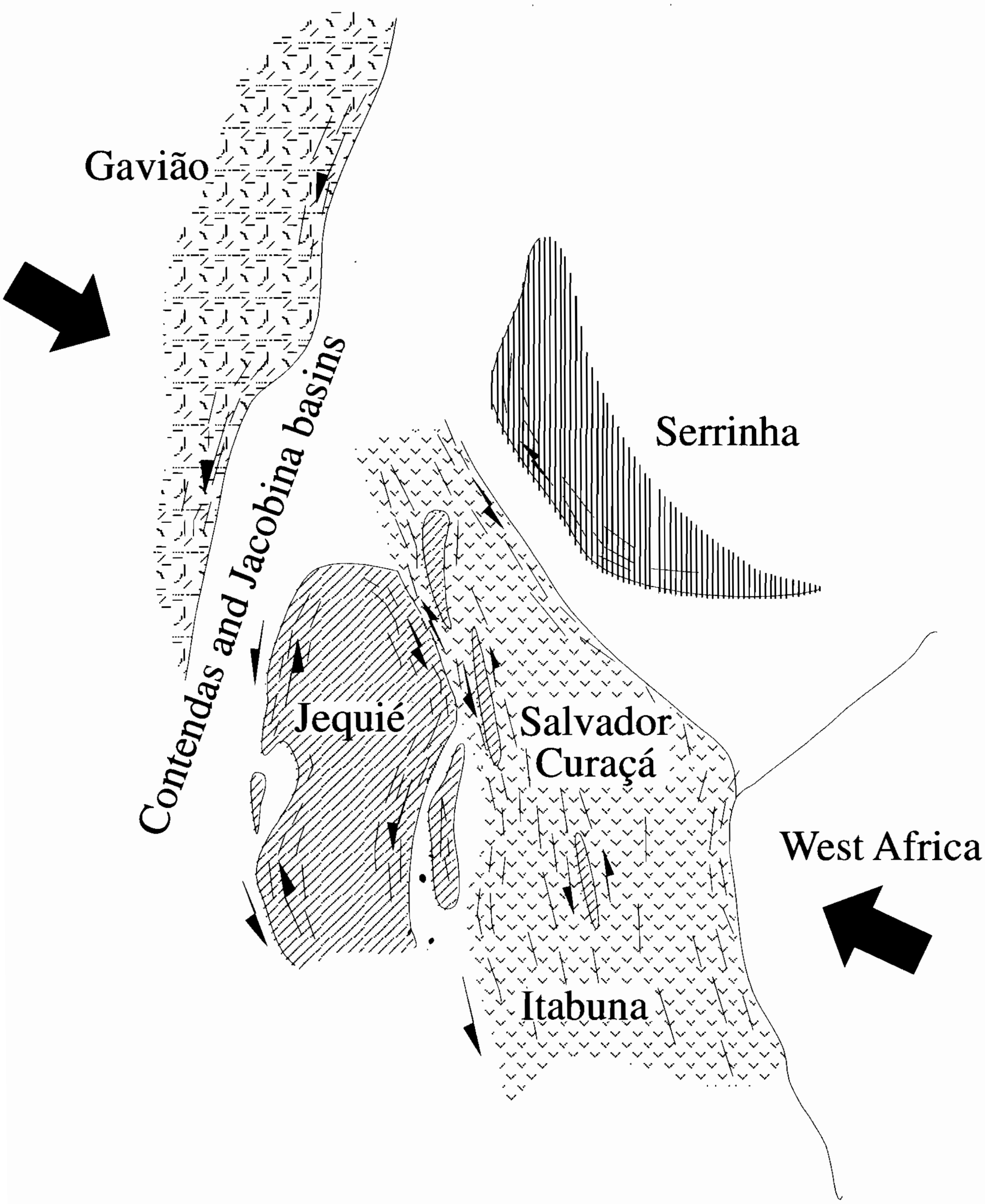


**Figure 1.** Postulated position of the archean blocks prior to collision.

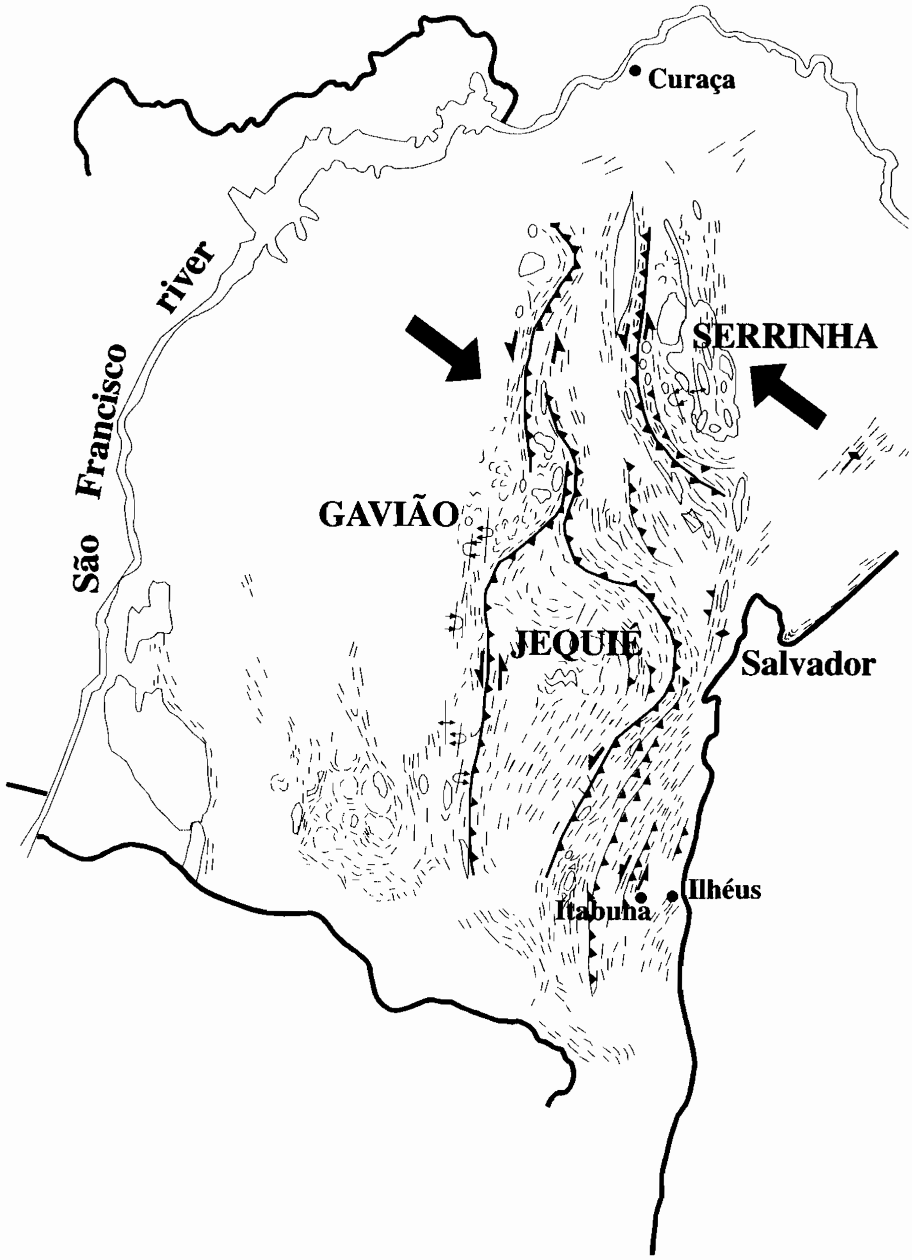


**Figure 2.** Display of the Archean blocks after collision during the Paleoproterozoic Transamazonian Cycle.

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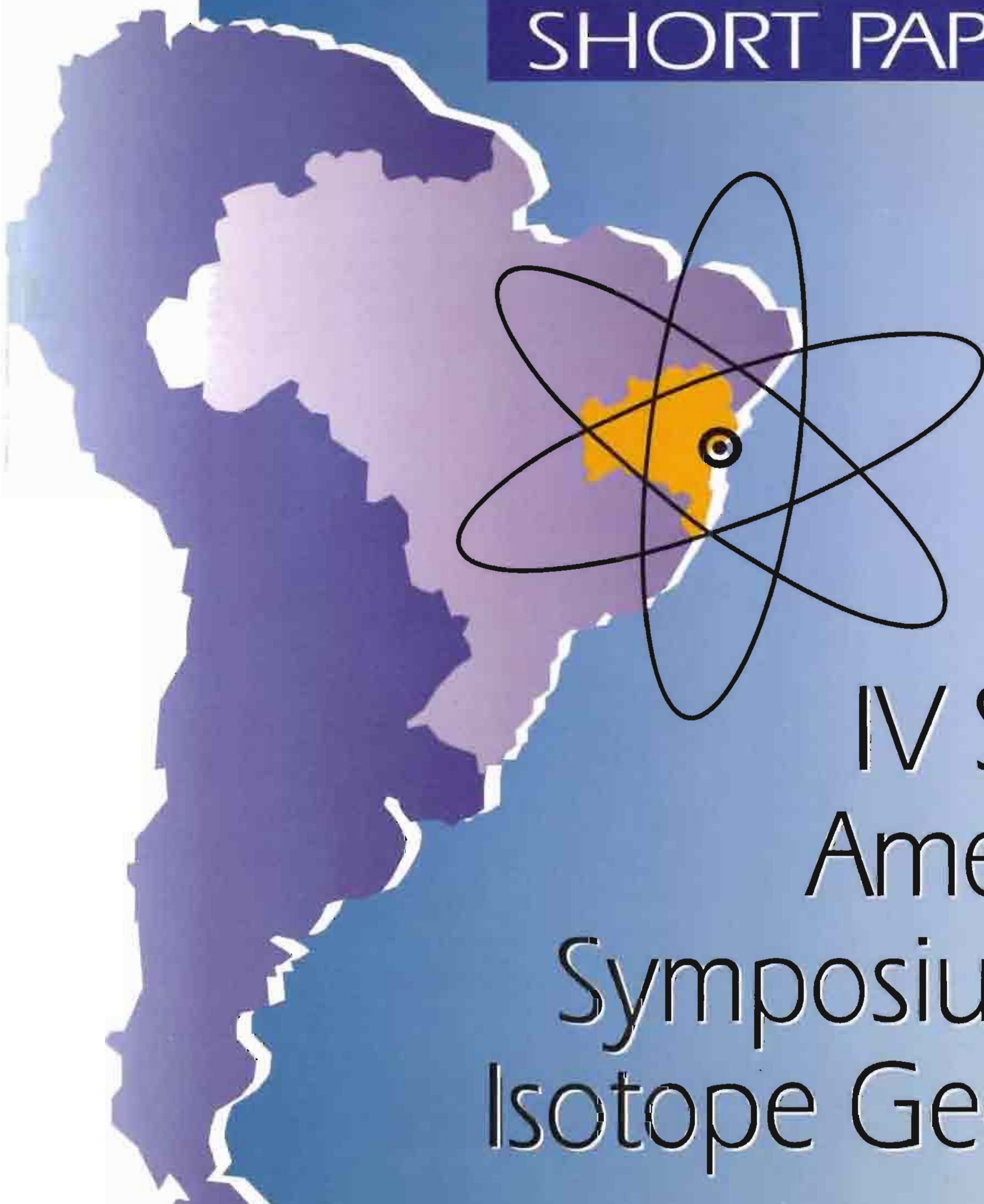

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SALVADOR-BA, BRAZIL AUGUST 24th - 27th, 2003

- VOLUME I -

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South American Symposium on Isotope Geology. (4.: 2003: Salvador)
Short Papers of the IV South American Symposium on Isotope Geology – IV SSAGI, Salvador, August 24th - 27th ; Maria de Lourdes da Silva Rosa et al. (Organizers). – Salvador : CBPM; IRD, 2003.
ii-xxii - 789p. : il.

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1. Isotope Geology. 2. Geology – South America. 3. Geology – International Meeting. 4. Symposium. I. Rios, Débora Correia. II. Kosin, Marília. III. Santos Pinto, Marilda. IV. Title.

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